Summary and main conclusions and recommendations

The Spanish climate

Spain's climate is extremely varied as a result of its complex topography and geographic location. Interannual climatic variability is high and is conditioned to a great extent, specifically with regard to rainfall, by atmospheric circulation patterns in the Northern hemisphere, in particular by the North Atlantic oscillation (NAO).

During the XX century, temperatures in Spain showed a general increase, with a magnitude greater than the global average. This is more accentuated in winter. Rainfall during this period showed a downward trend, especially in the South and in the Canary Isles, although the high variability involved prevents a more precise judgement. This tendency partly corresponds to an increase in the NAO index.

The tendencies of future climate depend upon the socioeconomic scenarios used and vary according to the general climate models employed. The temperature increase projected for the Iberian peninsula according to whether more or less favourable scenarios are used (less or more emissions, respectively) is uniform throughout the XXI century, with a mean tendency of 0.4 ºC/decade in winter and 0.7 ºC/decade in summer for the less favourable scenario (A2 according to the IPCC), and of 0.4 ºC and 0.6 ºC/decade, respectively, for the more favourable scenario (B2 of the IPCC).

With regard to rainfall, the change tendencies throughout the century are not generally uniform, with noteworthy discrepancies between the global models, which makes the result less reliable. They all, however, coincide in a significant reduction in total annual rainfall, somewhat greater in scenario A2 than in B2. These reductions are maximum in spring and somewhat lesser in summer.

The application of regional models allows the detail of climatic projections to be enlarged. The results of one of these models (*PROMES*) for the last third of the century provides these data: temperatures will increase by between 5 and 7ºC in summer and by 3 to 4ºC in winter, and will be somewhat lower on the coasts than inland, and also lesser (aprpox. 1º) for scenario B2 than for A2.

The changes in rainfall are more heterogeneous, with an accentuation in the Northwest-Southeast gradient in winter and autumn, with slight increases in one and decreases in the other. In spring and, above all, in summer, the decrease in rainfall is a generalised one. These variations are more accused in scenario A2 than in B2.

The frequency and range of monthly temperature anomalies increases in all seasons and in both scenarios, although there is great geographic variability. The changes in monthly rainfall anomalies are not conclusive.

The frequency of days with high temperatures increases in spring and autumn, although it is not conclusive on the islands. The days with minimum temperatures tend to decrease.

Considering the set of results for climate change projected throughout the XXI century for Spain by the different climate models considered, we can arrange their degree of reliability in a descending direction in the following way: 1: progressive tendency to increase of mean temperatures throughout the century. 2: Tendency towards more notable warming in a scenario of higher emissions. 3: The increases in mean temperature are significantly greater in the summer months than in winter ones. 4: Warming in summer is greater in the inland areas than on the coast or on the islands. 5: Generalised tendency towards less annual accumulated rainfall. 6: Greater range and frequency of monthly temperature anomalies. 7: greater frequency of days with extreme maximum temperatures on the Peninsula, especially in summer. 8: For the last third of the century, the greater reduction of rainfall on the Peninsula is projected in the months of spring. 9: Increased rainfall in the West of the Peninsula in winter and in the Northeast in autumn. 10: The changes in rainfall tend to be more significant in the scenario of higher emissions.

Main impacts of climate change in Spain

Terrestrial ecosystems

Climate change will affect the structure and functioning of terrestrial ecosystems, will alter the phenology and interactions among species, will favour the spread of invasive species and pests and will increase the impact of both natural and anthropic disturbances. The areas and ecosystems most vulnerable to climate change are islands and isolated ecosystems, such as edaphic islands and high-mountain systems, and ecotones, or areas of transition between systems.

Inland aquatic ecosystems

With a high degree of certainty, climate change can be expected to make many of Spanish continental aquatic ecosystems (SCAE) change from permanent to seasonal; some will disappear. The biodiversity of many of them will be reduced and their biogeochemcial cycles will be altered. The magnitude of these changes cannot yet be established. The ecosystems most affected will be: endorheic environments, lakes, lagoons, rivers and high-mountain streams (1600-2500 metres), coastal wetlands and environments depending upon subterranean waters.

