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Analysis of floog loss data in Spain at the municipal level

"El lector se encuentra ante el número decimocuarto de nuestra revista digital, en el que se abordan temas nuevos relacionados con los actores principales en la gestión de riesgos relacionados con las actividades y funciones del Consorcio de Compensación de Seguros (CCS), con papeles importantes tanto en los riesgos de catástrofe como en el seguro del automóvil.

Summary

Editors Board

The Consorcio de Compensación de Seguros digital magazine "Consorseguros" (CCS) is published every six months, its content particularly addressing matters related to the Consorcio's activities in various fields of insurance, reflecting on and analysing them.

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Summary

page

Editorial

The reader faces the 14th issue of our digital magazine, in which new items related to the main actors dealing with the management of risks aligned with the activities and functions of *Consorcio de Compensación de Seguros* (CCS) are presented. These actors have important roles in both catastrophic risk and automobile insurance. Other articles published in this issue delve further into matters already considered previously, bringing more complete information or new perspectives in accordance with the evolution of the editorial line of this magazine.

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The cover article is an analysis of flood loss data in Spain at the municipal level, jointly written by the Expertise and Studies Sub-Directorates from CCS. It provides a global overview and an unprecedented level of detail concerning damage from fluvial and pluvial flooding that has been indemnified by CCS, as well as a viewer for these data.

The objectives and functions of the AON Foundation's Catastrophe Observatory are described in another contribution by its president, Pedro Tomey. This initiative is now in its fifth year and offers a platform that brings together the insurance sector, catastrophe management, and knowledge generation and management in those fields, in which the CCS plays an active role.

In another article closely connected with the previous one, given their compromise with the Catastrophe Observatory, two distinguished members of the *Unidad Militar de Emergencias*, the Spanish Military's Disaster Relief Unit, Lieutenant Colonel Jorge Serra and Lieutenant Colonel Javier Barranco, describe the functions and activities of that important institution, one of the first responders to serious catastrophes.

The Scientific Coordinator of the *Instituto Volcanológico de Canarias* [Canary Island Volcanology Institute] (INVOLCAN), Nemesio Pérez, describes volcanic risk and certain aspects relating to managing that risk in the context of the Canary Islands, being this item a novelty for this magazine.

Delving further into risk management, this issue also contains a contribution by Aránzazu Gurrea-Nozaleda and her colleagues at the *Dirección General del Agua* [DG for Water] dealing with that Office's initiatives aimed at identifying and lessening flood risk, focusing especially on a pilot project that offers municipalities in the Cartagena County, one of the areas in Spain most affected by flood risk, as shown in the cover article, direct subsidies to undertake projects to reduce the vulnerability of existing buildings and infrastructure.

The last of the articles on natural perils and their management is a contribution by Mónica Sánchez Bajo, of the *Oficina Española de Cambio Climático* [Spain's Office for Climate Change], commenting on a monograph issued by the Spanish Ministry for the Ecological Transition and the Demographic Challenge on "Impacts, vulnerability, and adaptation to climate change by the insurance industry", the first of its kind and reach on the subject in Spain. This contribution also highlights the main aspects of the new National Climate Change Plan, 2021-2030, with a special focus on insurance activity.

Three additional articles in this number of the magazine deal with the important roles played by the CCS in the field of motor vehicle insurance. José María Cancer, Director General of CESVIMAP, the Centre for Experimentation and Traffic Safety of MAPFRE, describes the centre's objectives, activities, and facilities for increasing road safety and streamlining and expediting the processing and repair of damaged vehicles. Another contribution, by the CCS' Deputy-Director for the Technical Area and Reinsurance, Belén Soriano, reviews statistics concerning the CCS's activities in connection with Compulsory Motor car Third-Party Liability Insurance. An article by José Antonio Badillo, the CCS' Regional Representative in Madrid, considers case law relating to motor vehicle insurance and discusses a recent judgment by the Spanish Supreme Court bearing on standing as an injured party in traffic accidents.

Analysis of flood loss data in Spain at the municipal level

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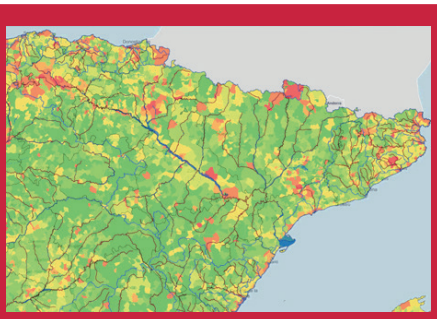
Introduction

The previous volume of this magazine published a depiction of flood risk in Spain based on Extraordinary Risk Insurance Scheme data. Resolution in that study was down to the provincial level, and a series of assumptions were made to refine the plot of the level of risk, e.g. extrapolation of loss data onto the percentage uninsured homes.

That study disclosed a series of spatial characteristics that predispose to higher losses: proximity to the sea or to large river drainage basins and high exposure. Let us just point out here that indemnities for flood losses, including coastal flood, as floods are defined in section 2 of the Extraordinary Risks Regulation, make up 69% of all compensation paid out under the extraordinary risk insurance scheme in the past 25 years. This important consideration and the plots of losses at the provincial level immediately led us to look for a way to plot risk at a higher level of granularity. That is why this study presents a tool, a viewer, for plotting the indemnities paid out by the CCS for floods, though excluding coastal flood, by municipality, in the last 15 years, from 2006 to 2020 (Figure 1). This increase in resolution from Spain's 50 provinces and its 2 autonomous cities to its 8,131 municipalities has multiplied data resolution by a factor of more than 150, and hence the need to use a viewer to take full advantage of such a wealth of information. Unlike the previous study, no assumptions or extrapolations have been made here. Instead, the actual data have been plotted, with economic values updated to 31 December 2020.



This study presents a tool, a viewer, for plotting the indemnities paid out by the CCS for floods, though excluding coastal flood, by municipality, in the last 15 years, from 2006 to 2020. The information contained in this viewer is taking full advantage of the CCS' wealth of data concerning flood indemnities, and is available to all stakeholders. The principal value of these data and of this viewer is, without a doubt, to facilitate an awareness of the risk of floods and to serve as an indicator for the implementation of risk-reduction measures by the competent government administrations and by the insureds themselves.

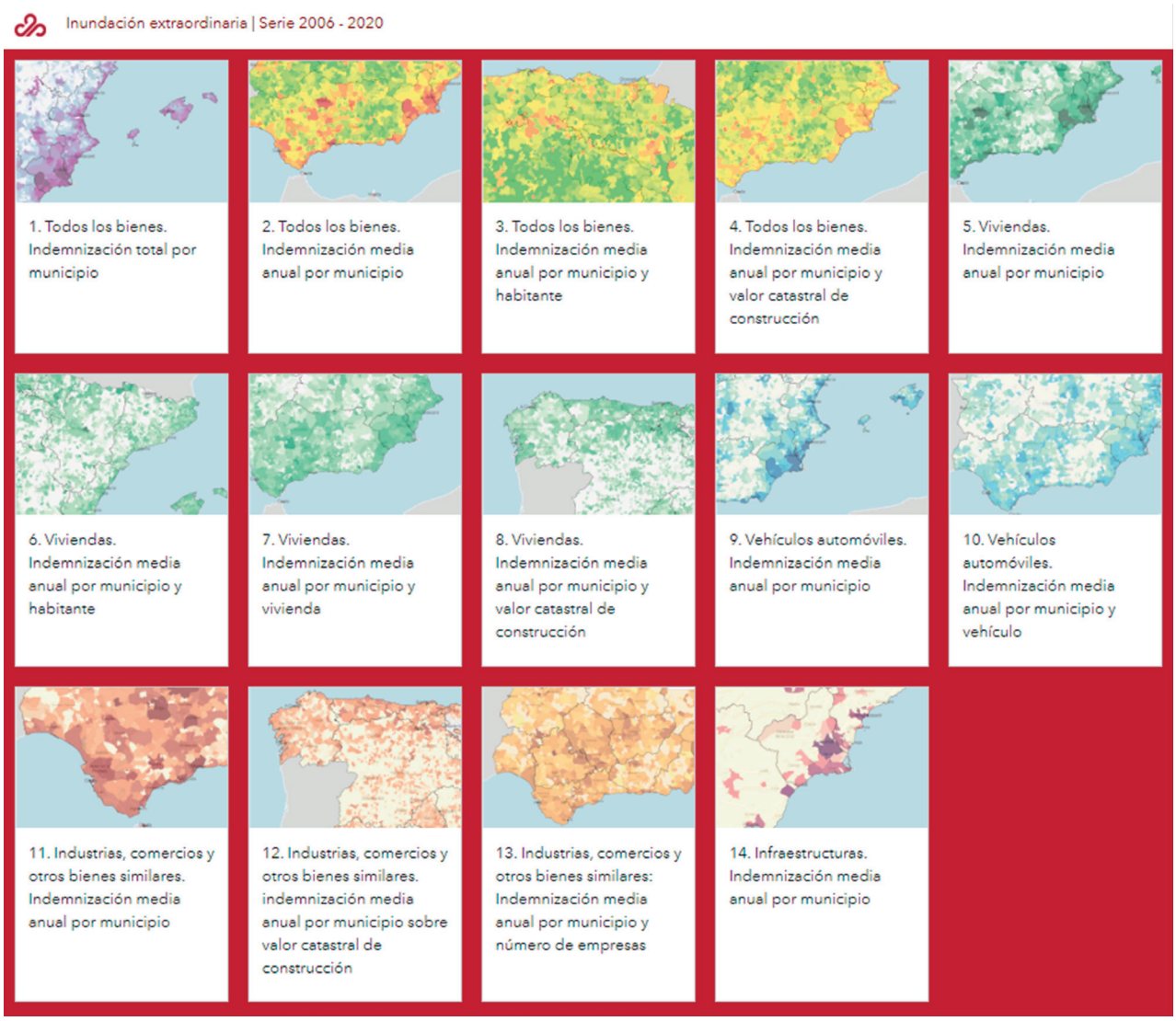


Figure 1. First page of the CCS flood loss compensation data viewer.

The extraordinary risk insurance scheme also covers personal injury and business interruption. However, these losses are low in proportion to the indemnities paid out for property damage, accounting for 97% of the total, plus compensation for personal injury results not from objective criteria but instead depends on the sum established as insured by the person in question. For this reason, since the goal of this study is to provide an x-ray of flood losses indemnified by the insurance scheme, its focus has been placed on property damage only.

Methodology

The viewer has been developed using the ArcGIS platform, and maps that plot the risk globally (i.e., total compensation data) have been created, along with others that attempt to refine the depiction of flood risk by dividing that amount by the various factors indicative of exposure:

- Population of the municipality. Source: *Instituto Nacional de Estadística* [Spain's National Institute of Statistics] (INE, from the Spanish abbreviation).
- Number of homes in the municipality. Source: population and residential park censuses 2011 (INE).
- Number of motor vehicles in the municipality. Source: *Dirección General de Tráfico* [Directorate-General for Traffic] (DGT, from the Spanish abbreviation).
- Number of companies per municipality. Source: INE.
- Aggregate assessed value of construction in each municipality. Source: compiled by the authors from statistical data released by the Land Survey Office [Spanish Ministry of Economic Affairs and Digital Transformation] and information furnished by the Land Survey Offices of Bizkaia and Gipuzkoa. At the time of this writing no data are available from the Land Survey Offices of Álava or Navarre.

Some maps plot all losses for all insured property, but other maps have also been drawn up plotting the following specific risk categories:

- Homes.
- Business, industry, and similar risks.
- Infrastructure.
- Motor vehicles.

For ease of reference and the ensuing cartographic analysis, the following layers of geographic data have been added to the viewer:

- Basic map of Spain. Source: *Instituto Geográfico Nacional* [Spain's National Geographic Institute] (IGN, from the Spanish abbreviation).
- Borders of Spain's Autonomous Regions. Source: IGN.
- Provincial borders. Source: IGN.
- Main rivers (rivers draining a basin with a surface area larger than 500 km^2). Source: Spanish Ministry for the Ecological Transition and the Demographic Challenge.
- Drainage basins for the main rivers. Source: Spanish Ministry for the Ecological Transition and the Demographic Challenge.
- Flood-prone zones with 500-year return periods. Source: National Flood Zone Mapping Service (Ministry for the Ecological Transition and the Demographic Challenge).

Table 1 lists the maps that can be viewed using the viewer and the main features of those maps.

Map number	Features	Units	Remarks
1	All properties. Total loss by municipality	€	
2	All properties. Mean yearly loss by municipality	€	
3	All properties. Mean yearly loss by municipality and inhabitant	€	
4	All properties. Mean yearly loss by municipality and aggregate assessed value of construction	Parts per million	Indemnified euros by each million of assessed (cadastral) value of construction exposed.
5	Flood: residential properties. Mean yearly loss by municipality	€	
6	Flood: residential properties. Mean yearly loss by municipality and inhabitant	€	
7	Flood: residential properties. Mean yearly loss by municipality and registered homes	€	Indemnified euros by municipality and registered homes (exposed).
8	Flood: residential properties. Mean yearly loss by municipality and residential value of construction	Parts per million	Indemnified euros by each million of residential assessed (cadastral) value of construction exposed.
9	Flood: automobiles. Mean yearly loss by municipality	€	
10	Flood: automobiles. Mean yearly loss by municipality and registered vehicle	€	Indemnified euros by municipality and registered (exposed) vehicle.
11	Flood: industrial, commercial and similar properties: Mean yearly loss by municipality	€	
12	Flood: industrial, commercial and similar properties: Mean yearly loss by municipality and registered business	€	
13	Flood: industrial, commercial and similar properties: Mean yearly loss by municipality and assessed construction value for this kind of risks	Parts per million	Indemnified euros to industries, commerces and similar risks by municipality and million of assessed (cadastral) value exposed for this kind of risks.
14	Flood: infrastructures. Mean yearly loss by municipality	€	

Table 1. List of maps on the viewer and their main features.

Results

To give an extensive description of all possible results that can be retrieved would far exceed the scope of this article, so we will confine our remarks to a limited selection of maps and to certain features of those maps.

Figure 2 shows the annual average flood losses paid under the extraordinary risk insurance per municipality during the period examined. The ten municipalities which received the highest annual average flood compensation appear on Table 2. It is appropriate to mention here that these are the total compensation data per municipality, and that the compensation payments are on the properties insured. That is, not all of the flood losses are represented here, but rather solely those which were insured and therefore paid compensation by the CCS.

Overall, it is estimated that the extraordinary risk insurance covers on the order of 50-60% of the total losses, with public infrastructures and other public properties constituting the principal source of this gap in coverage, since the Administration insures itself to a large extent. This is the reason why no comments will be made in this study on the information provided in the viewer on flood damage to infrastructures, since they are strongly dependent on the policy of the Public Administration to which they belong as to whether they are insured or not. Another relevant factor is the different level of insuring from one region to another, as well as the variation between urban and rural areas. Nevertheless, having made these considerations, coherent spatial characteristics can be observed.

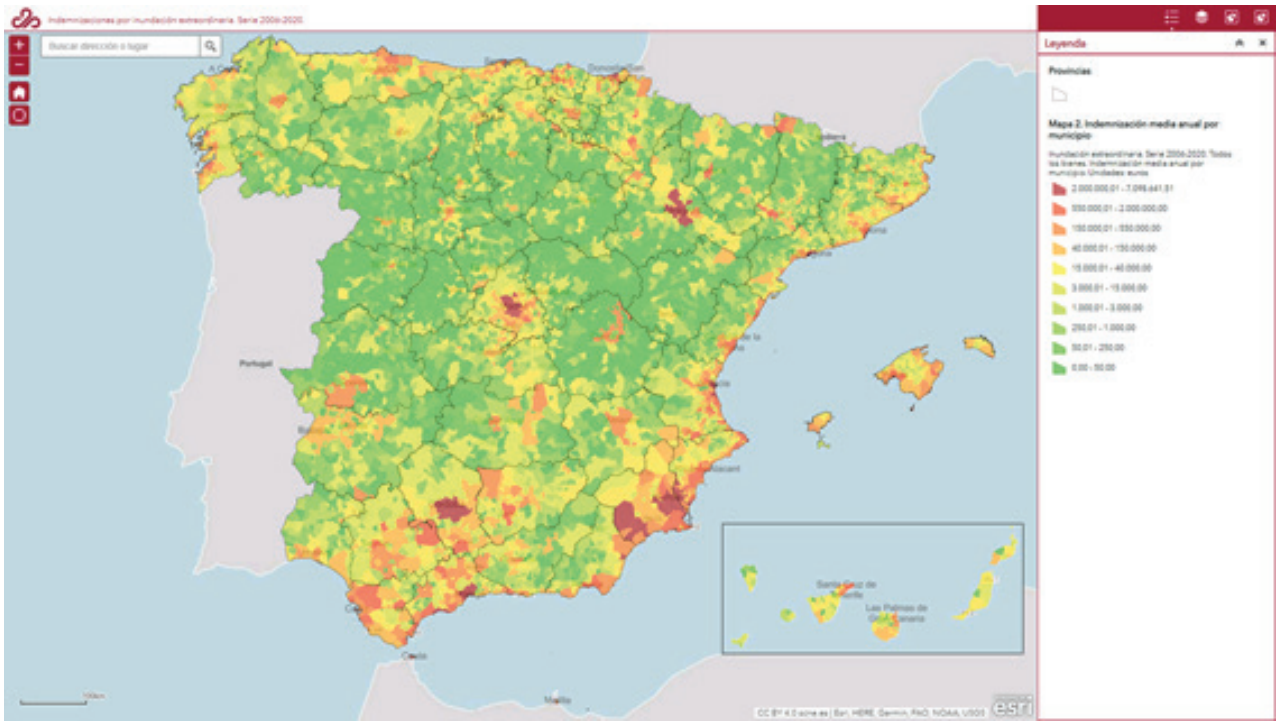


Figure 2: Annual average compensation under the extraordinary risk insurance due to floods, by municipality (2006-2020).

	Municipality	Basin Authority	Province	Loss (€/year)
1	Orihuela	Segura	Alicante	7,098,641.51
2	Los Alcázares	Segura	Murcia	5,350,222.91
3	Murcia	Segura	Murcia	4,182,169.95
4	Vera	Andalusian Mediterranean	Almería	4,128,396.24
5	Málaga	Andalusian Mediterranean	Málaga	4,095,421.18
6	Marbella	Andalusian Mediterranean	Málaga	3,201,282.98
7	Tarragona	Catalan Internal Basins	Tarragona	2,861,505.74
8	San Javier	Segura	Murcia	2,744,628.13
9	Lorca	Segura	Murcia	2,645,056.48
10	Donostia/San Sebastián	Basque Internal Basins	Gipuzkoa	2,522,306.66

Table 2. The ten municipalities of Spain with the highest annual average compensation (2006-2020).

Once again the cross between hazard level and exposure is what determines the highest loss. Thus, the coincidence between geographical features and coastal zones play a very relevant role in this higher amount of losses, particularly on the Mediterranean coast in Andalusia, Murcia Region, the Community of Valencia and the south of Catalonia, as well as the coast of the Bay of Biscay, together with the exposure. The large cities close to major river courses, such as Zaragoza or Cordova, for example, also reflect this cross between hazard level and exposure. The very weight of the exposure in the large metropolitan areas of Madrid and Barcelona is also responsible for their accumulation of greater losses. In addition to in Figure 2 and, of course, in the viewer itself, the analysis of the municipalities with the highest level of flood losses according to river basins, which appear on Table 3, casts greater light on this issue.

It is evident that the river basins presenting a higher loss level are those of the Segura –five of the ten municipalities which, on the national level, suffer the most losses belong to this basin–, the Mediterranean basins of Andalusia –three of whose municipalities are also among the top ten in Spain– and others, such as the Júcar, or the internal basins of Catalonia and the Basque Country. The major river basins, such as those of the Ebro or the Guadalquivir also include municipalities with extensive flood damage, as a result of their significant exposure or of tributaries of the main course which cause serious flooding and are due to a greater extent to processes which are more similar to those causing floods on the coast than to those from the overflow of a major river course: the cases of Tafalla, Écija, Lucena or Jaén.

	Municipality	Loss (€/year)		Municipality	Loss (€/year)		Municipality	Loss (€/year)
	GALICIAN ATLANTIC BASINS			**DOURO**			**GUADALQUIVIR**	
1	Vilagarcía de Arousa (Pontevedra)	1.443.047,42	1	Valladolid	514.715,39	1	Córdoba	2.425.400,29
2	Vigo (Pontevedra)	1.087.248,34	2	Salamanca	297.488,20	2	Écija (Sevilla)	1.766.701,24
3	Baiona (Pontevedra)	421.502,75	3	Laguna de Duero (Valladolid)	94.876,01	3	Sevilla	1.707.053,95
4	Cee (A Coruña)	381.564,03	4	Villaquilambre (León)	94.316,33	4	Lucena (Córdoba)	1.076.039,39
5	Pontevedra	339.383,48	5	Burgos	93.791,02	5	Jaén	1.053.095,13
	MIÑO-SIL			**TAGUS**			**ANDALUSIAN MEDITERRANEAN BASINS**	
1	Lugo	164.796,05	1	Madrid	2.276.867,11	1	Vera (Almería)	4.128.396,24
2	Ponteareas (Pontevedra)	98.059,44	2	Arganda del Rey (Madrid)	668.225,25	2	Málaga	4.095.421,18
3	O Porriño (Pontevedra)	64.751,36	3	Coslada (Madrid)	547.509,30	3	Marbella (Málaga)	3.201.282,98
4	Ourense	56.954,18	4	Rivas-Vaciamadrid (Madrid)	442.035,63	4	Estepona (Málaga)	1.316.461,34
5	Mos (Pontevedra)	56.329,37	5	San Fernando de Henares (Madrid)	352.177,99	5	Mijas (Málaga)	1.300.288,73
	BAY OF BISCAY AND BASQUE INTERNAL BASINS			**JÚCAR**			**ANDALUSIAN ATLANTIC BASINS**	
1	Donostia-San Sebastián (Gipuzkoa)	2.522.306,66	1	Valencia	2.357.164,75	1	Jerez de la Frontera (Cádiz)	1.254.108,20
2	Valle de Trápaga-Trapagaran (Bizkaia)	1.465.953,29	2	Alicante-Alacant	1.807.919,72	2	Cádiz	956.577,11
3	Avilés (Asturias)	1.240.879,31	3	Paterna (Valencia)	1.637.125,15	3	Chiclana de la Frontera (Cádiz)	687.504,75
4	Getxo (Bizkaia)	1.165.431,45	4	Beniparrell (Valencia)	1.376.025,80	4	Rota (Cádiz)	676.301,71
5	Hernani (Gipuzkoa)	1.058.258,28	5	Jávea-Xàbia (Alicante)	1.280.509,34	5	Conil de la Frontera (Cádiz)	280.065,11
	EBRO			**SEGURA**			**BALEARIC ISLANDS**	
1	Zaragoza	2.493.033,54	1	Orihuela (Alicante)	7.098.641,51	1	Sant Llorenç des Cardassar	685.528,85
2	Tafalla (Navarra)	1.276.095,05	2	Los Alcázares (Murcia)	5.350.222,91	2	Palma	637.394,85
3	Pamplona/Iruña (Navarra)	1.241.382,62	3	Murcia	4.182.169,95	3	Sant Josep de sa Talaia	260.014,81
4	Lleida	905.405,66	4	San Javier (Murcia)	2.744.628,13	4	Calviá	217.553,52
5	Huesca	687.250,64	5	Lorca (Murcia)	2.645.056,48	5	Santanyí	202.287,50
	CATALAN INTERNAL BASINS			**GUADIANA**			**CANARY ISLANDS**	
1	Tarragona	2.861.505,74	1	Ciudad Real	368.047,13	1	Santa Cruz de Tenerife	1.350.746,43
2	Barcelona	1.987.380,59	2	Alcázar de San Juan (Ciudad Real)	353.358,97	2	Las Palmas de Gran Canaria	424.833,60
3	Blanes (Girona)	1.144.425,84	3	Monesterio (Badajoz)	260.940,40	3	Telde (Las Palmas de Gran Canaria)	272.113,93
4	Girona	815.388,61	4	Villarrubia de los Ojos (Ciudad Real)	131.044,95	4	San Cristóbal de La Laguna (Sta. Cruz de T.)	227.418,67
5	Malgrat de Mar (Barcelona)	729.444,48	5	Villanueva de la Serena (Badajoz)	87.689,91	5	El Rosario (Sta. Cruz de Tenerife)	164.962,47

Table 3. The five municipalities with the highest annual average compensation due to floods, by river basin, in the period 2006-2020.

The absence of significant geographical reliefs next to major cities and the low population density mean that other major river basins, such as those of the Douro, Tagus (with the exception of Madrid and its metropolitan area, a result of the significant exposure), Guadiana or Miño-Sil, present relatively minor flood damage. In the coast of Galicia and the Bay of Biscay (with the exception of the Basque coast), rainfall of a lesser torrential nature –large accumulations can occur but with a lesser degree of intensity than on the Mediterranean coast– together with a lower level of urban development, or a more disperse development, mean that, except in the large population centres of Galicia and Asturias, flooding does not cause as much damage as in other coastal areas.

The Balearic and Canary Islands logically respond to flooding dynamics similar to those of other highly developed coastal areas, where the torrential nature of the rainfall combines with the geographical relief, generating courses with little response time and strong current, with high exposure.

Figure 3 represents these same average amounts of compensation by municipality and year, divided by the number of inhabitants, for the purpose of putting into perspective the effect of the exposure. On this map, the effects of the major population centres disappear and others which reflect the real hazard level better become clearer. The municipalities which appear with higher losses per inhabitant tend to be due, in general, to sudden flood dynamics occurring in short watercourses, with steep downgrades and short accumulation times. In addition to the coastal areas of the Mediterranean and Eastern Bay of Biscay, already mentioned, these effects appear in the Pyrenees, Cantabrian Mountains (especially on their southern side), the Middle Area of Navarre and both sides of the Catalan Mediterranean System and the Penibaetic System (in its most western sector). To a lesser degree, the same occurs in Sierra Morena and the Montes de Toledo.

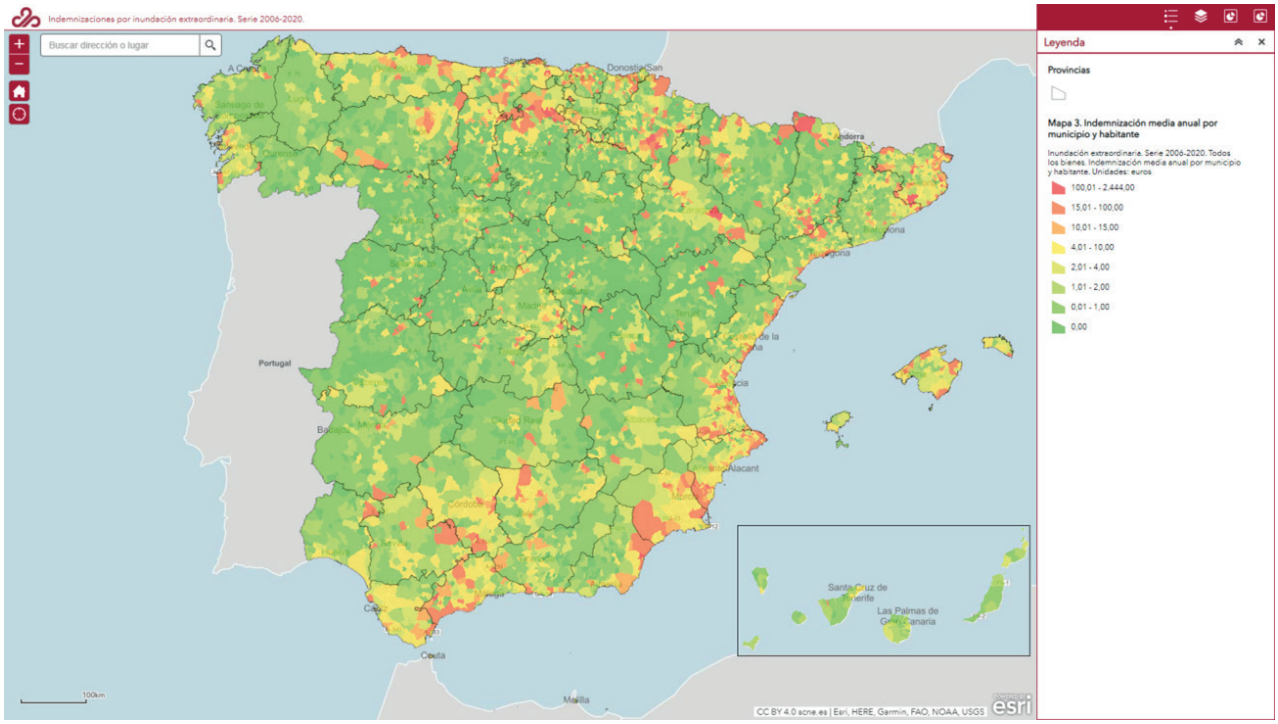


Figure 3: Annual average compensation under the extraordinary risk insurance due to floods, by municipality and inhabitants (2006-2020).

	Municipality	Basin Authority	Province	Loss (€/inhab/year)
1	Tirapu	Ebro	Navarre	1,105.58
2	Beniparrell	Júcar	Valencia	682.89
3	Frías	Ebro	Burgos	527.00
4	Vilamòs	Ebro	Lleida	438.10
5	Fontanilles	Catalan Internal Basins	Girona	384.45
6	Massanes	Catalan Internal Basins	Girona	345.33
7	Vinaixa	Ebro	Lleida	337.08
8	Castiello de Jaca	Ebro	Huesca	328.50
9	Los Alcázares	Segura	Murcia	322.50
10	Pueyo	Ebro	Navarre	279.78

Table 4: The ten municipalities of Spain with the highest annual average compensation by inhabitant (2006-2020).

The ten municipalities with the highest losses per inhabitant, which appear on Table 4, all coincide in these circumstances, with the annotation that the low population of some of them, such as Tirapu (40 inhabitants) makes the losses *per capita* soar. Although the series of data is of a relatively lengthy duration (15 years), the small population of some of these municipalities also means that events of great significant could have an impact on these classifications. Table 5 shows the five municipalities of each river basin that present the highest losses compensated per inhabitant in the period under study, and the previous assessment on those evidencing higher losses is confirmed. Thus, when comparing the five municipalities of each river basin with the highest amount of losses compensated *per capita*, the largest amounts appear, in general, in the Ebro River Basin (Figure 4), in its areas located in the Pyrenees or in the Iberian-Cantabrian headwaters of the river.

