CEA
Insurers of Europe

Reducing the Social and Economic Impact of Climate Change and Natural Catastrophes

Insurance Solutions and Public-Private Partnerships

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Executive Summary

The growing worldwide exposure to natural catastrophes has become very evident in recent years, as result of the major floods, heat waves and forest fires in Europe, as well as due the disastrous hurricanes in the US. Over the last two decades, the world has experienced a clear increase in the number, scale and economic impact of such events.

The impact of natural catastrophes on European societies and economies is likely to increase further as result of two complementary trends. Firstly, the scale and frequency of natural catastrophic events are likely to increase due to climate change. Secondly, the economic impact of natural catastrophes is increasing due to the growing number of people living in areas with a high risk exposure, as well as the increased economic activity in these zones.

A constructive dialogue with Politicians and relevant stakeholders

European insurers have a common purpose with politicians and other stakeholders: limiting the economic consequences of climate change and making the economic players take responsibility in this matter, with long-term and short-term proposals in particular for adaptation, insofar as one is concerned about the consequences of the increasing frequency and seriousness of extreme climatic hazards (e.g. construction or land use/spatial planning standards). The objective of this report is therefore twofold. It aims firstly to raise policymakers' awareness of the valuable contribution that the European insurance sector is already making with regard to natural catastrophes by providing research, encouraging prevention measures and delivering financial solutions. Secondly, to identify best practices number of areas a in which active public-private cooperation can achieve mutual benefits to the public, national and European public authorities and insurers alike.

Climate change will only affect natural catastrophes that are weather related. For this reason, this report will mainly focus on weather-related catastrophes. However, many of the insurance problems and of the solutions discussed are also valid for catastrophes with a geophysical cause (like earthquakes, tsunamis, volcano eruptions, etc.).

Promoting public-private cooperation in risk and loss reduction…

The negative effects of climate change on extreme weather events can be best managed by an active cooperation between public authorities and insurers at both the national and European level. Insurers have expertise in the identification and analysis of risk, developing sustainable financial solutions and encouraging risk reducing behaviour by both individuals and businesses. Public institutions on the other hand, decide on land-use planning (allowing or avoiding building in areas with a high risk exposure), adopting construction codes (to reduce the impact and costs of extreme weather) and are responsible for the investments in general prevention measures like coastal defences and river embankments.

European insurers are already providing cover against natural events. In those markets where cover is available and where it is combined with prevention requirements, it constitutes an effective measure for adaptation to climate change. On the other hand, where compensation schemes making use of insurance are not in place, the development of insurance solutions related to climate change in other markets cannot arise from the market alone. Insurance solutions are not always economically viable (e.g. due to a too high loss burden or a too small pool of policyholders) and are therefore not provided by the market. To make this type of natural risks insurable, the insurance sector and the state – acting as an insurer of lost resort only – should cooperate to reduce the financial burden for the insurance industry under extreme circumstances. It will allow coverage for risks that would not be normally economically viable for the benefits of consumers and businesses that have to face the increasing scale and frequency of extreme weather events due to climate change.

…And enhance the insurability of risks

Active public-private partnerships can help to ensure that the conditions of insurability are met or improved, thus allowing cover to be provided at a reasonable price. Public-private partnerships can encourage information and data sharing and in this manner enhancing the understanding of the short and long-term affects of climate change. This can help to identify the risk reduction and adaptation measures that are required to meet the insurability conditions, or to improve the economic viability of private insurance solutions.

Improving the conditions of insurability via public-private partnerships will achieve benefits of mutual interest to governments, public and insurers alike. Insurance solutions, which finance the potential economic losses before the occurrence of weather related catastrophes (ex ante financing), have a number of advantages in comparison to state or public donations after an event:

- Insurance solutions reduce the burden on the public purse at a time European public finances are already under pressure due to other developments like the demographic challenge
- Insurance provides the funding to cover potential losses in advance and can therefore be paid out more quickly than funds financed after an extreme weather event. Insurers have the capability and experience to handle claims in an efficient manner.
- Advance funding of potential losses caused by extreme weather events gives a stronger incentive to reduce the risks by adaptation, mitigation and prevention measures, in particular when such measures are a precondition to the availability of insurance coverage and when insurance prices are linked to the risk exposure.

For these reasons, European insurers initiate and actively support public-private partnerships that aim to encourage adequate prevention measures and improve the conditions of insurability. Such measures will improve the conditions for private insurance to develop innovative insurance solutions (or prevent them from disappearing due to increasing risk exposure and a rising potential loss burden). Consequently, the social-economic impact of climate change, in particular with regard to the negative effects of climate change on the occurrence and size natural catastrophes, can be reduced.

A sound and coherent legal framework - Market incentives

CEA recognises that, as result of the differences in risk exposure to natural catastrophes among EU Member States and differences in market's capacity, there is no general solution to deal with the problem of an increasing number of natural disasters in Europe caused by Climate Change (Member States in the South and East of the EU in which there is added exposure to the seismic risk on the one hand and the Netherlands on the other hand, because of the very high proportion of the country exposed to the risk of submersion, with State intervention envisaged on constitutional bases). Furthermore, across Member States, the level of catastrophic risk financing is far below optimum levels, mainly due to a weak demand for insurance services, adverse selection phenomena, etc. The expected further increase in the number of extreme weather events in the wake of a changing climate could put more strain on Member States and increase economic discrepancies. This should be prevented as far and as long as possible by market solutions such as insurance services, operating as incentives to prevention and adaptation, rather than by State of welfare. This is why, CEA urges national governments take adequate risk and loss reduction measures and to consider the cross-border aspects of (the lack of) such measures. It also supports the movement of each Member State towards a coherent legal framework to deal with the effects of natural catastrophes. This legal framework should encourage economic players to turn towards more appropriate market responses for *ex ante* financing of damages caused by natural disasters and limit the intervention of the state as an insurer of the last resort. If applicable, it must be explained clearly to private players that:

i. any intervention of the State, or the European Union, is limited, if necessary according to the country, to that of a last resort reinsurer and that it is reserved for situations in which previously specified extreme disaster thresholds have been exceeded;
ii. that the lack of insurance cover taken out at one's own initiative may have disastrous consequences.

But market forces alone are unlikely to deliver the full response necessary to deal with the serious risks from climate change. National governments have a role in providing a clear and coherent policy/legal framework to guide effective adaptation by individuals and businesses in the medium and longer term. Here though adaptation is global challenge, it requires local solutions.

Introduction

Now the public consultation on adaptation has just been launched at European level, the European Re/insurance industry wishes to play a full part in this debate. There is also a great deal of expectation to see insurers taking some leadership in this area of new emerging risks.

It is very critical for the European Re/Insurance industry to be actively involved in this public debate because the scale and frequency of weather related catastrophes constitute significant threats to the insurance businesses which in turn are the one who provide financial protection against any king of risks.

The Re/Insurance industry has a lot of expertise in risks analysis and measurement. Some powerful high technical tools in the fields of prevention, pricing and investment are being improved or developed in order to analyse the practical consequences of global warming on the day to day life for businesses and households. This requires both investing in sophisticated modelling of the distribution of damages resulting from climate change and risk mapping the risk areas according to frequency and intensity.

It is also an area for innovation in product design in order to enhance prevention with a high level of standards provided by the insurers to their clients and in product pricing to incentivise best practices among customers.

Finally the main challenge relies on increasing capacity for coverage by developing pooling of market players and rebuilding convergence of interest between direct insurers and reinsurers. This also includes the development of public/private partnerships (PPP) to combine optimally loss absorption and market adjustment.

Even when insurability is questionable, the Re/Insurance industry should be part of the solution. By being proactive in face of the anxiety of public opinion and growing political pressures, the Re/Insurance industry is here in a better position to protect the true added value of their activity.

Beyond the potential damage resulting from climate change, the real risk for the Re/insurance industry relies in the development of regulations like compulsory insurance, 'Universal' coverage, price control and loss of information related to the risk insured. Here in a constant dialogue with Policymakers and the Re/Insurance industry, a clear demonstration that the fundamental insurance technique is able to cope efficiently with the new wave of risks and that the market remains the right way to develop effective protection adapted to every single case without deriving towards unfunded commitments, will have to be made. This report constitutes a first attempt in this process.

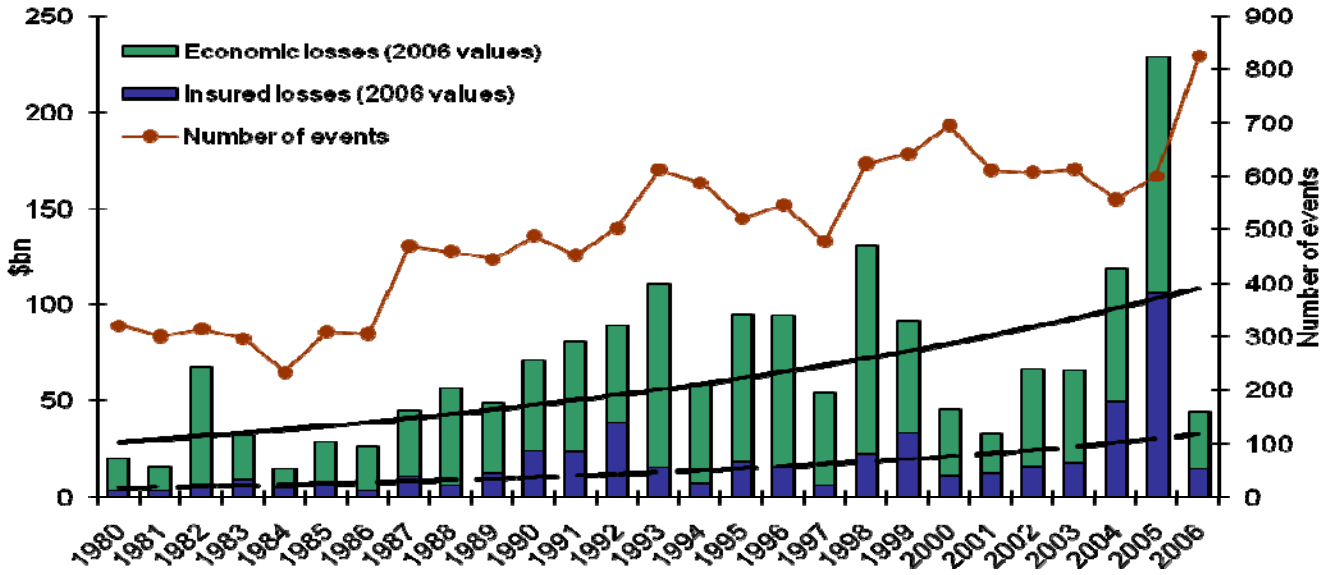
1. Impact of Climate Change and Natural Catastrophes on Europe