Marine ecosystems and the fisheries sector

The effects of climate change will differ for upwelling ecosystems or those comprising stratified areas and for coastal or oceanic areas. Reduced productivity is expected in Spanish waters, given their characteristics as subtropical or warm temperate seas. The changes will affect many groups of organisms, from phytoplankton and zooplankton to fish and algae. There will be changes in the marine trophic networks, affecting resource species, especially in their larval phase and in recruitment. Species distribution will change, with an increase in temperate waters and subtropical species and a decrease in boreal species. There will be a possible increase in invasive species. Marine cultures provided with no food supplement could be affected by the reduced marine productivity. Increases are to be expected in the appearance of species of toxic phytoplankton or parasites of cultivated species, favoured by the temperature increase in coastal waters. The areas and systems most vulnerable to climate change are benthic communities; fields of phanerogams will be the most affected.

Plant biodiversity

The direct impacts of climate change on plant biodiversity will occur through two antagonistic effects: warming and reduced hydric availability. The “Mediterraneisation” of the North of the Peninsula and the “aridification” in the South are the most significant tendencies. The biggest indirect impacts are those deriving from edaphic changes, changes in the fire regime and a rise in sea level. Interactions with other components of global change and the modification of interspecies interaction constitute another potential source of impacts for which evidence is now beginning to accumulate. High-mountain vegetation, forests and deciduous thickets sensitive to summer drought, sclerophyllous and lauroid forests in the South and Southwest of the Peninsula and coastal vegetation are among the most vulnerable types. Structural simplification and the predominance of local extinction over re-colonisation constitute recurring tendencies of the different impacts. The loss of floristic diversity is of particular relevance in Spain, given that our country contains a high proportion of Europe's plant diversity.

Animal biodiversity

Spain is possibly the EU's richest country with regard to animal species, and the one with the highest number of endemisms. Climate change will cause: 1) Phenological changes in populations, with advances (or delays) in the initiation of activity, arrival of migratory species or reproduction; 2) maladjustment between predators and prey due to differential responses to climate; 3) displacement in the distribution of terrestrial species northwards or towards greater altitudes, in some cases with a clear reduction of their distribution areas; in rivers, displacement of thermophilic species upstream and a decrease in the proportion of cold water species; in lakes and lagoons, altitude, latitude and depth have similar effects upon communities in relation with temperature; 4) greater virulence of parasites, and 5) an increase in populations of invasive species.

Hydric resources

In Spain, climate change will cause big decreases in water resources. For the 2030 horizon, we can expect average decreases in hydric rosurces in natural regime of between 5 and 14%, whereas for 2060 an average global reduction of hydric resources is expected of 17% on the Peninsula. These figures could exceed between 20 and 22% for the scenarios predicted for the end of the century. Along with this decrease in resources, an increase is expected in the interannual variability thereof. The impact will be noted more severely in the Guadiana, Canarias, Segura, Júcar, Guadalquivir, Sur and Balearic Isles river basins.

Soil resources

Much of Spain's territory is currently threatened by desertification processes, especially by the impact of forest fires and fertility loss in irrigated soils due to salinisation and erosion. The projected climate changes will exacerbate these problems in a generalised manner, especially in the areas of Spain with dry and semiarid Mediterranean climates. The projected climate changes will probably cause a carbon decrease in Spanish soils, which will negatively affect the physical, chemical and biological properties of the soils.

Forestry sector

Forests pests and diseases can play a fundamental role in the fragmentation of forest areas. Some perforating or defoliating species can complete up to two biological cycles per year or increase their colonisation area as a consequence of more benign winters.
The physiology of most forest species could be profoundly affected. There is a high risk that many of our forest ecosystems will become net carbon emitters during the second half of this century. Tip of mountain areas, the more xeric environments and riparian forests could become more vulnerable to climate change.

Agrarian sector

Changes in CO_2 concentrations, in air (and ground) temperature values, and variations in seasonal rainfall will have opposing and non-uniform effects upon Spain's agricultural systems. Climate change could affect the ingestion and wellbeing of the livestock and, consequently, the profitability of livestock farming systems. From the point of view of animal health, we can expect to observe the effects of climate change in all parasitic and infectious processes the etiological agents or vectors of which have a close relationship with climate.

Coastal areas

The main problems related to climate change in Spain's coastal areas are associated with a possible rise in mean sea level (MSL). Projections by the models vary from 10 to 68 cm for the end of the century. For the end of the century, a 50 cm rise in MSL can reasonably be expected, with 1 m in the most pessimistic scenario. With a generalised rise in MSL, the most vulnerable areas are deltas and confined and rigidized beaches. This could lead to the loss of many beaches, especially on the Cantabrian coast. Many coastal lowlands would be flooded (Ebro and Llobregat deltas, Manga del Mar Menor, Doñana coast), some of which might be built up.