	Municipality	Loss (€/inhab/year)		Municipality	Loss (€/inhab/year)		Municipality	Loss (€/inhab/year)
	GALICIAN ATLANTIC BASINS			**DOURO**			**GUADALQUIVIR**	
1	Cee (A Coruña)	50,54	1	Juarros de Riomoros (Segovia)	271,73	1	Villa del Río (Córdoba)	121,26
2	Vilagarcía de Arousa (Pontevedra)	38,41	2	Villabrázaro (Zamora)	158,21	2	Monturque (Córdoba)	102,28
3	Baiona (Pontevedra)	34,75	3	Lastras del Pozo (Segovia)	120,88	3	Cantillana (Sevilla)	86,38
4	Oia	23,54	4	Reinoso de Cerrato (Palencia)	98,90	4	Écija (Sevilla)	44,29
5	Irixoa (A Coruña)	21,29	5	Santiago del Tormes (Ávila)	91,86	5	La Puerta de Segura (Jaén)	36,86
	MIÑO-SIL			**TAGUS**			**ANDALUSIAN MEDITERRANEAN BASINS**	
1	Crecente (Pontevedra)	24,42	1	La Hoya (Salamanca)	136,69	1	Benaoján (Málaga)	275,16
2	Carballeda de Valdeorras (Ourense)	13,77	2	Valdastillas (Cáceres)	136,32	2	Vera (Almería)	242,90
3	Castrillo de Cabrera (León)	11,32	3	Sayatón (Guadalajara)	90,87	3	Jimera de Líbar (Málaga)	149,72
4	Rábade (Lugo)	7,19	4	Casas del Castañar (Cáceres)	74,41	4	Benahavís (Málaga)	77,28
5	Arbo (Pontevedra)	4,88	5	Pantoja (Toledo)	68,32	5	Campillos (Málaga)	76,39
	BAY OF BISCAY AND BASQUE INTERNAL BASINS			**JÚCAR**			**ANDALUSIAN ATLANTIC BASINS**	
1	Ampuero (Cantabria)	178,92	1	Beniparrell (Valencia)	682,89	1	Rota (Cádiz)	23,10
2	Sondika (Bizkaia)	141,73	2	Els Poblets (Alicante)	184,81	2	Higuera de la Sierra (Huelva)	13,56
3	Valle de Trápaga-Trapagaran (Bizkaia)	122,42	3	Sant Joanet (Valencia)	140,50	3	Conil de la Frontera (Cádiz)	12,30
4	Laukiz (Bizkaia)	110,06	4	Sollana (Valencia)	111,76	4	Punta Umbría (Huelva)	9,21
5	Parres-Llanes (Asturias)	91,65	5	Peñíscola (Castellón)	91,38	5	Cádiz	8,29
	EBRO			**SEGURA**			**BALEARIC ISLANDS**	
1	Tirapu (Navarra)	1.105,58	1	Los Alcázares (Murcia)	322,50	1	Sant Llorenç des Cardassar	78,42
2	Frías (Burgos)	527,00	2	Daya Vieja (Alicante)	258,61	2	Escorca	56,31
3	Vilamòs (Lleida)	438,10	3	Benferri (Alicante)	242,04	3	Ariany	32,84
4	Vinaixa (Lleida)	337,08	4	Dolores (Alicante)	129,09	4	Sant Lluis	28,59
5	Castiello de Jaca (Huesca)	328,50	5	Orihuela (Alicante)	90,42	5	Valldemosa	21,80
	CATALAN INTERNAL BASINS			**GUADIANA**			**CANARY ISLANDS**	
1	Fontanilles (Girona)	384,45	1	Villarrubio (Cuenca)	69,91	1	Garachico (Sta. Cruz de Tenerife)	17,95
2	Massanes (Girona)	345,33	2	Monesterio (Badajoz)	61,89	2	El Rosario (Sta. Cruz de Tenerife)	9,43
3	Sant Feliu de Buixalleu (Girona)	210,00	3	Villares del Saz (Cuenca)	31,04	3	Fuencaliente de la Palma (Sta. Cruz de T.)	9,22
4	Mieres (Girona)	200,79	4	Abertura (Cáceres)	19,90	4	Santa Cruz de Tenerife	6,46
5	Fogars de la Selva (Girona)	163,19	5	Valverde de Mérida (Badajoz)	19,88	5	La Aldea de San Nicolás (Las Palmas de G.C.)	2,87

Table 5. The five municipalities with the largest annual average per inhabitant of compensations due to flooding, by river basin, in the period 2006-2020.

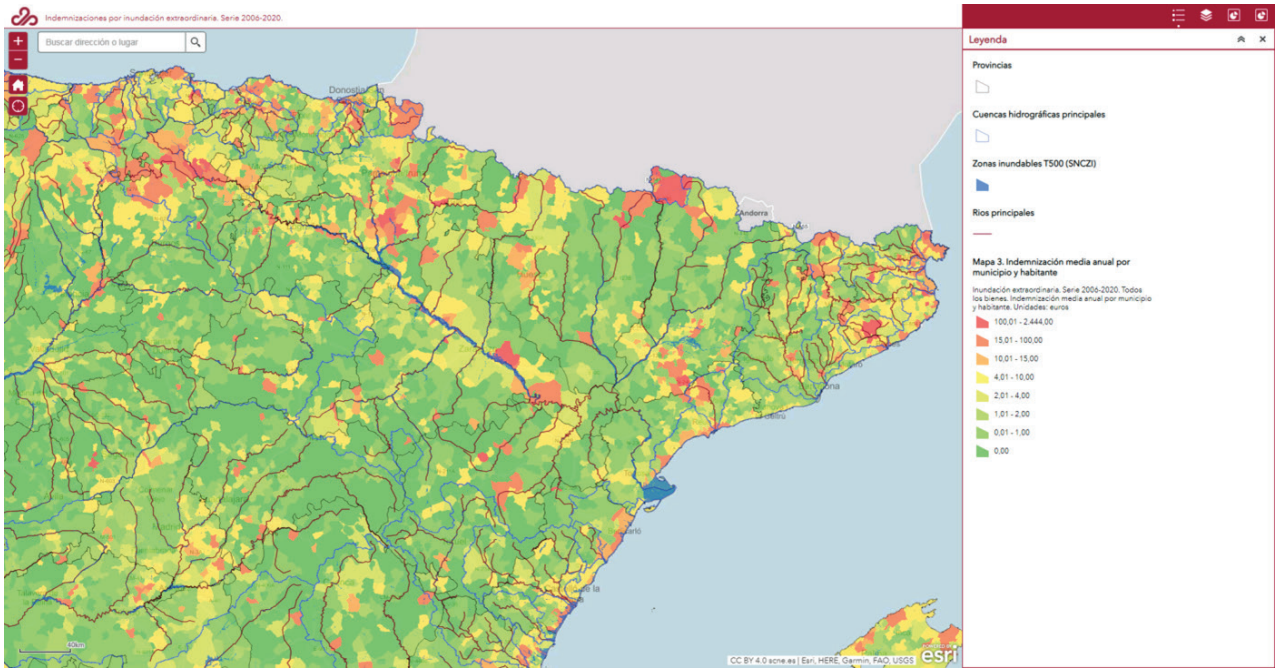


Figure 4. Example of visualisation of the Ebro River Basin in the viewer, with annual average losses by municipality and inhabitant, river courses and flood areas with a return period of 500 years (CNZI)[1].

We will examine in greater detail below the losses caused according to three major types of risk: residential properties (including condominiums), automobiles and businesses, industries and other similar risks such as offices, sports facilities, educational facilities, etc.

Figures 5, 6 and 7 show the annual average losses by municipality for each of these three types of risk, respectively.

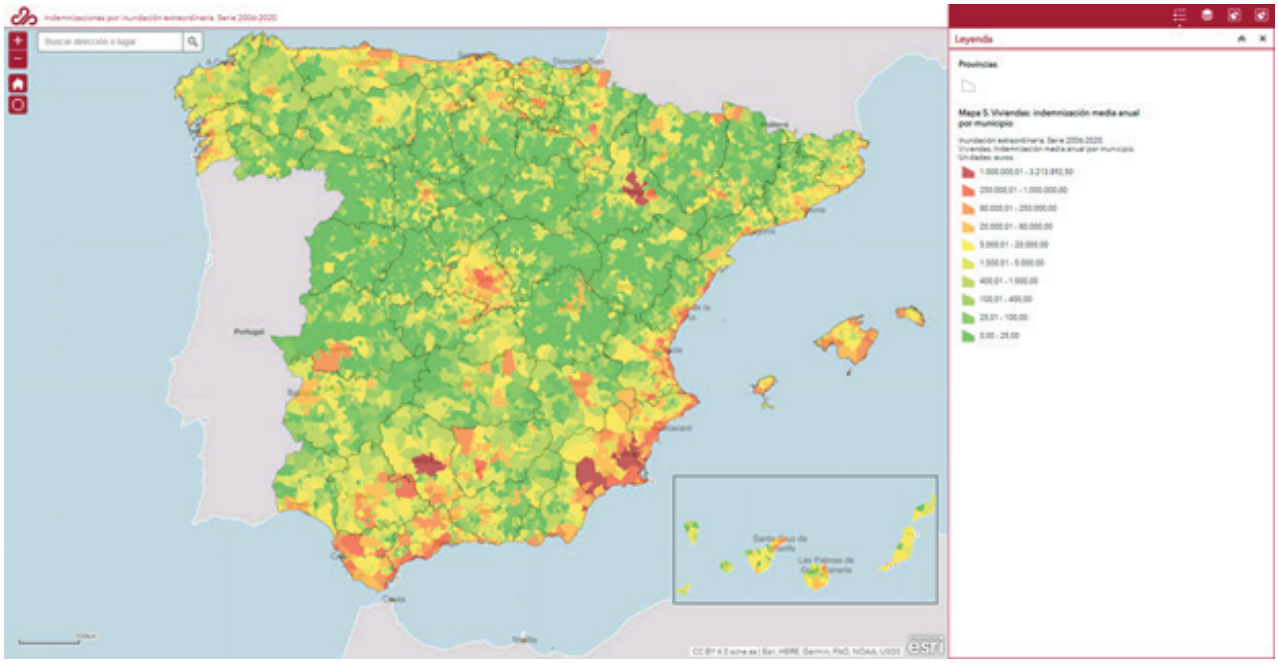


Figure 5. Annual average compensation for residential properties under the extraordinary risk insurance due to floods, by municipality (2006-2020).

(1) National cartography of flood zones.

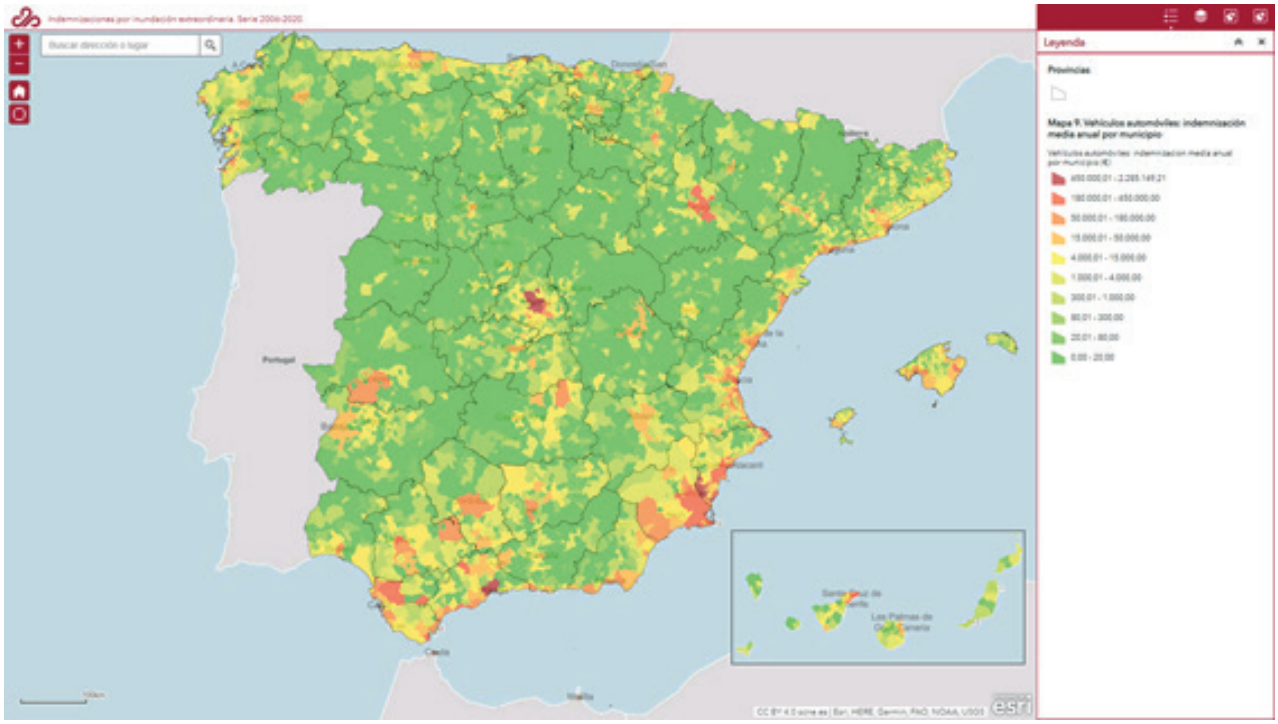


Figure 6. Annual average compensation for automobiles under the extraordinary risk insurance due to floods, by municipality (2006-2020).

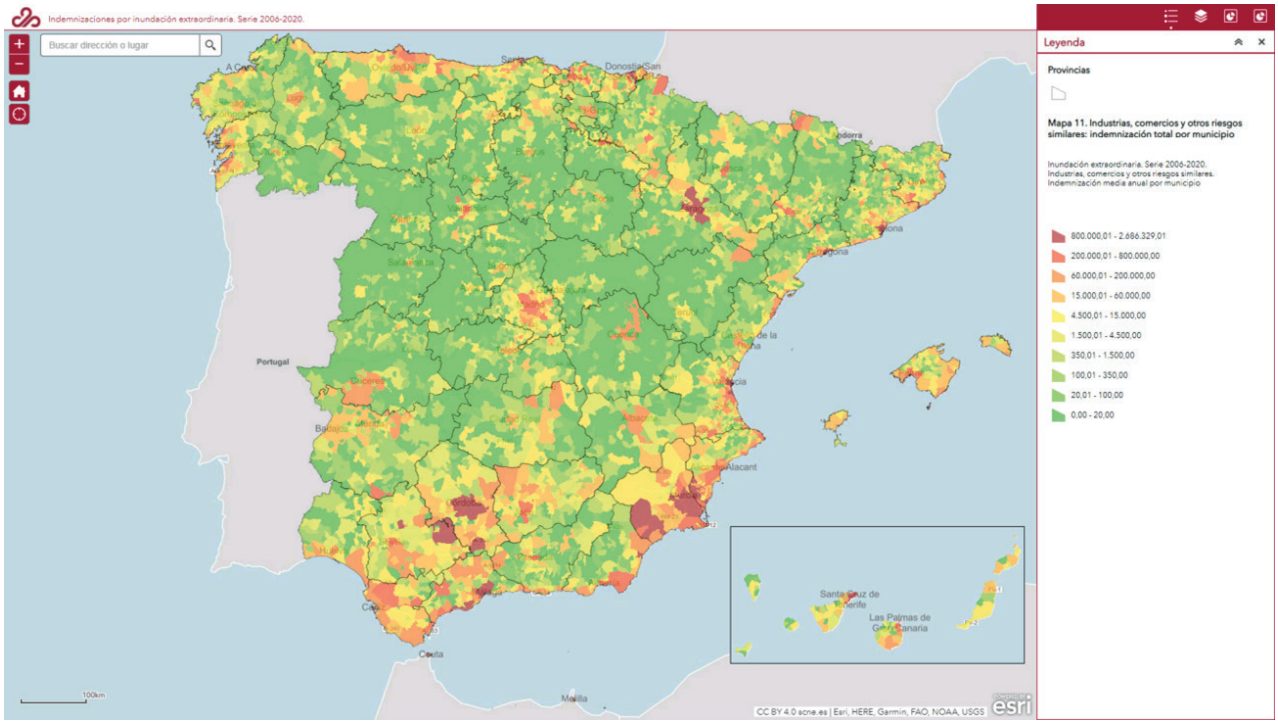


Figure 7. Annual average compensation for industries, businesses and other similar risks under the extraordinary risk insurance due to floods, by municipality (2006-2020).

The graphic information is complemented by the classifications shown on Tables 6 to 11, where, for each type of risk, the ten municipalities with the highest annual average losses, on a total basis, and the ten municipalities with the highest annual average losses for exposed residential properties, vehicles or businesses, respectively, are listed.

	Municipality	Basin Authority	Province	Loss (€/year)
1	Los Alcázares	Segura	Murcia	3.213.892,50
2	Vera	Andalusian Mediterranean	Almería	2.894.485,87
3	Orihuela	Segura	Alicante	2.049.173,28
4	Murcia	Segura	Murcia	1.790.125,28
5	Marbella	Andalusian Mediterranean	Málaga	1.566.089,36
6	Zaragoza	Ebro	Zaragoza	1.324.174,35
7	Lorca	Segura	Murcia	1.216.441,98
8	San Javier	Segura	Murcia	1.039.181,24
9	Córdoba	Guadalquivir	Córdoba	1.000.656,46
10	Cartagena	Segura	Murcia	913.351,54

Table 6. The 10 municipalities with the highest flood losses for residential properties, annual average.

	Municipality	Basin Authority	Province	Loss (€/prop/year)
1	Fontanilles	Catalan Internal	Girona	422,84
2	Alfajarín	Ebro	Zaragoza	422,77
3	Benferri	Segura	Alicante	314,63
4	Laukiz	Basque Internal	Bizkaia	311,96
5	Vera	Andalusian Mediterranean	Almería	274,46
6	Daya Vieja	Segura	Alicante	228,08
7	Villafranca de Ebro	Ebro	Zaragoza	212,11
8	Pitillas	Ebro	Zaragoza	206,19
9	Nuez de Ebro	Ebro	Zaragoza	203,11
10	Olaibar	Ebro	Navarra	196,85

Table 7. The 10 municipalities with the highest flood losses for residential properties, annual average per property exposed.

	Municipality	Basin Authority	Province	Loss (€/year)
1	Orihuela	Segura	Alicante	2.285.149,21
2	Los Alcázares	Segura	Murcia	946.430,14
3	Málaga	Andalusian Mediterranean	Málaga	801.427,00
4	Madrid	Tagus	Madrid	680.879,37
5	Murcia	Segura	Murcia	500.614,83
6	Marbella	Andalusian Mediterranean	Málaga	484.567,31
7	Vilagarcía de Arousa	Galician Atlantic	Pontevedra	448.882,01
8	Valencia	Júcar	Valencia	414.388,21
9	Algeciras	Andalusian Mediterranean	Cádiz	369.754,48
10	San Javier	Segura	Murcia	359.764,48

Table 8: The 10 municipalities with the highest flood losses for automobiles, annual average.

	Municipality	Basin Authority	Province	Loss (€/auto/year)
1	Los Alcázares	Segura	Murcia	86,78
2	Benferri	Segura	Alicante	55,71
3	La Hoz de la Vieja	Ebro	Teruel	50,15
4	Juneda	Ebro	Lleida	43,48
5	Beniparrell	Júcar	Valencia	41,68
6	L'Albi	Ebro	Lleida	38,54
7	Daya Vieja	Segura	Alicante	37,81
8	Campillos	Andalusian Mediterranean	Málaga	36,50
9	Vacarisses	Catalan Internal	Barcelona	33,98
10	Castraz	Douro	Salamanca	33,22

Table 9: The 10 municipalities with the highest flood losses for automobiles, annual average per automobile exposed.

	Municipality	Basin Authority	Province	Loss (€/year)
1	Orihuela	Segura	Alicante	2.686.329,01
2	Tarragona	Catalan Internal	Tarragona	2.458.423,15
3	Valencia	Júcar	Valencia	1.635.492,68
4	Donostia/San Sebastián	Basque Internal	Gipuzkoa	1.549.836,84
5	San Javier	Segura	Murcia	1.345.637,55
6	Valle de Trápaga-Trapagaran	Basque Internal	Bizkaia	1.345.626,01
7	Murcia	Segura	Murcia	1.336.318,76
8	Málaga	Andalusian Mediterranean	Málaga	1.310.591,71
9	Barcelona	Catalan Internal	Barcelona	1.262.881,70
10	Lorca	Segura	Murcia	1.262.292,61

Table 10: The 10 municipalities with the highest flood losses for businesses, industries and similar, annual average.

	Municipality	Basin Authority	Province	Loss (€/prop/year)
1	Massanes	Catalan Internal	Girona	5.694,37
2	Vilamòs	Ebro	Lleida	5.348,28
3	Seira	Ebro	Huesca	4.912,33
4	Vinaixa	Ebro	Lleida	4.263,55
5	Ampuero	Bay of Biscay	Cantabria	2.615,73
6	Beniparrell	Júcar	Valencia	2.414,16
7	Santiago del Tormes	Douro	Ávila	2.007,76
8	Valle de Manzanedo	Ebro	Burgos	1.968,39
9	Velilla de Ebro	Ebro	Zaragoza	1.899,65
10	Sant Joanet	Júcar	Valencia	1.892,93

Table 11: The 10 municipalities with the highest flood losses for businesses, industries and similar, annual average per company exposed.

From a comparison of both sources, graphics and tables, conclusions can be reached as to the effects of the exposure of dwellings in areas with a high hazard level, such as the Vega Baja area of the Segura River Basin or the area around the Mar Menor lagoon and, in general, the coastal areas of the south and southeast of the Peninsula, which are normally heavily developed as a consequence of the pressure of tourism and property development. When analysing the losses by municipality and dwellings exposed, the factors of proximity to more or less defined watercourses are those which become most evident. Many of these municipalities are located in the Middle Ebro Valley, Navarre or in the Bajo Segura.

In the case of automobiles, in addition to the usual municipalities, others appear with significant exposure, such as Madrid, Malaga or Valencia, as well as Vilagarca de Arousa in the demarcation of Galician Atlantic Basins. In the case of this kind of property, due to its mobility, it would be easier to avoid losses, by removing vehicles from flood areas in situations of warnings of intense rainfall or flooding, as well as by reducing the vulnerability of the parking facilities in the face of flood risks; perhaps this type of risk would be the one which could be more easily and quickly addressed through actions to reduce risk.

In the case of industries and businesses, which generally involve considerably higher losses than the other two types, it could be said that the municipalities with the greatest impact are affected more with respect to businesses, offices and other similar facilities than by eminently industrial risks. Although on the list of total losses there are municipalities with a strong industrial presence (Tarragona, San Sebastin, Valle de Trpaga, Barcelona, etc.), and that without a doubt very significant losses occur in this type of facility, it is the cumulative effect of many businesses, offices and other facilities (sports, educational, etc.) that ends up making the losses rise in the areas most exposed to flood hazards. When examining the list of the municipalities with the highest losses compensated per company exposed, this fact becomes evident, since some very small municipalities appear on the list, with very few commercial establishments, and make this average rise. It is relatively easier to undertake risk reduction actions in a few industries which, when flooded, suffer very high losses, than in a myriad of small businesses and facilities, more limited in their financial capacity and, perhaps, less aware of the risks. Here another possible line of priority action can be perceived with a view to the reduction of flood risk in Spain.

As we mentioned at the start, it is very difficult to synthesise in a few words and graphics all of the information this viewer contains and all of the potential of the wealth of data on compensation payments for flood damage held by the Consorcio de Compensacin de Seguros and which are made available here for all interested parties. The principal value of these data and of this viewer is, without a doubt, to facilitate an awareness of the risk of floods and to serve as an indicator for the implementation of risk-reduction measures by the competent government administrations and by the insureds themselves.

Statistics of the CCS' Guarantee Fund for compulsory Motor car Third-Party Liability insurance

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Consorcio de Compensación de Seguros

This statistical study discusses the historical trend for the economic results obtained by the Consorcio de Compensación de Seguros (CCS) in its role as a Guarantee Fund for the Compulsory Motor car Third-Party Liability Insurance (MTPL) over the past 20 years (time series for 2001-2020).

The CCS obtains the financial wherewithal to be able to pay for the Guarantee Fund covers through the **MTPL surcharge**, calculated based on the commercial compulsory insurance premium. This surcharge is collected with the insurance premiums on all motor vehicles normally based in Spain.

Legislative framework

The following laws set up the legal framework for the above-mentioned insurance scheme and CCS's activity.

• **Civil liability insurance for motor vehicles:**

a. Decreto 632/1968, de 21 de marzo, por el que se aprueba el texto refundido de la Ley 122/1962, de 24 de diciembre, sobre el uso y circulación de vehículos de motor [*Spanish Decree 632/1968 of 21 March 1968 approving the Consolidated Text of Law 122/1962 of 24 December 1962 on use of motor vehicles*], as subsequently amended, with its implementing regulations. In force until 5 November 2004.
b. Real Decreto Legislativo 8/2004, de 29 de octubre, por el que se aprueba el texto refundido de la Ley sobre responsabilidad civil y seguro en la circulación de vehículos a motor [*Spanish Royal Legislative Decree 8/2004 of 29 October 2004 approving the Consolidated Text of the Law on civil liability and insurance in respect of the use of motor vehicles*], as subsequently amended, with its implementing regulations. In effect since 6 November 2004.

• **Legal Statute of the CCS,** framing the functions performed by the CCS with regard to Compulsory MTPL Insurance:

a. Section 4 of Ley 21/1990, de 19 de diciembre, de adaptación del Derecho español a la Directiva 88/357/CEE, sobre libertad de servicios en seguros distintos al de vida, y de actualización de la legislación de seguros privados [*Spanish Law 21/1990 of 19 December 1990 adapting Spanish Law to Directive 88/357/EEC, on freedom of non-life insurance services, and updating the legislation on private insurance*], as subsequently amended. In force until 5 November 2004.
b. Texto refundido aprobado por el Real Decreto Legislativo 7/2004, de 29 de octubre [*Consolidated Text approved by Spanish Royal Legislative Decree 7/2004 of 29 October 2004*], as subsequently amended. In effect since 6 November 2004.

CCS' insurance duties as the Guarantee Fund for compulsory Motor car Third-Party Liability insurance

The CCS' functions in its role as Guarantee Fund for Compulsory Motor car Third-Party Liability Insurance under the scope of and the territory covered by the compulsory insurance scheme are:

a. To indemnify parties who have suffered personal injury caused by accidents that take place in Spain where the **vehicle responsible is unidentified**. Where there is significant personal injury, the CCS also indemnifies for property damage.
b. To indemnify for personal injuries and property damage caused by a vehicle normally based in Spain where the **vehicle responsible is uninsured**.
c. To indemnify for personal injuries and property damage caused in Spain where the **vehicle responsible has been stolen**.
d. To indemnify for personal injuries and property damage where the Spanish insurer of the vehicle normally based in Spain has been declared insolvent by a court of law or is in court-ordered administration or liquidation or has been taken over by the CCS (**insurers being wound up**).

From the above we can see that the CCS, as the Guarantee Fund, has been assigned a broad range of tasks: as is to be expected, it performs the two functions required of Guarantee Funds in each EU Member State established by the Directive relating to insurance against civil liability in respect of the use of motor vehicles (compensating for damage caused by vehicles operated unlawfully without insurance and by unidentified or hit-and-run vehicles). In addition, it performs a third function, namely, paying compensation for damage caused by vehicles that have been stolen or obtained by violence, which Member States, under the Directive, may assign either to the insurer of the stolen vehicle or to the Guarantee Fund. And lastly, the CCS takes on a fourth function not envisaged in the Directive, namely, paying compensation for accidents caused by vehicles which are insured with a Spanish insurer that is insolvent or being wound up. It should be noted that at the time of this writing an amendment to the Directive is in preparation to address a series of issues, one being to include this fourth function and in that way complete the full panoply of safeguards for traffic accident victims.

The CCS obtains the financial wherewithal to be able to pay for the Guarantee Fund covers through the **MTPL surcharge**, calculated based on the commercial compulsory insurance premium. This surcharge is collected with the insurance premiums on all motor vehicles normally based in Spain.

Statistics on the Guarantee Fund for compulsory Motor car Third-Party Liability insurance

These statistics provide a picture of the CCS in its role as the Guarantee Fund for Compulsory MTPL Insurance in the period between 2001 and 2020.

Data are provided on risk exposure (portfolio and surcharges) and loss rates by type (uninsured, unidentified, and stolen vehicles and vehicles insured with insurers in the process of being wound up).

All monetary values have been expressed in current euros as of 31 December 2020. Surcharges and loss rates have been adjusted on the basis of the changes in the consumer price index (CPI) over the period considered, set out below in Table 1.

Year	% annual CPI variation	Coefficient of accumulated variation (2020-12-31)
2001	2.7	1.403374
2002	4.0	1.349398
2003	2.6	1.315203
2004	3.2	1.274421
2005	3.7	1.228950
2006	2.7	1.196641
2007	4.2	1.148408
2008	1.4	1.132552
2009	0.8	1.123564
2010	3.0	1.090838
2011	2.4	1.065272
2012	2.9	1.035250
2013	0.3	1.032153
2014	-1.0	1.042579
2015	0.0	1.042579
2016	1.6	1.026160
2017	1.1	1.014996
2018	1.2	1.002960
2019	0.8	0.995000
2020	-0.5	1.000000

Adjusted CPI percentage coefficient values.

These statistics on the Guarantee Fund for civil liability insurance for motor vehicles have been divided into three sections, "Risk Exposure", "Loss Rate", and "Summary and Results" (respectively, Sections 1, 2, and 3).

Risk exposure data

The risk exposure data refer to the number of insured vehicles and the CCS's revenues for its risk covers.

Insured vehicles

Since the number of vehicles exposed to risk under the Guarantee Fund is unknown, it is taken to be the total number of Spanish motor vehicles according to data from the *Dirección General de Tráfico* [Directorate-General for Traffic]. Figures for the number of insured according to the *Fichero Informativo de Vehículos Asegurados* [Insured Vehicle Information Database] (FIVA, according to its Spanish abbreviation) are also given.

Surcharges

Accounting entry-based annual revenue from surcharges for each year.

Changes in **surcharge rates** to provide funding for the CCS to carry out its role as Guarantee Fund are explained below:

a. At the outset of the time series: **3%** of the commercial compulsory insurance premiums issued by the insurance companies pursuant to Orden de 30 de julio de 1980 [*Circular of 30 July 1980*], section four, item 1.
b. From 1 July 2009: **2%** of the commercial compulsory insurance premiums issued by the insurance companies pursuant to Resolución de 19 de mayo de 2009, de la Dirección General de Seguros y Fondos de Pensiones [*Decision of 19 May 2009 by the Bureau of Insurance and Pension Funds*].
c. From 1 July 2016: **1.5%** of the commercial compulsory insurance premiums issued by the insurance companies pursuant to Resolución de 31 de mayo de 2016, de la Dirección General de Seguros y Fondos de Pensiones [*Decision of 31 May 2016 by the Directorate-General for Insurance and Pension Funds*].

This decrease in the surcharge rate is attributable to the continuous decrease in loss rates, as will be shown below.

Loss rate data

The loss rate data are for claims submitted and approved, either already processed or being processed.

The loss rates shown are through 31 May 2021.

The criteria for time distribution of the claims and their sums paid out and provisioned, is that of the year of occurrence of the loss, regardless of other circumstances such as the date of declaration, date of payout or termination date of the claim.

The data collected and used to compile these loss rate statistics were number of claims, compensation paid out, and mean costs. Indemnities were the total sums paid out or for which provisions have been allocated (i.e., for compensation, interest, and court costs) but not including expenses for property damage, claims adjusters, medical experts, lawyers' fees, or other costs). In addition, compensation paid out has not been set off against claims recovered by the Guarantee Fund.

The following information is provided for each type of insurance:

1. Number of claims, indemnities paid out, and mean costs by year of occurrence.
2. Maps showing the occurrence of losses by province.
3. Indemnities paid out by year of occurrence and type of loss.

When considering the loss rate data, changes in compulsory insurance coverage limits should also be taken into account.

- The limits for losses that took place from 1 January 1996 to 12 February 2001, were as follows pursuant to Transitional Provision Twelve of Ley 30/1995, de 8 de noviembre, de Ordenación y Supervisión de los Seguros Privados [*Spanish Law 30/1995 of 8 November 1995 on the Regulation and Supervision of Private Insurance*]:

  a. Limit of 601.01 euros for medical/hospital attention at unapproved medical centres, no limit at approved centres.
  b. For personal injury: 336,566.78 euros per victim.
  c. For property damage: 96,161.94 euros per loss.

- The limits for losses that took place from 13 February 2001 to 31 December 2007 were as follows pursuant to Real Decreto 7/2001, de 12 de enero, por el que se aprueba el Reglamento sobre la responsabilidad civil y seguro en la circulación de vehículos de motor [*Spanish Royal Decree 7/2001 of 12 January 2001 approving the Implementing Regulations to the Law on civil liability and insurance in respect of the use of motor vehicles*]:

  a. For medical attention, pharmaceuticals, and hospital care: no limit.
  b. For personal injury: 350,000 euros per victim.
  c. For property damage: 100,000 euros per loss.

- The limits for losses that have taken place from 1 January 2008 to the present were and are as follows pursuant to Ley 21/2007, de 11 de julio, por la que se modifica el texto refundido de la Ley sobre responsabilidad civil y seguro en la circulación de vehículos a motor [*Spanish Law 21/2007 of 11 July 2007 on civil liability and insurance in respect of the use of motor vehicles*]:

  a. For medical attention, pharmaceuticals, and hospital care: no limit.
  b. For personal injury: 70,000,000 euros per loss.
  c. For property damage: 15,000,000 euros per loss.

Summary and results

This last section has three subsections presenting the trends for risk exposure, loss rates, and the results obtained.