1.1 Implications of Climate change on the scale and frequency of weather related catastrophes

The Frequency and Scale of Extreme Weather Events already High and Increasing

The increase of extreme weather events is one of the most noticeable changes detected as result of the recent global warming.[1] World-wide the average number of great weather-related natural catastrophes has increased significantly, from about 1,5 in the 1950s to 4,5 in recent years. Apart from the increase in the frequency of weather-related natural catastrophes, the global economic impact of these events has also increased significantly, as indicated by the trend line of the economic losses in graph 3. An increasing part of these economic losses are covered by insurers (Insured losses in 1980s 18% of overall loss (mean value) and in 2000-2006: 21%. In 2005, for the second year running, the economic and insured losses hit a record high, with economic losses of $228bn (0.5% of world GDP) and insured losses reaching $106bn. A large portion of the insured losses were caused by the costliest hurricane of all time - Katrina (25-30 August 2005) – which resulted in overall economic losses of $125bn of which $61bn were insured[2]. The economic losses caused by Katrina represented approximately 1% of US GDP in 2005, which is comparable with the size of the 6 smallest EU economies in 2005[3]. In Australia, drought in 2002 cut farm output by 30% and shaved 1.6 point of GDP. Europe has also witnessed a growth in the scale and frequency of extreme weather events. In comparison with the global trend, Europe has experienced a less steep growth in terms of frequency and intensity of weather related events. Storms and floods are the most frequent and costly extreme weather events occurring in Europe, representing 77% of the economic losses caused by weather related disasters between 1980 and 2006 (or 69% of overall natural catastrophic losses). Floods caused around € 15bn of economic damage in 2002 whereas Europe witnessed between €10 and 17bn economic cost of heat wave in 2003 plus around 55 000 premature deaths.

Graph 1 | Number of Global Weather Related Disasters and the Economic and Insured Loss Caused, 1980 – 2006



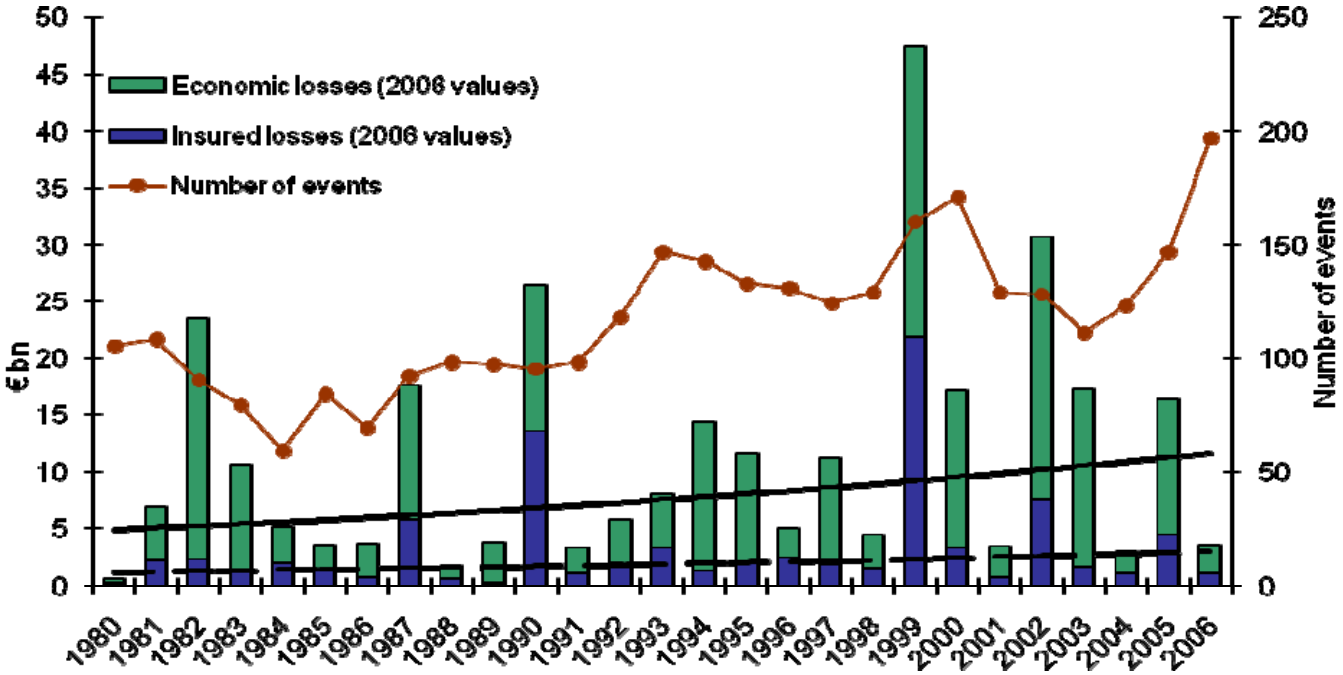
Source: NatCatSERVICE, Geo Risks Research, Munich Re (December 2006)

[1] The Center for Health and the Global Environment, Harvard Medical School (2006), Climate Change Futures, Health Ecological and Economic Dimensions, p18

[2] Munich Re (2006), Topics GEO - Annual review: Natural catastrophes 2005

[3] US GDP was $12 455bn and GDP of Slovenia, Lithuania, Cyprus, Latvia, Estonia and Malta was in total $110bn in 2005

Graph 2 | Number of Weather Related Disasters and the Economic and Insured Loss Caused in Europe, 1980 – 2006



Source: NatCatSERVICE, Geo Risks Research, Munich Re (December 2006)

Between 1980 and 2006, extreme weather related events represented 89% (€238bn) of the €366bn overall losses caused by natural catastrophes[4]. Indeed, on average, Europe is facing an annual economic loss burden of €12bn as result of extreme weather events, of which 28% has been compensated by insurers. The insured percentage of catastrophic losses has increased from 17 in the 1980s until 28% in 2006.

The economic impact of extreme weather events is well illustrated by the floods in Central Europe in 2002 (see Table 2 and Box 1), which caused aggregated losses in Germany, Austria and the Czech Republic of in total almost €16.5bn[5]. For these countries, the economic losses represented a share of their 2002 GDP of respectively 0.54%, 1.4% and 3.75%.

Table 1 | Costliest Weather Catastrophes in Europe 1980-2005 (ordered by overall losses)

Date	Loss Event	Region	Overall losses* (US$m)	Insured losses (US$m)	Fatalities
August 2002	Floods	Germany, Austria, Czech Republic	16 500	3 400	39
July-Aug.2003	Heatwave, drought	Entire Europe, esp. France	13 000		35 000 - 50 000
Dec. 1999	Winterstorm Lothar	France, Germany	11 500	5 900	110
Nov. 1994	Floods	Italy	9 300	65	68
October 2000	Floods	Italy, Switzerland	8 500	470	38

*Original values
As at: December 2006. *Source: NatCatSERVICE, Geo Risks Research, Munich Re (December 2006)*

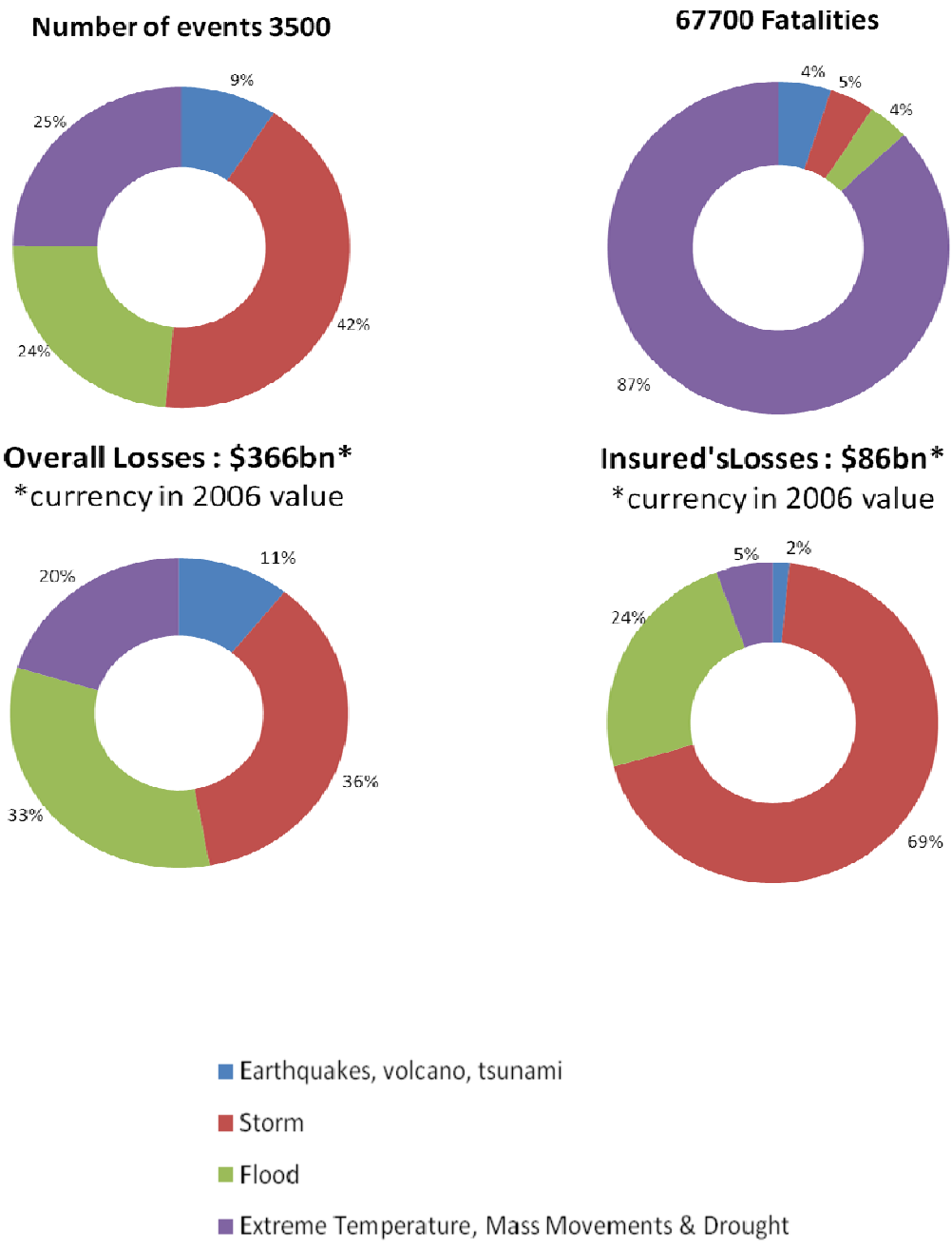
[4] Both figures in 2005 values
[5] The 2002 flood are in fact two separate events: the economic loss of the first event (4-13 august 2002) was approx. €5bn, the second event (12-20 august 2002) caused approx. €16.5bn of economic losses