Natural hazards of climatic origin

Flood risk

Hydrological variability in Atlantic basins will increase in the future as a result of the intensification of the positive phase of the NAO index. This might reduce the frequency of floods, although not the magnitude of these. In the Mediterranean and inland basins, the greater irregularity of the rainfall regimes will cause an increase in the irregularity of the regimes of floods and flash floods.

Slope instability risk

Landslides and avalanches are concentrated in the main mountain ranges, especially in the Pyrenees, and the Cantabrian and Betic ranges. Slope instability currently causes losses of hundreds of millions of Euros annually, especially in communication channels and, to a lesser extent, in population settlements. The number of deaths caused by landslides has dropped in the last few decades, but there has been an increase in those caused by avalanches as a result of the mountains being more frequented. While confirmation by more accurate climate models is being awaited, increased torrentiality will cause a greater number of surface landslides and debris flow, the effects of which could be exacerbated by changes in land uses and less plant cover. Consequently, increased erosion is expected on slopes, along with a loss of quality of surface waters, due to increased turbidity, and a higher rate of clogging in reservoirs.

Forest fires risk

Temperatures and soil moisture scarcity will increase, which will cause greater and more long-lasting desiccation of fuels. Fuel flammability will therefore increase. Mean danger indices and, in particular, the frequency of extreme situations will increase. The average duration of the fire-danger season will be prolonged. There will be more ignitions caused by lightening. There will be an increase in the frequency, intensity and magnitude of fires.

Energy sector

In a scenario of temperature increases and reduced rainfall, an increase is expected in the demand for electric energy, which should be covered without having to resort to hydraulic energy production, as this would be reduced; an increase in the demand for oil and natural gas is also predicted, along with reduced deposits of biomass (currently scarce). Only solar energy (in its different forms) would be favoured by the plausible increase in hours of insolation. If there were to be an increase in episodes of strong winds, there might also be an increase in the production of aeolic-generated electricity.

Tourism sector

The impacts of climate change on the geographic-tourism space could cause changes in the associated ecosystems. Water scarcity would cause problems related to the functionality or economic viability of certain destinations. Temperature increases could cause changes in some activity schedules, leading to more travel between seasons. A rise in sea level would threaten the current location of certain touristic resorts and the infrastructures thereof. These impacts would have a greater effect upon the more deteriorated areas with a greater combination of the different climatic effects. There might be a reduction in the average stay at each destination, a delay in the moment of deciding to travel and a change of destination, foreign tourists thus staying at home and nationals travelling to northern coasts or inland.

Insurance sector

The detection of the effects of climate change upon the Spanish insurance sector involves analysis of the claims rates for coverage of flooding, storms, frosts, hail and drought, damages being the branch most affected. Storms and flooding are the most numerous and costly events. Compensation for flooding in the 1971-2002 period increased, most likely due to the increase in the insurance index, in exposure and in insured capital. Statistics for agricultural insurance show that the eastern half of the Peninsula is the most sensitive to climate change.

Human health

From the point of view of the possible impacts upon human health, we would need to consider the effects on morbidity and mortality of extreme temperatures, fundamentally through heat waves, which have been indicated as the most frequent with regard to intensity and duration for the coming years. Furthermore, the foreseeable increase in fine particles and ozone will constitute the main impacts in relation to atmospheric pollution. To these impacts we must add the geographic spread to our country of pre-established vectors or the establishment of subtropical ones adapted for survival in cooler, drier climates.

Main recommendations for policies in a scenario of climate change in Spain

Terrestrial ecosystems

The management of terrestrial ecosystems should involve society as a whole and seek creative ways of financing activities aimed at mitigating effects and for restoration and research. The conservation of terrestrial ecosystems in a scenario of climate change clashes with many human activities, especially in relation to the use of natural resources like water. There is a need for integrated management of the multiple goods and services provided to us by terrestrial ecosystems.

Inland aquatic ecosystems

The possibilities of adaptation of CAE to climate change are limited. In order to mitigate the effects thereof, there is a need for water saving policies, improved water quality and an intensification of the measures for the conservation of the surrounding terrestrial environments. Given that new conflicts over water are to be expected as a result of climate change, it is reasonable to expect the conservation of CAE to be the easiest priority to ignore. The changes the CAE are really subjected will affect environmental conservation and the tourism sector, population protection, water supply and continental fisheries.