Section 1: risk exposure statistics, time series for 2001-2020

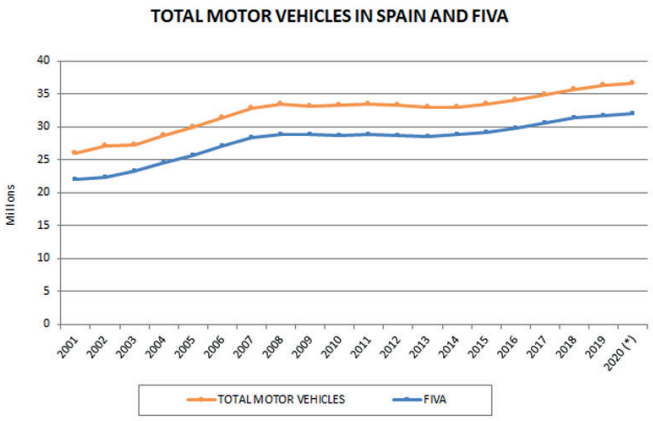
1. Total motor vehicles and FIVA database

Year	Lorries and vans	Coaches	Cars	Motorcycles	Industrial tractors	Trailers and semitrailers	Other vehicles	Mopeds	Total motor vehicles Mopeds included	FIVA
2001	3,949,001	56,146	18,150,880	1,483,442	155,957	454,445		1,806,758	26,056,629	21,958,146
2002	4,091875	56,953	18,732,632	1,517,208	167,014	287,220	212,830	2,044,242	27,109,974	22,408,462
2003	4,188,910	55,993	18,688,320	1,513,526	174,507	306,842	241,354	2,143,593	27,313,045	23,338,997
2004	4,418,039	56,957	19,541,918	1,612,082	185,379	330,933	287,333	2,242,046	28,674,687	24,594,286
2005	4,655,413	58,248	20,250,377	1,805,827	194,206	353,946	339,259	2,311,773	29,969,049	25,747,209
2006	4,910,257	60,385	21,052,559	2,058,022	204,094	380,147	388,597	2,343,124	31,397,185	27,085,809
2007	5,140,586	61,039	21,760,174	2,311,346	212,697	404,859	427,756	2,430,414	32,748,871	28,347,255
2008	5,192,219	62,196	22,145,364	2,500,819	213,366	418,629	436,631	2,410,685	33,379,909	28,839,766
2009	5,136,214	62,663	21,983,485	2,606,674	206,730	412,840	447,363	2,352,205	33,208,174	28,788,437
2010	5,103,980	62,445	22,147,455	2,707,482	199,486	414,673	450,514	2,290,207	33,376,242	28,700,325
2011	5,060,791	62,358	22,277,244	2,798,043	195,960	415,568	459,117	2,229,418	33,498,499	28,913,319
2012	4,984,722	61,127	22,247,528	2,852,297	186,964	410,369	460,196	2,169,668	33,372,871	28,724,457
2013	4,887,352	59,892	22,024,538	2,891,204	182,822	407,847	463,181	2,107,116	33,023,952	28,597,783
2014	4,839,484	59,799	22,029,512	2,972,165	186,060	413,155	475,872	2,061,044	33,037,091	28,801,437
2015	4,851,518	60,252	22,355,549	3,079,463	195,657	426,510	420,734	2,023,211	33,412,894	29,125,792
2016	4,879,480	61,838	22,876,830	3,211,474	207,889	443,598	425,411	1,987,470	34,093,990	29,838,361
2017	4,924,476	63,589	23,500,401	3,327,048	218,154	459,712	435,624	1,961,523	34,890,527	30,613,146
2018	4,980,911	64,905	24,074,151	3,459,722	225,942	474,737	449,614	1,933,445	35,663,427	31,452,863
2019	5,015,973	65,470	24,558,126	3,607,226	232,680	487,823	467,493	1,908,492	36,343,283	31,776,323
2020(*)	--	--	--	--	--	--	--	--	36,660,225	32,023,762
TOTAL 2001-2019	**91,211,201**	**1,152,255**	**410,397,043**	**48,315,070**	**3,745,564**	**7,703,853**	**7,288,879**	**40,756,434**	**610,570,299**	**527,652,173**
% 2019	**14%**	**0%**	**68%**	**10%**	**1%**	**1%**	**1%**	**5%**	**100%**	

Data from the Directorate-General for Traffic and CCS (FIVA).
(*) Provisional data.

In 2019 68% of motor vehicles were passenger cars. That percentage has held steady over the course of the time series considered. The trend in total motor vehicles has been upward except for 2009-2014, when it flattened out.

The difference in the total number of motor vehicles and the total number of insured vehicles on record in the FIVA database has held constant at around 4.4 million vehicles, around 14% of the total. This does not mean that the difference represents uninsured vehicles still in operation in Spain. The basis for tallying the total number of motor vehicles is not exactly the same as the tally in the FIVA database, because the former tally includes vehicles that are no longer in use but have not yet been taken off the registers kept by the traffic authorities.



(*) The figure for the total number of motor vehicles for 2020 is provisional.

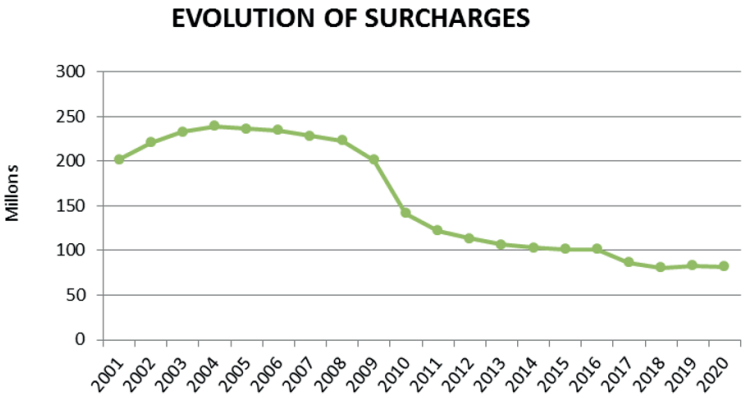
2. Total surcharges collected

In current euros as of 31 December 2020

Year	Amount	% increase up on previous year
2001	201,866,890	16%
2002	220,730,726	9%
2003	232,572,154	5%
2004	238,720,434	3%
2005	236,054,609	-1%
2006	234,247,697	-1%
2007	228,085,841	-3%
2008	222,913,306	-2%
2009	201,281,472	-10%
2010	141,521,069	-30%
2011	121,899,951	-14%
2012	113,408,902	-7%
2013	106,367,990	-6%
2014	102,803,917	-3%
2015	101,181,772	-2%
2016	101,186,323	0%
2017	86,306,121	-15%
2018	80,629,006	-7%
2019	83,211,215	3%
2020	82,045,100	-1%
TOTAL	**3,137,034,493**	

Surchages incurred.

Despite the growth in the number of insured vehicles, the trend for total surcharges for the Guarantee Fund collected by the CCS has been just the opposite. This difference can be accounted for in large part by the successive reductions in the applicable rate, from 3% at the start, to 2% after 1 July 2009, and then to 1.5% from 1 July 2016 to the present. The other factor responsible for the downward trend in the total surcharges is the mean compulsory insurance premium charged by insurers for civil liability for motor vehicle operators.



Section 2: loss rate statistics, time series for 2001-2020

I. Uninsured vehicles

1. Number of claims, indemnities paid out, and mean costs for losses caused by uninsured vehicles paid for by the CCS by year of occurrence

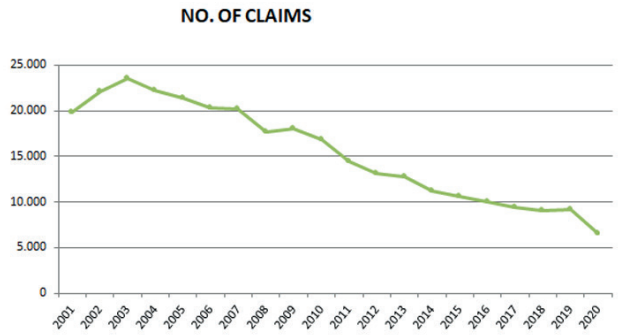
In current euros as of 31 December 2020

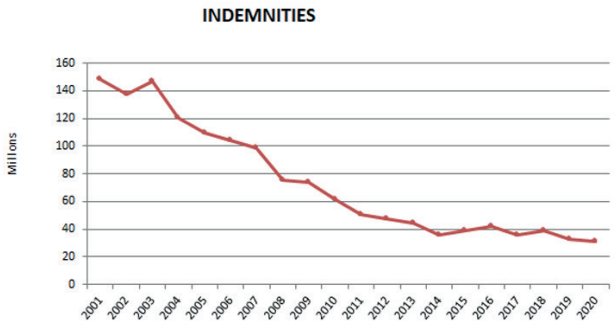
Year	Nº of claims	Indemnities	Mean costs
2001	19,863	148,759,295	7,489
2002	22,072	137,271,515	6,219
2003	23,508	146,637,840	6,238
2004	22,171	120,447,644	5,433
2005	21,429	109,327,077	5,102
2006	20,256	104,134,280	5,141
2007	20,160	98,981,337	4,910
2008	17,634	75,653,185	4,290
2009	18,041	73,892,257	4,096
2010	16,882	61,559,491	3,646
2011	14,429	50,557,697	3,504
2012	13,103	47,406,065	3,618
2013	12,752	44,399,260	3,482
2014	11,220	36,012,736	3,210
2015	10,643	39,199,877	3,683
2016	9,983	42,158,766	4,223
2017	9,379	35,682,427	3,805
2018	9,093	39,242,903	4,316
2019	9,161	32,960,617	3,598
2020	6,583	31,106,332	4,725
TOTAL	**308,362**	**1,475,390,599**	**4,785**

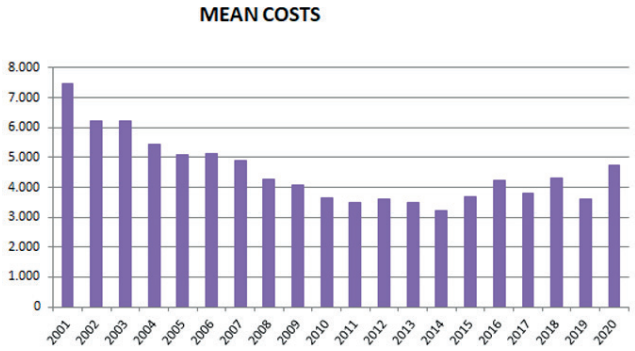
The number of claims and the corresponding amount of compensation paid out have been dropping. This trend holds true even when the number of losses occurring in the period that have not yet been claimed (IBNR, *incurred but not reported*) is added.

Mean costs have gone up since 2015.

These variables have been plotted in the Figures below.







2. Maps showing number of claims, compensation paid out, and mean costs by province, respectively, as is reference to the number of standard deviations from the arithmetic mean, for the time series for 2001-2020. (Red provinces have values above 1.5 standard deviations from the national mean; green provinces have values below 1.5 standard deviations from the national mean, and blue provinces are in between)

Accidents caused by uninsured vehicles take place mainly in Spain's coastal regions and in Madrid, as the first map shows, causing indemnities to be concentrated in those same areas, map two.

The third map plots the distribution of mean costs.

Also, 1.3% of accidents took place outside Spain and represented 1.5% of the total compensation paid out.

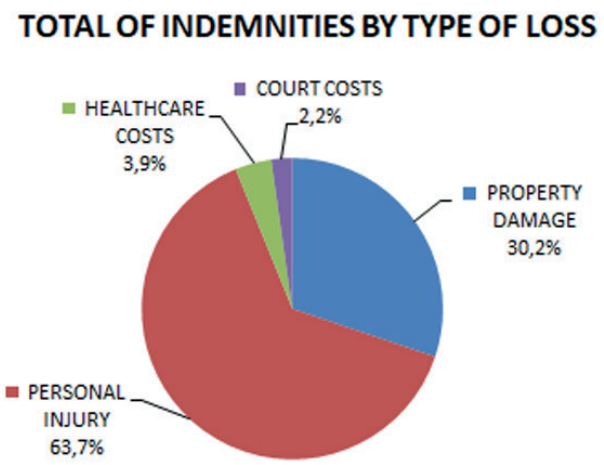
3. Indemnities paid out by year of occurrence and type of loss

In current euros as of 31 December 2020

Year of occurrence	Property damage	Personal injury	Healthcare costs	Court costs	Total
2001	34,712,522	100,405,567	5,316,658	8,324,548	**148,759,295**
2002	37,111,368	90,295,603	4,520,376	5,344,168	**137,271,515**
2003	39,392,383	97,560,654	6,160,858	3,523,945	**146,637,840**
2004	36,001,750	77,556,889	4,173,830	2,715,176	**120,447,644**
2005	34,408,933	68,619,860	4,115,084	2,183,200	**109,327,077**
2006	32,577,552	64,504,370	4,841,945	2,210,413	**104,134,280**
2007	31,244,210	62,197,670	3,489,070	2,050,387	**98,981,337**
2008	26,104,432	46,272,174	2,345,908	930,671	**75,653,185**
2009	24,699,850	45,745,011	2,404,960	1,042,437	**73,892,257**
2010	21,484,009	37,446,961	1,909,485	719,035	**61,559,491**
2011	18,148,374	30,100,020	1,739,199	570,103	**50,557,697**
2012	15,046,130	29,089,857	2,317,144	952,934	**47,406,065**
2013	14,072,367	28,318,834	1,413,434	594,625	**44,399,260**
2014	12,056,385	22,082,982	1,428,460	444,908	**36,012,736**
2015	11,602,968	25,523,559	1,587,799	485,550	**39,199,877**
2016	11,524,390	28,124,765	2,038,233	471,379	**42,158,766**
2017	11,532,455	21,814,970	2,154,534	180,468	**35,682,427**
2018	11,415,084	25,822,722	1,879,651	125,445	**39,242,903**
2019	11,884,078	19,147,413	1,883,940	45,187	**32,960,617**
2020	9,990,569	18,944,643	2,157,054	14,067	**31,106,332**
Total	**445,009,809**	**939,574,524**	**57,877,621**	**32,928,645**	**1,475,390,599**

By type of damage caused, 63.7% of the indemnities paid out or for which provisions were made were personal injuries, with property damage (to vehicles and other property) accounting for the next 30.2%.

The pronounced and sustained decrease in the proportion of court costs in the total amount of indemnities paid out yearly is an effect of the speed with which the CCS is increasingly handling claims for compensation and its focus on achieving negotiated settlements.



II. Unidentified vehicles

1. Number of claims, indemnities paid out, and mean costs for losses caused by unidentified vehicles paid for by the CCS by year of occurrence

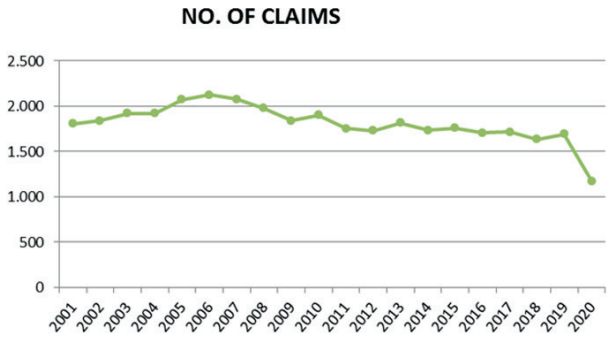
In current euros as of 31 December 2020

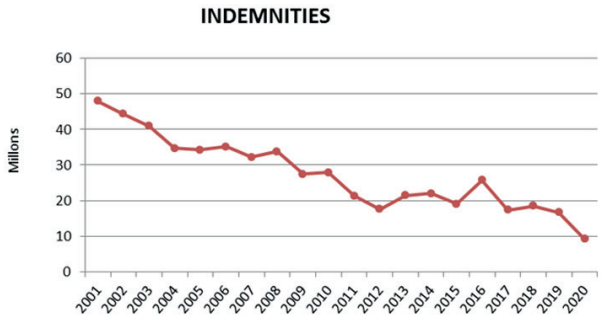
Year	Nº of claims	Indemnities	Mean costs
2001	1,806	48,004,069	26,580
2002	1,839	44,285,178	24,081
2003	1,918	40,879,719	21,314
2004	1,919	34,668,567	18,066
2005	2,074	34,211,277	16,495
2006	2,126	35,100,880	16,510
2007	2,076	32,206,407	15,514
2008	1,976	33,798,565	17,105
2009	1,841	27,452,550	14,912
2010	1,903	27,943,963	14,684
2011	1,751	21,347,421	12,192
2012	1,727	17,578,770	10,179
2013	1,816	21,397,182	11,783
2014	1,735	21,985,805	12,672
2015	1,760	19,004,629	10,798
2016	1,707	25,694,098	15,052
2017	1,717	17,374,366	10,119
2018	1,632	18,490,884	11,330
2019	1,693	16,706,735	9,868
2020	1,172	9,242,369	7,886
TOTAL	**36,188**	**547,373,433**	**15,126**

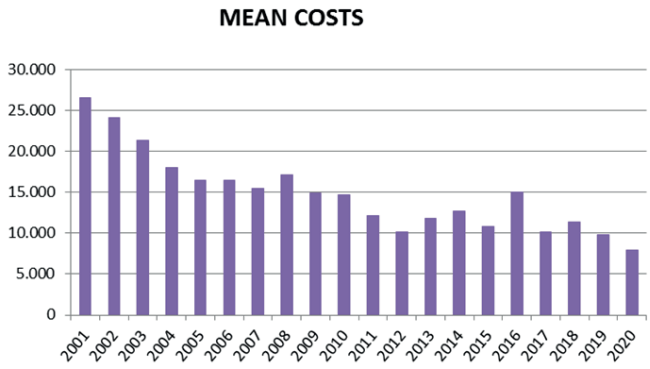
The number of claims for this type of cover can be observed to have held relatively steady, a trend that is even more pronounced when claims incurred but not reported (IBNR) are added, mainly affecting the most recent years in the series. The compensation paid out follows a downward trend, and this too continues when indemnities for IBNR claims are considered.

Accordingly, mean costs have been falling as the years pass by. These costs are particularly high compared with other covers, since in most cases they involve personal injuries. It should be noted that according to the compulsory civil liability insurance Directive, EU Guarantee Funds take responsibility for paying compensation for property damage in accidents caused by unidentified vehicles only when significant personal injuries occur in those accidents. This provision arose from the need to prevent and combat potentially fraudulent claims placed with the Guarantee Fund. Correspondingly, in Spanish law compensation for property damage is payable only when there are personal injuries in the form of death, permanent disability, or temporary disability with hospitalisation for at least seven days.

These variables have been plotted in the Figures below.







2. Maps showing number of claims, compensation paid out, and mean costs by province, respectively, as is reference to the number of standard deviations from the arithmetic mean, for the time series for 2001-2020. (Red provinces have values above 1.5 standard deviations from the national mean; green provinces have values below 1.5 standard deviations from the national mean, and blue provinces are in between)

The first map shows that losses caused by unidentified vehicles take place mainly in Andalusia, the Valencian Community, and Murcia Region, as well as in Madrid and Barcelona, causing indemnities to be concentrated in those same areas, as shown in map two.

The third map plots the distribution of mean costs.

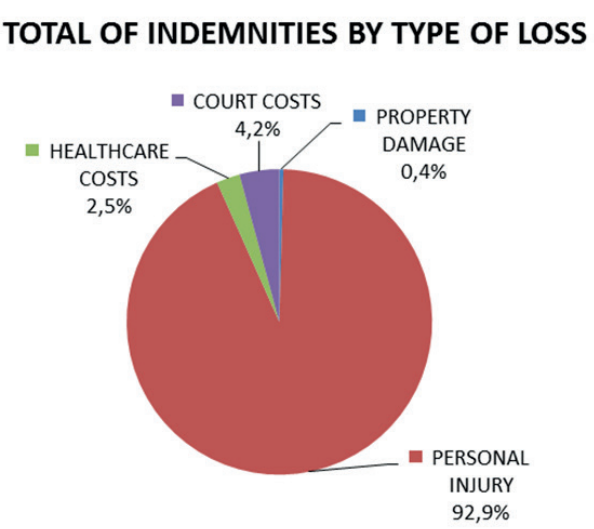
3. Indemnities paid out by year of occurrence and type of loss

In current euros as of 31 December 2020

Year of occurrence	Property damage	Personal injury	Healthcare costs	Court costs	Total
2001	10,824	44,000,083	742,956	3,250,206	**48,004,069**
2002	20,898	39,834,368	661,498	3,768,414	**44,285,178**
2003	26,070	38,493,054	523,951	1,836,644	**40,879,719**
2004	28,282	31,813,586	1,095,154	1,731,545	**34,668,567**
2005	32,741	31,982,262	783,130	1,413,144	**34,211,277**
2006	19,826	32,070,346	1,170,096	1,840,611	**35,100,880**
2007	179,427	29,954,310	607,422	1,465,248	**32,206,407**
2008	260,286	29,981,943	868,446	2,687,892	**33,798,565**
2009	209,191	26,126,077	565,516	551,765	**27,452,550**
2010	277,312	25,879,319	803,419	983,912	**27,943,963**
2011	78,658	20,040,189	444,922	783,651	**21,347,421**
2012	109,815	16,445,604	559,797	463,554	**17,578,770**
2013	110,497	20,016,211	738,642	531,831	**21,397,182**
2014	54,183	20,881,853	529,251	520,518	**21,985,805**
2015	175,615	17,961,599	451,943	415,473	**19,004,629**
2016	326,782	24,283,971	603,901	479,443	**25,694,098**
2017	75,906	16,514,965	602,506	180,989	**17,374,366**
2018	110,138	17,415,278	875,661	89,806	**18,490,884**
2019	121,388	15,832,967	732,393	19,986	**16,706,735**
2020	120,323	8,865,961	255,693	392	**9,242,369**
TOTAL	**2,348,162**	**508,393,947**	**13,616,300**	**23,015,025**	**547,373,433**

By type of damage caused, 92.9% of the indemnities paid out or for which provisions were made were personal injuries. Property damage made up only a small percentage compared to the other damage covers, because indemnities can only be collected when there are significant personal injuries.

This type of activity by the CCS as a Guarantee Fund also displays a decrease in court costs, on the one hand due to negotiated settlement of compensation claims and on the other due to the record of success in court proceedings the CCS has when indemnity proposals are rejected.



III. Stolen vehicles

1. Number of claims, indemnities paid out, and mean costs for losses caused by stolen vehicles by year of occurrence

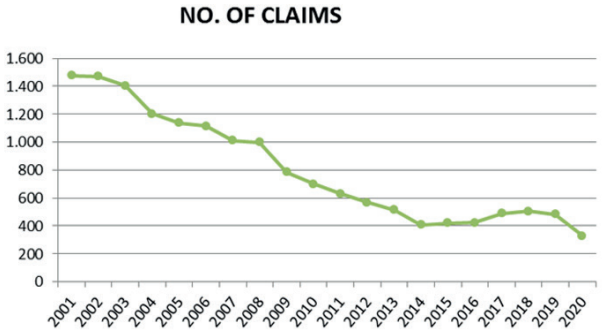
In current euros as of 31 December 2020

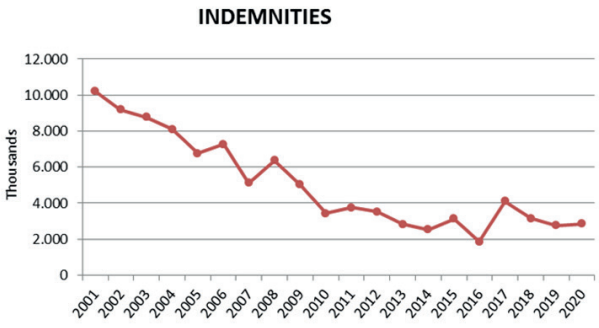
Year	Nº of claims	Indemnities	Mean costs
2001	1,478	10,195,821	6,898
2002	1,469	9,176,865	6,247
2003	1,403	8,773,139	6,253
2004	1,203	8,095,204	6,729
2005	1,138	6,761,369	5,941
2006	1,115	7,274,589	6,524
2007	1,010	5,112,014	5,061
2008	1,000	6,371,028	6,371
2009	786	5,029,739	6,399
2010	698	3,416,361	4,895
2011	631	3,755,732	5,952
2012	568	3,514,183	6,187
2013	513	2,819,671	5,496
2014	408	2,531,512	6,205
2015	420	3,126,584	7,444
2016	424	1,864,700	4,398
2017	489	4,092,506	8,369
2018	504	3,148,166	6,246
2019	481	2,767,940	5,755
2020	328	2,845,252	8,675
TOTAL	**16,066**	**100,672,374**	**6,266**

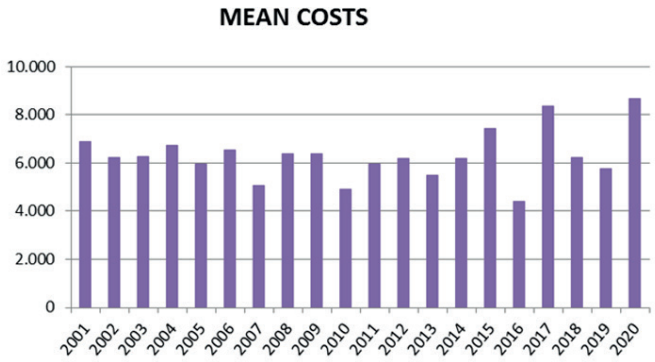
The number of claims and the corresponding amount of compensation paid out for this type of cover have been falling. This trend holds true even when the number of claims filed for losses occurring in the period that have not yet been claimed is added.

Mean costs have held steady.

These variables have been plotted in the Figures below.







2. Maps showing loss occurrence by province, as is reference to the number of standard deviations from the arithmetic mean, for the time series for 2001-2020. (Red provinces have values above 1.5 standard deviations from the national mean; green provinces have values below 1.5 standard deviations from the national mean, and blue provinces are in between)

Accidents caused by stolen vehicles take place mainly in Spain's coastal regions and in Madrid, as the first map shows, causing indemnities to be concentrated in those same areas, map two.

The third map plots the distribution of mean costs.

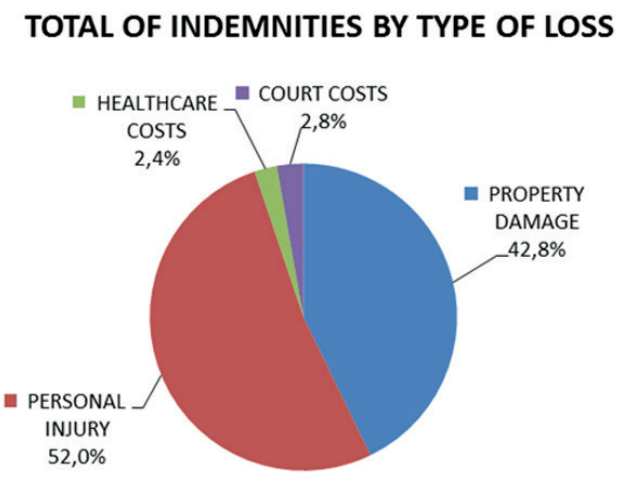
3. Indemnities paid out by year of occurrence and type of loss

In current euros as of 31 December 2020

Year of occurrence	Property damage	Personal injury	Healthcare costs	Court costs	Total
2001	3,677,669	5,597,729	194,538	725,884	**10,195,821**
2002	3,993,093	4,598,264	104,135	481,372	**9,176,865**
2003	3,721,641	4,269,882	379,633	401,983	**8,773,139**
2004	3,660,931	4,039,983	153,884	240,407	**8,095,204**
2005	2,945,793	3,411,907	129,678	273,991	**6,761,369**
2006	3.163.147	3,743,176	136,750	231,515	**7,274,589**
2007	2,670,068	2,268,138	79,807	94,001	**5,112,014**
2008	2,898,912	3,215,325	176,229	80,563	**6,371,028**
2009	2,212,673	2,694,839	76,377	45,850	**5,029,739**
2010	1,932,973	1,276,788	160,149	46,452	**3,416,361**
2011	1,499,315	2,135,718	97,323	23,377	**3,755,732**
2012	1,309,589	2,074,102	123,010	7,481	**3,514,183**
2013	1,275,818	1,440,712	50,489	52,652	**2,819,671**
2014	958,458	1,486,437	57,518	29,099	**2,531,512**
2015	1,055,990	1,897,917	156,196	16,481	**3,126,584**
2016	1,055,230	765,271	35,276	8,924	**1,864,700**
2017	1,324,683	2,684,055	73,181	10,587	**4,092,506**
2018	1,412,031	1,703,025	22,723	10,387	**3,148,166**
2019	1,355,358	1,379,129	29,630	3,822	**2,767,940**
2020	1,021,288	1,652,207	171,757	0	**2,845,252**
TOTAL	**43,144,661**	**52,334,603**	**2,408,284**	**2,784,827**	**100,672,374**

By type of damage caused, 52.0% of the indemnities paid out or for which provisions were made were personal injuries, followed by property damage (to vehicles or other property) accounting for 42.8%.

The same observations made concerning the appreciable decline in court costs in respect of losses caused by uninsured vehicles being driven unlawfully or unidentified vehicles can also be made for this third cover by the CCS.



IV. Vehicles insured by companies being wound up

1. Number of claims, indemnites paid out, and mean costs caused by vehicles insured by companies being wound up by year of occurrence

In current euros as of 31 December 2020

Year	Nº of claims	Indemnities	Mean costs
2001	87	785,048	9,024
2002	79	2,092,963	26,493
2003	62	1,320,827	21,304
2004	79	2,628,306	33,270
2005	92	2,103,240	22,861
2006	154	3,126,512	20,302
2007	303	4,491,471	14,823
2008	829	7,243,542	8,738
2009	3,956	23,683,274	5,987
2010	2,673	7,917,538	2,962
2011	18	250,631	13,924
2012	49	395,371	8,069
2013	21	92,900	4,424
2014	-	-	-
2015	-	-	-
2016	-	-	-
2017	-	-	-
2018	-	-	-
2019	-	-	-
2020	-	-	-
TOTAL	**8,402**	**56,131,623**	**6,681**

The last insurance company offering civil liability insurance for motor vehicles was wound up in 2013.

No plots of the time or geographic distributions or distributions by type of loss have been prepared because the numbers are not significant.

Section 3: summary and results, time series for 2001-2020

I. Risk exposure summary

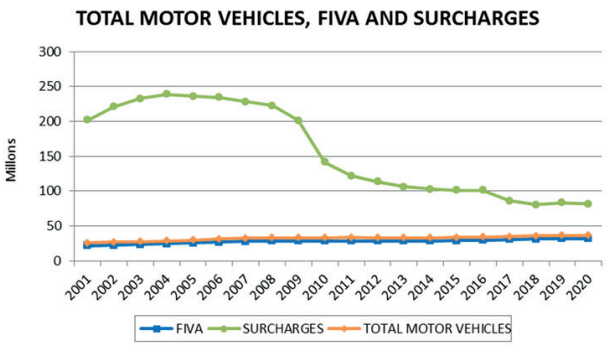
In current euros as of 31 December 2020

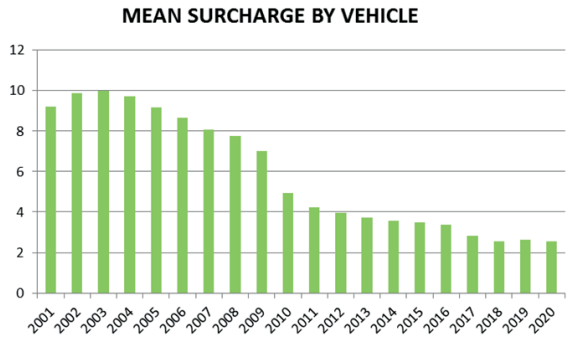
Year	Total motor vehicle	FIVA	Surcharges	Mean surcharge by FIVA vehicle
2001	26,056,629	21,958,146	201,866,890	9.19
2002	27,109,974	22,408,462	220,730,726	9.85
2003	27,313,045	23,338,997	232,572,154	9.96
2004	28,674,687	24,594,286	238,720,434	9.71
2005	29,969,049	25,747,209	236,054,609	9.17
2006	31,397,185	27,085,809	234,247,697	8.65
2007	32,748,871	28,347,255	228,085,841	8.05
2008	33,379,909	28,839,766	222,913,306	7.73
2009	33,208,174	28,788,437	201,281,472	6.99
2010	33,376,242	28,700,325	141,521,069	4.93
2011	33,498,499	28,913,319	121,899,951	4.22
2012	33,372,871	28,724,457	113,408,902	3.95
2013	33,023,952	28,597,783	106,367,990	3.72
2014	33,037,091	28,801,437	102,803,917	3.57
2015	33,412,894	29,125,792	101,181,772	3.47
2016	34,093,990	29,838,361	101,186,323	3.39
2017	34,890,527	30,613,146	86,306,121	2.82
2018	35,663,427	31,452,863	80,629,006	2.56
2019	36,343,283	31,776,323	83,211,215	2.62
2020	36,660,225	32,023,762	82,045,100	2.56
TOTAL	**647,230,524**	**559,675,935**	**3,137,034,493**	**5.61**

The figure for the total number of motor vehicles for 2020 is provisional.