Globally, over 85% of all global natural catastrophes between 1980 and 2005 were caused by extreme weather events like windstorms, , hail storms, severe storms, floods and extreme temperatures. In Europe, the figures are even more striking. In the same period, 91% of all natural catastrophes were related to extreme weather (see Figure 1). While major natural catastrophes caused by extreme weather (for example wind storms, floods, extreme temperatures) have increased significantly in frequency during the last 50 years, great catastrophes with geophysical causes (for example earthquakes, tsunamis, volcano eruptions) have remained relatively stable. These are clear indications that the growth in the occurrence of natural catastrophes is linked to the globally observed climatic changes. Clearly action is required to cope with the rising frequency, scale and economic impact of weather-related catastrophes.

The ability of climate data and computer models to provide enough information to make reasonable estimates about the future changes in the climate will be a decisive factor in developing adequate adoption and mitigation strategies.[6] European insurers have been studying the possible impact of climate change for three decades and are at the forefront of this research which gives insight into the adverse affects of climate change on the occurrence and impact of extreme weather disasters.

[6] Munich Re (2005), Weather catastrophes and climate change: Is there still hope for us?, p. 219

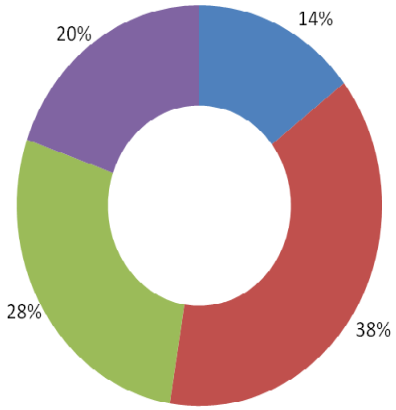
EUROPE



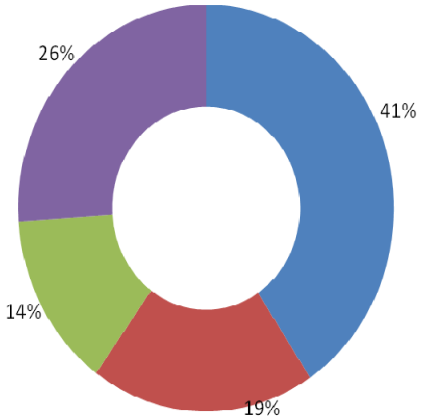
Source: NatCatSERVICE, Geo Risks Research, Munich Re (June 2007)

WORLD

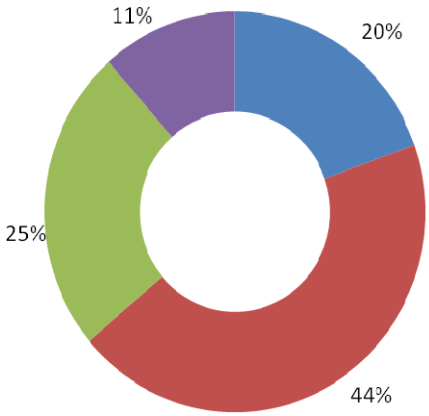
Number of events 16 000



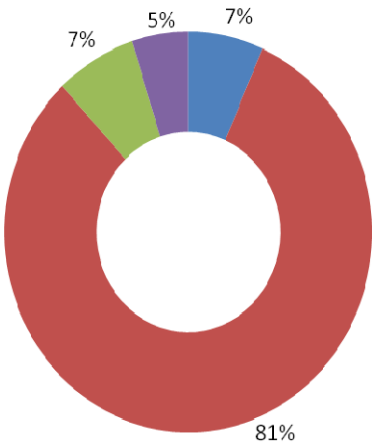
1 500 000 Fatalities

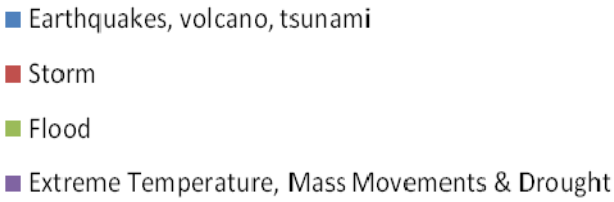


Overall Losses : $2200bn*
*currency in 2006 value



Insured'sLosses : $520bn*
*currency in 2006 value





Source: NatCatSERVICE, Geo Risks Research, Munich Re (June 2007)

Estimating the financial impact of climate change

The majority of studies on climate change focus on projecting the possible weather related changes due to global warming. A study of the Association of British Insurers (ABI), published in 2005, made a significant step forward in the quantifying impact of climate change on the costs of changes in extreme weather. The study focussed on the impact of climate change on the costs of Atlantic hurricanes in the US, typhoons affecting Japan and European windstorms. The ABI concluded that climate change could increase total annual average damages from these severe windstorms with 65% ($10.5bn) above a baseline of $16.5bn today[7]. However, these projections underestimate the full potential impact of climate change on future storm losses as the costs of flooding through intense precipitation and storm-surges were not explicitly modelled. Besides, the impact of social-economic developments, like growing population size, wealth, infrastructure and assets at risk were not considered, while such developments could substantially increase society's exposure to severe storms.

The economic losses caused by weather-related catastrophes are already high and increasing, as mentioned above, with annual losses of around $86bn since the 1990s (0.2% of World GDP). A recent study has shown that since the 1970s, economic losses as result of weather-related catastrophes – corrected for changes in wealth, inflation and population growth/movement – have on average increased by 2% each year[8]. The Stern Review[9] concluded on the basis of this study that `*if this trend continued or intensified with rising global temperatures, losses from extreme weather could reach 0.5-1% of world GDP by the middle of the century*[10]. The Stern Review estimated that the overall costs of climate change will be equivalent to losing at least 5% of global GDP each year. Indeed, according to these estimates, the annual costs of extreme weather events will double in the coming decades and account for 10% to 20% of the total economic impact of climate change[11].

While these studies give a useful insight in the magnitude of the `economics of climate change`, further studies are needed to improve the modelling of the economic and financial costs arising from the effects of climate change on our society and economy. In this respect, CEA shares therefore the opinion of the European Parliament that the Commission will have to develop further studies and stresses that European insurers are keen to participate.

1.2 A European approach to climate change and natural catastrophes?

Europe's diverse climate makes it vulnerable to a wide range of risks. For example, Western, Central and Eastern Europe areas are vulnerable to flooding due to the large rivers in these areas. Southern Europe is susceptible to drought as well as forest fires, Western Europe to storms and mountain areas such as the Alps and the Pyrenees to landslides and avalanches. Thus, while almost all European countries are affected by the negative consequences of climate change, they are not necessarily exposed to the same type of risk. As some Northern as well as most Southern and Eastern EU countries are also exposed to catastrophes with a geophysical cause (like earthquakes, tsunamis, volcano eruptions, etc.) the coverage of the potential financial costs of these events and those of extreme weather catastrophes are addressed in combined way by most of these insurance markets. In practise this means, that the insurance coverage for property is extended to cover both climatic and geophysical perils.

As a result of the differences in risk exposure to natural catastrophes among EU Member States and differences in market's capacity, there is no general/EU wide solution to deal with the problem of the increasing number of natural disaster in Europe caused by climate change. However, the European Union has an important role to play. Europe should maintain its leading role in the international efforts to combat climate change. National and European public authorities should work together, in close cooperation with the insurance industry, to take adequate prevention, adaptation and mitigation measures which reflects both the cross border aspects of weather-related catastrophes – floods do not stop at the border and neither should prevention measures – as well as the regional differences in risk exposure among Europe. As national, European and international regulators are examining the possibilities to reduce the burden of climate change on the public purse, European insurers believe that public-private partnerships are the best way to move forward as discussed in part 4.

[7] ABI (2005) Financial Risks of Climate Change

[8] Wood et al. (2006) The search for trends in a global catalogue of normalized weather-related catastrophe losses, p 161

[9] Independent Study requested by the UK Chancellor, led by Sir Nick Stern to conduct a major review of the economics of climate change in order to understand more comprehensively the nature of the economic challenges and how they can be met, in the UK and globally.

[10] Stern review, Part II The Impacts of Climate Change on Growth and Development, p.131-132

[11] Stern review, Executive summary, p.VI

2. The Impact of Natural Catastrophes and Climate Change on Insurers

What is at stake?
Climate change is today's problem not tomorrow's. The significance of mitigation and adaptation measures for insurers, to combat climate change and natural catastrophes, can be illustrated by an example of river and coastal floods, and urban floods (ABI 2005).