Marine ecosystems and the fisheries sector

The management of coastal marine ecosystems and of marine species should be considered from a multispecific and ecosystemic perspective. The search for solutions that mitigate the effects of direct human activity should be promoted, along with medium- or long-term follow-up of actions.

Plant biodiversity

Avoiding losses of biodiversity caused by the impacts of climate change requires global responses. The sectorial strategies designed require a broader geographic framework than that of regional or local administrations, upon which they currently depend. The network of protected spaces, conservation policy, ecological restoration, forest management, the regulation of livestock farming and hunting uses, land planning, environmental evaluation and education constitute the policies most involved in the challenge of providing responses to the impacts of climate change.

Animal biodiversity

The areas most vulnerable to climate change are coastal areas, wetlands and permanent water course which will become seasonal and seasonal ones that will have a more irregular flow or will even disappear, high mountain areas and moist pasturelands. Neither the displacement of distribution ranges (hypothesis I) nor rapid adaptation to new ecological conditions (hypothesis II) appear to constitute feasible solutions for most of the species studied. The main management solutions should include the design of nature reserves and parks interconnected by biological corridors. The network of protected areas should include latitudinal and altitudinal gradients in order to protect populations undergoing processes of geographic displacement as a result of climate change. The zones or areas especially sensitive to climate change should be identified, especially for species with no option for habitat displacement.

Hydric resources

The change will necessarily involve re-modelling and redefining new policies such as those related to science and technology, hydraulics, energy, agriculture, environment and land planning. We recommend continuing with the tradition of measurements established in Spain by means of control systems, which are generally well-established or being improved. However, the convenience should be highlighted of designing and establishing, or clearly improving, the water use control networks, in relation both to surface and groundwater, along with the flow gauge network in fountains and springs.

Soil resources

The reforestation of marginal, barren land and the practice of a type of agriculture aimed at soil conservation, along with an increase in organic carbon content and improved edaphic fertility, offer great possibilities with regard to counteracting the negative effects of climate change. The amendment of the PAC (Agenda 2000) offers possibilities for applying this principle. Soil quality should be taken into account in town planning and in any re-classification of use. The drafting of the *European Strategy for Soil Conservation* s should established the basis for the development of European regulations dealing with the conservation and sustainable use of soils.

Forestry sector

In view of the foreseeable changes, an adaptational strategy is recommendable. Clipping of the underbrush to reduce stump density has proved to be an efficient treatment that improves the response of these forests to climate change. Control and adjustment of exploitation turns and intensities should be considered as an option for optimising the response of the forest. Equally important is the careful selection of the origins of the seeds in reforestation, for appropriate management of genetic diversity.

Agarian sector

In agricultural systems, extensification or forestation should be favoured in areas with increased instability, or intensification of stabilisation by means of irrigation in other areas, along with the establishment of alternative crops or areas of compulsory fallow and new design of integral control of pests and diseases. In livestock farming, reduced carrying capacity should be favoured, along with the necessary changes in grazing management; there should be support for supplementing and adapting facilities. The farming of autochthonous species and vector control should be considered, due to their possible repercussions in relation to foreseeable pathologies.

Coastal areas

Immediate action is required in relation to the human factors affecting the stability of the coast, such as the maintenance of discharge and solid deposits by rivers as a solution to the “origin” of the problem (the lack of sedimentary material). As a solution to the “symptoms” of the problem (excessive retreat or mobility of the coast), we can indicate the stabilisation of beaches and dunes, the construction of structures for limiting the transport capacity of incoming waves and artificial deposits of sediments. Protection of natural values (strict land planning to ensure the maintenance and recovery of valuable areas) is vital. There is also a need to demarcate and inventory the areas and elements that could be affected by a rise in sea level, in order to define where to apply abandonment and retreat strategies, or ones related to protection.

Natural hazards of climatic origin

Flood risk

We must improve the quantification of risk and prevention in relation to climatology and land planning, especially in urban areas and tourist resorts, particularly in Mediterranean ones; we also need to improve catchment prediction systems.

Slope instability risk

Land and town planning, aimed at avoiding the areas most susceptible to slope instability constitute the best and most economical adaptational tool.

Forest fires risk

Policies on fire fighting, land and forest planning and training and information for the public should be adjusted to the new conditions. Management schemes based on the total exclusion of fire should be modified, providing the possibility to use fire as a tool for reducing the hazadousness of certain areas. Plans for conserving biodiversity or for combating desertification ought to incorporate the new scenarios of increasing fire-danger. Management of public spaces for recreational use should take into account the growing danger that approaches.