The rising trend in the number de insured vehicles (FIVA) compared with the descending trend in surcharges shows that the mean surcharge per policy has decreased from 9.19 euros per policy in 2001 to 2.56 euros per policy in 2020, values adjusted as of 31 December 2020.

The plots are set out below:





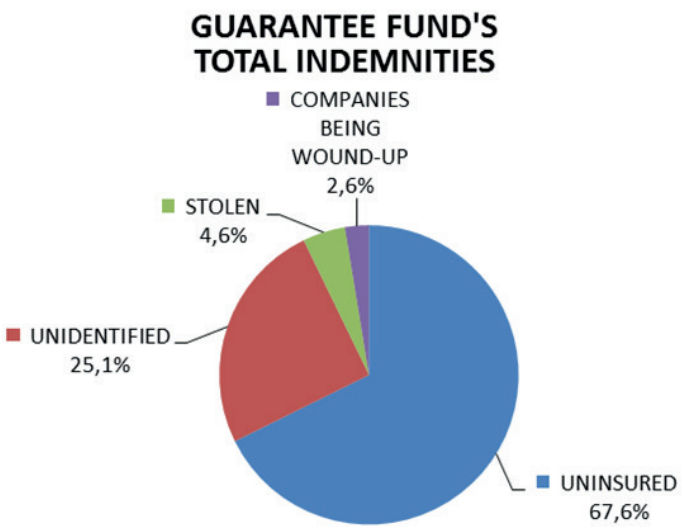
II. Loss rate summary

Guarantee fund's indemnities

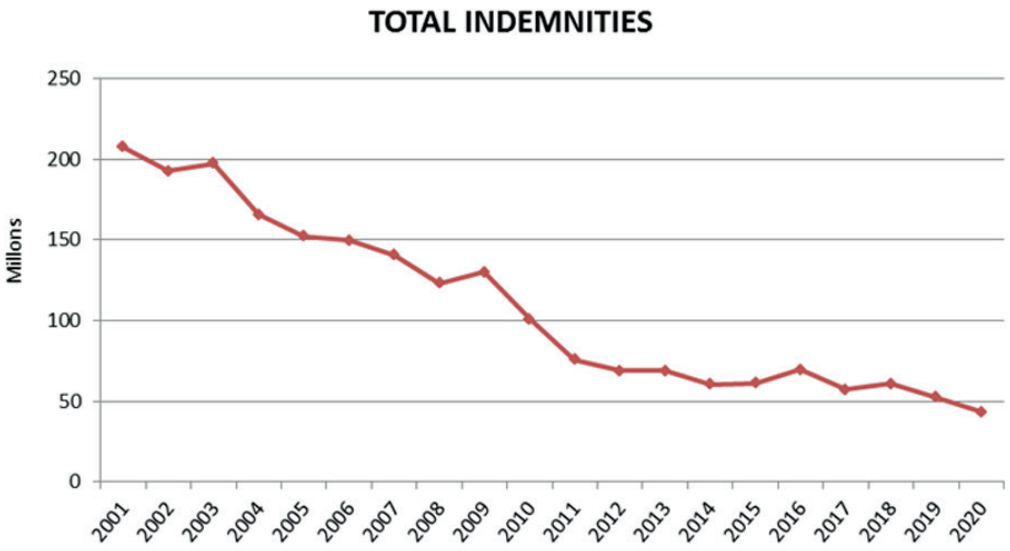
In current euros as of 31 December 2020

Year	Uninsured	Unidentified	Stolen	Companies being wound-up	Total
2001	148,759,295	48,004,069	10,195,821	785,048	**207,744,232**
2002	137,271,515	44,285,178	9,176,865	2,092,963	**192,826,520**
2003	146,637,840	40,879,719	8,773,139	1,320,827	**197,611,524**
2004	120,447,644	34,668,567	8,095,204	2,628,306	**165,839,721**
2005	109,327,077	34,211,277	6,761,369	2,103,240	**152,402,963**
2006	104,134,280	35,100,880	7,274,589	3,126,512	**149,636,261**
2007	98,981,337	32,206,407	5,112,014	4,491,471	**140,791,229**
2008	75,653,185	33,798,565	6,371,028	7,243,542	**123,066,321**
2009	73,892,257	27,452,550	5,029,739	23,683,274	**130,057,821**
2010	61,559,491	27,943,963	3,416,361	7,917,538	**100,837,353**
2011	50,557,697	21,347,421	3,755,732	250,631	**75,911,481**
2012	47,406,065	17,578,770	3,514,183	395,371	**68,894,389**
2013	44,399,260	21,397,182	2,819,671	92,900	**68,709,012**
2014	36,012,736	21,985,805	2,531,512	0	**60,530,052**
2015	39,199,877	19,004,629	3,126,584	0	**61,331,090**
2016	42,158,766	25,694,098	1,864,700	0	**69,717,564**
2017	35,682,427	17,374,366	4,092,506	0	**57,149,299**
2018	39,242,903	18,490,884	3,148,166	0	**60,881,952**
2019	32,960,617	16,706,735	2,767,940	0	**52,435,292**
2020	31,106,332	9,242,369	2,845,252	0	**43,193,953**
TOTAL	**1,475,390,599**	**547,373,433**	**100,672,374**	**56,131,623**	**2,179,568,029**
	67.7%	**25.1%**	**4.6%**	**2.6%**	**100%**

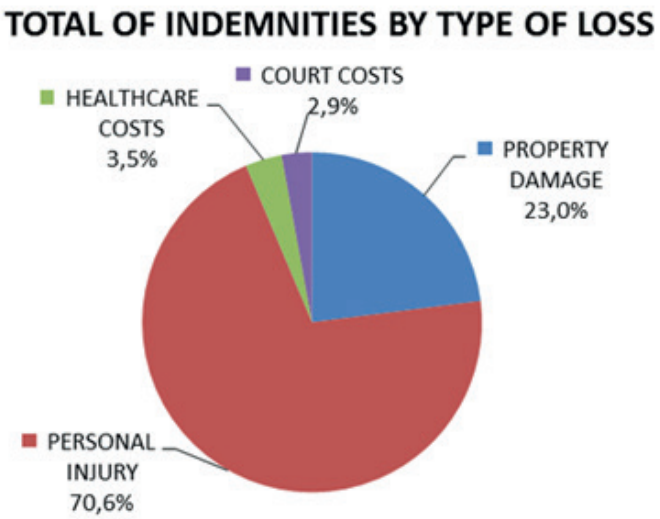
The preceding Table shows indemnities paid out by the Guarantee Fund by type of cover, with payments for uninsured vehicles accounting for the largest share at 67.7% of the total compensation, followed by payments for unidentified vehicles, at 25.1% of pay-outs.



Even including compensation for IBNR losses, the trend is downward.



Total indemnities paid out by the Guarantee Fund are broken down in the following Figure:



III. Results

Year	Loss ratio	Combined ratio
2001	103%	95%
2002	87%	81%
2003	85%	80%
2004	69%	67%
2005	65%	62%
2006	64%	62%
2007	62%	61%
2008	55%	55%
2009	65%	62%
2010	71%	69%
2011	62%	64%
2012	61%	64%
2013	65%	67%
2014	59%	63%
2015	61%	63%
2016	69%	71%
2017	66%	70%
2018	76%	77%
2019	63%	67%
2020	53%	64%
TOTAL	**69%**	**68%**

The first column is the loss ratio between the loss, sums paid out or for which provisions were made for claims filed, i.e., excluding IBNR provisions, and the surcharges charged, broken down by year of occurrence of the loss. The result gives a mean loss ratio of 69%.

The second column combines the IBNR provisions, expenses charged to benefits, operating expenses, and other technical costs less loss recoveries. The mean combined ratio for the time series is 68%.

The Catastrophe Observatory of the Aon Spain Foundation: research, prevention, assistance and continuity

Pedro Tomey
President of the Catastrophe Observatory and Director General of the Aon Spain Foundation

Aon Spain Foundation

The Aon Spain Foundation is a private non-profit foundation established in 2015. Its motto is **"always with people against risk"**, and its primary objective is to help make a better society through its activity in the areas of social integration, art and culture, and catastrophe hazards. It also has an extensive volunteer programme that undertakes initiatives to promote and enhance participation in projects and activities that are related to its objectives.

One of these objectives is research, prevention, assistance and continuity in cases of major natural **catastrophes** that occur in Spain, whether by chance or any other cause, paying special attention to the most disadvantaged groups, providing Aon's knowledge, expertise, resources and volunteers.

Another objective is **social and work integration** for the most disadvantaged people or at risk of social exclusion, through collaborative solidarity projects in multiple areas.

Promoting and disseminating **art and culture** across society and protecting and rehabilitating our natural and cultural heritage are two other objectives of the Aon Spain Foundation, undertaken by designing artistic and cultural activities and providing funding for its implementation and development.

1. Introduction

Disasters occur regularly all over the world, occasionally taking on catastrophic proportions depending on their impact on especially vulnerable populations or on the convergence of particularly unfortunate circumstances. Hurricane Katrina, the Haiti earthquake or the great tsunami in eastern Japan are examples of catastrophes that hold a special place in our collective memory. It is not unusual for both governments and society as a whole to take years to recover and rebuild effectively.

The COVID-19 pandemic is a worldwide non-natural disaster of tragic proportions which, besides the loss of life, has triggered a global crisis over and above health considerations alone, setting off a global shockwave and calling our environmental and socioeconomic systems into question. The pandemic has exacerbated inequalities and has cast us into the most serious worldwide economic recession since 1930. In Spain in 2020, this has meant an 8.7% decline in GDP over the previous year.

But this has not been the only disaster in recent months. Aon's latest annual catastrophe report reveals that there were 416 natural disasters in 2020 with 8,000 fatalities, at least 3,500 of which were caused by protracted monsoons in Asia. Economic losses came to 268 billion dollars, 8% more than the average annual loss in this century, with costs continuing to climb because of the changing climate, populations shifting into areas at risk, and the increase of world wealth. Of that amount, 97 billion dollars were covered by private and public sector insurance programmes, a protection gap (percentage of uninsured economic losses) of 64%.

In addition, 2020 was the second warmest year on record since 1880, with ocean and land surface temperatures + 0.98 °C higher than the twentieth century average. Global warming is aggravated by man's impact on nature, which is acting to speed up climate change, the cause behind the rise in natural disasters, plus deforestation, depletion of the ozone layer, landslides, drought, declining food safety, large shifts in population and the emergence and spread of viruses.

2. The Catastrophe Observatory of the Aon Spain Foundation

The Aon Spain Foundation stands out for its hazard and catastrophe management. We are experts in the field and are able to make a significant contribution to society. We have set up the Catastrophe Observatory for that purpose, as a platform for exchanging experience and lessons learned from disasters that have already taken place, for conducting disaster-related research, taking preventive steps — drawing up guidelines on best practices and useful and effective measures — helping with the recovery of the hardest hit regions and providing aid for the most vulnerable disaster victims.

Climate change is a natural process that is increasingly exacerbated by progress and unrestrained growth. It remains the cause of a large proportion of natural disasters, but it would seem that there is insufficient awareness around the world to convince everyone to behave sustainably and reduce our impact on the environment and on society. The COVID-19 pandemic has in fact been a wake-up call to our lack of awareness of and unpreparedness for unexpected events and the need to build more resilient societies with more highly developed coping capacities.

At the Catastrophe Observatory we are well aware that in order to be able to meet these risks and build a more resilient and sustainable society, it is necessary to put in practice what are known as **the three "Cs": Consciousness-raising, Commitment and Compliance**:

- First, society must become **aware** of the overriding need to take action to stop the harmful effects of climate change, which has had effects highly detrimental to mankind. We need to teach future generations to respect the environment.

- Second, we need **commitment** to solidarity with the most underprivileged to foster currents of public-private cooperation within our society.

- Third, we need to promote a willingness to **comply** with that commitment and act ethically and responsibly, fundamental values of human behaviour.

The Catastrophe Observatory is an instrument of change, a vantage point along the path to change on which science and innovation play leading roles. Aware of our responsibility to society in the performance of the Aon Spain Foundation's mission to build a better, fairer world, at the Observatory we focus on research and scientific and technical progress under our Chair of Catastrophes. At the same time, we also work on disaster prevention through preparedness, seeking responses to their impacts, sustainable solutions to their consequences, and help for those who are most exposed to weather events, ensuring equality and avoiding social exclusion of those least able to cope.

Figure 1. Meeting of the Catastrophe Observatory's Think Tank.

The Catastrophe Observatory's **Think Tank** meets quarterly. Each year it chooses a catastrophe hazard on which to concentrate its activity (Figure 1). Coordinated by the journalist Jesús Martínez de Rioja under my chairmanship, the Think Tank's members are first responders like the Spanish Red Cross — represented by the Head of its Health and Aid Department, Carmen Martín —; the Spanish Military's Disaster Relief Unit [*Unidad Militar de Emergencias* (UME)] — represented by Lieutenant Colonels Jorge Serra Llopart and Daniel González Garrido —; and Spain's Emergency and Civil Protection Agency [*Protección Civil y Emergencias de España*] — represented by its Director General Leonardo Marcos —; along with top-level institutions such as the Spanish Insurer's Association (UNESPA) — represented by its President, Pilar González de Frutos —; Spain's *Consorcio de Compensación de Seguros* (CCS) represented by its Director General, María Flavia Rodríguez-Ponga —; the Spanish Insurance and Risk Management Association [*Asociación Española de Gerencia de Riesgos y Seguros* (AGERS)] — represented by its President, Juan Carlos López Porcel, and by its Executive Secretary, Gonzalo Iturmendi —; the Spanish Resilience Institute [*Instituto Español de Resiliencia* (IER)] — represented by its President, Dr. Rafaela Santos —; Spain's Foundation for the Blind and Disabled [*Fundación ONCE*] — represented by its Universal Accessibility Director, Jesús Hernández-Galán —; the Comillas Pontifical University (ICAI-ICADE) — represented by the Director of the University Institute for Migration Studies (IUEM), Alberto Ares, the Director of the Research Knowledge Transfer Office, Jorge Larena, and the researcher Mercedes Fernández —; the University of Navarre — represented by the Senior Lecturer Leire Labaka and Research Professor Cinta Lomba —; and Aon Benfield Iberia — represented by its CEO, Alfonso Valera.

The Aon Spain Foundation's Observatory brings its knowledge, resources and volunteers to bear on three different aspects: research, preparedness and prevention, when disaster hits, and during the continuity and recovery process.

2.1. Research, preparedness and prevention

Disasters may entail enormous human and economic costs, and anticipating their impact can be of great help when deciding on steps to be taken before they occur in order to mitigate them, by permanently reducing the disaster risk and minimising their impact insofar as possible.

Preparedness and prevention are perhaps the most critical components of catastrophe management and are fundamental to avoid that a natural or man-made event or a potential hazard exert harmful effects on people and property. For preparedness and prevention planning, we start by identifying the hazards, the actual threats faced by a community, and we then assess vulnerability, the community's risk, and its ability to cope with the consequences of a disaster. Based on these analyses, we go on to decide on the most suitable preparedness and prevention strategies.

In terms of preparedness, prevention and resilience-building, in 2016 we established the **Aon Spain Foundation's Chair of Catastrophes**, a ground-breaking initiative in Europe the goal of which is to conduct catastrophe research and studies in a structured, systematic manner.

Classes are held at the Comillas Pontifical University ICAI-ICADE and at the University of Navarre and are the framework for systematically and continuously extending the work carried on by the Observatory into the academic and scientific sphere and a huge step forward in connection with the Foundation's interest in promoting research into events of this kind, systematising and transferring knowledge and helping to create a network of highly qualified professionals who can place their findings at the service of preparedness and prevention, response and mobilisation in crisis situations produced by natural and environmental events and by other hard to control causes.

The Chair of Catastrophes also has an Advisory Council and a three-year Master Plan that picks the subjects of study and research projects and other activities to be carried out, for instance, attending international scientific meetings, training for students and working professionals, visiting researcher positions in Spain and abroad, meetings for information sharing, dissemination on social media and a blog to explain findings.

The Programme's first doctoral thesis was completed at the University of Navarre's Tecnun School of Engineering and published in 2018, entitled ***A framework for public-private-people partnerships in the city resilience-building process***. The second thesis was completed at the Comillas Pontifical University ICAI-ICADE in April 2021 and was entitled ***Socioeconomic variables related to vulnerability and their effect on the characteristics of forest fires in Galicia***. Both thesis earned the grade of excellent and were awarded *cum laude*.

A doctoral thesis on ***Climate change and environmentally forced migrations*** is currently being carried out at the Comillas Pontifical University's Institute for Migration Studies and a fourth is in preparation at Tecnun concerning ***Enhanced resilience of critical urban infrastructure to climate change*** including a ***Taxonomy of predictive tools for catastrophes***.

A further research study was also released by the University Institute for Migration Studies in 2020, on ***Migrations and pandemics: Infectious disease threats in a globalised world***, examining interactions between migratory movements and the spread of infectious diseases and the implications for our country. Last year, Tecnun researchers published a **Manual of lessons learned and best practices for managing pandemics** based on a simulation model explaining the dynamics involved, setting out recommendations to enhance decision-making and resilience in future health emergencies.

The Observatory also created the **José María Sarriegi Science Award** for technical and scientific research in 2018, awarded each year to the best academic research article on catastrophe-related subjects published in a high-impact journal.

The first article to win the prize was *How are cities planning to respond to climate change? Assessment of local climate plans from 885 cities in the EU-28*, published in the *Journal of Cleaner Production* in 2018. The 2020 prize was awarded to *Bi-objective multilayer location-allocation model for the immediate aftermath of sudden-onset disasters*, published in *Transportation Research Part E – Logistics and Transportation Review* in 2019.

This prize is in memory of José María Sarriegi, PhD in industrial engineering, researcher and professor at Tecnun and one of the founders of the Observatory, who died in a sporting accident in 2018. It is a testimony to the personal and professional values exhibited by this extraordinary teacher of engineers, whose integrity, enthusiasm, professionalism and personal stature are and will remain a beacon for many students and professors alike.

2.2. When a catastrophe strikes

Some response measures implemented when a disaster hits include evaluating urgent needs, alleviating suffering, limiting spread, mitigating impact and paving the way to recovery.

When a catastrophe strikes, we at the Catastrophe Observatory act through the Emergency System of the Spanish Red Cross, contributing to its sustainability with material and economic resources and volunteers. This first responder´s Emergency System has proven its ability to intervene and to collaborate in resolving crisis situations and catastrophic emergencies, assuaging human suffering, protecting health and safeguarding the environment.

Precisely because of the importance of intervening at the moment of impact, each year the Observatory awards a **Distinction** for exemplary action in catastrophes, for relevant contributions to the professional values of business and professional institutions and organisations, and for dedication to catastrophe hazards in Spain.

The first Distinction was awarded to the Emergency Immediate Response Teams (ERIES) of the Spanish Red Cross that were engaged in life-saving, evacuation and support for other intervention units during the forest fire that ravaged nearly 5,000 hectares of land on the island of La Palma in Tenerife province, in August of that year. The **2016 Distinction** was awarded for the Teams' decisive action there but was also recognition for the Spanish Red Cross' unparalleled history of disinterested support and humanitarian efforts all over the world. Its organisational model has been emulated outside of Spain.

The **2017 Distinction** went to the Spanish *Unidad Militar de Emergencias* (Military's Disaster Relief Unit) for its exceptional deployment of material and human resources for fighting the forest fires in Galicia in October of that year, which endangered the lives of thousands of people. The scale of that catastrophe required mobilising more than 900 Disaster Relief Unit service personnel and massive logistical support, both on the ground and in the air, to lessen the impact of the fires on the affected inhabitants and regions.

The **2018 Distinction** recognised the Rafa Nadal Foundation (Figure 2), in the person of its founding patron Rafael Nadal, for its role in debris removal and clean-up of the streets, homes and local businesses in Sant Llorenç des Cardassar. That town was one of the areas hardest hit by the floods that followed the torrential rains on the island of Majorca on 9 October 2018, causing thirteen fatalities and requiring the evacuation of more than one hundred inhabitants. Rafa Nadal not only participated in the clean-up effort but also made sizable donations to help the victims and placed the premises of his tennis school, located in the vicinity of the hardest hit town, at the disposal of the people who had been forced to leave their homes.

Figure 2. Awarding the 2018 Distinction to María F. Perelló, Director of the Rafa Nadal Foundation.

The **2019 Distinction** was awarded to the Spain's *Consorcio de Compensación de Seguros* (CCS) for its efficient management of losses suffered and for making substantial resources available to provide indemnities for the damage caused by natural disasters in Spain that year, particularly the devastation caused by the cut-off lows that hit in the last quarter. The CCS is a unique insurance institution in Europe, an international touchstone for the sector and a source of pride for Spain. This entity's track record has been profound and exemplary, and it has always stood out for its agile response in situations of collective misfortune and social distress.

2.3. Continuity and recovery

After the response when a disaster strikes, when a permanent solution has been achieved, comes the recovery and rebuilding phase, in which one of the priorities is to aid the most vulnerable victims and strengthen their resilience, not only in terms of adjusting to the new scenarios and circumstances but also in terms of preparing for future disasters.

The Aon Spain Foundation and the *Instituto Español de Resiliencia* (Spanish Resilience Institute) promote the capacity for resilience, the continuity and recovery of affected areas and their inhabitants, with special concern for the most vulnerable.

3. Symposium: floods, storms, forest fires and earthquakes, climate change and COVID-19

Every year the Catastrophe Observatory holds a symposium that brings together leading specialists to discuss the current status of catastrophe hazards during the year.

Flooding is one of the most significant natural events in Spain, and our country suffers an average of 10 serious floods each year. According to CCS' statistics, this entity paid out indemnities amounting to 4.564 billion euros for flood-related damage between 1987 and 2015. For that reason, the Observatory focused on **"Flooding"** in 2016. The symposium was held at Fundación ONCE (Spain's Foundation for the Blind and Disabled), and speakers included

authorities from the Integrated Management Bureau for the Public Water Supply and Hydraulic Resources [*Subdirección General de Gestión Integrada del Dominio Público Hidráulico*], the Directorate General for Water [*Dirección General del Agua*] of the then Spanish Ministry of Agriculture, Food and Environment [*Ministerio de Agricultura, Alimentación y Medio Ambiente*], the Spanish Red Cross, CCS, and the Fundación ONCE.

The Spanish Red Cross addressed the main actions required during floods (evacuation, supplying basic aid necessities, installing and operating temporary shelters, medical attention and transport and providing drinking water and sewage disposal). Authorities from the city council of San Sebastián explained their city's flood management. The Fundación ONCE discussed protocols for taking action in the case of persons with disabilities in these emergency situations and the main challenges that were faced.

The following year, the Observatory took up the subject of **"Storms and Tempests"**. Its symposium was held at the Comillas Pontifical University in Madrid, and speakers included the Rector, Julio Martínez, a panel of experts from the Spanish Military's Emergency Relief Unit, the Spanish Electrical Grid Authority, CCS, and the universities that host the Chair of Catastrophes.

CCS reported that between 2005 and 2017 seven windstorms caused 454,314 claims, and indemnities totalling 877.27 million euros were paid out. Worldwide, hurricanes and cyclones caused 4.2 billion dollars' worth of damage between 1980 and 2016, only 1.1 billion dollars of which was covered by insurance according to Munich Re Spain.

Coinciding with the European Year of Cultural Heritage, the symposium dealt with **"Forest Fires and Earthquakes"** in 2018 and was held in Lorca (Murcia) in the framework of the International Conference on Cultural Heritage and Disasters.

Lorca provided a practical instance of proper coordination and was a turning point for the Spanish *Unidad Militar de Emergencias* and the Spanish Red Cross. Both first responders spoke on emergency measures, strategic action in the initial stages of these types of catastrophic event, coordinated mobilisation of the responding organisations and responses to meet the needs of victims in potentially changing scenarios.

CCS and Aon Benfield discussed insurance for such catastrophes as earthquakes and forest fires, making special reference to the 2011 Lorca earthquake, the largest earthquake in the CCS' history, which resulted in 33,200 claims and 487 million euros in indemnities. It was noted that to allay and lessen the effects of the substantial insurance gap existing in some countries, the insurance industry was taking steps aimed at greater public-private cooperation in establishing organisations for mitigating catastrophes, creating insurance pools, and implementing measures for preparedness and for improving infrastructure and building quality codes as a means of lowering risk through risk awareness.

Particularly notable was the discussion by Carlos del Álamo, a forestry engineer and former Secretary for the Environment of the Regional Government of Galicia, and Natalí González, a universal accessibility specialist from the Fundación ONCE, on how to reduce the risk from fires due to arson, in view of the high percentage of fires that are set intentionally in Spain (54%), improved mechanisms and strategies for evacuating the disabled during forest fires (the disabled need special training and guidance on how to act during forest fires), and measures to be taken to improve the safety of residents when fighting forest fires and ensure a rapid response.

The fourth symposium was held at the Postgraduate Campus of the University of Navarre in Madrid in 2019, with H.M. the Queen as President of Honour. The topic was **"The effect of climate change on catastrophes"**. Participants included the Spanish Weather Service (AEMET), the Hydrology Research Centre of the Public Works Experimental and Research Centre (CEDEX), Swiss Re, the Spanish Government's High Commissioner for the 2030 Agenda, CCS, the Spanish Military's Emergency Relief Unit, the Spanish Red Cross, the Spanish Insurance and Risk Management Association (AGERS), the Ecology and Development (Ecodes) Foundation, and researchers of the Chair of Catastrophes (Figure 3).

Figure 3. Fourth Catastrophe Observatory symposium on "The effect of climate change on catastrophes", held in November 2019.

AEMET explained that heatwaves were a killer that society was mostly unaware of and presented a series of scenarios in Spain in 2100, e.g., pollutant gases drive temperatures up to 50 °C, with heatwaves lasting from 5 to 30 days or longer, or temperatures holding constant at around 20 °C. The CEDEX predicted growing water shortages in our country.

Cristina Gallach, the High Commissioner for the 2030 Agenda at the time, said that COP25, which was meeting in Madrid a few days after the symposium, would provide "an excellent opportunity for Spanish private enterprises to become more involved in fighting climate change". AGERS regarded climate change as an inescapable challenge to companies that could not be put off and called for Spain to approve a stable regulatory framework for economic development that would make the Spanish economy more competitive.

The Chair of Catastrophes´ researchers noted that there would be more and more "climate refugees" and that "consciousness raising, mitigation and adaptation" were necessary strategies for successfully making critical urban infrastructure more resilient.

The fifth symposium was held at the headquarters of the Spanish Red Cross in Madrid in 2020, and its topic was **"COVID-19: experiences and resilience to future pandemics"**. The actions taken by first responders and the pandemic's impact were discussed on the basis of ethical-healthcare, psychological resilience, social-migratory, industrial, economic, insurance, and legal-regulatory aspects. After the welcoming speech by the President of the Spanish Red Cross, Javier Senent, and the opening address by the Director General of Civil Protection, Leonardo Marcos, the first responders took centre stage. The Spanish Red Cross reported on the outcome of its COVID-19 Response Plan; the Spanish National Association of Civil Protection Volunteer Organisations [*Asociación Nacional de Agrupaciones de Voluntarios de Protección Civil* (ANAV)] spoke about the important role its volunteers played in the pandemic, and the Spanish Military's Emergency Relief Unit reported on the Balmis and Baluarte Operations, carried out during the health emergency.

Figure 4. Fourth Catastrophe Observatory symposium on "COVID-19: experiences and resilience to future pandemics", held in November 2020.

The President of the IER (Spanish Resilience Institute), Dr. Rafaela Santos, spoke on neuroscience and resilience in the age of COVID and the VUCA world (the anacronym for volatility, uncertainty, complexity and ambiguity) and elaborated on the importance of talking about resilience instead of crises.

Health and ethical concerns in the response to COVID-19 were raised by Dr. Fernando García López, Head of the Research Ethics Committee at the National Epidemiology Centre, Carlos III Institute of Health [*Centro Nacional de Epidemiología del Instituto de Salud Carlos III*]. He pointed out that strategies for coping with the pandemic would entail "policies prioritising fairness to balance all sectors, avoiding selective criteria among the health services, protecting those prone to suffer the most from the effects of COVID and taking care of frontline workers".

Jaime de Rábago, Head of the Spanish Engineering Institute's Committee on Industrialisation [*Comité de Industrialización del Instituto de la Ingeniería de España*], asked for a Compact with Industry to build a more competitive, more enterprising and more modern production model.

The President of UNESPA (the Spanish Insurer's Association), Pilar González de Frutos, reported that Spanish insurers set up a fund with 38 million euros for a group policy affording free life insurance coverage to all healthcare workers involved in the fight against COVID in case of death from contracting the disease.

Gonzalo Iturmendi, Executive Secretary of AGERS, spoke on the legal repercussions of the pandemic. He noted that "the reactive rather than proactive response in the field of law is due to a lack of organised risk management that enables firmly addressing events like the pandemic".

Dr. Alberto Ares, Director of the IUEM (Institute for Migration Studies), set out the results of research on *Migrations and Pandemics: Infectious disease threats in a globalised world*, and Dr. Leire Labaka, Senior Lecturer at Tecnun, explained the lessons learned and best practices for managing pandemics contained in the manual they had drawn up based on a simulation model.

4. The cost of disasters in Spain and Storm Filomena

The effect of climate change is unquestionably discernible in the greater frequency and impact of natural disasters and their increasingly more serious consequences. Ascertaining the losses they cause is essential if we are to be able to get a clear idea of the risks and extract the key factors to be taken as a basis for setting public civil defence policy.

With this in mind, in 2021 the Aon Spain Foundation, in cooperation with Spain's Emergency and Civil Protection Agency, is conducting research into the *Cost of disasters in Spain (2015-2020)* and a case study on *Storm Filomena within the COVID-19 pandemic (2021)*, with the participation of the institutional members of the Catastrophe Observatory's Think Tank and the Chair of Catastrophes' researchers.

Furthermore, early in the year, Madrid and a number of other regions in Spain were buffeted by Storm Filomena, a history-making blizzard that sorely tested the emergency response systems contemplated in Spanish Law 17/2015 on the National Civil Protection System [*Ley 17/2015 del Sistema Nacional de Protección Civil*], intended to strengthen the mechanisms for expanding and enhancing operability of the national civil defence system in emergencies and catastrophes. Filomena gave rise to countless incidents and declarations of disaster areas. This has put the capacity to manage the myriad personal injury and property damage claims lodged with government agencies and insurance companies and the system's durability under great strain, with the ensuing administrative procedures.

The cost of the losses brought on by this weather emergency, coming on top of the COVID-19 health crisis, is the subject of a case study focusing on examining convergence and crosscutting involving the storm and the pandemic.

5. The Aon Spain Foundation and the SDGs

The Aon Spain Foundation's mission is to build a better, fairer future based on equality, inclusivity, peace, environmental sustainability and resilience. In carrying out its activities in the context of its three aims, namely, Catastrophes, Social Action and Art and Culture, the Foundation is helping to achieve the United Nations' 2030 Agenda, consisting of 17 Sustainable Development Goals (SDGs) and 169 targets.

The Catastrophe Observatory brings knowledge, resources and volunteers to bear to mitigate the harm caused by disasters occurring in Spain, focusing on the most vulnerable people. We promote health and well-being for all (SDG 3), we have substantial resources available for reducing inequality (SDG 10) and we take action to protect the environment and enhance the planet's sustainability, for instance, through reforestation and the recovery of degraded areas by our volunteers and other third sector organisations we collaborate with (SDG 13 and SDG 17).