If we accept the scientific evidence that climate change exists (resulting in higher temperatures and an increasing level of CO_2 concentration in the air), we should develop policy options to deal with the changes in climate and the mitigate costs of extreme weather events. A combined approach of reducing emissions and adapting to increasing risk of flooding may be effective in reducing the effects of climate change.

In general, the following policy options can be distinguished, with regard to:

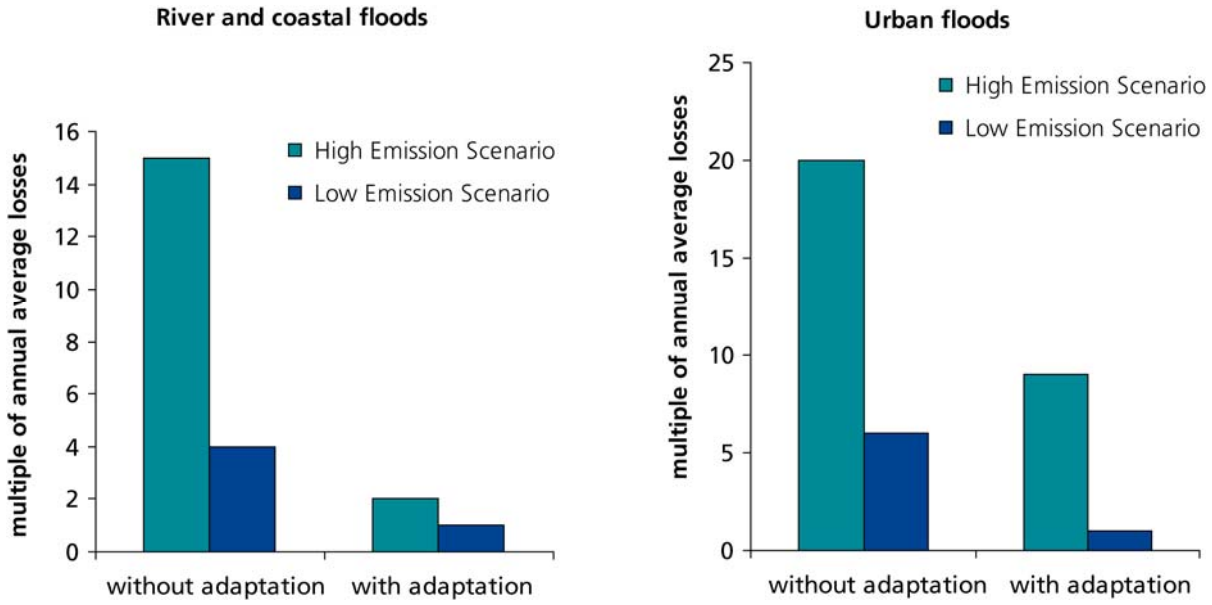
Mitigation measures:
- Low emission scenario: Mitigation measures to drastically limit the elevation of C02 concentration (to about 500 ppm)
- High emission scenario: Not taking any measures or staying below the objectives of the Kyoto protocol.

Adaptation measures:
- Adaptation measures to reduce society's vulnerability to the impacts of climate change, such as better flood protection and stronger land-use planning.
- No development and implementation of adaptation measures.

According to estimates for the UK, presented in the graph below, not investing in both mitigation (low emission scenario) and adaptation measures, would multiply the economic loss by 15 times compared to a situation where we would have invested in both prevention measures. The ratio rises to 20 if we exclusively assess urban floods.
However, investing in one prevention measure but not in the other would multiply the economic impact by a factor varying from 2 to 9 according to types of floods and the measures taken. As it is shown by the two graphs investing in mitigation is particularly important to reduce the impact of urban floods while investing in adaptation measures is particularly important to reduce the impact of river and coastal floods.

This example clearly reveals the dependency of the insurance industry on policy decisions to combat the negative effects of climate change on the occurrence and size of weather related catastrophes (when these natural hazards remain widely insured).

Graph 3 & 4 | The effects of mitigation and adaptation measures on economic losses



Source: adapted from ABI (2005), 'Financial risks of climate change' , based on estimates for UK around the 2080s.

2.1 Consequences for the Insurance Industry

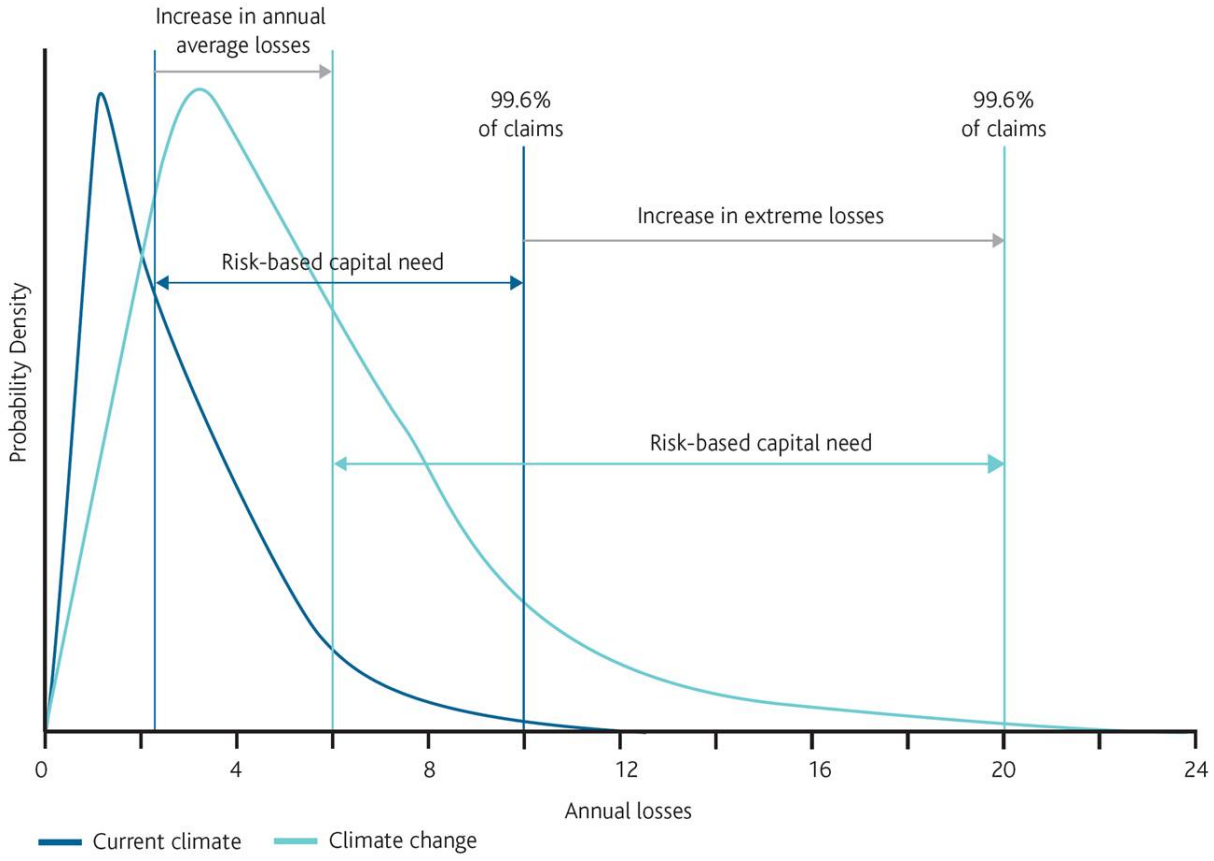
Insurance is in the front line of climate change, as it is often insurers and re-insurers that have the responsibility to deal with its consequences [12]. Climate change presents a range of challenges and opportunities to the insurance industry, affecting many business lines (e.g. property & casualty, agriculture and health insurance).

Risk Measurement
Risk measurement and the calculation of insurance prices in relation to weather-related catastrophes has typically been retrospective (looking at the loss experience in the past). As climate change is altering the global risk environment, a more forward-looking approach is required. Hence insurers are making use of geo-scientific methods of analysis, such as geographical information systems, risk mapping and event scenarios.

Adequate risk assessment and measurement is not only essential for the insurance sector but also for the society and policy-makers. By quantifying the expected changes of future weather related events and incorporating them in the premium calculations, insurance prices provide clear signals about the size of climate risks. Moreover, these quantitative approaches ensure that policy-makers can consider the full social, economic and financial consequences of catastrophic scenarios for a specific region when they decide on land-use plans.

Capital
As discussed above, the insured losses caused by natural catastrophes and their volatility will rise. Therefore, with a stable insurance coverage, insurance companies will have to cope with an increasing average and maximum loss burden. Sufficient capital is required to bridge the gap between expected and extreme losses. [13]

Graph 5 | Impact of Climate Change on Portability Loss Distribution and Implications for Risk Capital Requirements



Source: ABI (2005), Financial risks of climate change, p.37

[12] ABI (2004), A changing climate for insurers, p. 3
[13] ABI (2005) Financial Risks of Climate Change, p 36

In some markets the insurance industry has developed new innovative forms of risk transfer thus allowing an increase in the financial capacity of the market. Alternatives to transferring the risk to reinsurers or to the state, as insurer of last resort, include 'catastrophe bonds' (cat bonds) [14]. Cat bonds are securities that (re)insurance companies use to transfer natural catastrophe insurance risk to institutional investors in the form of bonds. As such, they help the (re)insurer to spread the peak exposures caused by extreme natural catastrophes by transferring the risk to the capital market.

Coverage

As the negative effects of climate change become increasingly apparent, the demand for insurance solutions to cover the costs resulting from weather-related catastrophes will grow. While this could offer a potential business opportunity, the requirements for insurability (see part 3) have to be met if coverage is to be realised.