Energy sector

We seem to be following the right path with regard to energy policy, both in the EU and in our country, but our energy production, however, is far from being sustainable. We therefore need to study these policies in depth in order to adopt specific and additional measures for implementing strategies, in order to make our energy production sustainable, especially with regard to reducing emissions.

Tourism sector

Implications for public policies, from the incorporation of financial and fiscal aid and investment in specific infrastructures, to the modification of existing legislation on land planning, delimitation and uses, transport and even school schedules. All of this can be established through policies that reinforce investment in tourist infrastructures that capitalise on new opportunities in new areas, apart from the necessary restructuring of certain destinations and traditional products. This will require the vital public leadership and the active incorporation of all the companies in the tourism sector.

Insurance sector

We recommend the follow-up, in each regional autonomy, of the following measures, to be analysed and applied at national level: 1) Review of the Basic Construction and Design Regulations, and Review of Land Planning and Land Uses, in accordance with the climatic risk of each area and the foreseeable evolution of this. 2) Promotion of prevention education from primary school level. 3) Promotion of insurance as a prevention instrument. 4) Adaptation by the insurance market to the possible demands in a new scenario of climatic risk. 5) Analysis of the variability of agricultural policy in future climate scenarios.

Human health

There is a need for public health action plans based on early warning systems aimed at identifying risk situations before these occur, which involves an agile and reliable morbidity and mortality database. We need to apply and follow up European Directives relating to all the aspects that might affect human health, both in the short- and long-term. It is also of vital importance to promote and develop specific surveillance and control programmes related to vector-borne diseases, and to initiate activities aimed at increasing citizen awareness and participation in all the activities related to climate change and the implications thereof for human health.

Main needs for research and data for the detection of climate change

Terrestrial ecosystems

Among the main research needs, we can highlight the consolidation of long-term ecological follow-up networks, making as much use as possible of the existing and favouring the interdisciplinary participation of the scientific community, the study of interactions, both between environmental factors and between species and trophic levels, and the determination of minimum tolerance values (climatic, structural, functional) in systems vulnerable to climate change.

Inland aquatic ecosystems

The knowledge gaps are due to: 1) the lack of reliable long-term data series; 2) the fact that there is still scant information on the ecological state and biology of the most important species; 3) ignorance of hysteresis processes, and 4) the lack of knowledge of the possible effects on the SCAE of abrupt or gradual changes in terrestrial plant communities and in the geology of the catchments in which they are located. The research needs are many, as practically no study has been conducted of the relationship between CAE and climate change.

Marine ecosystems and the fisheries sector

We need to consolidate the long-term environmental and ecological follow-up networks, improving and making use of the existing ones. There is a need to promote Spanish participation in international programmes, along with research plans aimed at establishing the impacts of oceanic change upon species and ecosystems, from both a retroactive and prospective perspective.

Plant biodiversity

The three main lines of research to be promoted are: follow-up of the changes underway, including long-term programmes of measures in the field; the response by species and communities to changes and the design of predictive models, based on the information provided by the former and on the projections by climate models.

Animal biodiversity

There is a need to promote research on taxonomy, and research that includes long time series, at both specific and community level. More and better knowledge is required of faunistic diversity and the distribution thereof for the study of eco/geographic biodiversity patterns. We should not allow the deterioration or progressive disappearance of information sources, such as the phenological database on plants and animals (birds and insects) started in 1940 by the Agricultural Meteorological Service, belonging to the National Meteorology Institute (NMI).

Hydric resources

In relation to climate change, there is a vital need to conduct research aimed at improving predictions of rainfall and temperatures and of the spatial and temporal distributions thereof; of those tending to define methods of generation of data climate series based on scenarios; of those providing better and more reliable methods of evaluation of evaporation and evapotranspiration; the role of rainfall interception and use of water by plants, data for the more reliable establishment of aquifer recharge and the development of models for computerising calculations of inflow and storage; watershed management models.

Soil resources

An initial basic need in relation to edaphic resources involves the inventory thereof at a useful scale of management (at least 1:50.000), with which to establish an evaluation of their condition, to plan their management and project change tendencies. It would be of great use to compile the existing information, dispersed throughout institutions at different scales and in different formats, and to homogenise and computerise these using the criteria from the FAO-CSIC database. Long-term basic studies should be promoted in order to attempt to detect tendencies in the evolution of soils, along with responses to disturbances and to climate change, especially in relation to low-periodicity events.