SDG 13, "Climate Action", is an opportunity and a responsibility. In this respect, we are a member of the Ecodes Foundation's Comunidad #PorElClima [*Community for Climate Action*], established to speed up climate action by bringing together the different sectors of society that are already battling the crisis and reducing their emissions to attain carbon neutrality by 2050. Furthermore, in 2020 we adhered to the #FundacionesPorElClima [*Pro Climate Foundations*] action and consciousness raising movement and signed the Pacto por el Clima [*Climate Compact*] promoted by the *Asociación Española de Fundaciones* (AEF) [Spanish Association of Foundations]. Its aim is a foundation sector which is active and fosters actively combatting the climate crisis and the inequalities it produces. In addition, I head the Sustainability Committee of Multinacionales por marca España [*Multinationals for Brand Spain*], which promotes actions and makes proposals for contributing to sustainable development and wealth and job creation without jeopardising environmental and social needs.

Figure 5. Activities with Aon Foundation volunteers.

The Chair of Catastrophes works towards sustainable development by promoting sustainable industries, investing in research and scientific innovation (SDG 8), and developing tools that can be used for integration and to adopt the principles of the circular economy (SDG 12) by reducing waste generation and optimising the waste life cycle. Through our scientific and technical research we help make cities more inclusive, safer, more resilient and more sustainable (SDG 11) and promote taking urgent measures to fight climate change and its effects on the environment (SDG 13).

In the framework of our "Social Action" objective, we are working to attain zero hunger (SDG 2) in cooperation with soup kitchens, we support equal, inclusive, quality education for people with different abilities and people at risk of social exclusion and promote learning opportunities for all (SDG 4), and we are involved in numerous cooperative projects to achieve integration in the workplace.

We work with the Spanish Red Cross to face energy poverty (SDG 7) by helping to pay the bills of families in dire circumstances so that they can meet their most essential needs, distributing energy efficiency kits, and holding household savings workshops. Furthermore, to mitigate the digital divide (SDG 9), we donate computing equipment and material to those most in need.

Ensuring that promoting "Art and Culture" and conserving and protecting our natural and cultural heritage (SDG 11) are key elements in sustainable development policies is the only way to guarantee that these policies will be equitable, inclusive, and human-centred. Culture plays a cross-cutting role in all the SDGs and at the same time the environmental, social and economic aspects of sustainable development are part of safeguarding our tangible and intangible cultural heritage and nourishing creativity.

The Aon Spain Foundation helps diminish social inequality by designing inclusion initiatives and by bringing people in a position of vulnerability, at risk of exclusion or with different abilities into contact with art and culture. In an effort to recover the values of our country's cultural roots, we are committed to peace, justice and solid institutions (SDG 16). Culture plays a key role in building peace by promoting knowledge and freedom of thought, which, broadly speaking, help create better informed, more participatory societies through quality education (SDG 4) and exposure to cultural expression.

6. Ethics, research and responsible behaviour in a more resilient, sustainable, and fairer world

The next ten years will be critical. In that time span an urgent priority will be to change the way we view the world and take definite action to stop the effects of climate change and in that way to a large extent keep catastrophes from happening and mitigating the damage they cause to humankind and ecosystems.

The action we take, and the action we take all together, must be ethical, responsible, in the service of the common good and rooted in solidarity; and to be effective, consciousness raising and collective commitment to building a fairer, more sustainable and more resilient world are needed. Only in that way can this be attained.

Ethics is the basis for correct economic, social and political decision-making. In 2020 we learned that a lack of medical resources to combat a global pandemic in combination with massive numbers of victims raises ethical challenges for crisis management. Therefore, understanding the nature of these challenges is crucial both to preventing ethical conflicts and to being able to select the most suitable option when conditions grow dire.

Research too is key, because more effective, accessible use of scientific findings and past experiences will contribute enormously to our handling of disasters at the preparedness and prevention, response and recovery stages.

The planet also needs a change in **individual behaviour**, not just to create communities that are more resilient to catastrophes but to be able to take the most appropriate decisions, practice responsible consumption, reduce greenhouse gas emissions and become agents of change and thus contribute to sustainable development while teaching future generations to respect the Earth and its inhabitants.

We must conduct ourselves responsibly and ethically, and we need to be prepared and to be capable of reacting to adversity quickly, sustainably and effectively in a manner rooted in solidarity, because only in that way will we be able to become more resilient. The decisions we take today may diminish tomorrow's vulnerabilities, facilitate future responses to the unpredictable and help build a more resilient, sustainable and fairer world.

Volcanic risk management in Spain

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1. Introduction: Volcanism in the Canary Islands, hazards and eruption history

Although volcanic activity in Spain is not only present in the Canary Islands, the Directriz Básica de Planificación de Protección Civil ante el Riesgo Volcánico en España [*Basic Civil Protection Planning Guidelines and Volcanic Risk in Spain*] approved by the Council of Ministers on 19 January 1996 (BOE [*Official Spanish Government Gazette*], 1996) describes the Autonomous Region of the Canary Islands as the only region in the territory of Spain that is exposed to volcanic risk.

The origin of volcanism in the Canary Islands has been the source of intense debate over the past 50 years, but the theory most widely accepted by the scientific community is that Canary Island volcanic activity is linked to the presence of a deep thermal anomaly inside the Earth (lower mantle) capable of building and continuing to build these island volcanic systems. Simple spatial analysis of the age of the oldest subaerial rocks making up each of the island volcanic systems reveals a declining trend in the age of these rocks from the easternmost to the westernmost islands, with the older subaerial rock that is youngest in age located on the islands of La Palma and El Hierro (Carracedo J.C. *et al.*, 1998). Furthermore, current emission levels of helium-3, the best indicator of underground magmatic activity volcanologists have, also exhibit a clear spatial distribution in the Canary Island volcanic systems, rising from the easternmost to the westernmost islands, with the highest helium-3 emission levels on the islands of La Palma and El Hierro (Pérez N. M. *et al.*, 1994). The combination of these two trends or progressions, one downward (rock age), the other upward (helium-3 emissions), from the easternmost to the westernmost islands suggests that the western part of the island chain is the part of the Canary Islands with the strongest connection to the deep thermal anomaly (Figure 1) and hence that it is the region in the archipelago most likely to experience future volcanic eruptions.

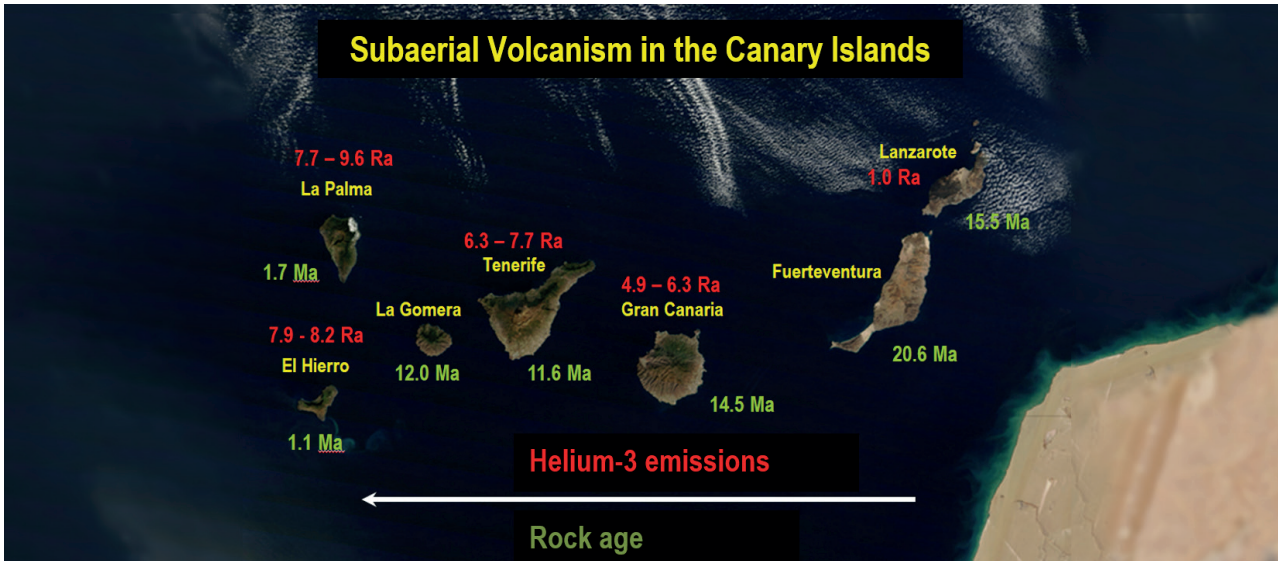

Figure 1. Spatial distribution of the oldest subaerial rock age and helium-3 emission levels in the volcanic systems in the Canary Islands.

Although volcanic activity in Spain is not only present in the Canary Islands, the Directriz Básica de Planificación de Protección Civil ante el Riesgo Volcánico en España [*Basic Civil Protection Planning Guidelines and Volcanic Risk in Spain*] approved by the Council of Ministers on 19 January 1996 (BOE [*Official Spanish Government Gazette*], 1996) describes the Autonomous Region of the Canary Islands as the only region in the territory of Spain that is exposed to volcanic risk. This assertion is clearly borne out by the 16 recorded eruptions that have taken place in the Canary Islands since the fifteenth century (Table 1) in four of the seven principal island volcanic systems located there (Figure 2), the most recent being the one that took place on the submarine slope of the El Hierro island volcanic system, the Tagoro eruption of 2011-12 (Romero C., 1990; Romero C., 2000; Romero C. *et al*., 2009; Pérez N.M., 2015). Therefore, while the Canary Islands are exposed to a number of different natural hazards, the volcanic hazard is the central natural hazard faced by that Autonomous Region and the risk that sets it apart from the rest of Spain (Sansón Cerrato, 1995).

#	Eruption	Island system	Date	Duration (days)
1	Tacande	La Palma	1430-1447	?
2	Christopher Columbus*	Tenerife	1492	?
3	Boca Cangrejo	Tenerife	S. XVI	?
4	Tehuya	La Palma	1585	84
5	Tigalate	La Palma	1646	82
6	San Antonio	La Palma	1677-1678	66
7	Siete Fuentes-Fasnia-Arafo	Tenerife	1704-1705	71
8	Arenas Negras	Tenerife	1706	40
9	Charco	La Palma	1712	56
10	Timanfaya	Lanzarote	1730-1736	2,055
11	Chahorra o Narices del Teide	Tenerife	1798	99
12	Tao-Nuevo del Fuego-Tinguatón	Lanzarote	1824	86
13	Chinyero	Tenerife	1909	10
14	San Juan	La Palma	1949	47
15	Teneguía	La Palma	1971	24
16	Tagoro	El Hierro	2011-2012	145

* The volcanic eruption on the island of Tenerife described by Christopher Columbus (actual location unknown).

Table 1. List of the 16 recorded historical eruptions in the Canary Islands.

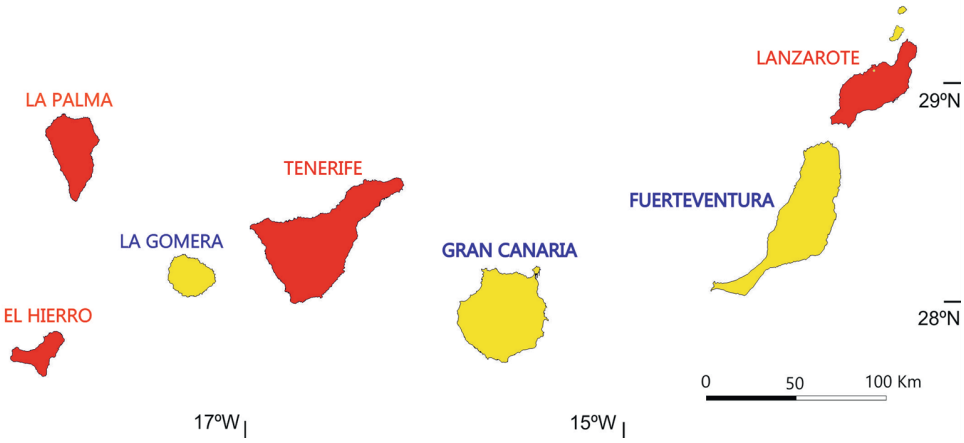

Figure 2. Eruptions in the Canary Islands have been recorded in the island volcanic systems of La Palma, Tenerife, Lanzarote, and El Hierro.

Some publications have made reference to other historical eruptions in the Canary Islands, such as the eruption of Lomo Negro on the island of El Hierro, which may have occurred in 1783. However, that eruption, like some others that have sometimes also been included as historical, is not supported by any documentary records. For an eruption anywhere in the world to be classified as historical, the volcanic event must be recorded by some sort of documentary reference, either written and/or graphic reports attesting to the incident.

Historically, eruptions in the Canary Islands have mainly been basaltic fissure eruptions with low volcanic explosivity index (VEI) values. Therefore, the volcanic hazards associated with eruptions of this kind have mainly been lava flows, pyroclastic falls, both ballistic projectiles and ash cloud dispersion, volcanic gases, volcanic earthquakes, and lahars or mudflows. On the other hand, in the geological past the Canary Islands have also been witness to eruptions with higher volcanic explosivity index values and catastrophic processes that have left traces of more extreme volcanic hazards on the land, for instance, pyroclastic flows, pyroclastic falls associated with explosive eruptions, landslides, and volcanic tsunamis. These larger-scale, more catastrophic phenomena have longer return periods than smaller-scale events (Figure 3).

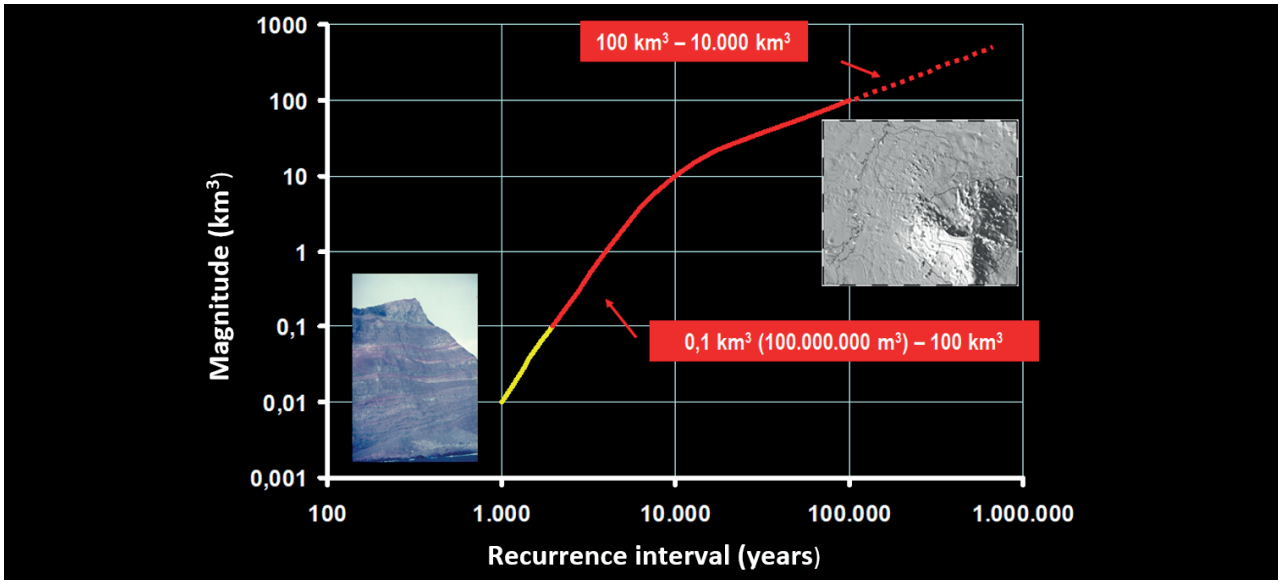

Figure 3. Magnitude and recurrence interval for volcanic hazards associated with landslides.

2. Probability of future eruptions in the Canary Islands

Volcanism is inherently complex because of the geological characteristics of planet Earth. Concatenation of deep magma generating processes, the rise of magma to the surface, its accumulation in magma chambers, and eruptions are highly complex. One obvious expression of that complexity is the great range of different volcanic phenomena across our planet, more specifically, the high variability in the frequency of volcanic eruptions. Some volcanoes are in a virtually non-stop process of eruption, like Mount Stromboli in Italy, and conversely some volcanoes may lie dormant for centuries before erupting again, like Mount Pinatubo in the Philippines, which awakened in 1991 after a centuries-long period of calm, resulting in one of the most catastrophic eruptions of the twentieth century. Because of this complexity, at the present time long-term deterministic prediction of volcanic eruptions is unfeasible. For this reason, statistical analysis is the only valid scientific tool. From a physical and mathematical standpoint, the complexity of volcanism finds expression in its pronounced non-linearity. In other words, small variations in the interior of the Earth are capable of bringing about relevant changes in volcanic activity at the surface. As a result, eruptions in most volcanoes are marked not by regularity but by the converse, and a volcano may experience eruptions in the span of just a few years and then lie dormant for scores of years. It has been possible to develop statistics that fit the special characteristics of certain individual volcanoes. However, for most volcanoes detailed statistical analysis is not possible because of the small number of eruptions that have been able to be precisely dated. In this respect, studies performed on a worldwide scale have indicated that, on average, for the approximately 1,500 volcanoes on planet Earth, the interval between one eruption of a volcano and the next by that same volcano follows a Poisson distribution. That is to say, according to this model, a volcano has no memory of its history after an eruption, and the interval to the next eruption depends only on one specific factor, the mean interval between one eruption and the next. For volcanoes with a historical record like those in the Canary Islands, that factor can be calculated directly. The probability of occurrence of an eruption for an interval ΔT, where T is the mean interval, can be calculated using the formula:

$$P(\Delta T) = 1 - e^{-\frac{\Delta T}{T}}$$

For example, according to the historical record, the Cumbre Vieja volcano on La Palma has erupted seven times in the past 600 years, which yields a mean interval of 85.7 years between eruptions. According to the preceding formula, the probability that the Cumbre Vieja volcano will erupt in a time window of 50 years is 44.2%. Table 2 lists the probabilities that an eruption will take place in the Canary Islands as a whole and on some of the islands in the group over different time intervals. In addition to giving the probabilities for the volcanic systems on the islands of La Palma and Tenerife, which have undergone an appreciable number of recorded eruptions, the Table also gives the probability for systems like that of Grand Canary Island, which has not experienced any eruption during the historical period but has been the site of twenty-odd eruptions over the past 10,000 years.

	5 years	10 years	50 years	100 years	500 years
Canary Islands	12.5%	23.4%	73.6%	93.1%	100.0%
La Palma	5.7%	11.0%	44.2%	68.9%	99.7%
Tenerife	4.9%	9.5%	39.4%	63.2%	99.3%
Grand Canary	1.1%	2.2%	10.3%	19.6%	66.4%
Fogo	25.1%	43.8%	94.4%	99.7%	100.0%

Table 2. Probability of future eruptions in the Canary Islands and Fogo (Cape Verde) over different time windows.

The probabilities of a future eruption of the Pico do Fogo volcano, an island volcanic system in the Cape Verde islands quite similar to those in the Canary Islands geologically but with more frequent eruptions, have also been listed for comparison.

3. Is volcanic risk increasing in the Canary Islands?

Volcanic risk is a sensitive area of civil defence that compromises, or may very well compromise, calamitously people's lives and personal safety and the welfare of their property and the collective heritage. Regarding that risk, the recent geological history of the Canary Islands has demonstrated that these islands have been the site not only of volcanic eruptions with low explosivity index values but also of eruptions with moderate to high explosivity index values.

Distinguishing between the concepts of danger and volcanic risk, it is to be noted in this respect that at the present time, volcanic risk in the Canary Islands is greater than several decades ago because currently there are more people and greater economic development exposed to volcanic events (Figure 4).

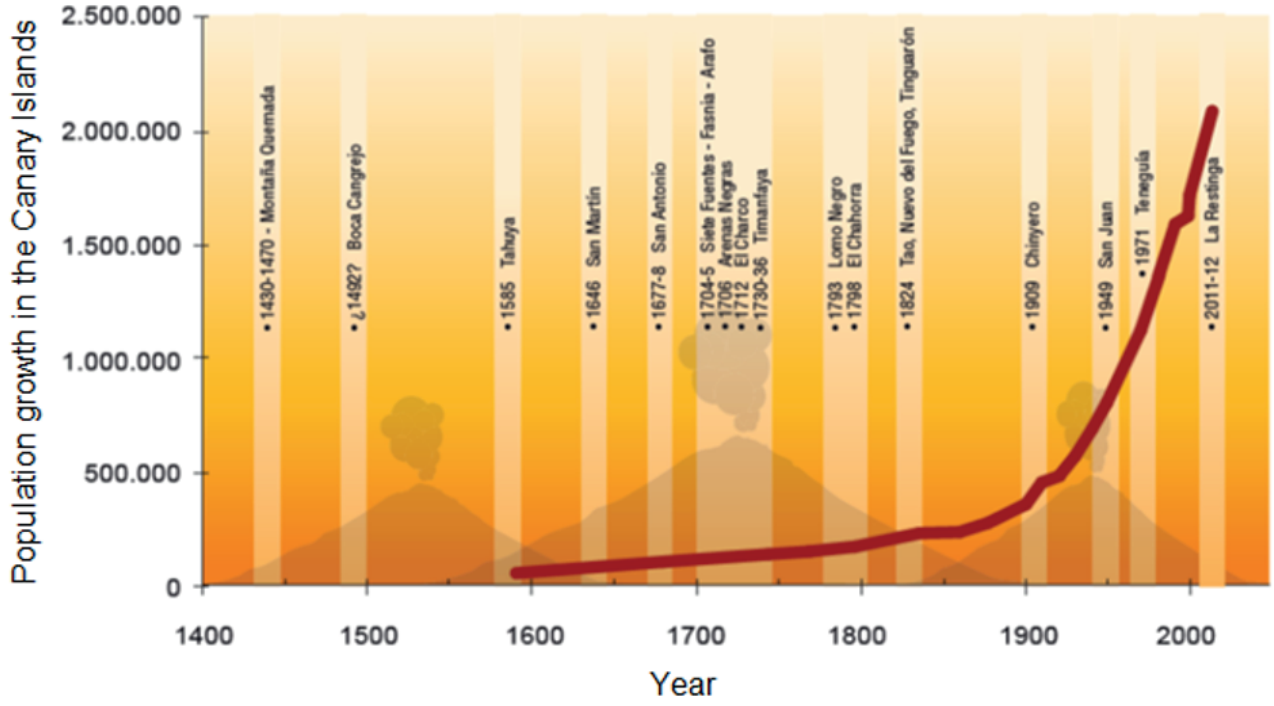

Figure 4. Population growth in the Canary Islands and historic eruptions since the fourteenth century.

Figure 5 depicts an image of the extent of lava flows from the Arafo eruption in 1705 projected onto an aerial photograph of the Güimar Valley in the present day. That eruption lasted 54 days (2 February 1705 – 27 March 1705) and was part of the triple eruption of the Siete Fuentes-Fasnia-Arafo volcanoes that took place at the end of 1704 and beginning of 1705. Had this eruption taken place not in 1705 but today, the lava flows would have devastated the entire main population centre of Güimar. This hypothetical scenario clearly shows why volcanic risk is on the rise in the Canary Islands, namely, because population growth in the Canary Islands has resulted in expansion over more territory.

The property damage caused by historic eruptions in the Canary Islands depended on the impact of the different volcanic hazards associated with those eruptions. Homes, infrastructure, and farmland were destroyed by the effects of the lava flows. Plant cover and farmland were damaged and destroyed by pyroclastic falls. There were landslides, flows in watercourses decreased, rooftops caved in, and buildings collapsed from the seismic activity linked to the eruptions.

Turning to the loss of human life, historic eruptions in the Canary Islands have caused the deaths of at least 24 people; certain historical documents mention the loss of human lives but do not give a number (Table 3). It is noteworthy that 16 of the 24 lives lost were associated with volcanic earthquakes that took place during the Siete Fuentes-Fasnia-Arafo eruption in 1704-05. The rest of the fatalities were caused by volcanic gases, posteruptive lahars, and even volcanic ash falls.

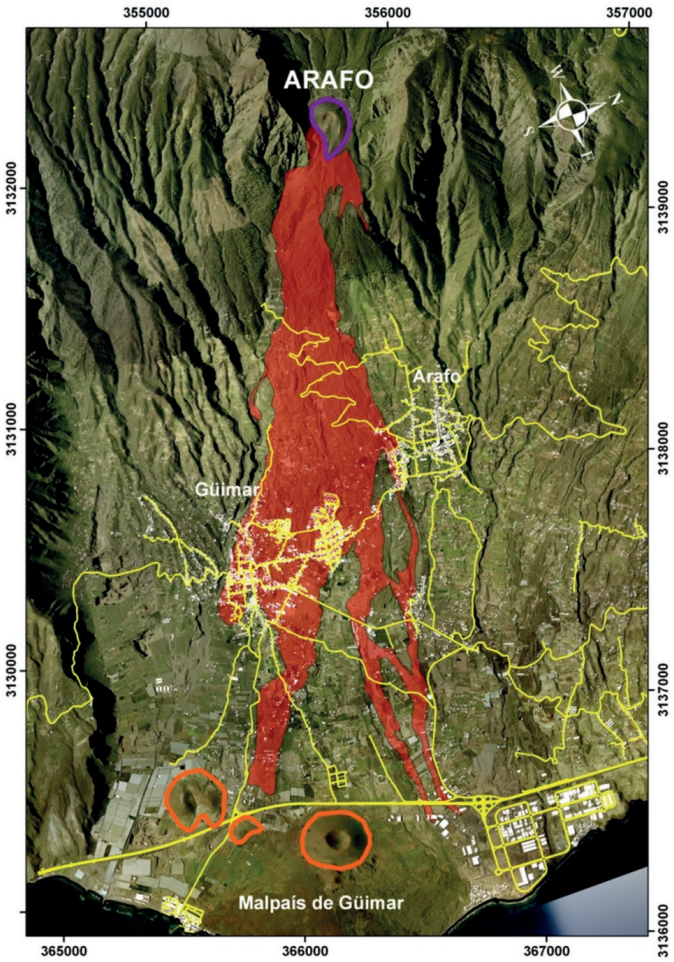

Figure 5. Map illustrating the extent of lava flows from the Arafo eruption in 1705.

Eruption	Year	No. of victims	Cause
Tehuya	1585	Multiple	Noxious gases
		Number not reported	Associated with falling ash
San Antonio	1677-78	3	Cause not reported
		1	Noxious gases
Arafo-Fasnia-Siete Fuentes	1704-05	16	Volcanic earthquakes
Timanfaya	1730-36	1	Cause not reported
San Juan	1949	1	Missing
		Number not reported	Posteruptive lahars
Teneguía	1971	2	Noxious gases
TOTAL		**24**	

Table 3. Number of victims caused by historical eruptions in the Canary Islands.

The "GeoMEP – Modelo de Evaluación de Pérdidas por Peligros Geológicos. Aplicación al Caso de las Islas Canarias [*Model for Assessing Losses from Geological Hazards. Application to the Canary Islands*]" study, prepared by the Spanish Geological Survey [*Instituto Geológico y Minero de España* (IGME)] and published by the Consorcio de Compensación de Seguros (CCS), shows that the volcanic hazard is unquestionably the risk that could have the greatest economic impact on the Canary Islands, as compared to such other natural hazards as floods and earthquakes. Looking specifically at the case of Tenerife, with a probability less than or equal to 0.2% per year, the sums insured against damage from lava flows could come to some 5.5 billion euros. Another 2.5 billion euros in further losses would lack insurance coverage (Llorente Isidro M., 2015).

4. Awareness of volcanic risk by Canary Island society

Even though Basic Civil Protection Planning Guidelines and Volcanic Risk in Spain have been in place since 1996, awareness of the volcanic hazard and of the steps to be taken to reduce or mitigate volcanic risk by the citizens of Spain is low and insufficient. There is much and varied evidence to that effect.

There may be a range of causes for the low awareness of the volcanic hazard in Spain, chief among which could be (a) Spanish society's short memory concerning natural phenomena of this kind because of the relatively low frequency of volcanic eruptions during the past 600 years; (b) disinformation that historic eruptions in the Canary Islands have caused no loss of human life spread in society by certain sectors; (c) the idea that the most likely volcanic scenario in the Canary Islands (basaltic fissure eruptions) does not pose a substantial risk to inhabitants, because in the past (the last 600 years) natural events of this type have not caused large numbers of human fatalities, overlooking the fact that population density and land use today are much greater than before; (d) the belief by some scientists, and communication of that belief to society, that volcanic eruptions in the Canary Islands are and will be quiet, ignoring the fact that that term should never be used to describe any deleterious natural phenomenon, however small in size it may be and however minor its potential effects may be; (e) the belief that future volcanic eruptions in the Canary Islands will only be like the ones that have occurred in the past 600 years, overlooking the fact that more dangerous eruptions have taken place in the islands in the recent geological past (the last 10,000 years); and (f) conflation of the concepts of danger and volcanic risk and the probability of occurrence of an eruption event.

5. Future challenges to reduce volcanic risk in the Canary Islands

Society faces a number of challenges to lower the volcanic risk in the Canary Islands. Based on the preceding discussion, these include: (1) fulfilling unanimous calls by the legislature for the Instituto Volcanológico de Canarias (INVOLCAN) [*Volcanology Institute of the Canary Islands*] to bring together all public efforts to optimise scientific volcanic risk management; (2) putting in place the necessary legislative mechanisms to provide ongoing funding to strengthen research for lowering volcanic risk in the Canary Islands; (3) improving assessments of the economic costs posed by volcanic risk in the Canary Islands in the next 50 years; (4) carrying out regular information and educational campaigns concerning volcanoes and management of volcanic risk in the Canary Islands for both residents and tourists to help break the equivalence volcano = alarm and instead reinforce the message volcano = alert + opportunities; and lastly, most probably one of the most important challenges, designing and strengthening a solid programme of communications regarding volcanic risk management.

5.1. Communication and volcanic risk management

Suitable communication among all organisations, institutions, and private parties interested in volcanic risk management is vital to be able to reduce disaster risk. The importance of this type of communication has been

gaining recognition over the past 20 years, and it is an integral part of volcanic emergency response planning in the advanced countries (Solana C. *et al*., 2017).

Our understanding of what comprises suitable communication has changed from its merely being a one-way flow of information to its being a participatory process with room for the opinions of all stakeholders and interested individuals and for listening to and considering their points of view.

From a scientific standpoint, this communication includes preparing all parties affected by volcanic risk, from the authorities in charge, to responders and the media (including social networks), and to other stakeholders like non-governmental organisations (NGOs), companies and businesses, educators, and the general public, in advance of an emergency. Proper handling of communication and information expectations ahead of an emergency is crucial to the successful handling of a volcanic crisis.

Planning and scientific information management during an emergency should include not only a consensus among all the parties making up the scientific committee concerning the information to be released to key groups (e.g., the people in charge of the emergency, the mass media, and the general public). It should also specify the most suitable format for each of those groups and methods to ensure that the message and its consequences have been understood. This entails arranging, in parallel to the response plan, a specific information plan for each key group in the emergency, at least one for the group in charge and the action group and another for the media. It is critically important for that information plan to have been agreed to by all the groups in advance and for it to comprise the information of interest to each group, the amount and the frequency of release of the information, the information format, and a verification and response mechanism. The globalised nature of the population and information today further requires taking into account the languages of the permanent local residents and the transient population (tourists) and issuing announcements to the international press.