The increasing demand goes hand-in-hand with an increasing risk exposure. The potential losses of certain weather-related catastrophes in regions with a high risk exposure might be too high for the insurance industry to bear on its own. The problems of adverse selection – the tendency of policyholders with high prospects of loss to buy more insurance products than buyers with lower prospect of loss – makes adequate diversification of the risks for insurers difficult, and need to be tackled.

The insurance industry is an innovative sector. Therefore, if public authorities, at all levels, work closely with insurers and reinsurers, sustainable financial solutions can be found to provide insurance coverage for weather-related catastrophe risks which would otherwise be commercially unviable. As an example of territorial needs, one may for instance consider the specific developments of flood management authorities, to offer contractual indemnification to upstream landowners of dedicated over-flooding areas, in order to reduce the exposure of downstream main urban settlements.

As indicated above, in most countries, insurance coverage against extreme weather events is sold in combined manner with coverage against telluric perils (reflecting their natural risk profile), thus increasing mutualisation conditions.

2.2 Consequences on Specific Insurance Classes

Climate change and the increasing occurrence and intensity of extreme weather events will have an impact upon several lines of insurance business. Property insurance seems the most vulnerable line in the sector. Nevertheless, a wide range of other insurance lines is likely to be affected as well. The impact of climate change on the losses in individual insurance classes is summarized in table 3.

Table 2 | The impact of climate change on losses in individual insurance lines [15]

Lines	Flood, storm surge		Severe weather, flash flood		Heat, drought		Cold weather, frost	
	short-term	long-term	short-term	long-term	short-term	long-term	short-term	long-term
Property (personal lines)	–	– –	– –	– – –	–	– –	+	+ +
Property (commercial)	–	– –	– –	– – –	–	– –	+	+ +
Property (industrial)	–	– –	– –	– – –	–	– –	+	+ +
Engineering (CAR)	– –	– – –	– –	– – –	–	– –	+	+ +
Engineering (EAR)	–	– –	– –	– – –	–	– –	+	+ +
Marine	–	– –	– –	– – –	–	– –	+	+ +
Agricultural (crops, livestock, etc.)*	–	– –	– –	– – –	– –	– – –	+	+ +
Motor own damage	–	– –	– –	– – –	–	–	+	+ +
Aviation, space	–	–	–	– –	–	– –	e	e
Contingency risks (cancellation-of-events, etc.)	– –	– – –	– –	– – –	–	– –	– –	– – –
Health	–	–	–	–	–	– –	+	+ +
Life	–	–	–	–	–	– –	+	+ +

*Only applies given the current coverage concept in Europe, multi-peril covers severely affected (corresponding to property)

Source: Munich Re, Geo Risks Research, 2004

Negative effects
– – – high
– – medium
– low

Positive effects
+ low
+ + medium
e insignificant

[14] Munich Re (2006), Topics 1/2006: p 14
[15] Munich Re (2005), Weather catastrophes and climate change: Is there still hope for us?, p. 220

Property
Coastal property is at risk from the rising see level and increasing strength of storm surges. In general, Europe will have to deal with increased average precipitation and flash floods, whilst homes and industry located close to rivers, will be threatened by the rising water levels causing more frequent or intense floods.

Drought, on the other hand, could lead to an aggravation of damage to foundations due to soil settling/subsidence. Rising average winter temperatures might however decrease the losses caused by frost. However, sudden and extreme frost events can undermine effects of such a decrease.

Life/health
The unprecedented heat and duration of the 2003 European heat wave made clear that the potential impact of climate change on health insurance is much bigger than previously expected. With temperatures up to 6°C hotter than the 20th century average, the heat wave contributed to many hospital admissions and the premature deaths of 22 000-35 000 people in five European countries.[16] It is projected that by the 2040s, more than half of all European summers will be warmer than that of 2003. [17] The increasing occurrence of floods, storms, and cyclones could also lead to an increase in the risk of infectious diseases.

Agriculture
Drought and floods can also have different consequences for farmers: rise in heat stress in animals, increase in the risks of damage to certain crops, drop in returns from crops, more risk of forest fires, lower productivity of agricultural land. Prolonged droughts will fuel forest fires that could endanger agricultural land and result in air pollution in the affected regions.

Motor insurance
As result of poor or extreme meteorological conditions, accidents could surprisingly become more numerous in summer. A study in 2003 by Munich University shows a link between the number of road accidents and meteorological variations. The relationship is not solely established for major natural events such as storms. Thermic conditions also play an important role. Statistics showed that road accidents were more numerous on hot days (+ 18%).

Consequences can also be very important concerning damages to the vehicles (so called CASCO insurance), in case of storm (falling trees, rocks, pieces of roof), of hail, but also floods, landslides, avalanches, which are damaging a lot of cars.

Liability
There could be a rise in claims in the liability field, particularly concerning authorities or operators in charge of prevention measures or defences (e.g. in case of lack of maintenance), in charge of land planning or building authorization (e.g. when delivering permits in risky areas), for house and buildings constructors (if they are not complying with building codes), rather than cases concerning greenhouse gas emitters.

Other insurance classes
In some cases extreme weather events result in business interruption. Such interruptions have negative consequences on turnover and operating results. During this interruption, the undertaking must continue to pay its fixed overheads.

Box 1 | Fact sheet: Europe's Largest Weather-Related Catastrophes

[16] The Center for Health and the Global Environment, Harvard Medical School (2006), Climate Change Futures, Health Ecological and Economic Dimensions, p. 55
[17] ABI (2005) Financial Risks of Climate Change, p 8

2003 European summer heat wave

Extreme heat
In the summer of 2003, a large part of Europe experienced summer temperatures of more than three standard deviations from the average summer values. Temperatures were 6°C above long-term averages experienced since 1851. [18] For example, in Paris, all but eight days were above average between 1 June and 31 August 2003.

Social, environmental and economic consequences
Extreme heat leads primarily to excessive mortality due to dehydration and heat stroke. Cardiovascular collapse, cerebrovascular and respiratory distress can also lead to a premature death. [19] In general, the elderly are the most severely affected. It has been estimated that between 22,000 and 35,000 lives were lost in 2003 due to the extreme weather conditions.

According to UNEP estimations in 2004, 10% of total mass of the ice cover of the Alps was lost in 2003, which corresponds to five times the average annual loss from 1980-2000. Moreover, 647 069 hectares of forest area was estimated to be destroyed, as well as 44.132 hectare of agricultural land and 1 700 hectare of inhabited areas in the more than 25 000 fires that were recorded in Portugal, Spain, Italy, France, Austria, Finland, Denmark and Ireland.

" The economic losses included life insurance payments for heat wave and wildfire deaths, property damage and direct health costs, including hospital stays, clinic treatments and ambulance rides. The livestock and crop losses (largely uninsured by private companies) were approximately US $12.3 billion […] Fire and timber losses included 400,000 acres in Portugal (approximately 14% of its forest cover), costing about US $1.6 billion. And the cost of monitoring and preparations in subsequent years was estimated to be US $500 million annually."

Source: The Center for Health and the Global Environment, Harvard Medical School (2006), Climate Change Futures, Health Ecological and Economic Dimensions

[18] The Center for Health and the Global Environment, Harvard Medical School (2006), Climate Change Futures, Health Ecological and Economic Dimensions, p. 54
[19] The Center for Health and the Global Environment, Harvard Medical School (2006), Climate Change Futures, Health Ecological and Economic Dimensions, p. 54

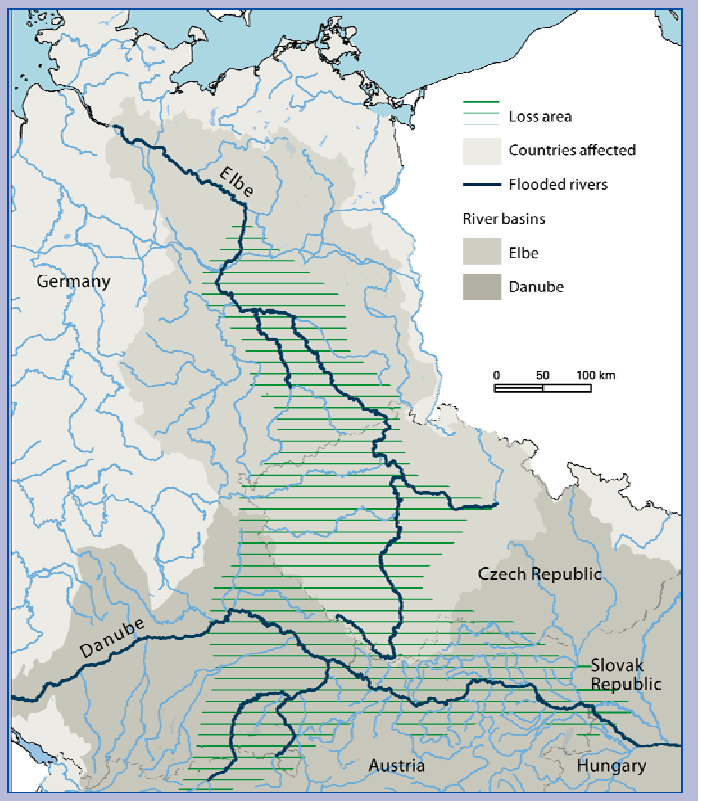
2002 Central European Floods

Since 1998, different parts of Europe experienced about 100 serious floods, which caused 700 deaths and the temporary displacement of approximately a half million people. These floods inundated an estimated area of one million square meters, including the areas that were flooded more than once. In this period, around 1,5% of the European population was directly affected by flooding.[20]

2002 was the year of the major catastrophic floods, as floods took place throughout Europe. The human impact of the 2002 floods in Europe includes 82 drowning-victims and several outbreaks of infectious diseases.[21] Central Europe was hit the hardest as heavy rainfall in August caused the Danube and Elbe rivers to flood parts of Germany, Austria and the Czech Republic. The flooding in this area was one of the worst floods since the middle ages.[22] Moreover, in absolute terms it was the most expensive catastrophic floods ever to occur in Europe. In Germany, Austria and the Czech Republic economic losses amounted to almost €18bn, of which just under a fifth was insured. Map 1 shows the area affected by the floods of August 2002 and is a good illustration of the cross-border effects of a European catastrophic flood, as a flood usually affects more than one European country. This cross-border effect of floods is a good example on why European cooperation on prevention and mitigation is important.