Forestry sector

Among the most pressing needs for the future, we can highlight the need for more accurate knowledge of the subterranean of our forest species, to establish or consolidate networks for the observation and analysis of the ecophysiological factors determining regeneration and, as a whole, the response of the forest to environmental changes; another aim involves promoting the development and application of forest growth models, aimed at predicting the response by the forest to environmental changes or management patterns.

Agrarian sector

The development and implementation of dynamic models for simulating different crops, in order to describe the interception of solar radiation by leaves, the generation of biomass (aerial fraction and roots), water and nitrogen balances and the generation of yields. Data on the response by agriculture and livestock farming to climate changes in long time series aimed at predicting effects on production yield of the different farms. The development of simulation models to account for the behaviour of different pathogenic agents in relation to climate; their capacity for adaptation to the biotope and the seasonal dynamics of the different processes.

Coastal areas

There is a need for more detailed knowledge of past processes (with annual or ten-year resolution). There is also a need for further study of the impact that climate changes, in particular with regard to MSL and other driving factors such as waves, together with the corresponding morphodynamic change, could have on sensitive coastal ecosystems. There is a need for follow-up systems and systematic data collection of the necessary parameters in order to establish empirical relationships or to design and validate models. We need to learn of the impacts of climate change upon wind and wave regimes and on the circulation patterns affecting each area.

Natural hazards of climatic origin

Flood risk

Development of coupled climate-hydrology regional models in order to provide reliable scenarios of hydrological extremes, taking into consideration the particularities of the Atlantic and Mediterranean basins. Reconstruction of past floods and study of the gauging series, referring these to natural conditions.

Slope instability risk

There is a need for a complete inventory of landslides and better damage assessment, as this is much greater than the official figures. More in-depth study is needed of the relationships between rainfall events and the different types of landslides, in order to appropriately integrate them into the hydrological and mechanical models.

Forest fires risk

More detailed knowledge is needed of the interactions between drought, fire danger, the occurrence of fires and the response by the vegetation in adverse situations. We must learn of the synoptic conditions that set extreme events in motion, thus allowing to anticipate and prevent fires. Climatic scenarios are needed with suitable spatial and temporal resolution, as well as models of vegetation response. We require more in-depth knowledge of the sociology of fires. Detecting change in the occurrence of fires necessitates maintaining the EGIF database on forest fires of Spain, and availing of cartography of the fires in order to verify changes in the spatial or temporal patterns thereof.

Energy sector

There is a need for more in-depth knowledge of the possible effects of climate change on energy demand at regional level and according to economic sectors. All of this is due to different reasons: generalist scenarios of climate change could lead to big information losses; thus, we should establish whether the foreseeable increase in mean temperature will be homogeneous, or whether it will affect certain regions more than others; this obviously affects different local infrastructures; and with regard to the series of indicators proposed for the detection of climate change in relation to the energy sector, there is a need to design models that break down the different elements influencing the evolution of these indicators.

Tourism sector

Research needs focus on critical knowledge gaps: 1) Study of the current role of climate in Spain's tourism system and the impacts of climate change according to the most vulnerable zones and products, integrating the different scales of manifestation of the phenomenon. 2) Creation of systems of indicators of the climate change-tourism relationship in order to detect and measure this. 3) Design of management models for optimising the main adaptational options and implications for tourism policies. This involves setting up and maintaining a specific line of funding for research projects, with explicit programmes dealing with this theme, to be integrated into the National R+D+I Plan.

Insurance sector

Greater availability in time, and adjusted to the needs of the sector, of meteorological and climatic data. Didactic explanations of the scenarios designed by the IPCC and the consequences of these. Experimental studies of the vulnerability of structures and crops in the different geographic areas to the main meteorological and climatic phenomena in their most extreme manifestations. Detailed statistics, prolonged in time, related to claims on the Spanish insurance market, according both to areas and to catastrophic events. Development of catastrophe models, combining risk and the financial parameters of the insurance and reinsurance sectors, in order to recreate historic and to estimate future losses.

Human health

There is a vital need for a more in-depth evaluation than the one conducted here of the possible impact on health of climate change in Spain, as has been conducted in other countries. This evaluation should include the quantitative assessment of the impacts upon health, taking into account the different scenarios of climate change and predictions of the demographic structure of our country. This would involve following the recommendations and methodology that the World health Organisation has developed in order to establish the degree of vulnerability in relation to human health and to make the necessary adaptations with regard to human health and climate change.