References

- Allard P. y 115 firmas adicionales de la comunidad científica nacional e internacional (2005). El Instituto Volcanológico de Canarias (IVC): una tarea inaplazable. EL DIA, 1 de diciembre, p. 34.
- Araña V., Carracedo J.C., Ortiz R., Viera R. (2001). Canary Islands: volcanic surveillance network. I Asamblea Hispano Lusa de Geodesia y Geofísica, pp.1-6.
- Araña V. (2010). La volcanología española una perspectiva histórica. Aportaciones Recientes en Volcanología 2005-2008, pp. 17-28.
- BOC (2010). Plan Especial de Protección Civil y Atención de Emergencias por riesgo volcánico en la Comunidad Autónoma de Canarias (PEVOLCA), BOC Nº 140. Lunes 19 de julio de 2010 – 4147.
- BOC (2018). Nuevo Plan Especial de Protección Civil y Atención de Emergencias por riesgo volcánico en la Comunidad Autónoma de Canarias (PEVOLCA), BOC Nº 154. Jueves 9 de agosto de 2018 – 3785.
- BOCG (2005). Sobre el Instituto Volcanológico de Canarias. Boletín Oficial de Las Cortes Generales, Senado, VIII Legislatura, Núm. 59, pp. 3275-3279.
- BOCG (2009). Sobre el Instituto Volcanológico de Canarias. Boletín Oficial de Las Cortes Generales, Congreso de los Diputados, IX Legislatura, Núm. 443, pp. 2-5.
- BOE (1996). Directiva Básica de Planificación de Protección Civil ante el Riesgo Volcánico. Boletín Oficial del Estado, nº 55, 4 de marzo de 1996.
- BOPC (2006). Sobre la creación del Instituto Volcanológico de Canarias. Boletín Oficial del Parlamento de Canarias, VI Legislatura, nº 65, pp. 8-9.
- Carracedo J. C., García M., Jiménez M. J., Pérez N.M. (1992). El riesgo volcánico en España. 1er Congreso Iberoamericano sobre Técnicas Aplicadas a la Gestión de Emergencias sobre Riesgos Naturales. Valencia, pp. 4.
- Carracedo J.C., Day S. J., Guillou H., Rodríguez Badiola E., Canas J. A. and Pérez Torrado F. J. (1998). Hotspot volcanism close to a passive continental margin: the Canary Islands. Geol. Mag., pp. 135, 441-591.
- FECAI (2014). La Fecai solicita la creación del Instituto Volcanológico de Canarias. https://www.eldiario.es/canariasahora/lapalmaahora/canarias/fecai-instituto-volcanologico-creacion-riesgo_1_4932127.html
- Fernández Navarro L. (1911). Erupción volcánica del Chinyero (Tenerife), en noviembre de 1909. Anales de la Junta para la Ampliación de Estudios e Investigaciones. Tomo V. Memoria 1ª. Madrid, pp. 99.
- Fuster J. M., Cendrero A., Cariacedo J. C., Herraiz M., García O., Sánchez M., Benito F., y Serrano T. (1985). La catástrofe de Colombia. Cuadernos de Protección Civil, Noviembre-Diciembre, pp. 9-12.
- Llorente Isidro M. (2015). GeoMEP. Modelo de evaluación de pérdidas por peligros geológicos. Aplicación al caso de las Islas Canarias. Consorcio de Compensación de Seguros (ed.) e Instituto Geológico y Minero de España. 151 figuras, 44 tablas. 151 figuras, 44 tablas. NIPO: 720-15-133-1; Depósito Legal: M-34018-2015.

- Pérez N.M., Wakita H., Nakai S., Sano Y. and Williams S. N. (1994). 3He/4He isotopic ratios in volcanic-hydrothermal discharges from the Canary Islands, Spain: Implications on the origin of the volcanic activity. Mineral. Mag. 58, pp. 709–710.

- Pérez N. M. (2015). The 2011-2012 El Hierro submarine volcanic activity: a challenge of geochemical, thermal and acoustic imaging for volcano monitoring. Surtsey Research, 13, pp. 55-69.

- Pérez N. M. and Schmincke H.-U. (2016). Science development on volcanology flawed by the Spanish IGN. Geophysical Research Abstracts, Vol. 18, EGU2016-10379.

- PAIV-Tenerife (2020). Plan de Actuación Insular frente al Riesgo Volcánico de la isla de Tenerife. https://www.tenerife.es/portalcabtfe/es/site_content/52-proteccion-civil/12194-plan-de-actuacion-insular-frente-al-riesgo-volcanico-de-la-isla-de-tenerife-paiv

- Romero C. (1990). Las manifestaciones volcánicas históricas del archipiélago canario. Universidad de La Laguna ISBN: 84-7756-219-9.

- Romero C. (2000) Actividad volcánica histórica en las islas Canarias. En Curso Internacional de Volcanología y Geofísica Volcánica. pp. 115-128. Edits. Cientfs:. Mar Astiz y Alicia García. Serie Casa de Los Volcanes. Servicio publicaciones del Cabildo Insular de Lanzarote. Madrid.

- Romero C., Coello, E., Dóniz, J. and Sánchez, N. (2009). New data about historic volcanism on Tenerife Island. 250th anniversary of Volcán Jorullo´s birth, pp. 46-47.

- Sansón Cerrato J. (1995). La protección civil ante el riesgo de erupciones volcánicas. En: Riesgo Volcánico (Ed. Ramón Ortiz), Serie Casa de los Volcanes, Cabildo Insular de Lanzarote, pp. 5, 197-216.

- Solana M.C., Calvari S., Kilburn C.R.J., Gutierrez H., Chester D., Duncan A. (2017) Supporting the Development of Procedures for Communications During Volcanic Emergencies: Lessons Learnt from the Canary Islands (Spain) and Etna and Stromboli (Italy). In: Fearnley C.J., Bird D.K., Haynes K., McGuire W.J., Jolly G. (eds) Observing the Volcano World. Advances in Volcanology. Springer, Cham. https://doi.org/10.1007/11157_2016_48

The Spanish Emergency Military Unit (*Unidad Militar de Emergencias*). The Goverment's special emergency tool

Lieutenant-Colonel Jorge Serra Llopart
Lieutenant-Colonel Javier Barranco García
The Spanish Emergency Military Unit

Introduction

This article is intended to provide an overview of the Spanish Emergency Military Unit, or *Unidad Militar de Emergencias* (UME according to its Spanish abbreviation), from its inception, its structure, its response capabilities, and its most recent involvement in combating the COVID-19 pandemic and its action following Storm Filomena. Its primary missions and tasks are also described.

Inception and Formation

The increase in the frequency and severity of natural disasters due to global warming and responses to emergencies and catastrophes are a worldwide concern. Different countries have embraced a range of different solutions aimed at bringing available resources to bear against the most likely hazards, though in all cases with the shared intent of seeing to the safety and wellbeing of their citizens. Involving the Armed Forces in aiding populations struck by natural disasters goes back to the very origins of the military. The organisation and hierarchical structure of the military makes it an ideal instrument to be used in an emergency. For that reason, certain countries, one of them Spain, have decided to form military units that specialise in dealing with disasters.

Figure 1. Fifteenth UME Anniversary Celebration (7 October 2020). Source: UME website.

Since its first response in 2007, the UME has been called on more than 570 times, chiefly to deal with **forest fires** (404 times), followed by **floods and rescues** (57), **winter storms** (35), **technology hazards** (37), **foreign missions** (17), and "miscellaneous" operations (20). Its most protracted response was required to **combat the pandemic** in 2020, primarily Operation "BALMIS".

The UME has responded in six **earthquakes**, two in Spain in Lorca (2011) and Melilla (2016) and four overseas in Haiti (2010), Nepal (2015), Ecuador (2016), and Mexico (2017). In addition, the UME was also deployed to the island of El Hierro during the underwater volcanic eruption in 2011. It has deployed abroad to fight forest fires in Chile (2017), Portugal (2017, 2018, and 2019) and Greece (2018 and 2019). It has also played a very active role within the UN's mission in Lebanon (UNIFIL), training emergency response personnel.

Civil defence in Spain is a public service that protects people and property intended to ensure a suitable response to the different types of emergencies and calamities from natural causes or human activities, whether accidental or intentional. Emergencies confined to the level of Spain's Regions are dealt with by the Autonomous Regions themselves. However, the national government bears responsibility for handling catastrophic events that are declared to be "national emergencies". The UME therefore arose as an instrument in the service of the national government to deal with situations of this kind.

The UME was formed on 7 October 2005 to enhance the national government's capacity to respond to this kind of emergency. The Unit was created to be the mechanism of first resort within the Armed Forces to fall back on when taking action to see to the safety and wellbeing of the country's citizens who are in grave danger and to respond to national disasters and calamities and other public needs. It is designed for flexible, rapid response, with specialised personnel and equipment to each hazard that has been identified. Still, cooperation with the rest of the Armed Forces is essential in operations which are protracted in time or require outside resources.

Figure 2. Fighting a forest fire.
Source: UME website.

The organic affiliation of the UME has changed over the course of its short history, and it is now under the direct command of the Minister of Defence. According to Spain's National Defence Act currently in force, its mission is to contribute militarily to the action taken by the government in national emergencies or as a special asset that can be called on in support of Spain's Regions and Cities, a task that falls on the Armed Forces as a whole.

That is, the UME is a permanent joint force whose mission is to take action anywhere inside or outside the territory of Spain to cooperate with the institutions of the government and its administrative bodies in the interest of the safety and wellbeing of its citizenry in situations of grave risk, disasters, calamities, and other public needs[1].

(1) Spanish Organic Law 5/2005 of 17 November 2005 on National Defence [Ley Orgánica 5/2005, de 17 de noviembre, de la Defensa Nacional].

One of the most important provisions of law concerned is Spanish Royal Decree [Real Decreto] 1097/2011 of 22 July 2011 on the Action Protocol for the UME [*Protocolo de intervención de la UME*], which lays down the conditions for it to act in serious emergencies resulting from natural hazards such as floods, river overflows, earthquakes, landslides, heavy snowfalls, and other severe adverse weather conditions; forest fires; technology hazards like chemical, biological, radiological and nuclear (CBRN) events; terrorist attacks or unlawful acts of violence, including those directed at critical infrastructure, hazardous installations, or carried out using CBRN agents; environmental contamination; and in any other situations at the discretion of the Prime Minister of Spain.

Organization of the UME

The UME consists of some 3,500 military personnel specially trained to be able to carry out their missions successfully. The components of its organic structure are: The Headquarters (CG; Spanish abbreviations are used throughout), the Headquarters Unit (UCG), the Military Emergency School (EMES), the Emergency Response and Support Regiment (RAIEM); the Signal Battalion (BTUME), and the First Emergency Response Battalion (BIEM I), all based in Torrejón de Ardoz (Madrid); the Second Emergency Response Battalion (BIEM II), based in Seville, and its subordinate, the Canary Island Emergency Response Contingent (Grand Canary and Tenerife Islands); the Third Emergency Response Battalion (BIEM III) in Valencia; the Fourth Emergency Response Battalion (BIEM IV) in Zaragoza; and the Fifth Emergency Response Battalion (BIEM V) in León.

The guiding concept underpinning UME deployment is for it to be capable of reaching any place within the territory of the mainland in less than four hours by land so as to ensure the rapid reaction required in emergencies.

The main mission of the UME's Headquarters is to advise and assist the UME's Commanding General (GEJUME) in exercising his command. It consists of the General Staff, the Evaluation and Relations Department, the Economic Affairs Section, and the Legal and Technical Advisory Service.

The Military Emergency School was established as Military Training Centre by Ministry of Defence Decree [*Orden*] DEF/85/2017 and serves as the cornerstone for training in the UME. It is responsible for ongoing training in how to handle emergencies.

The UME's Signal Battalion (BTUME) is responsible for providing the UME's Command and Headquarters with the information, telecommunications, supervisory, and command capabilities needed to manage and direct the operations the UME is assigned.

The Response Units (RAIEM, BIEM, and BTUME) all have their own Staffs and Commands, Staff and Service Companies, as well as, respectively:

The Emergency Response and Support Regiment (RAIEM) is the unit that gives the UME its logistical support, affected personnel support, and environmental and technology (CBRN) emergency response capacities. That is, emergency logistical support for both responders and victims and for the emergency action to deal with events caused by CBRN or environmental hazards.

The Emergency Response Battalions (BIEMs) are the UME's building blocks that enable it to perform its assigned missions in the areas within their purview. Each battalion is primed to respond in all situations in which the UME is called into action and is prepared to handle all manner of situations in which people's lives or the safety of property, the environment, natural spaces and their resources, or the country's artistic and historical heritage are potentially at risk, all based on the Unit's Action Protocol.

The UME is also in command of operations of seaplanes with Air Force Group 43 and light and medium helicopters with Army Emergency Helicopter Battalion II (BHELEME II). Aerial teams are extremely high-value for fighting forest fires and for rescue missions during floods.

Emergency Operations Command (DOE)

In case of declared national emergencies in which the UME is ordered to take action, operational civil defence action in the disaster area is directed and coordinated by the UME Commander under the Ministry of the Interior.

In these circumstances the UME is responsible for coordinating the entire organisation set up to handle the emergency, ordinarily involving local, regional, and national government resources, public as well as private. The operational organisation and command system are capable of overseeing the efforts of up to 35,000 team members.

With this in mind, each year the UME organises a Combined Joint Exercise, running drills to practice the operational management of national emergencies with the participation of the various agencies and institutions that exist to handle emergencies, including those from other countries with which Spain has bilateral cooperative agreements or in its role as a member of international organisations (the EU, the UN, NATO). It is held in a different Spanish Region each year to gain a working knowledge of the particular factors and special aspects local to each and of how to deal with the most likely local hazards.

The Commanding General of the UME (GEJUME) is in charge of operational supervision of the emergency from his Permanent Command Post at the Joint Operations Centre (JOC) at the UME's Headquarters. To be able to perform this function effectively, an Integrated Operations Command Post (MOPI) is deployed in the vicinity of the area where the catastrophe has occurred under the command of the Deputy Commander of the UME (SEJUME) to address needs on the ground.

The Evaluation and Testing Section is an essential component responsible for setting up an exercise monitoring system, comprising a series of associated incidents and events aimed at simulating the conditions that could arise in a disaster and implementing the operational and coordination procedures to be tested and refined. This Section also systematically evaluates the UME's various operational units for different hazards on a routine basis to ensure a high state of operational and safety readiness.

Capacity Modules

Capacity modules are either "distributed" or "centralised". Distributed capacities are the capabilities of each response battalion that enable them to tackle the most common hazards, e.g., forest fires, severe winter storms, floods and other adverse weather events, volcanic eruptions, earthquakes, and support for the civilian population affected. Centralised capacities are highly specific, specialised capacities available in certain units only, e.g., search and rescue operations in complicated situations such as earthquakes, blizzards, confined spaces, or underwater caves; deployment of telecommunications and command and control systems during disasters; technology hazards and environmental contamination; housing and camps for victims; protection of the cultural heritage; fluid management systems (SIGEFLU); drone operations (RPAS); semi-permanent bridges; mortuary services for victims, etc.

Time is a critical factor in emergency situations, and the capacities need to be ready for deployment and use in the shortest possible time. The UME is in a state of permanent preparedness and has a system in place that enables all its personnel to be brought in stages in a very short span of time. Rapid deployment personnel, known as first intervention, are on permanent duty at the UME's bases. There is an advance reconnaissance group that maintains readiness to deploy in less than 15 minutes, while the rest of the first response force must be ready for deployment in under an hour.

This is followed by the back-up action force immediately behind, ready for deployment in less than two and a half hours. All other UME personnel are to be ready for deployment in under six hours.

Actions by the UME are based on three fundamental principles: planning, training, and deployment. For events that are handled at a regional level, tactical groups act together as a single unit under the natural command structure and are placed at the disposal of the emergency manager.

Figure 3. Search and rescue (USAR).
Source: UME website.

Two of the capacity modules deserve special mention, namely, Urban Search and Rescue (USAR, this abbreviation from the English) and the Environmental and Technology Emergency Response Group (GIETMA).

The first time the UME was deployed outside the borders of Spain was in Haiti after the fateful earthquake that struck on 12 January 2010. That experience led the UME to have its Urban Search and Rescue teams classified by INSARAG (International Search and Rescue Advisory Group) as conforming to UN standards and thus becoming an asset it can turn to within its humanitarian aid network. One of the UME's Urban Search and Rescue teams successfully completed the classification process in November 2011 and was classified by UN international evaluators.

The UME achieved full operational capacity for natural hazards in 2009. By contrast, it did not have the capacity to handle accidents relating to the manufacture, transport, storage, and use of toxic substances or contaminant spills or leaks produced by natural disasters or other causes or to minimise the environmental impact of certain invasive species.

It was therefore decided to undertake a project to build its capacities against these hazards through the creation of an Environmental and Technology Emergency Response Group (GIETMA), which gained full operational status in 2014.

This involved developing a series of interrelated capacities: a Light Reconnaissance Vehicle (VELIRE) capacity for scouting; a Rapid Response Laboratory (LABIR) to analyse samples; a Tactical Response Vehicle (VINTAC) capacity for operations; a decontamination capability for personnel, vehicles and sensitive equipment; a Contaminated Water Treatment Plant (ETAC) and protective environmental contamination equipment, e.g., containment barriers for spills on water.

More specifically, these capacities involve limited remote chemical point detection and biological point detection; provisional and confirmed identification of biological agents and chemical substances; CBRN sampling; remote and point radiation detection and identification; industrial accident response; CBRN mass and operational personnel decontamination; decontamination of material (vehicles) and sensitive equipment; contaminated water treatment; hydrocarbon containment and removal; and control and mitigation of the environmental effects of invasive species.

One of its first actions was Operation "CHILOECHES" in late August 2016 in response to an industrial fire at a toxic waste treatment and recycling plant in Guadalajara. The main risk was potential environmental contamination of the Henares River, which in the end was successfully averted.

Operations

Within Spain, the UME is ordinarily called on to respond at the request of one of Spain's Regions or Cities whose own capabilities have been overburdened, making special outside assistance necessary. The request is sent through the corresponding National Government Representative's Office to the Ministry of the Interior's Civil Defence and Emergency Agency (DGPCYE), and from there it is routed to the Ministry of Defence, i.e., to the Office of the General Director of Defence Policy (DIGENPOL), which places the UME on active status. The UME may request support from the Army, Air Force, and Navy depending on the nature of the emergency.

Since its first response in 2007, the UME has been called on more than 570 times, chiefly to deal with forest fires (404 times), followed by floods and rescues (57), winter storms (35), technology hazards (37), foreign missions (17), and "miscellaneous" operations (20). Its most protracted response was required to combat the pandemic in 2020, primarily Operation "BALMIS".

The UME has responded in six earthquakes, two in Spain in Lorca (2011) and Melilla (2016) and four overseas in Haiti (2010), Nepal (2015), Ecuador (2016), and Mexico (2017). In addition, the UME was also deployed to the island of El Hierro during the underwater volcanic eruption in 2011. It has deployed abroad to fight forest fires in Chile (2017), Portugal (2017, 2018, and 2019) and Greece (2018 and 2019). It has also played a very active role within the UN's mission in Lebanon (UNIFIL), training emergency response personnel.

Some of the actions in which the UME has taken part, notable because of their special features or impact, are discussed below.

Environmental Operation "Extremadura 2018"

The proliferation of invasive species expanding into new habitats has become a serious environmental menace. A case in point is the common water hyacinth (*Eichhornia crassipes*), which in optimal conditions can double its biomass in around 12 days, interfering with water oxygenation and causing serious damage to biodiversity. Large quantities of this plant were discovered in the Guadiana River. Removal proved to be extremely difficult, and accordingly the UME joined the Guadiana River Basin Authority's task force on 9 October 2018 at the request of the Government of Extremadura.

For several months the UME deployed 120 troops and 70 items of equipment full time to remove plants from the 175 kilometres of affected river bed (Figure 4).

Figure 4. Operation Extremadura.
Source: UME website.

This operation was something new to the UME, which had to come up with innovative solutions to improve the efficiency of removal procedures. Monitoring the work performed and how the invasion progressed using geographic information systems turned out to be vitally important. By the time the operation ended in 2018, some 250,000 tonnes of water hyacinth had been removed from the river. Many more thousands of tonnes were removed on a second pass carried out in 2019, which succeeded in eradicating this invasive species.

Flooding in Murcia y Orihuela in 2019

Major flooding occurred in the Murcia Region and in Alicante, namely, Orihuela, as a result of heavy rains brought on by a cut-off low pressure system in September 2019. Both these Autonomous Regions experienced difficulties in rescuing large numbers of people who had been isolated and requested outside assistance, so the UME was again activated and deployed. In view of the extent of the damage and the adverse weather forecasts, the UME mobilised troops and equipment from all of its units and called on the Army, Air Force, and Navy for further assistance. In all, more than 1,100 service members were deployed.

Two tactical groups designated "Murcia" and "Orihuela" were organised. They were composed of UME action groups and engineers, units of engineers from the Spanish Legion, boats from the Navy's diving unit, Military Police units from the Legion and the Navy, paratroopers from the Special Operations Command and III Airborne Squadron, BTUME drones, and an Army helicopter along with two more helicopters provided by the Air Force, some 300 pieces of equipment in all. The groups were mainly involved in rescuing people who had been stranded, in preventive evacuation, and in pumping out specific locations, such as Los Alcázares, San Pedro del Pinatar, Beniel, Santomera, and Siscar in Murcia and in the towns of La Vega Baja like Orihuela, Dolores, Redován, and Almoradí. Rescuing stranded people was

performed using all-terrain vehicles, boats, and helicopters (Figure 5). Certain areas could only be reached on foot.

The Armed Forces contingent had specialised equipment for dealing with floods, e.g., the UME's SIGEFLU system, capable of pumping 17,000 l/min to a distance of 4-5 km using pumps connected in series or 50,000 l/min to a distance of 1 km using pumps connected in parallel. The EMBAL mud pumping system capable of pumping 320 m^3/h was also used. The UME's and the Legion's equipment and engineers were essential for water containment and putting infrastructure back in service.

The complex nature of the operation and the need for reinforcements meant stationing BIEM V in Alcalá de Henares and BIEM IV in Valencia. The Armed Forces also kept various helicopters on alert for use in possible helicopter transport and search and rescue missions.

Figure 5. Flooding caused by a cut-off low pressure system in Alicante and Murcia.
Source: UME website.

Operations "BALMIS" and "BALUARTE"

The Armed Forces have been involved in combatting the COVID-19 emergency through operations "Balmis" and "Baluarte", the latter still in progress. Both these operations entailed providing support for Government action in the current health crisis. The UME, along with the Army, Air Force, and Navy, were placed at the disposal of the Defence Staff Operations Command.

Operation "BALMIS" was the Armed Forces' initial response at the outbreak of the pandemic. This mission lasted 98 days and involved 188,173 service personnel measured in troops per day, 45,414 corresponding to the UME. A total of 5,301 retirement homes were disinfected (Figure 6), 3,828 by the UME, along with 12,410 other premises, hospitals, and health care and social facilities (7,048 by the UME). Other actions were also taken, such as reconnaissance and security support tasks, setting up camps, logistics support, transport of the ill and the deceased, disinfection training for Civil Defence teams, and PCR diagnostic analyses by the Rapid Response Laboratory (LABIR) – see the section on the Environmental and Technology Emergency Response Group (GIETMA). The latter made it possible to test members of the Armed Forces deployed on the various international missions in which Spain is participating, for COVID-19.

After this mission, the Ministry of Defence offered the regional governments support by contact tracers to locate people who had been in contact with infected persons to curb uncontrolled spread of the virus. The UME was the first unit activated for this task and had to design a methodology and procedure to be able to complete this mission. The Armed Forces subsequently made personnel available to provide support to train training staff. This task, together with the task of disinfecting priority facilities, has given rise to Operation "Baluarte".

In order to achieve the best outcome in the fight against COVID-19, R&D initiatives have been carried out with the support of engaged Spanish companies, e.g., for adapting and developing backpack fire extinguishers for use in disinfection, electrostatic sprayers, fumigation drones, remote controlled UV lamps, disinfection engines, and full face mask 3D printing.

Figure 6. COVID-19 support deployment. Operation BALMIS.
Source: UME website.

Winter Storm Filomena 2021

Storm Filomena hit the central portion of the Iberian Peninsula in early January of this year, bringing such major cities as Madrid to a standstill, closing the Adolfo Suárez Madrid-Barajas Airport, the Atocha Train Station, and the Mercamadrid Central Food Market and more, and making such essential facilities as hospitals and health care clinics impossible to reach. The severity of the situation resulted in immediate response by the UME with the support of the Army (ET). The response was not compromised, because UME units had been moved into pre-assigned staging positions based on weather forecasts, BIEM V to Segovia and BIEM I to Albacete. All UME units were placed on alert for possible call-up to active status.

The mission lasted 15 days, from 7 to 21 January, and was concentrated mainly in the provinces of Albacete, Toledo, Madrid (Figure 7), Guadalajara, Zaragoza, and Teruel. A series of independent operations were organised based on the areas concerned, namely, "YESTE", "MADRID", "BARAJAS", "ARAGÓN", "TOLEDO", and "GUADALAJARA". Assigned missions were mainly ploughing out ring roads, highways, streets, runways, parking areas, and access ways to hospitals, pharmacies, logistics centres, and food distribution centres; transporting sick people and key personnel, and checking on towns that had been cut off.

By way of example, on 13 January there were 488 UME troops and 396 Army troops with 289 vehicles at work in Madrid; 202 Army troops and 22 vehicles in Toledo; 220 UME troops and 86 vehicles in Aragón; 94 UME troops and 88 Army troops operating 67 vehicles at Barajas; and 135 Army troops and 31 vehicles in Guadalajara.

Figure 7. Deployment for winter storm Filomena in Madrid.
Source: UME website.

Foreign Operations

Actions by the UME outside Spain may spring from bilateral agreements between Spain and other countries as part of the European Union's civil protection mechanism, from supporting UN humanitarian assistance, or from participating in military emergency operations support under the command of NATO. Requests for help by the UME can be sent by different channels: to the Ministry of the Interior from the European Union's civil protection mechanism or the UN, to the Ministry of Foreign Affairs under bilateral agreements, or to the Ministry of Defence itself from NATO. The missions described below provide some examples.

"Ecuador Tactical Group"

On 16 April 2016 Ecuador suffered one of the most devastating earthquakes in its history. A magnitude 7.8 tremor caused grave damage to different cities and towns in the provinces of Esmeralda and Manabí. In these serious circumstances, international search and rescue teams deployed within 24 hours of the quake to assist in rescuing those still alive.

The Spanish government mobilised the UME and the Community of Madrid Immediate Response Team (ERICAM), the only two Spanish teams classified by INSARAG. An Air Force plane carrying 45 UME and 12 ERICAM personnel took off for Ecuador from Torrejón on 18 April. The main task of these teams was victim search and rescue, and they took with them six dogs, four for finding those still alive and two for finding bodies, plus telescopic cameras, geophones, and drones (Figure 8).

On arrival, on instructions from the UN, the Spanish teams first deployed to Canoa, where they worked with local teams in locating and recovering bodies from the wreckage using drilling and cutting tools.

Figure 8. Operation Ecuador, April 2016.
Source: UME website.

At the UN's request, they then went to Manta to survey an extensive area and confirm the presence or absence of bodies under the rubble and to check on the safety condition of buildings for recovery operations. This helped local teams to move on to the stage of clearing away the rubble using heavy machinery.

After its search and rescue mission, the contingent went to Chone to check on the condition of the region's main hospital, which had sustained structural damage. The Spanish teams assessed the condition of the building and marked off safe areas. They recovered 105 items of major medical equipment, such as x-ray machines, intensive care cribs, incubators, electrocardiograph machines, and electric hospital beds. The recovered equipment was valued at 1.2 million dollars, but at that point in time its functional value was incalculable because it was needed to attend to some 800 injured a day in the aftermath of the tragedy.

The next day the team was assigned the task of securing the Archaeological Museum of Bahía de Caráquez, designated a national cultural heritage site. It took two days to make the building safe by shoring and by repairing unsafe areas to prevent future collapses that could damage objects and works of great historical significance.

"Chile Tactical Group"

In January and February 2017 Chile suffered a wave of vast forest fires that resulted in a call for international assistance. Through its civil protection mechanism, the European Union sent teams from France, Portugal, and Spain. On 27 January 56 UME service personnel left for Santiago de Chile on an Air Force Airbus 310.

Together with the members of Chile's National Forest Corporation, Spanish service members fought the fire using line of defence tactics in the form of firebreaks created with chainsaws and hand implements.

It was the UME's first action fighting forest fires on the other side of the Atlantic and posed a deployment challenge.

Conclusions

The UME was formed as a specialised unit for emergencies to improve the national government's ability to deal with situations of that kind. The Armed Forces thus possess a specific instrument that helps enhance the safety and wellbeing of Spain's citizenry during catastrophic events, with the UME as the military's frontline instrument of response. It has made it possible to cut reaction times and has made available more specialised personnel and equipment. Even so, the Armed Forces as a whole still play a vital role in providing resources in complex or prolonged situations. The UME has been able to evolve and to adapt to changing times by developing new capacities and enhancing existing ones. Its operations are based on three linchpins: planning, a vantage point for contemplating an uncertain future in which disasters seem to be becoming increasingly frequent and severe; training, to prepare personnel to tackle enemies in the form of hazards; and deployment, placing it in the service of our country's citizens to mitigate the consequences of unwanted events.

At the present time the UME enjoys broad popularity in Spanish society, which has been able to appreciate the attributes that distinguish our service men and women, the outcome of a centuries' old code of ethics, the "Royal Regulations of the Armed Forces [*Las Reales Ordenanzas para las Fuerzas Armadas*]". Honour, discipline, courage, a spirit of sacrifice, and humility are traits that prepare Spanish soldiers to face the worst of all calamities: war.

The path to adaptation to flood risk: proactive measures

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Introduction

The measures for implementation considered in this article can be understood to fall under the category of **resilience**, defined as the **capacity** of society or ecosystems to **adapt** to the risks to which they may be subjected.

Adaptation to flood risk is considered to be the range of actions aimed at reducing the vulnerability of property elements exposed to flood risk so as to lessen the impact and the adverse repercussions of flooding. These elements include, for example, buildings, facilities, and infrastructures.

All the government bodies involved need to promote a series of measures to raise awareness of the unavoidable connection between the occurrence of extreme weather phenomena and the need for self-protection, namely, measures taken to supplement traditional structural measures which, though they may mitigate the consequences, are incapable of ensuring zero risk.

Flood risk management plans are the basic tool used by the Directive on the assessment and management of flood risks, which provides the framework for coordinated action by all government bodies and society to implement the actions set out below.

In 2017 the DG for Water released its ***"Guía para la Reducción de la Vulnerabilidad de Edificios frente a Inundaciones"*** [*"Guide to Reducing Vulnerability of Buildings to Floods"*] in cooperation with the Consorcio de Compensación de Seguros (CCS). The Guide's main objective was to advise the various building owners, users, and managers, from a practical perspective, on how to reduce risk by recommending guidelines and solutions they could follow to mitigate the damage caused by flooding.

Actions taken by the Directorate General for Water

In recent years, the Directorate General for Water of the Ministry for the Ecological Transition and the Demographic Challenge [*Ministerio para la Transición Ecológica y el Reto Demográfico*] has put its efforts into promoting measures of this kind in the framework of those flood risk management plans, working to achieve a series of primary objectives that include:

- Improving administrative coordination between all players involved in risk management.

- Enhancing resilience and decreasing vulnerability of property located in flood-prone zones.

- Increasing awareness of flood risk and self-protection strategies among the citizenry, social partners, and economic agents.

- Helping to improve spatial planning and exposure management in flood-prone zones to make cities more resilient.

First steps

As a starting point in this context, in 2017 the DG for Water released its ***"Guía para la Reducción de la Vulnerabilidad de Edificios frente a Inundaciones"*** [*"Guide to Reducing Vulnerability of Buildings to Floods"*] in cooperation with the Consorcio de Compensación de Seguros (CCS). The Guide's main objective was to advise the various building owners, users, and managers, from a practical perspective, on how to reduce risk by recommending guidelines and solutions they could follow to mitigate the damage caused by flooding.

In addition, the guides listed below were also issued in view of the need to provide guidelines tailored to the different types of facilities, services, and goods in the different economic sectors:

"Evaluación de la resiliencia de los núcleos urbanos frente al riesgo de inundación: redes, sistemas urbanos y otras infraestructuras (2019)" [*"Assessing resilience of urban centres to flooding: networks, urban systems, and other infrastructure (2019)"*]: This guide was aimed at ascertaining the direct and indirect damage floods may cause to a city and its environs to enhance the resilience of cities and all their services (electric power, communications, utilities, supply, sewage systems).

"Recomendaciones para la construcción y rehabilitación de edificaciones en zonas inundables (2019)" [*"Recommendations for building and rebuilding in flood-prone zones (2019)"*]: This guide set out different standards and recommendations for both new and existing buildings in flood zones.

"Guías de adaptación al riesgo de inundación: sistemas urbanos de drenaje sostenible (2019)" [*"Guidelines for adapting to flood risk: sustainable urban drainage systems (2019)"*]: This guide discussed the causes and consequences of urban flooding and set out different strategies and design and maintenance standards for implementing SuDS (Sustainable Drainage Systems).