The fact that only a small part of the economic losses of this flood were insured, is something that often can be observed with flood damage. This is complemented by the fact that the majority of flood-losses are attributable to public infrastructure. As table 4 shows, the proportion of insured losses in the Czech Republic (40%) was much higher than in Germany (16%) due to the fact that the demand for insurance increased following the floods of 1997 in that country.

Map 1 | August 2002 floods affecting the Danube and Elbe basins



Source: Geo Risks Research, Munich Re 2005.

Table 3 | Aggregated and Insured Losses August 2002 Floods in Germany, Austria and Czech Republic

	Aggregate loss (€ Bn)	Insured loss (€ Bn)	Insured portion	GDP (€ bn)	Aggregate loss/ GDP
Germany	11.5	1.8	16%	2145	0.54%
Austria	3.1	0.4	13%	221	1.40%
Czech Republic	3	1.2	40%	80	3.75%
Total	17.6	3.4	19%	2446	0.72%

Source: CEA compilation based on Munich Re (2005) 'Claims Management after Natural Catastrophes'

[20] International Commission for the Protection of the Danube River. http://www.icpdr.org/icpdr-pages/floods.htm
[21] The Center for Health and the Global Environment, Harvard Medical School (2006), Climate Change Futures: Health, Ecological and Economic Dimensions, p.61.
[22] Munich Re, Topics 2002, p.19

3. Coverage for natural catastrophes in Europe

3.1 Requirement and principle of insurability

By pooling risks, insurance can mitigate the risks borne by each individual over a large group of insureds. Nevertheless, insurance can not support all risks. Some requirements are fundamental to allow insurability and more specifically to enable insurability of natural catastrophes. It is not the intention of this paper to detail all of the criteria of insurability. However, when considering the potential of insurance solutions to combat the consequences of climate change on the frequency and intensity of weather-related catastrophes, the following factors should be considered.

Risks have to be measurable
In order to allow insurer to fix a price and to estimate whether or not a risk can be accepted, they need to be able to measure the risk. This means the insurer should be able to determine the average cost and the frequency of a type of event. Optimally, the frequency has to be high enough, in order to allow the Law of larger Number[23] to be applicable, and the average loss has to remain moderate in order for insurers to offer products for a reasonable and affordable price.

The frequency of natural catastrophes is relatively low compared with other more standardized insurance risks (such as fire or motor insurance) and rather variable across the years. The use of past data and of prediction from scientific models helps insurers in measuring risks.

Maximum loss need to be manageable
The maximal loss of an event has also to be manageable. Natural catastrophic insurance is characterized by great variation in the event size and therefore in the economic and insured losses. For this reason, large scale events have a relatively large effect on the average losses and consequently the price and affordability of the insurance premium.

Natural disasters affecting a whole region or even a country, may give rise to extremely large costs which may be difficult to cover. If the total potential loss of a single (extreme) event could endanger the financial stability of an insurer, there will be no insurance available or the price of the insurance will not be affordable for the customer.

Risk transfer, either through reinsurance or state intervention, can increase the insurer's ability to cope with the potential average and maximum losses. In order to increase the insurability of natural catastrophes, it is also important to take steps to reduce risk to the maximum extent. This can be best achieved via adequate risk prevention, adaptation and mitigation measures. This will also have a positive affect on reinsurance prices and limit the need for governmental support as insurer of last resort.

Adverse selection and moral hazard
Adverse selection is the tendency of customers with high prospects of loss to buy more insurance product than buyers with lower prospect of loss. Developing wider mutualisation of risks and low level of premium contribute to minimize the adverse selection problem. Moral hazard refers to the tendency of insureds to behave in a more risky manner than those without insurance coverage, because the insured doesn't suffer fully (or completely) from the consequences of their behaviour. For example, in relation to weather events, such behaviour could refer to leaving an electricity supply network below the expected water height in a flood zone. Insurance conditions therefore include appropriate deductibles as an incentive to avoid moral hazard.

Widespread and large pool
Insurance works efficiently when the pool of insureds on which risk are spread is sufficiently large and widespread. The more policyholders the better the law of large number will be applicable. For natural hazard, as large geographical zone may be affect by a single event, it is important for insurers to have geographically diversified risk portfolios.

Insurers need therefore to have a large pool of insureds. Where other methods are not sufficient in achieving an adequate pool of insureds, compulsory insurance is sometimes used as a solution (e.g. natural catastrophe insurance is compulsory in Belgium, France and Spain).

[23] The Law of Large Numbers states that if a sample of observations drawn from a given population of independent events is sufficiently large, the average value of the sample will be close to the average value of the overall population. For example, the claims frequency of 1000 randomly selected motorist will be close to the overall population's (Swiss Re « Innovating to insure the uninsurable » P. 5/ Sigma N°4/2005)

For countries with a high risk exposure to natural hazards that are exposed to several different natural hazards (e.g. both weather and geophysical related), with a large potential of cumulated losses, the pooling of risks can become more easy by combining these perils in the same extended property damage coverage.

Natural catastrophes insurance, whether or not compulsory, should include a graded premium system (linked to the risk profile), in order to give policyholders incentives to reduce their risk exposure (e.g. by adaptation and mitigation measures).

3.2 Which risks are covered by whom in Europe?

Table 4 | Insurance Coverage and Penetration Rate for Different Natural Catastrophes Across Europe

Events covered:	AT	BE(1)	CH	CZ	DE	DK	ES	FI	FR	GB	GR	IT	NL	NO	PL	PT	SE	TR
Storm	O	C(2)	C	O	O	O	P	O	C	O	S	N	O	P	O	O	O	O
Cyclone/Hurricane	O	C(2)	C	N	O	O	P	O	C	O	S	N	O	P	N	O	O	O
Floods	O	C	C	O	S	N	P	O	C	O	S	O	N	P	O	O	O	O
Hail	O	O	C	O	O	O	O	O	O	O	S	O	O	S	O	C(3)	O	S
Water damage	O	O	O	O	O		O	O	O	O	O	O	O	O		O	O	O
Landslides	O	C	C	O	S	O	S	O	C	O	S	O	S	P	O	O	O	O
Snow	O	O	C	O	S	O	O	O	O	O	S	O	O	O	O	N	O	O
Frost	O	O	O	O	O	O	O	N	O	O	S	O	O	O	O	N	O	N
Avalanche	O	N	C	O	S	N	O	O	C	N	N	O	N	P	O	N	O	N
Drought	O	N	N	S	N	N	S	N	C	N	N	N	N	N	N	N	O	N
Subsidence	O	N	N	O	S	N	S	N	C	O	S	N	N	N	O	O	O	O
Earthquakes	N	C	O	O	O		P		C	O	O	N	N	P	O	O	O	C
Forest fires	S	N	N	N	O	O	S	O	S	N	S	N	O	O	O	O	O	S
Volcanic eruption	N			O	O		P		C	N	O	N	N	P	O	O	O	
Lightning	O			O	O		O	O	O	O	O	O	O	O			O	O

(1) In accordance with the law of 17 September 2005, published in the Monitor (O.J) on 11 October 2005. The rate of penetration of cover is not yet known.
(2) For large undertakings only
(3) Only if hail follows a storm

Key (type of insurance cover):

C	=	Compulsory cover by law
P	=	Obligatory pool
O	=	Optional cover
S	=	Cover proposed but not greatly taken out
N	=	Non-existent

Rate of penetration of cover:

	=	≥ 75%
	=	between 25% and 75%
	=	between 10% and 25%
	=	<10%
	=	cover not known

Source: CEA

National covers

Natural catastrophe coverage by both the insurance industry and the state varies widely. In Europe, four main categories are apparent:

- In countries like The Netherlands or Denmark, insurers play a minimal or optional role in the provision of cover against natural hazards. The state organizes the insurance scheme through the government annual budget or through tax levied on fire damage policies which are managed by a specific fund.
- In Switzerland, the State does not intervene in the provision of insurance but makes the insurance of certain risks compulsory, most of the time by means of fire contract.
- In countries like Belgium, France or Norway, the solution is a mix of compulsory insurance and of state intervention in case of damage. Similar schemes are currently considered by the public authorities in Italy and Romania. In most of the countries, the inclusion of such coverage in certain branches policies is compulsory whereas underwriting by policyholders is made on a voluntary basis.
- Finally, the solution, which is the most widespread, is the case in which the state's intervention is totally absent and most of the covers relating to natural hazard are optional. The rate of penetration of these covers varies according to the risk perception and to the effective risk exposure.

The collaboration between the state and the insurance sector in several countries shows the need of public-private partnerships in the field of natural catastrophes in order safeguard insurability. These partnerships are complemented by reinsurance schemes, by co-insurance schemes, and other type of risk sharing such as the EU Solidarity fund.

EU Financial instruments and political initiatives to combat natural disasters: which role for insurance?

The European Union Solidarity Fund (EUSF)[24] was created after the floods in Central Europe in the summer of 2002 with the aim of providing fast, effective and flexible financial aid after a major natural disaster has occurred. The need for a financial instrument distinct from the structural ones was deemed to be all the more necessary after the 2003 heat wave, which largely damaged the EU Mediterranean countries.

The EUSF was not designed to cover all costs linked to natural catastrophes. Payments are limited to emergency operations undertaken by public authorities and exclusively for non-insurable damages. The fund does not finance any long-term actions, such as prevention measures and it does not compensate for private losses. Therefore, as indicated in the table below, the aid granted by the Solidarity Fund covers only a small percentage of the global economic losses due to natural disasters occurring in Europe.