"Guías de adaptación al riesgo de inundación: Explotaciones agrícolas y ganaderas (2019)" [*"Guidelines for adapting to flood risk: farming and livestock breeding (2019)"*]: This guide discussed flood risks in farming and livestock breeding areas, set out specific methodologies for assessing damage and risks, and proposed remedies. It was aimed at farm owners, managers, and workers.

Implementation. Initial pilot cases of adaptation

The first pilot cases of adaptation to flood risk were carried out in 2019 and 2020 to put the guides into practice. They were spread all around Spain and included a range of different types and uses.

Following the methods set out in the guides, they all started by assessing the problems associated with their flood risk and building considerations and then went on to put forward proposals based on four strategic courses of action: **preventing** water from reaching the building; **resisting** the entry of water once it had reached the outside of the building; **withstanding** incoming water to enter while taking steps to minimise damage; and even **abandoning** use when the risk was too high. The different alternatives were considered and the economic value of the damage that the structure and contents would no longer suffer was estimated, together with the cost of the steps to be taken, to obtain a benefit-cost ratio indicative of the feasibility of taking action from a financial standpoint.

The pilot cases had highly favourable benefit-cost ratios and showed that small investments executed in a short span of time could greatly mitigate the risk and reduce the cost of future damage that might occur due to flooding.

Work in progress

To continue this work and expand the methods employed to other economic sectors, the Directorate for Water issued tenders for a Service Contract for a *"PLAN PIMA ADAPTA. Desarrollo de Programas Piloto de Adaptación al Riesgo de Inundación y de Fomento de la Consciencia del Riesgo de Inundación en diversos sectores económicos"* [*"PIMA ADAPTATION PLAN. Developing Pilot Programmes for Adapting to Flood Risk and Raising Flood Risk Awareness in various economic sectors"*], which started in 2020. They were split into three categories to assess the farming and livestock breeding, industry and infrastructure, and urban facilities and buildings.

The general objectives were:

- Further developing the technical content of the guidelines for adapting to flood risk.
- Identifying and training the players involved and promoting risk culture.
- Improving our understanding of the mechanisms exerted by floods when causing damage to the different types of buildings and potential measures.

The activities undertaken included identifying the main risk and damage components occurring in the

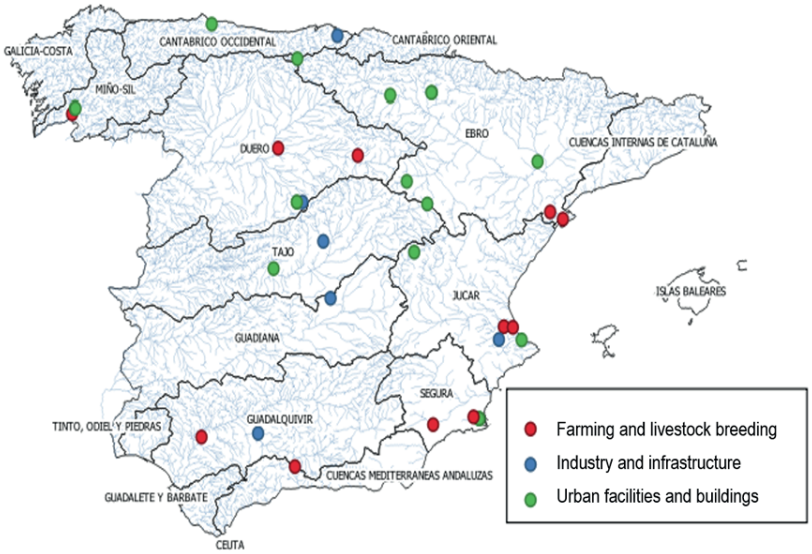

Figure 1. Pilot cases in progress by economic sector.

economic sectors considered for each category, to expand our knowledge for assessing the impact of flooding on each; performing 75 assessments on various types of structures that were used to draw up 30 preliminary adaptation designs suitable for specifying in detail the measures intended to decrease the vulnerability of the different property elements at risk or under study; for each type considered, determining the water level to expected damage ratio for a flood event to provide as much information as possible for use in risk management.

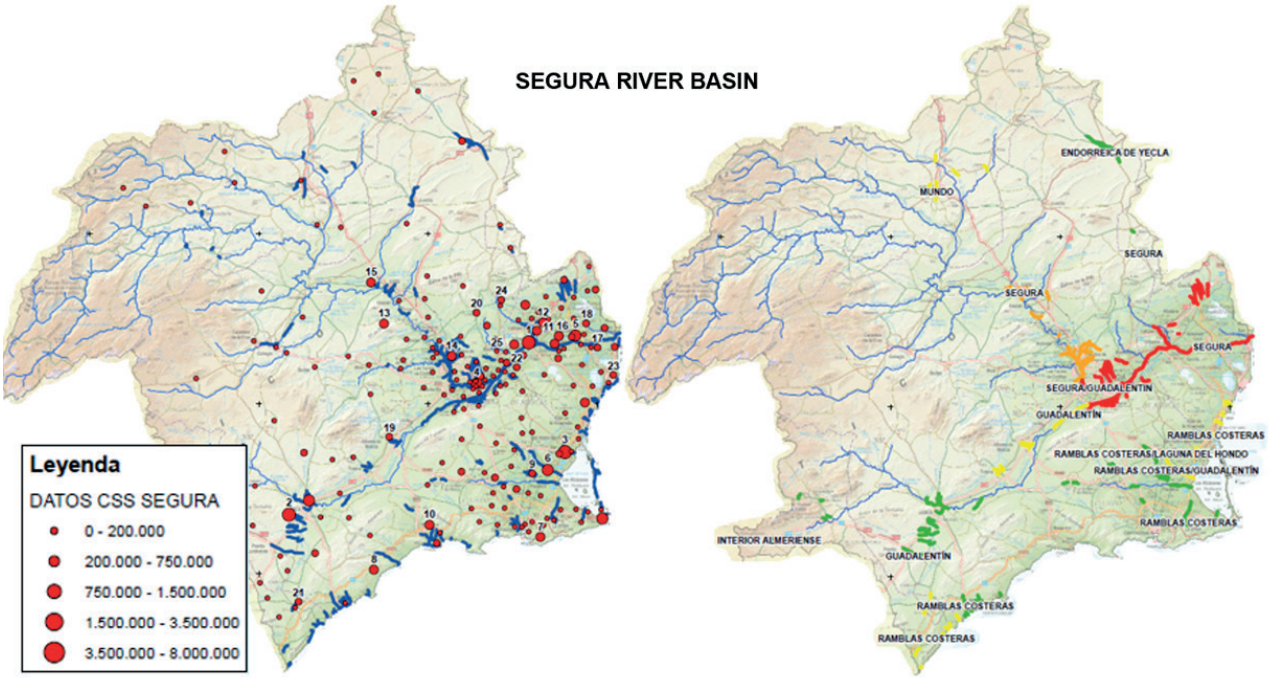

Figure 2. Assessment of the impact of flooding on industry and infrastructure. Comparison of indemnities paid out by the CCS (2005-2019) and definition of areas with significant potential flood risk (ARPSIS) based on data from the risk maps for the Segura River Basin District.

Training courses on flood risk and dissemination of educational materials to the citizens and to economic agents and social partners is intended to raise the public's risk awareness and perception.

Proactive measures: the Campo de Cartagena initiative

Providing subsidies for adaptation to flood risk is an essential instrument for implementing the proposed measures in installations and buildings vulnerable to flooding. This ensures that the proposed measures will be put into practice and that the beneficiaries can execute work on upgrades against flood risk and buy equipment and material such as temporary barriers, dewatering pumps, check valves, and the like in accordance with existing approaches and guidelines.

Based on the particular destructiveness of flooding in the **Campo de Cartagena**[1] area, evidenced by events like the cut-off low that passed through in **September 2019**, which by some estimates reached levels of accumulated

(1) Campo de Cartagena is a natural region (*comarca*) located in the Region of Murcia, in the southeast of Spain.

precipitation on the order of a return period of 500 to 1,000 years, and the 90,000 residents in the flood-prone zone (based on hazard maps and flood risk maps drawn up for the area), **Los Alcázares, San Javier, Torre-Pacheco, Cartagena**, and **San Pedro del Pinatar** were selected as pilot centres for implementing tools of this type. This was corroborated by CCS data, which showed that total indemnities of more than **180 million euros** were paid out in these cities and towns from 2005 to 2019.

Figure 3. Santa María Flood (2019 cut-off low). Los Alcázares.

Therefore, to take further steps towards adaptation to flood risk and to bring the different self-protection measures to fruition, at the end of 2020 the Ministry for the Ecological Transition and the Demographic Challenge approved the *Royal Decree 1158/2020 of 22 December 2020 on the direct grant of subsidies to develop pilot projects to promote adaptation of buildings, infrastructure, installations, and farms in the cities and towns of Los Alcázares, San Javier, Torre-Pacheco, Cartagena y San Pedro del Pinatar (Murcia) to flood risk [Real Decreto 1158/2020, de 22 de diciembre, por el que se regula la concesión directa de subvenciones para el desarrollo de planes piloto de fomento de la adaptación del riesgo de inundación de las edificaciones, equipamientos e instalaciones o explotaciones existentes en los términos municipales de Los Alcázares, San Javier, Torre-Pacheco, Cartagena y San Pedro del Pinatar (Murcia)].*

In all, three million euros will be dispensed, broken down as follows:

- Los Alcázares Town Council: 1,300,000 euros.
- San Javier Town Council: 600,000 euros.
- Torre-Pacheco Town Council: 500,000 euros.
- Cartagena City Council: 400,000 euros.
- San Pedro del Pinatar Town Council: 200,000 euros.

Figure 4. Breakdown of subsidies approved by Royal Decree 1158/2020 of 22 December 2020.

In calculating the breakdown for distributing subsidies to the beneficiaries, the Ministry for the Ecological Transition and the Demographic Challenge considered indemnities paid out by the CCS in the five municipalities, with the grants being proportionate to the damage sustained, in the following percentages:

By percentage, **45%** to Los Alcázares, **22%** to San Javier, **16%** to Torre-Pacheco, **13%** to Cartagena, and **4%** to San Pedro del Pinatar, which accounted for 96% of the indemnities paid out in the Campo de Cartagena county.

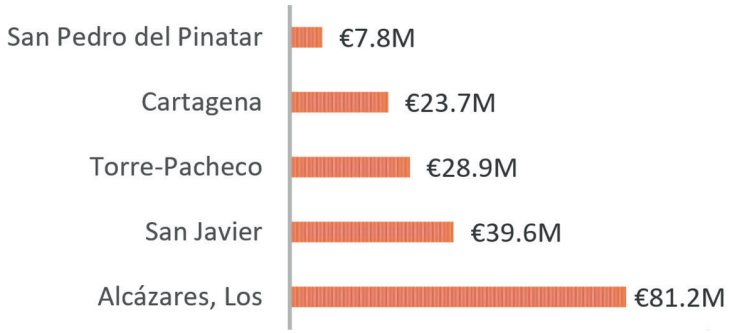

Figure 5. Indemnities paid out by the CCS in 2005-2019.

The measures funded include **buying equipment and material**, such as temporary or permanent barriers, dewatering pumps, check valves, and other equipment and **building work**, such as waterproofing or redesigning façades, building or upgrading perimeter walls, protecting or sealing voids (windows, ventilation grilles, installation shafts, etc.), protection or relocation of vulnerable installations (electric panels, boilers, fuel tanks, etc.), and other work that will upgrade the adaptation of existing equipment and buildings to flood risk and increase their resilience.

The Decree envisages distributing the subsidies by beneficiary type by locality, with up to **40%** of the total subsidies being awarded for measures for publicly owned buildings and equipment and at least **50%** being awarded for measures for privately owned buildings and equipment, with up to **10%** of the total subsidies being awarded for hiring technical personnel.

New challenges

A public consultation for a second cycle of flood risk management plans to continue with measures of this type will be held in the coming months.

The priorities of these plans include promoting a suitable risk culture in the public and in the various economic agents and social partners, building awareness, and fostering participation by all the players concerned. This will open up new prospects to continue promoting coordination among all government bodies and developing new and specific programmes for adaptation to flood risk.

Expanding awareness of these types of strategies and carrying out assessments and projects all over the country pursuant to work already under way will make it possible to extend these kinds of measures to other river basin districts in the framework of the programmes envisaged under these new plans.

The success of these measures will depend on the ability of all the government bodies and players concerned to foster the spread of self-protection measures in society. **Subsidies for adaptation to flood risk provides a new strategic instrument that can help achieve this goal.**

CESVIMAP: Innovation as a service

José María Cancer
Director general
CESVIMAP (Centro de Experimentación y Seguridad Vial de MAPFRE)

CESVIMAP, Centro de Experimentación y Seguridad Vial MAPFRE [*MAPFRE's Center for Experimentation and Road Safety*], is MAPFRE's R&D centre in the framework of **MAPFRE Open Innovation (MOI)** model. We are a MAPFRE's innovation laboratory involved with new mobility products and services developed around, for instance, Usage Based Insurance (UBI).

Figure 1. The CESVIMAP headquarters building in Ávila.
Source: CESVIMAP.

Our **mission** is to contribute to overall mobility and to the design, development, experimentation, and implementation of innovative practical solutions that help transform the insurance sector, based mainly on technology.

We are a **global bellwether as a technology centre** for designing, using, maintaining, repairing, recycling, and improving the safety of automobiles and other mobility solutions for goods and people. Our technology research is aimed at reducing the accident rate and finding more efficient, less expensive procedures for effecting repairs.

CESVIMAP includes environmental aspects and social value generation by coming up with innovative formulas for insurance based on its R&D activities, innovation, consultancy, training, knowledge dissemination, and promoting the circular economy connected with managing the end of the life cycle of vehicles.

CESVIMAP was established in 1983 and is currently a **global bellwether for innovation**. Other centres using CESVI's approach have been created around the world since that time, in Argentina, Brazil, Colombia, France, and Mexico, working to achieve a safer future and increasingly coordinating among themselves.

Relevant facts

In figures, CESVIMAP operates daily around a core of nearly 120 researchers, engineers, and technicians working in a cutting-edge technical facility of over 40,000 square metres in size. We have been adding value to MAPFRE and to society from our headquarters in Ávila for almost 40 years.

A **high level of environmental and social responsibility** is our foundation, and our goal is to create value for MAPFRE and for society using a range of work vectors, as already mentioned a little earlier.

- Research and Development and Innovation.
- Sharing knowledge.
- Consultancy activities.
- Providing updated training.
- Doing valuable work on projects concerning vehicle end of life management.

From our inception we have experimented on over 700 vehicles in our crash test facility and have completed more than 600 research projects.

With our sights continuously set on the future, we have been in the forefront of studying new means of transport: electrified vehicles, PMDs (personal mobility devices), etc. We have also experimented on self-driving vehicles to ensure that their technology meets the highest safety standards.

We **share** the **knowledge** gained from our research **with industry** and with society: insurers, vehicle manufacturers, transport providers, mechanics, and students. In this connection, we are proud to assist **claims adjusters**, mechanics, and students in entering the insurance sector and in gaining knowledge of MAPFRE's best practices. By way of an example of the scope of that work, let us say that over 76,000 students have visited our facilities or our online platform and that we have taught over 6,000 courses.

Our journal and social media are other ways we use to share our knowledge. In numbers, today we reach:

- More than 145,000 readers of the CESVIMAP Journal.
- More than 33,000 followers on social media.
- More than 7,500,000 YouTube views.
- And we have released nearly 2,600 technical publications and 50 books for professionals and students.

Through our **consultancy** activity, we provide independent advice for professionals on request using B2B[1] and B2A[2] business models. Our consultancy work already totals nearly 65,000 hours.

Referring to the field of **claims adjusters**, over five million adjuster's reports are drawn up yearly based on CESVIMAP's bodywork and paintwork standards in such countries as Argentina, Chile, Colombia, Ecuador, Spain, Mexico, Peru, Portugal, Venezuela, and more.

A concern for **sustainability** and the environment are among our chief core values. With that in mind, in 2004 we created **CESVI Recambios (spare parts)**, CESVIMAP's centre for processing vehicles no longer in use. There we eliminate the potential environmental impact of MAPFRE vehicles that have been declared a total loss. To date we have decontaminated more than 46,000 vehicles, recycled their hazardous parts, and put back on the market nearly a million and a half parts, giving them a warrantied new lease of life so that other, new ones do not need to be manufactured. By our own decision we do not market the structural or safety components of vehicles.

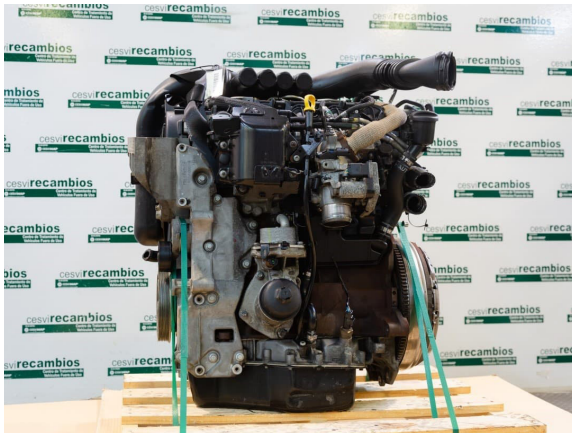

Figure 2. CESVI Recambios.
Source: CESVIMAP.

International presence

CESVI BRAZIL (1996), CESVI ARGENTINA (1996), CESVI MEXICO (1998), CESVI FRANCE (1999), and CESVI COLOMBIA (1999). MAPFRE decided to transplant the CESVIMAP approach to other countries, where our working methods have been successfully implemented.

(1) B2B: *Business-to-Business*, a business model or means of exchanging information between two businesses.
(2) B2A: *Business-to-Administration*, a business model comprising a series of cooperative activities or transactions between business and government bodies.

CESVIMAP is also a member of RCAR (*Research Council for Automobile Repairs*), an international organisation with the shared goal of conducting research to enhance vehicle repairability.

We are also a *Global Innovation Partner* of International Bodyshop Industry Symposium, IBIS Worldwide, and we work with them on various international conferences on automotive topics that are worldwide in scope.

Comprehensive training

CESVIMAP provides comprehensive training in the workshop aimed at all the different categories of automotive professionals, executives, garage managers, receptionists, body repairmen, painters, electricians, and mechanics for vehicle manufacturers, contract hire companies, car sharing companies, automotive suppliers, government law enforcement agencies, etc. Our training is also directed at secondary school teachers and **university programs**, and there is an agreement with the Catholic University of Ávila in place. Training can be either through classroom or online learning.

CESVIMAP is an expert in **garage management and consultancy**. It has excelled at garage setup and design for more than 30 years, developing public-oriented work stations and best practices. Our TQ (qualified workshop) and PROMASS garage certification programmes bring a professional outside look at businesses. Our CESVIRating programme provides practical guidelines for independent garages or repair shop networks to help them optimise their resources and obtain return on their investments so as to attain their goals, and it is now 100% online.

All of CESVIMAP's knowledge comes from studying new automobile models. First, they are subjected to a series of collision tests in the special crash test area. They are then assessed and put back into their original safety conditions at the centre's experimental shop. The vehicles are then classified on the basis of the test results so that insurance policies can be issued having in mind the cost of repairs.

CESVIMAP's research work is rounded out by its outstanding work in traffic accident reconstruction. This lets us establish the conditions preceding the accident and work out what happened with a view to providing objective data for the claims adjuster's report and potentially for use in court. The work also has a helpful impact on road safety by furnishing relevant data on human factors, road and weather conditions, vehicle condition, and the functioning of safety components. This work is topped off by studying vehicle burning.

CESVIMAP also provides **comprehensive training for claims adjusters and insurance companies** in all matters related to adjuster's reports and vehicle appraisals for university credit, e.g., the Advanced Automobile Claims Adjuster Course. This year's course in 2021 will mark the 25th anniversary of this training. We also hold technical courses on industrial vehicles, agricultural machinery, motorcycles, and traffic accident reconstruction.

Figure 3. Claims adjuster and garage manager.
Source: CESVIMAP.

Vocational training

CESVIMAP supports vocational training in different ways; these include putting together complete technical reference works and publications, building an extensive multimedia document collection, issuing the CESVIMAP Journal quarterly for more than 35 years, and directly working with and supporting vocational training students and teachers

with programmes like the COMFORP and FORTECO programmes, lending them parts, bodies, and other materials to practice on.

CESVIMAP's technical publications for professional appraisers and repairmen report on the results of research conducted on vehicle repairs and appraisals. All our publications depict the working procedures carried out a CESVIMAP shops in full documentary and graphic detail.

CESVITECA is an extensive document collection specialised in vehicle repair and appraisal, an online CESVIMAP library for garages, claims adjusters, the automotive sector, and teaching staffs. On the occasion of the pandemic, we made this available to professionals free of charge for six months.

The CESVIMAP Journal is a free communications medium that sets out the results of CESVIMAP's research and experimentation in technical articles that contain illustrations of working processes and equipment and product testing carried out by CESVIMAP.

University courses

The CESVIMAP BUSINESS CHAIR was established in 2009 under a cooperative agreement between CESVIMAP and the Catholic University of Ávila (UCAV). Some of this programme's chief attributes include:

- Involvement in developing curricula.
- Subjects are taught by experienced professors and CESVIMAP technicians.
- Proposals and guidance of degree course final projects.
- Training and advice during work and teaching internships at CESVIMAP and ongoing monitoring of performance.
- Involvement in the sustainable development doctoral programme.
- Holding conferences, seminars, meetings, and symposia concerning the automotive sector, one of these being the CESVIMAP Lecture Series.
- Teaching courses for UCAV's own degrees.

Besides acting as thesis directors and advisers for students, a series of teaching activities are carried out under CESVIMAP's aegis, including the University Advanced Course in Automobile Appraisal, the Expert Technician in Automotive After-Sales Course, and the University Technical Course in Road Traffic Accident Reconstruction.

Mobility

CESVIMAP has a special department that studies and analyses all aspects of what is known as CASE (***Connected / Autonomous / Shared / Electric***) mobility. We examine mobility from different vantage points from a claims adjuster and bodywork perspective, considering how electric mobility modifies all the parts and components making up the structure of a vehicle. We have thus ascertained that manufacturers are taking a two-fold approach to developing electric vehicle platforms, adapting internal combustion engine vehicle platforms to electric vehicles or creating platforms especially for electric vehicles. Conventional modular platforms permit cost savings through standardised components and economies of scale, but they also present difficulties to developing electric cars, mainly because of the batteries, because the platforms developed for internal combustion engine vehicles were not designed to house the traction batteries for electric vehicles from the get-go.

Recent EU emissions regulations and tough anti-pollution measures (Regulation 2019/631 of 17 April 2019) have taken a mean of 95 g/km CO_2 as their fleet-wide goal for vehicles. These regulations are currently being implemented and mean that electrification is clearly here to stay. In addition, the multi-billion euro fines faced by automobile manufacturers that exceed those limits will bring about a radical shift in the playing field. CESVIMAP's involvement and its research take on still greater significance in this context.

We can say that here at CESVIMAP we are a leader **in electrification and mobility**. We were the first research centre to study electric cars, back in 2011. With the knowledge we have gained, we are now in a position to offer the market the specialised training it needs, with unrivalled teaching staff and equipment and the ability to work on actual vehicles or use virtual reality.

Figure 4. The CESVIMAP garage and its self-driving car.
Source: CESVIMAP.

PMD research at CESVIMAP

New means of transport based on the concept of micromobility (small distances with the final stage being covered on foot or by bicycle) adapted to users' mobility needs have been developed. This is the context in which personal mobility devices, or PMDs, have arisen, and they are making greater inroads daily.

CESVIMAP, in cooperation with the MAPFRE Foundation, has performed a study entitled "Crash tests on electric scooters and risks associated with charging procedures". The report breaks down accident data form PMDs by accident type, the vehicles involved, rider age, the road on which the accident occurred, and severity. This report garnered intense media coverage – more than 10 television channels, 14 radio stations, and 70 newspapers covered the story. The report includes experiments focused on modifying PMD components and on overheating from manipulating their batteries and using portable chargers.

The analysis of this information on the most common accidents involving PMDs in cities initially made possible simulations using special traffic accident reconstruction software. Then based on that assessment real crash tests with dummies were designed and performed at the CESVIMAP facility. The apparatus used to conduct the crash tests for PMDs with dummies has been patented at the Spanish Patent and Trade Mark Office.

CESVIMAP, an ADAS laboratory

Since 2015 CESVIMAP has been conducting research, testing, disassembling, and evaluating vehicles that include ADASs(3) as standard equipment, for instance Autonomous Emergency Braking (AEB) systems or Lane Departure Warning (LDW) systems and developments enabling them to correct steering. The object is to gain a clear and precise picture of how these systems work and their limits, that is, to ascertain the circumstance in which they may not work, either because their sensor has failed to detect the situation or because the system's programming does not contemplate cases of that kind.

Why are we evaluating ADAS vehicles? The main objective of our research is to **assess a vehicle's ability to avoid accidents** and, in that way, avert personal injury and property damage, which directly impacts on road safety. Furthermore, the presence of ADAS sensors *may affect vehicle repair costs*, since they tend to be located in places relatively highly exposed to the effects of accidents. For instance, a parking accident involving a ball hitch coupling will have a substantial effect on repair costs and thus on insurance companies' bottom lines and on policyholders' pocketbooks.

The point is to weigh the cost-benefit of these systems, taking as a starting point that if an ADAS works properly, repair costs become a secondary consideration. However, if a system malfunctions or does not work at all, the increased repair cost is not justified, hence the system's cost-benefit ratio is dubious.

Services for insurers and claims adjusters

We here at CESVIMAP have been in a privileged position from which to observe the changes that have been taking place in the work of insurance companies in assessing damage to automobiles. **We have worked with them side-by-side the whole time**, in the face of technical changes, changes in processing and file management, evolving technologies, and the like. Our whole reason for being is to provide automobile claims adjusters and professional damage appraisers working with garages, fleet management companies, contract hire companies, and others with the necessary know-how to enable them to cope with the tasks they face. Thanks to the new connectivity technologies, different products for locating stolen vehicles, variable insurance premium rating, and accident prevention and detection are coming onto the market.

Claims adjuster mobility

For claims adjusters, mobility is a must. This has understandably caused the conventional tools of their trade they use to draw up their reports for insurance companies and policyholders to be adapted so that their mobile devices can be linked online to all the applications contained in the *claims adjuster's tool kit*. This allows them to assess losses, provide guidance to garages, reconstruct accidents, etc. The benefits are clear: cases can be processed faster, and adjusters can increase the number of appraisals and close processing right at the garage, reducing the number of visits and enhancing follow-up of the work they have performed.

The power of AI when appraising damage to vehicles

In cooperation with CESVIMAP, MAPFRE's Innovation and Operations Departments have developed an artificial intelligence model for use in directly purchasing insurance policies for used vehicles online. This is made possible by the company's use of trailblazing artificial intelligence (AI) software capable of detecting dents, scratches, and small defects in the bodywork in real time from photographs taken by the user him or herself on their mobile phone. This was done in cooperation with the company Control Expert, which trained the predictive model using a very high

(3) ADAS stands for Advanced Driver Assistance Systems.

volume of varied images and the expected response for each. As a result, the software is able to determine whether a vehicle is damaged or not from photographs it has never seen before, with an accuracy of 95%.

The innovative aspect of this pilot project is to have a learning algorithm (state-of-the-art technology known as *Deep learning*) analyse images in real time and detect the presence or absence of damage of all kinds. This appraisal allows policies to be personalised for each customer. If the customer approves, he or she can then benefit from the insurance policy on the spot, with no waiting and no need move, and the policy can be issued in minutes, without any human involvement.

Automated appraisal from images using AI is one of the strategic objectives of MAPFRE as an insurer and of **MAPFRE Open Innovation** as the company's innovation division.

Systems like these can also be used to buy home or business insurance apart from car insurance. Expediting procedures and giving customers a simple, modern, personalised experience is key to these new generation products.

Online audits

Besides offering quality work, managing a garage **profitably** also requires **optimising procedures**. It is therefore necessary to monitor all aspects of the business carefully so as to keep profit margins at an acceptable level. In recent months the market has changed drastically, and the traditional business model of companies that viewed digitisation as a long-term project has shifted to one in which online functions have become much more important.

In keeping with the current changes in business practices, CESVIMAP now offers **online audits**. This procedure provides repair shops with data concerning their strong points and where they have room for improvement based on the documents and images furnished by the shops themselves or by the network or brand they belong to. The objective is to offer the same guarantee of quality as the on-site inspection variety but with fast assessments made possible thanks to this innovation.

ISO certification

From the very outset CESVIMAP decided to put its faith in the quality of its research, dissemination, services for repair shops, and training while carrying out all its activities with the utmost concern for protecting the environment.

In 2001 we implemented a Quality Management System to certify training activities. This certification under ISO standard 9001 recognises CESVIMAP's creative ability to adapt to its customers' needs and design bespoke training programmes in the automotive field. This ability was the result of our own know-how and methods. This is the building block CESVIMAP uses to organise whatever is needed for training and to monitor progress and outcomes with the objective of continuous improvement in its training capabilities to be able to fulfil the increasingly exacting demands of its customers.

A year later, in 2002, CESVIMAP certified its environmental Management System under ISO standard 14001. This certification recognised the measures taken by CESVIMAP to comply with applicable legal requirements and each year's environmental commitments in the framework of its dedication to preventing pollution and protecting the environment.

ISO standard 14001 helps manage and identify environmental risks that may arise internally in the company in the course of its activities. Risk prevention and environmental protection are both taken into account. The quest for sustainability has become one of the linchpins on which the business activities are based.

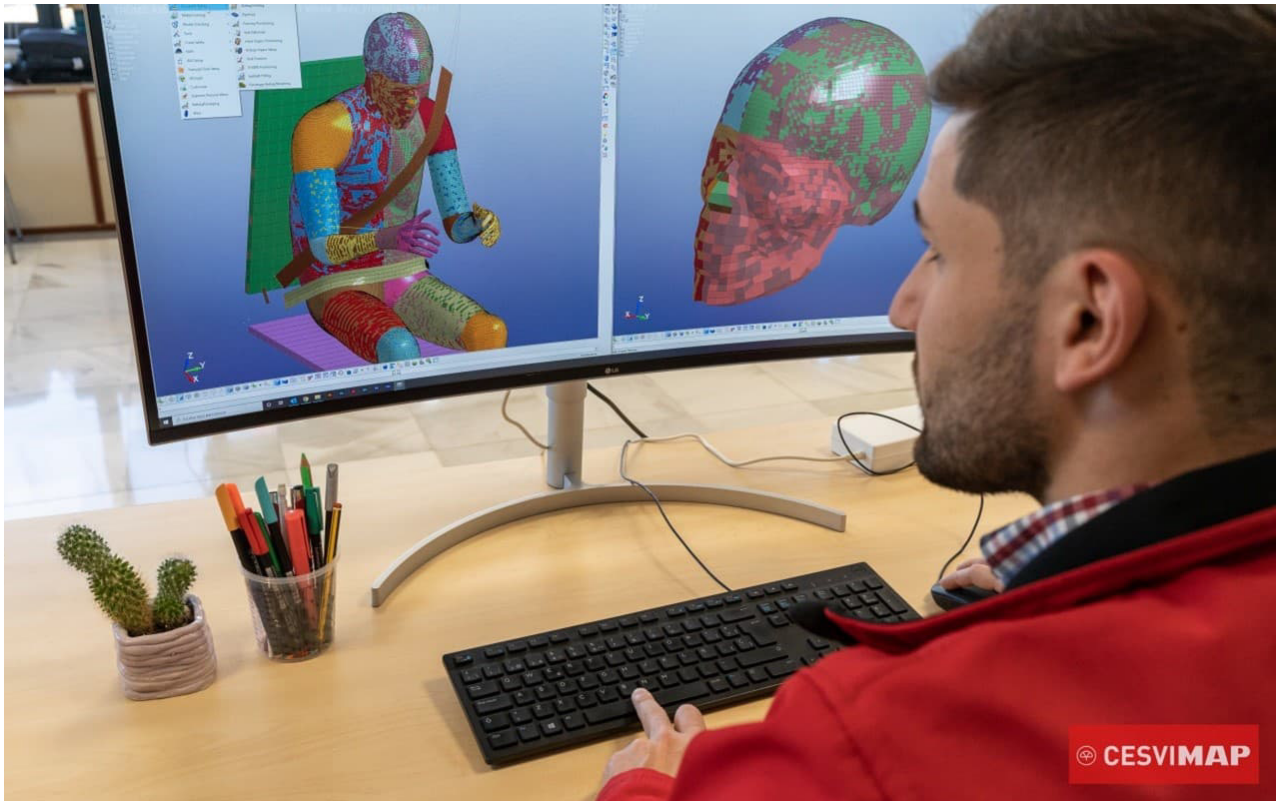

Figure 5. Computer road safety simulation software.
Source: CESVIMAP.

Furthermore, in 2016 we were certified under ISO standard 39001 Road Traffic Safety, recognising our engagement in that area and the many actions taken to promote road safety in our society. The road traffic safety management system is a tool that helps organisations reduce the incidence and the risk of suffering traffic accidents and limit their consequences. CESVIMAP's management system also encompasses sustainable mobility and promotes methods of transport consistent with its commitment to the environment.

Additive manufacturing and the automotive industry

CESVIMAP works in other fields related to the automotive industry. For example, it studies advances in additive manufacturing[4] technology to see how vehicle manufacturers and other providers design, market, and apply 3D printing to this field. CESVIMAP specialised engineers regularly attend the major trade fairs in Spain and in Europe (ADDIT 3D, BIEMH International Machine Tool Exhibition, MetalMadrid, Formnext, etc.) to collect first-hand all information related to the sector so we can be ready for these advances and play a role in a future that is increasingly turning into the present.

CESVI Recambios

Today no-one can imagine our society and our way of life without the automobile. However, when a car reaches the end of its useful life, it can pose a threat to the environment. Cesvi Recambios, CESVIMAP's Authorised Parts

(4) Additive manufacturing is a process based on converting a digital model into a solid three-dimensional object.

Processing Centre, is a touchstone for how to dispose of vehicles in an ecologically responsible manner, prolonging the lifetime of parts (*recambios* in Spanish) that are in good condition by using them to repair other vehicles and helping to recycle the base material of the rest, steel, plastic, aluminium, glass, rubber, tyres, fabric, and so on.

Responsible consumption means prolonging the lifetimes of the products we use and subsequently converting them into other, new products to the extent possible. Automobiles too can be reused or recycled. But is a used car as reliable as a new one? How can we be sure that it is still suitable for use after an accident? And if it breaks down, does it have a guarantee? Cesvi Recambios works to ensure that the used parts recovered from an automobile meet all the requisite requirements and safeguards so that they can extend their lifetimes into a second cycle.

Since it started operating, Cesvi Recambios, CESVIMAP's End of Life Vehicle Processing Centre, has recycled more than 46,000 vehicles. It decontaminates hazardous components like batteries and all the vehicle's fluids. It recovers the vehicle's materials: steel (currently most of the total weight) and other materials that can put to a wide range of industrial uses like aluminium, plastics, copper wiring, and glass. In that way it can give at least 85% of the weight of vehicle a new lease of life.

More than 53,000 tonnes of CO_2 saved attest to the work carried out by CESVI Recambios on behalf of the environment. Its automated working methods are able to neutralise the environmental impact of MAPFRE vehicles that have been declared a total loss by affording their parts a second life.

In short, CESVIMAP endeavours to create value for MAPFRE and society through its strong commitment to the **environment**. CESVIMAP can be defined by four terms, research, innovation, generation of knowledge useful to the insurance industry, and support for applying that knowledge to day-to-day operations. This knowledge is conveyed to **claims adjusters, insurance companies, and transport professionals** to help attain a safer society on the road.

Scope of subrogation actions brought by insurance companies against the Consorcio de Compensación de Seguros in cases of dispute. Interpretation of the status of injured party

Judgment 148/21 of 16 March 2021 by the Spanish Supreme Court Opinion written by Justice José Luis Seoane Spiegelberg

José A. Badillo Arias
Regional Representative in Madrid
Consorcio de Compensación de Seguros

One of the problems encountered in practice –the substantive matter addressed by the judgment discussed below– concerns who is to be understood to be the "injured party" to be paid compensation by the CCS in a dispute, because sometimes there are "other injured parties" involved in an accident that claim entitlement to compensation from the CCS by application of the dispute mechanism. These are insurance companies that have paid compensation to their insured party, hospitals that have treated the victim, repair shops, and the like.

1. The Consorcio de Compensación de Seguros (CCS)'s role in helping victims in cases of dispute

1.1. Background

Under the former legislation, in cases where both the insurer and the Guarantee Fund took the view that neither should pay for the consequences of an accident, the victims of traffic accidents were condemned to the odyssey of having to bring suit against one or both, not only incurring considerable cost but also suffering delays in collecting the indemnity to which they were entitled because of the accident. This was ordinarily the result of discrepancies over whether or not a policy was in force. Furthermore, since rulings generally went against only the Guarantee Fund or the insurance company, the victim had to pay the costs of the entity found not to be at fault.

Most disputes – past or present – between the Guarantee Fund and private insurers concern automobile insurance. In certain difficult cases, the insurance company says that it is not the insurer of a given vehicle that has caused injury to a third party, while the Guarantee Fund maintains that according to the information submitted by the insurer to the Informative Records of Insured Vehicles [*Fichero Informativo de Vehículos Asegurados (FIVA)*], the policy is in force, so it

too does not accept liability for the loss. These are cases involving non-payment of the initial premium, subsequent premiums, or premium instalment payments.

Difficulties have also arisen, for instance, in cases in which the insured automobile has been sold, but under sections 34 and 35 of the Spanish Contracts of Insurance Act [*Ley de contrato de seguro* (LCS henceforth)] it is not always easy to decide which was liable, the insurer of the seller of the automobile or the Guarantee Fund itself when the automobile was sold without the compulsory insurance.

1.2. Third Directive relating to insurance against civil liability in respect of the use of motor vehicles

Faced with this problem, to protect the victims of traffic accidents, Article 4 of the Third Directive relating to insurance against civil liability in respect of the use of motor vehicles sought to settle the matter once and for all by providing that in the event of a dispute between the Guarantee Fund and the civil liability insurer as to which must compensate the victim, the Member States would take the appropriate measures so that one of these parties was designated to be responsible in the first instance for paying compensation to the victim without delay. This was without prejudice to reimbursement of the party that had paid by the other party if it was ultimately decided that that other party should have paid all or part of the compensation.

In the case of Spain, that provision in the Third Directive was transposed in section 8(1)(d) of the Spanish Insurance against Civil Liability in respect of the Use of Motor Vehicles Act [*Ley sobre responsabilidad civil y seguro en la circulación de vehículos a motor*] (the "Act"), now section 11(1)(d), whereby the CCS is responsible for compensating victims of personal injuries or property damage in cases where there are discrepancies between the CCS and the insurance company as to which is liable for indemnifying the injured party in the cases that fall under the compulsory insurance scheme or are stipulated in section 11(1), letters (a) to (c), setting out the duties of the CCS. Without prejudice to the above, if it is later decided that the insurance company is responsible for paying compensation, the company is to reimburse the CCS for the sum of the indemnity plus statutory interest, increased by 25%, from the date on which the indemnity was paid out.

1.3. The concept of Injured Party in the Directive and in Spanish legislation

One of the problems encountered in practice –the substantive matter addressed by the judgment discussed below– concerns who is to be understood to be the "injured party" to be paid compensation by the CCS in a dispute, because sometimes there are "other injured parties" involved in an accident that claim entitlement to compensation from the CCS by application of the dispute mechanism. These are insurance companies that have paid compensation to their insured party, hospitals that have treated the victim, repair shops, and the like.

We have seen that Article 4 of the Third Directive refers to "a dispute between the Guarantee Fund and the civil liability insurer as to which must compensate the victim". When the Directive was transposed under section 8(1)(d) of the Act, now section 11(1)(d), the term "victim" was changed to "injured party", namely, "a dispute between the Consorcio de Compensación de Seguros and the insurance company as to which must compensate the injured party". In our opinion the change from "victim" to "injured party" was due to the need to use a more precise term, because where the victim dies, the victim is not the same as the injured party. Accordingly, in speaking of an injured party we are referring to a victim that has survived but to the injured party when the victim of the accident has died. In fact, during the Directive review process currently in its final trilogue stage among the Commission, the European Parliament, and the European Council, a proposal has been made to replace the term "victim" with the term "injured party".

In any case, it seems to us that this change from "victim" to "injured party" should not go beyond the intended purpose of the Third Directive when dealing with disputes of this kind. As just explained, what the Directive was endeavouring to avoid was for the "victim" or the "injured party" left by a deceased victim to have to bring suit when neither the insurer or the Guarantee Fund could reach agreement, for example, as to whether or not there was insurance coverage. In short, the point is to avoid delays in paying indemnities to accident victims who have suffered

personal injury or property damage. That is the basis for the interest in paying compensation to victims before a final decision as to who is ultimately liable for paying the indemnity is taken.

By contrast, it seems obvious that there is no justification for this exceptional procedure where the beneficiary of the indemnity is, for instance, another insurance company that had previously indemnified the victim in the performance of its own obligations under another insurance policy that was bringing an enforcement action against the CCS to try to benefit from application of the dispute mechanism pursuant to section 43 of the LCS.

It should be borne in mind that in this case the CCS is not *a priori* actually liable for the loss but rather that under the law it is to pay the corresponding compensation on a *prima facie* basis solely to benefit the victim until a decision is subsequently taken as to which party is liable for the accident by a court or by agreement between the parties.

Therefore, we take the view that in line with the Third Directive, coverage of the matter in dispute by the CCS is solely for the benefit of traffic accident victims and that for the reasons discussed above this is not extensible to other injured parties such as insurance companies, hospitals, repair shops, and so forth. This was the ruling made, for example, by the judgment of 24 May 2012 by the Fourth Section of the Provincial Court of Appeals of Murcia (JUR [*Law Reporter*] 2012\232467), in which the appellant insurance company, after paying its insured party for the own damage cover, sought the status of an injured party for purposes of application of the dispute mechanism. The judgment found that "in the event of a dispute, the lawful party is the injured party that has been directly harmed; that is not the status of the insurance company, which paid the indemnity it is now claiming under an all-risks insurance policy".

Naturally, the scope of application of the dispute mechanism is the scope of application of the Act. Therefore, the matter should involve a traffic incident caused by a motor vehicle. It also does not seem reasonable to rely on application of the dispute mechanism when there is a discrepancy between two or more insurance entities as to which of them should take liability for a given accident or a discrepancy regarding which of the drivers of the vehicles involved was responsible for causing the accident or regarding the grounds for discharge of civil liability under section 1 of the Act.

2. Judgment 148/21 of 16 March 2021 by the Spanish Supreme Court

Notwithstanding the above, the positions taken by the lower courts have not been devoid of controversy concerning the concept of "injured party" under the aforesaid section 11(1)(d) of the Act. Some judgments have taken the position of the CCS described above, while others, in contrast, have expanded the concept of injured party to other entities apart from the victim on condition that they had a right of claim against the CCS.

The recent judgment of 16 March 2021 by the First Chamber of the Supreme Court has held insurance companies to be injured parties where they have exercised the subrogation action envisaged in section 43 of the LCS and have taken the place of the victim after indemnifying the victim under a voluntary own damage cover. The Court therefore held that they should be considered injured parties for purposes of applying the dispute mechanism pursuant to sections 11(1)(d) of the Act and 20(2) of the Spanish Regulation on compulsory civil liability insurance for motor vehicle use [*Reglamento del seguro obligatorio de responsabilidad civil en la circulación de vehículos a motor*] (Compulsory Motor car Third-Party Liability Insurance, MTPL).

2.1. Findings of Fact in the Judgment

In the case considered here, the appellant insurance company brought a subrogation action under section 43 of the LCS against the CCS based on section 11(1)(d) of the Act.

The insurer had paid out for damage to the insured vehicle under a voluntary own damage cover. The other vehicle

was responsible for the accident, so after paying compensation to its insured party, it sent an out-of-court claim letter to the other vehicle's insurer, which denied coverage on grounds that the vehicle was uninsured, and to the CCS, which argued that the vehicle was in fact insured and that the claimant was not an injured party for purposes of applying the dispute mechanism under the aforesaid section 11(1)(d) of the Act.

The CCS refused to pay, and the insurer took legal action against it, arguing, in short, that pursuant to the subrogation action brought against the CCS, the insurer took the position of the victim and hence was to be considered the injured party for purposes of applying the dispute mechanism.

2.2. The position taken by the lower-court judgments

The trial court accepted the CCS's arguments explained above and dismissed the claimant's action, holding the injured party to be the accident victim, not the insurance company that had been subrogated to the victim's position.

The Provincial Court of Appeals of Madrid dismissed the claimant's appeal on grounds similar to those set forth in the trial court's judgment, though it based its decision directly on the provisions of Directive 2009/103/EC of 19 September 2009 relating to insurance against civil liability in respect of the use of motor vehicles. The Court therefore held: "The wording of Article 11 of the Directive headed 'Disputes' has the same telos or ultimate purpose, namely, to ensure that the victim is compensated without delay. This being the case, compensation of its insured party by the insurance company and bringing a subrogation or recovery action under section 43 of the LCS cannot be taken to come within the scope of operation of section 11(1)(d) of the law said to have been breached, which differentiates between the injured party and the insurance company".

2.3. The Supreme Court's ruling

The claimant insurer lodged an appeal in cassation against the aforesaid judgment. The grounds put forward by the claimant in its appeal can be summarised as breach of section 43 of the LCS and of the Supreme Court's settled case law, in that the insurance company that brought the direct action envisaged in section 11(3) of the Act against the CCS after previously having paid its insured party (who did not cause the accident) the indemnity owed under the policy was not considered to be the injured party in Finding of Law One in the judgment of the Provincial Court of Appeals of Madrid.

The Court accepted the claimant's appeal in cassation and thus held the aggrieved insurance company to be the injured party within the scope of the dispute mechanism laid down in section 11(1)(d) of the Act. It first made reference to the dispute mechanism in Directive 2009/103/EC of 19 September 2009 relating to insurance against civil liability in respect of the use of motor vehicles.

It then touched on transposition of the above-mentioned Directive in section 11 of the Act and noted that pursuant to the decision-making authority conferred by the Directive on the Member States, Spanish lawmakers opted for the CCS to take on the obligation to redress the harm suffered in case of dispute.

Lastly, the Court then considered in detail the nature of the subrogation action envisaged in section 43 of the LCS and the case law interpreting it. Accordingly, it stated that the case law has set out the prerequisites for successfully bringing a subrogation action and cited judgment 699/2013 of 19 November 2013, which held that "(i) the insurer has fulfilled its obligation to pay the insured party the indemnity under the coverage specified in the policy; (ii) the insured party has a claim for redress against a third party that caused the harm, in other words, subrogation does not arise where there is no third party liable for compensation, (Supreme Court judgments of 14 July 2004 and 5 February 1998, *inter alia*); and (iii) intent on the part of the insurer to be subrogated, inasmuch as subrogation is an optional right that may or may not be exercised, as the insurer prefers, hence under the Spanish Commercial Code [*Código de Comercio*] subrogation does not arise by operation of law".

In the case that concerns us here, the Court held that the aforesaid prerequisites for subrogation actions were fulfilled and that in addition a dispute had arisen, in that it had been proven that the claimant had approached the insurance company for the vehicle responsible for the accident, which had refused to take liability for the accident on grounds that the vehicle was uninsured. These were the circumstances in which it brought its claim against the CCS for purposes of section 11(1)(d) of the Act to have the CCS to take charge of the indemnity it had paid in settlement of the accident. The CCS refused the claimant's request because "... the claim cannot be accepted, because it is a case in which there is a dispute, and since all risks cover is involved, the company is not an injured third party under the law".

That is, the CCS expressly acknowledged that there was a legal situation that involved a dispute, although it did not accept the claimant's request because it did not recognise the claimant's legal status as injured party.

With respect to application of the dispute mechanism by the CCS, the Court held that the finding that the insurance company was not the injured party contained in the lower court's judgment was contrary to the nature of subrogation actions, which put the insurer in the same position as the injured party. It therefore held the Provincial Court of Appeals' interpretation not to be in conformity with the fundamental nature of subrogation actions, which confer on the claimant the capacity to exercise the rights and actions of the insured party entitled to take direct action against the CCS under section 11(1)(d) of the Act.

Conclusions

The CCS's interpretation regarding application of the dispute mechanism set up by section 11(1)(d) of the Act is that in accordance with the Third Directive, coverage by the CCS has been established solely for the benefit of traffic accident victims and that for the reasons discussed in section 1.3, this is not extensible to other injured parties such as insurance companies, hospitals, repair shops, and the like. Basically, the purpose of the Third Directive was to avoid delays in paying indemnities to accident victims who have suffered personal injury or property damage. That is its objective and the basis for arranging to pay compensation to victims up front, before any decision as to who is finally liable for paying the indemnity is taken.

However, in the judgment considered here, the Supreme Court concluded that by its very nature a subrogation action places an insurer that has indemnified an insured party under a voluntary own damage policy in the same position as the insured, and hence that the insurer should be considered to be the injured party for purposes of application by the CCS of the dispute mechanism envisaged in section 11(1)(d) of the Act.

Still, a single judgment does not set doctrine, and it is our understanding that this does not mean that the dispute mechanism should be extended and applied to other types of injured parties, e.g., repair shops, medical centres, or hospitals, because that issue was not specifically addressed by the judgment under discussion.

Insurance and climate change: knowledge generation as a driver of adaptive action

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Impacts, vulnerability, and adaptation to climate change by the insurance industry

Climate change poses an enormous challenge to society on two interconnected fronts: strategies to reduce greenhouse gas emissions are needed to bring its causes under control, while at the same time, to address its consequences, adaptation strategies to protect against the effects of a hotter, more extreme, and more unpredictable climate, effects that are already in evidence, need to be implemented.

Insurance is a strategic sphere of activity in the battle against climate change. First, it is a fundamental means of transferring risk, enabling society to enhance its ability to recover after the damage caused, for instance, by climate-related events. Second, insurance may play a key role by developing strategies to mitigate and adapt to climate change, helping to transition to a low-carbon society resilient to its unavoidable impacts. Nevertheless, climate change is also a grave menace to strategic economic sectors such as the insurance industry, because it is associated with an increase in certain physical hazards that can pose challenges to its business strategies and compromise the sector's long-term sustainability.

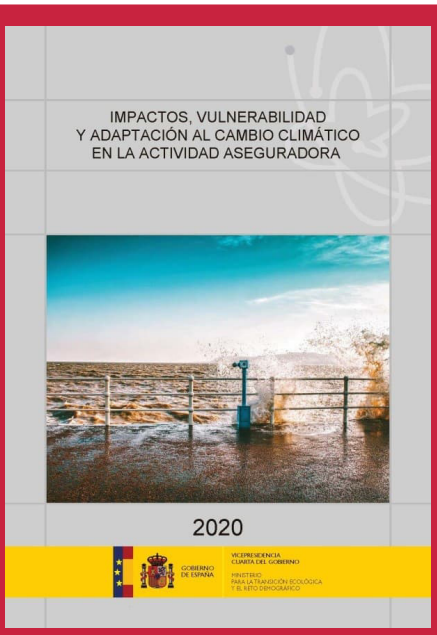

Figure 1. Cover of the report entitled "Impacts, vulnerability, and adjustment to climate change by the insurance sector".

The first **National Climate Change Adaptation Plan (in Spanish PNACC, Plan Nacional de Adaptación al Cambio Climático),** approved in 2006, included insurance among the vulnerable industries and considered the need to assess the sector's impacts, vulnerability, and adaptation. Since then a series of actions have been taken regarding adaptation and the insurance sector. One such action was a meeting held in 2017 in the framework of a programme of ongoing PNACC seminars to give scientists and insurance professionals an opportunity to exchange knowledge on the impacts of climate change and adaptation to climate change by the insurance industry in Spain. Some of the main conclusions reached were published in an article in issue number 8 of this journal in the spring of 2018. That seminar gave a major boost to knowledge generation on the topic and resulted in an initial proposal of content for granular analysis of the impacts, vulnerability, and potential adaptation measures in the field of insurance activity in Spain.

Pursuing this process further, in 2020 Spanish Climate Change Office issued a report entitled "Impacts, vulnerability, and adjustment to climate change by the insurance sector" [*Impactos, vulnerabilidad y adaptación al cambio climático en la actividad aseguradora*]. The report was based on a wide-ranging review of the literature on the insurance industry and

its relationship to climate change at both the national and international levels. Like the seminar in 2017, certain key players in the sector in Spain took part and conveyed their thoughts on the matter through interviews. The report addresses some of the challenges from climate change faced by the sector and considers possible adaptation measures for the insurance industry and opportunities for it to help build resilience. Furthermore, it identifies certain emerging issues of interest to the sector and certain gaps in knowledge that should foster reflection, discussion, and engagement on the part of players involved in the insurance field. In many cases, this is already finding a foothold in international forums and national initiatives.

The report discusses the national and international context of climate change, identifies relevant global climate hazards facing the insurance sector, and gives examples of management in such countries as the United Kingdom, the United States, Canada, and Australia. After examining the characteristics of the sector in Spain and its special features compared with other countries in our milieu, it sets out national forecasts on climate change, assesses the possible impacts on and vulnerabilities of the insurance sector (in response to such events as flooding, drought, and heatwaves), and identifies the key players involved. Lastly, it compiles some current and potential contributions of the insurance business to adaptation generally, assesses the viability of the sector and possible measures to help it adapt, and identifies knowledge gaps.

One of its chief **conclusions** is that globally the insurance sector is experiencing an increase in the frequency and intensity of events associated with relevant climate hazards. The damage they cause is also on the rise, though for the time being this trend is associated basically with increased exposure resulting from extensive urban transformation and economic development worldwide. In recent years events associated with secondary hazards (fires, flooding caused by cyclonic storm surges, etc.) have become more commonplace and more intense, and these secondary hazards have sometimes caused greater damage than the primary hazards, highlighting the need to improve the predictive models for these hazards. Nevertheless, the insurance sector considers that at the present time it has the capacity and sufficient solvency to cope with the climate-related perils associated with global warming in the short term thanks to ongoing upgrading of its activities.

Transposing that analysis onto the situation in Spain, it should be borne in mind that all climate perils, from the risks associated with such events as flooding and storm surges to those involving hail, drought, forest fires, and heatwaves, are affected by climate change to a greater or a lesser extent, which may in turn affect loss rates in most lines of insurance. The impacts of climate change in Spain may therefore affect both the coverage of the so-called "extraordinary risks" by the Consorcio de Compensación de Seguros (CCS), agricultural insurance, and many other lines, e.g., life, health, accident, vehicle, and travel medical insurance.

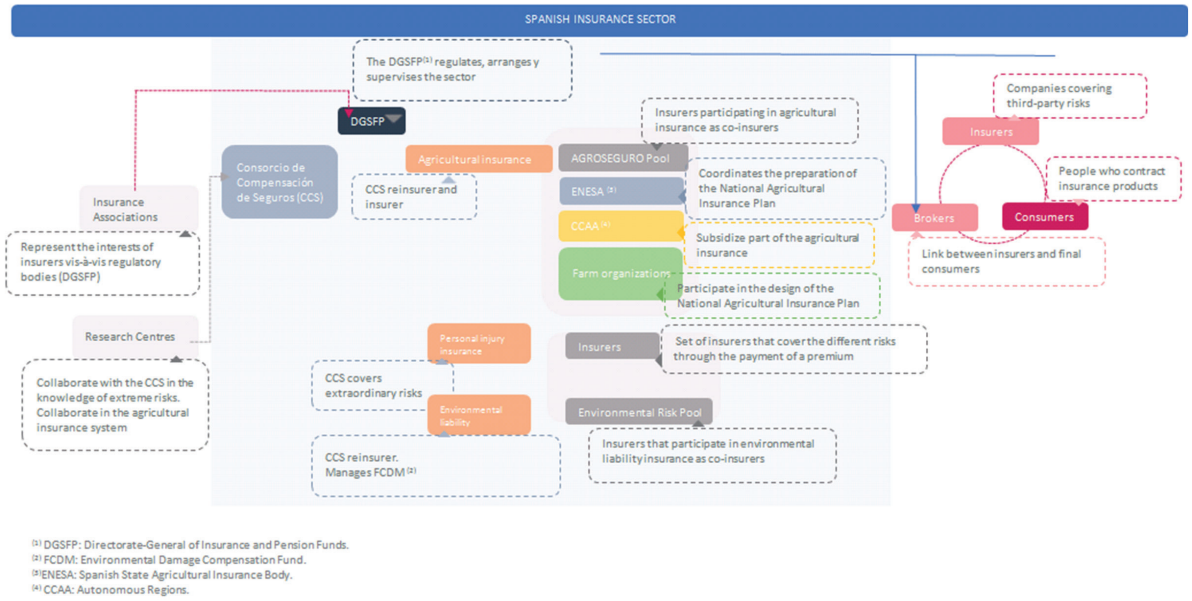

Figure 2. Diagram summarising the structure of the insurance industry in Spain.
Source: "Impacts, vulnerability, and adjustment to climate change by the insurance sector" report.

Nationally, the main climate perils affecting the sector are flooding and wind storms, natural phenomena that come under the extraordinary risk covers provided by the CCS. In the CCS's view, for the present the current system of coverage does not require changes based on the results of studies that have been carried out and the reserves on hand, despite the growing frequency and intensity of exceptional climate events.

Multi-peril agricultural insurance is likely to be most affected by climate change because of the farming sector's heavy dependence on climate factors, but by the same token it is one of the lines with the greatest capacity for adaptation. The main climate perils affecting agriculture are drought and hail, which for several consecutive years have caused catastrophes requiring recourse to the CCS's reinsurance capacity. In this connection, the system's flexibility and ongoing research studies, while at the same time promoting the necessary adaptation measures, will be vital to the long-term sustainability of multi-peril agricultural insurance.

The conclusion reached concerning other climate hazards not covered by the CCS's extraordinary risk scheme or multi-peril agricultural insurance was that there was insufficient disaggregated data on the climatic or environmental circumstances associated with these losses, making it hard to forecast the possible impacts of climate change. This could delay the development of any suitable adaptation strategies that may be required.

Turning to options in response, there was found to be a need to boost scientific research and to transfer scientific knowledge to the insurance sector. The main purpose would be to ascertain in detail the effect of environmental changes on existing perils and to identify emerging new perils in both the short term and the long term. This knowledge is essential to be able to undertake the required adaptations to the system, to design new products to cover the new risks without endangering the system's sustainability, and to generate new opportunities for the insurance sector to make it more innovative and resilient.

The Spanish insurance system, with its broad experience and special structure marked by public-private cooperation, is taken as an example of success internationally. It enjoys enormous potential to exert influence and take the lead in introducing sustainability measures into its business model in the current context of climate change and so bring social, economic, and financial stability to society.

The struggle against the effects of climate change is one that requires joint, coordinated efforts by all the players that can help the different sectors adapt to climate change. Commitment by public bodies, insurance companies, associations, research centres, and the private financial sector is essential to meet the challenge of adaptation in the insurance sector. A key mechanism for understanding climate change and taking action would be to set up new frameworks for cooperation and jointly promote initiatives to adapt to the risks, from exchanging information on trends in the various risk components (peril, exposure, vulnerability), to resilient recovery (employing “build back better” strategies), to potentially creating special financial instruments to reduce catastrophe risks.

Moving from knowledge to action: the National Climate Change Adaptation Plan (PNACC) 2021-2030 and the new EU Strategy on Adaptation to Climate Change

While knowledge generation on adaptation to climate change is still regarded as a priority, especially in areas with major knowledge gaps like those mentioned above, there is a growing consensus as to the urgent need to identify and implement effective measures to limit the risks arising from climate change and to increase the level of resilience on the basis of the knowledge that is already available.

The recently approved National Climate Change Adaptation Plan (PNACC) 2021-2030 recognises this priority and includes guidelines for action on cross-cutting issues to be addressed in order to be able to advance with adaptation. This new PNACC for 2021-2030 was approved by the Council of Ministers last September and is a basic planning

instrument for promoting coherent, coordinated action to tackle the threats and hazards posed by climate change in the different spheres of society based on a multi-level (on different territorial scales), cross-cutting (across different sectors) approach. That is, the PNACC 2021-2030 is aimed at averting or reducing present and future damage brought about by climate change and at building a more resilient economy and society.

This second PNACC is part of a strategic energy and climate framework, a package of instruments that encompasses the Energy Transition and Climate Change Act *[Ley de Cambio Climático y Transición Energética];* the long-term strategy towards achieving a modern, competitive, climate-neutral economy by 2050; the Integrated National Climate and Energy Plan 2021-2030 *[Plan Nacional Integrado de Energía y Clima 2021-2030];* and the Just Transition Mechanism [Estrategia de Transición Justa]. This material also addresses adapting to climate change and is clearly connected to the PNACC.

The PNACC 2021-2030 contains major new developments and new ways of viewing adaptation governance in our country. To wit:

Figure 3. Cover of the PNACC 2021-2030.

- It emphasises the need to consider a series of guiding principles that should inform adaptation policies and measures, such as taking into account the territorial and social dimensions and taking the best available knowledge and science as a basis.

- It sets out 81 courses of action for different sectors arranged into 18 working areas, chief among which are human health; water and water resources; farming and livestock raising; and cities, urban development, and building; not to mention insurance activities and the financial system.

- It specifies 7 cross-cutting issues to be promoted in the various working areas.

With respect to the financial system and insurance industry, the new PNACC puts forward four specific objectives:

- Promoting the role of the financial system as a catalyst for adaptation to climate change and further exploring and fomenting specific contributions to adaptation by the insurance industry, placing special emphasis on agricultural insurance and on establishing incentives for risk prevention.

- Fostering the generation of knowledge and skills with regard to the impacts of climate change on the financial system and the insurance sector and identifying investment opportunities for contributing to adaptation to climate change.

- Promoting measures for adapting to the financial risks associated with climate change by means of assessment, dissemination, and prevention.

- Supporting frameworks for cooperation and partnering with regard to adapting to climate change by the different actors involved in the financial system, placing special attention on the insurance sector, and buttressing the sector's adaptation capabilities.

Four courses of action have been put forward to achieve these objectives, intended to promote making adaptation to climate change a part of sustainable finance initiatives, creating incentives for risk prevention by integrating adaptation into insurance activities, implementing stable frameworks for coordination and cooperation with key actors in the financial system and the insurance field with respect to adaptation, and strengthening these sectors' adaptation capabilities.

The European Commission, in its turn, has recently presented **the new EU strategy on adaptation to climate change — Forging a climate-resilient Europe.** The new strategy sets out how the European Union can adapt to the unavoidable impacts of climate change and become climate resilient by 2050, setting four main objectives: making adaptation smarter, swifter, and more systemic and stepping up international action for adaptation to climate change. Like the earlier 2013 Strategy on Adaptation, the Commission has underscored the connection between adaptation and insurance, expanding its previous proposal, which consisted of promoting insurance and other financial products with a view to investment decision-making and resilient enterprises.

In the context of **smarter adaptation,** with a focus on improving knowledge and managing uncertainty, the new European Strategy sets out the need to acquire *more and better climate-related risk and losses data.* The Strategy proposes that the European Commission, together with the European Insurance and Occupational Pensions Authority (EIOPA) and the industry, should study the best ways to collect comprehensive and harmonised data on insured losses.

As concerns **swifter adaptation,** it aims to step up adaptation in all areas and includes a section specially dedicated to *Closing the climate protection gap.* In this connection it states that in the context of the Renewed Sustainable Finance Strategy, the European Commission will:

- help to examine natural disaster insurance penetration in Member States, and promote it, for example, through guidelines, and invite EIOPA to develop its natural catastrophe dashboard allowing country level assessments;
- strengthen dialogue between insurers, policymakers, and other stakeholders;
- identify and promote best practices in financial instruments for risk management, in close cooperation with EIOPA;
- explore the wider use of financial instruments and innovative solutions to deal with climate-induced risks.

Both the PNACC 2021-2030 and the new EU strategy on adaptation to climate change are intended to drive adaptation policies ahead and to strengthen the role of the insurance sector in this process. They also represent a major step forward towards developing specific measures for an urgent and suitable response to the climate emergency we are currently facing.

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