Table 5 | Comparing economic and insured losses caused by weather related catastrophes with aid granted by the EU Solidarity fund

Year	Economic losses (in € mln)	Insured losses (in € mln)	Insured losses % of Economic losses	Aid granted by EU Solidarity Fund[25] (in € mln)	Aid granted by EU Solidarity Fund[25] % of Economic losses
2002	28 789.3	6 964.1	24%	728	3%
2003	16 226.9	1 249.7	8%	107.1	1%
2004	2 229.7	724.2	32%	19.6	1%
2005	15 355.9	4 108.3	27%	204.9	1%
Total	62 601.8	13 046.4	21%	1 059.6	2%

Source: CEA compilation based on NatCatSERVICE, Geo Risks Research, Munich Re (December 2006) & European Commission MEMO/06/153 (April 2006)

[24] More information available on http://ec.europa.eu/regional_policy/funds/solidar/solid_en.htm

[25] Including the amounts waiting to be paid out in 2006 for applications from 2005. European Commission, MEMO/06/153 (April 2006)

In 2005, within the framework of the 2007-2013 Financial Framework, the European Commission put forward a proposal for a new Solidarity Fund. In May 2006, the European Parliament adopted a report which suggests mobilizing the Fund when the damages cost reach 1 billion Euros – instead of 3 billion -, as well as the possibility of enlarging the scope of the Fund to include the consequences of terrorist attacks, major health crises and major environmental, industrial and technological disasters[26].

In relation with this Community initiative, we would like to raise the question of the interface and possible overlap with existing insurance schemes. In particular, the establishment of such fund should not be risk imperilling the use of insurance or introducing a difference in treatment and can create discrimination between citizens and States who make the effort to take out insurance and those who do not. This is why such regulation must be very clear in the definition of its scope and, above all, concerning the conditions of its implementation. Particularly to avoid that, as a first result, insurance interventions are substituted by EU or national interventions, instead of being part of a common approach to face consequences of natural disasters.

3.3 How to explain differences in demand for catastrophic insurance

As shown above, the coverage for natural hazards varies strongly from country to country and the way these risks are covered can be very different. The differences in the coverage may be reflected by the differences in risk exposure but other reasons can also explain these differences: underestimation or unawareness awareness of the size of the risk exposure and the anticipation of non-insurance compensation by for example the state or public.

Differences in risk exposures across Europe
Differences in risk exposure are certainly an important factor of the demand for coverage. Risks such as drought and forest fire affecting southern Europe more while heavy rains and water damage risks seems to be more likely in northern and eastern countries. The rise in sea level will affect most European countries with a coast line with countries like The Netherlands or countries where large cities are near the sea being most at risk.

Unawareness/underestimation of risks
The great variability in the occurrence of natural catastrophe also leads to variation in the risk awareness. After an important flooding or storm, the population is very conscious of the risk and accepts to invest in protection such as insurance policies, prevention measures in order to reduce the impact of similar catastrophes in the future. Nevertheless after several years without catastrophes the attention is often softening, leading to lack of prevention, construction in dangerous area, diminishing of the insurance coverage, etc.

The future impacts of the climate change are not always very clear for the population and often also underestimate explaining a low level of penetration of insurance. Public awareness is therefore very important.

Expectation of state intervention
There is an expectation of state intervention in the event of major natural catastrophes. These expectations tend to decrease the demand for ex-ante protection such as those provided by insurance products. As noted by a study from the University of Hamburg: *'The 2002 floods as well as other catastrophic events have shown that victims to a great extent receive assistance from the state and from private sources. The low demand for fundamental risk coverage and insufficient loss prevention can therefore be explained by the potential victims' anticipation of (costless) non-insurance assistance. We need to be aware that this considerably reduces incentives to invest in loss prevention on an individual as well as on a collective basis.'* [27]

Difficulties in meeting the conditions of insurability
In several countries, insurance coverage for natural hazards is difficult to provide given the potential size of the risk and the limited size of the pool of policyholders.

The underestimation of the risk as well as expected assistance from the state or other donators limit the demand for natural catastrophe insurance and therefore reduce the size of the pool which will support the risks. Consequently, the insured community is smaller than it could be, leaving mainly people exposed to the economic consequences of a natural catastrophe.

[26] source Article from EPP-ED Newsletter 18 May 2006. More information available on http://www.europarl.europa.eu/oeil/file.jsp?id=5242592
[27] M. Nell and A. Richter, Catastrophic Events as Threats to Society: Private and Public Risk Management Strategies (University of Hamburg 2004) p.17

In some countries, compulsory insurance for natural catastrophes (with graded premiums) or incentives to buy such insurance products facilitate enlarging the size of the pool and therefore improve the insurability conditions.

3.4 Advantages of Private Insurance over Publicly Financed Funds

The damage caused by natural catastrophes can be funded in two ways: before the occurrence of the event, in the form of private insurance, public-private partnership schemes or systems with State intervention, or after the occurrence, by government or private donations. Funding before the occurrence poses a number of advantages for the European economy and society.

Better cover of risks
Private insurance can provide cover for a range of eventualities. According to the reinsurer Swiss Re: '*if the solidarity community is properly organised and the essential principles of insurability are observed, practically all private property damage and even losses due to business interruption can be covered by insurance*.'[28] That way government can concentrate on immediate matters as a consequence of a disaster, such as, rescue operations and repairing infrastructure.

Risk awareness and prevention
When individuals and companies finance solutions themselves, they are more aware of the risk and the possible financial consequences. This encourages them to limit their exposure by taking preventative measures and helps to mitigate potential human, economic and financial costs due to a natural catastrophe. The insurance industry has expertise in the field of risk gained through extensive research and experience. Insurance encourages preventative behaviour by giving financial incentives to the market. By encouraging individuals and businesses to take preventative measures, private insurance is a key driver in reducing the potential human and financial costs of natural catastrophes.

Public funds are limited
Funds can be costly solutions for the public sector. In addition, in most cases, due to their restricted scope as structural funds, such public financial resources are not at all sufficient to cover the damages resulting from a natural catastrophe.

Supporting the victims of natural catastrophes
As insuers' receive their premiums in advance of a natural catastrophe, they are able to quickly provide financial support to their policyholders. Funds, such as the EU Solidarity Fund, depend on financing by governments from tax. In case of insufficient cover it will take governments more time to organize financial compensation for losses.
Private insurance can provide a more efficient solution in providing cover for Europe's citizens and businesses. For example, in the Spanish agricultural damages in 2005 *(cf. 3.2, Fernandez)* the insurance industry was able to cover losses larger than the size of the initial fund (i.e. the annual premium income) as insurers are able to efficiently manage the fund.

[28] Swiss Re, *Floods are insurable!* (2002) p.3

Box 2 | Example: Insurance Solutions for the Spanish Agricultural Sector

The Spanish authorities have favoured insurance solutions as the best means of managing risk and crises in the agriculture and livestock sectors. The Spanish experience of a public-private financed system has proven to be the most efficient and effective way to cover the agricultural sector. Other countries have also initiated similar schemes: Greece, Italy and The Netherlands.

The Spanish Crop Insurance System involves all stakeholders:

- Farmers take out an insurance and choose the level of coverage
- The government subsidises the insurance premiums and provides for reinsurance trough public agencies
- Agroseguro, an association of insurance companies, pools the risks and has a large administrative role in the program.

Public authority support covers around 50 percent of all the costs, including administrative costs. The efficiency of this system is responsible for the fact that participation in agricultural insurance in Spain is relatively high in comparison to other European countries.[29]

In 2005, the Spanish Crop Insurance System collected about €492.48 million of net earned premium and paid €601.88 million in claims, that is, a loss ratio of 122.22%. From this sum, the government (Ministry of Agriculture plus the Autonomous Regions) subsidized 58% and the farmers paid the remaining 48%.
In this fiscal year *Consorcio de Compensación de Seguros*, the Public Agency who acts as the main reinsurer of the system, received premiums for the amount of € 91.55mln and had to settle, once a 'Deviation Reserve' was applied by the insurers (€25.22 mln), a sum of €162.55 mln, in terms of excess of loss.

The above example of 2005 underlines that agricultural insurance associated with a public support system is an effective method of protecting farmers against these climatic risks. As the frequency of droughts, forest fires and other natural catastrophes increases there are strong arguments to further develop public-private financial solutions in order to increase coverage:

- Insurers have the proven expertise in developing risk assessment models, which are a necessary component of an efficient system to provide cover for farmers against climatic risks. Moreover, the insurance penetration rate will rise.
- It is more efficient for the State to support farmers by helping to finance insurance coverage rather than via ex-post aid mechanisms, because they can establish a budget in advance. In addition, the indemnities will be paid out more quickly, without interference of political debates and decision-making that would distort and delay aid.

It benefits the farmers because the insurance industry has the necessary know-how and expertise in efficient claims-handling. The indemnities, as they were established in the insurance contract, will be paid out much faster than public authorities could pay them.

[29] USDA Economic Research Service, US-EU Food and Agriculture Comparisons WRS-04-04, Risk Management Tools in Europe: Agricultural insurance, Futures, and Options (2004) p.28. http://www.ers.usda.gov/publications/WRS0404/WRS0404d.pdf

4. Public-private partnerships to encourage prevention measures and improve the conditions of insurability

4.1 What is the added value of prevention?

Reducing the impact of climate change on natural catastrophes
Adaptation and prevention measures will be crucial in reducing vulnerability to climate change. While it is no longer possible to prevent the changes that will take place in the climate in the near future, the investments in adaptation and prevention made over the next 10 to 20 years will have a significant effect on the climate in the second half of this century and in the next century. These measures are crucial to reduce the negative impact of climate change on the occurrence and intensity of weather-related catastrophes (as discussed in part 1).

The costs of stabilising the climate and the risk of natural catastrophes are significant but manageable, according to the Stern Review: *'If we don't act, the overall costs and risks of climate change will be equivalent to losing at least 5% of global GDP each year, now and forever. … In contrast, the costs of action – reducing greenhouse emissions to avoid the worst impacts of climate change – can be limited to around 1% of global GDP each year.'*[30] Insurers are therefore supportive of measures, such as the Kyoto Protocol, to reduce greenhouse gas emissions at national, European and international level. While insurers are not major emitters of greenhouse gas emissions, many insurance companies are reducing their own emissions[31]. Some have even pledged to become entirely greenhouse-gas neutral across their operations by in-house energy reduction and investing in projects which generate carbon credits.

Decreasing the socio-economic impact of natural catastrophes
The European insurance sector can also make a significant contribution to risk and loss reduction measures to decrease the social and economic impact of natural catastrophes as far as possible. Insurers have expertise in the identification and analysis of risk, developing sustainable financial solutions and encouraging risk reducing behaviour by both individuals and businesses. Such measures are of great value to private insurers because they can reduce the claim costs and ensure that insurance coverage can be sustainable. Besides, prevention and mitigation measures will not only reduce the direct losses when a disaster occurs, but will also have a reductive effect on other risks such as health risks and business interruption risks. [32]

Experience has however shown that the measures to reduce natural catastrophe related damage should not only be undertaken at the level of the individual, but that there also has to be a collective effort, requiring political support from the authorities. For example, it are mostly public institutions that decide on land-use planning (e.g. allowing or avoiding building in areas with a high risk exposure), adopting construction codes (e.g. to reduce damage caused by extreme weather) and are responsible for the investment in general prevention measures like coastal defences and river embankments. CEA believes therefore, that active public-private cooperation is the best way to ensure proper involvement of involved stakeholders.

Public private partnerships plays to the strength of each party and will help to deliver clear advantages for the European society and the economy Active public-private cooperation will help to reduce the risks and damage caused by extreme weather events and can help improve the conditions of insurability. Such partnerships are therefore of mutual interest to governments, public and insurers alike.

4.2 Public Private Partnerships: The role of private insurers and public authorities

Society will bear the costs of climate change in Europe, but the availability of insurance coverage will determine who picks up the bill. The European insurance industry encourages close and proactive public-private partnerships, as they can be vital for effective risk assessment, for reasons of insurability, for risk transfer and funding and for ensuring adequate adaptation, mitigation and prevention measures. Key areas to tackle are:

- **Raising risk awareness**. The extent of public awareness can have a major effect in mitigating the direct and indirect impacts of extreme weather caused by climate change: risk awareness encourages risk reducing behaviour and increase the demand for insurance coverage. Insurers and public authorities can work together in increasing public awareness by collecting and providing high quality information about the risk of natural

[30] Stern review, summary of the conclusions, p.VI
[31] CERES (2006), From Risk to Opportunity: How Insurers Can Proactively and Profitably Manage Climate Change
[32] ABI, Coastal Flood Risk – Thinking for tomorrow, acting today, November 2006

catastrophes and helping to translate this awareness into real action. Risk and loss reduction measures and increasing demand for insurance coverage will both improve the conditions for insurability.

- **Spatial and land use planning, risk mapping and zoning as well as adequate risk pricing**.
  Government land planning can play a key role in mitigating society's exposure to natural catastrophic risk. Avoiding building in areas with a high risk exposure is the most sustainable solution to managing natural catastrophic risk in the long term, if the risk exposure can not be reduced. It is essential that, wherever possible, critical infrastructure projects such as hospitals, schools, emergency services and key transport links are not situated in high-risk areas. Public authorities should invest in protection of infrastructure and assets and improve emergency responses with for example by early warning systems. The measures taken should guarantee access to basic needs like water, food and health services in case of a natural disaster.
  Certain risks might require cross-border action. For example, with regard to the risk management of floods, one might want to consider in one country to offer contractual indemnification to upstream landowners of dedicated over-flooding areas, in order to reduce the exposure of downstream main urban settlements in another country.
  The European insurance industry supports land use planning and risk awareness raising by developing improved risk mapping and zoning tools within European Markets (see annex). These tools are good examples of various 'Public-Private Partnership' approaches. By providing better information on risks, public understanding and awareness of natural catastrophic risk can be improved. Moreover, European insurers will make sure that the impacts of climate change are systematically integrated into their risk assessment and risk management. Increased use of risk-based pricing in insurance markets could also prove to be an important mechanism to promote risk reduction measures, by making society more aware about the costs of the risks that it is faces. Thus, risk-based insurance schemes provide strong signals about the size of climate risks and therefore encourage good risk management.

- **Mitigation measures: Building and technical standards.** In many EU Member States, governments have developed either mandatory regulations or good-practice guidance for construction standards for building in risk locations, which are complemented by the European-level building codes (Euro-codes) for storm and flood-prevention. Such measures reduce the impact and cost of damage to people and property when an event occurs.
  The European insurance industry has produced recommendations for construction standards to improve property against natural hazards. It can also provide its customers with practical guidance and information on, for example, how to minimize damage caused by natural catastrophes or on emergency procedures during an event to reduce risks to property and people.

- **Proactive risk and loss reduction measures and public authority support.** European insurers act proactively to the risks that climate change and natural catastrophes pose. With proactive measures like mapping/zoning, research funding, collective data sharing and active participation in climate protection projects, associations and events, they are making a substantial contribution to the mitigation of the negative effects of climate change. Moreover, the insurance industry can encourage their policyholders to support development of sustainable prevention measures in natural catastrophic risk locations by giving financial incentives. Insurers can make an effort to insure climate protection projects (e.g. renewable energy and Kyoto projects), develop innovative risk transfer capacity for sectors with high risk and provide products that support emission reduction and adaptation to global warming.
  Public authorities can support insurers by working together on these issues and creating an environment where the greatest possible use is made of private insurers' initiatives. They can encourage and support the development of private sector initiatives, by limiting exposures and by providing a favourable legal, fiscal and regulatory environment. European public authorities could also promote insurance coverage for natural catastrophes.

- **Sharing the financial burden by public private cooperation.** If the conditions of insurability can not be met (see part 3.1), insurance coverage for natural hazards can be difficult to provide (at all or against affordable prices), given the potential size of the risk and the limited size of the pool of policyholders. When in such cases the risk transfer to reinsurers or to the capital market is not sufficient (or too expensive to be economically viable), insurers will have to transfer a part of their risk to the state (as insurers of last resort) in order to be able to offer insurance policies that include coverage against natural hazards.
  If insurance coverage can be provided by the insurance market but only at prices that are barely affordable, financial support from governments subsidizing the insurance premium can be useful instrument to improve the size of the insurance pool, as long as premium prices are graded (reflecting the differences in risk

exposure). However, such financial support from governments should not imply a reduction of the investment in adequate risk prevention measures.
Indeed, public-private financed solutions to increase the financial capacity of insurance solutions, should only be used as measure of last resort and should aim to enlarge the pool of insured by making premiums available at affordable prices, in countries with very high-risk profile for natural perils

Public authorities hold the central responsibility for reducing natural catastrophic risk locally and nationally. European insurers are a valuable partner in identifying and quantifying natural catastrophic risks. In many cases, the insurance industry works closely with public authorities to help learn lessons from natural catastrophic-events to prevent (if possible) or to reduce the impact of similar such events in the future by actively encouraging risk reduction and adaptation measures.

In public-private partnerships it is essential that the different responsibilities, principles and limitations of both the public authorities and private insurers are understood and are taken into account. Public authorities, private insurers and all interested parties should work together to find a partnership that constitutes 'the best of both worlds'. European private insurers are ready to take on these new challenges and to contribute in the adaptation and mitigation of climate change and weather related events. They recognise that action is needed as soon as possible and want to play a leading role in taking mitigation measures

Raising risk public risk awareness, sharing information on the effects of climate change, ongoing cooperation and increased dialogue between public authorities and private insurers are the best measures to deal with climate change and its effects on weather related catastrophes.

5. Conclusions and Recommendations

A constructive dialogue with Politicians

Insurers have expertise in the identification and analysis of risk, developing sustainable financial solutions and encouraging risk reducing behaviour by both individuals and businesses. The Re/ Insurance industry wishes to play a full and proactive part in the climate change debate since it shares a common purpose with Politicians and other stakeholders to limit the economic consequences of climate change.

Insurers can play a key role in spreading climate change risks but must be free to respond to risks appropriately

Private and voluntary insurance solutions have a number of advantages for society in comparison to state solutions when dealing with the consequences of climate change. Where possible the most efficient solutions must be sought as the cost of climate change will continue to increase.

- Insurance solutions promote adaptation, mitigation and prevention measures by providing incentives to reduce their exposure to the potential risks of climate change. In this way insurance is a catalyst driving responsible behaviour individuals and businesses.
- Insurance solutions reduce the burden on the public purse at a time European public finances are already under pressure due to other developments, such as the aging of the population
- Following a natural catastrophe it is important that those affected receive compensation as quickly as possible. As insurance solutions are funded before the event, insurers are in the position to process claims more quickly after the event than state donations which were not foreseen

Adaptation and Mitigation must go hand in hand

- **Reducing greenhouse gas emissions.** Insurers are supportive of measures, such as the Kyoto Protocol, to reduce greenhouse gas emissions at the national, European and international level. Such actions will help to reduce the impact of climate change in the long term.

- **Public Private Partnerships (PPPs)**
  - PPPs allow the public sector to benefit from synergies with the private sector
  - With civil security and environmental management authorities, in charge of risk management
    - Awareness raising
    - Risk mapping and zoning
    - information sharing;
    - improved analysis of financial costs and risks (modelling): ex ante approaches
    - lessons learned
  - **For state authorities in charge of budget and financial services:** It is important that European society and economy are safeguarded from the effects of climate change on weather related catastrophes as much as possible. However, private insurance solutions are not always possible due to various factors which can make a particular risk uninsurable. The use of Public Private Partnerships (PPP) can be a key element in Europe's response to the challenge of climate change. Such partnerships can help ensure that the conditions of insurability are met or improved, thus allowing cover to be provided at a reasonable price. Such partnerships increase the protection of European citizens and businesses and help to alleviate the consequences of natural catastrophes on the economy.

Governments has a role in providing a clear and coherent framework

European public authorities can further improve the conditions of insurability by ensuring a consistent legal framework for insurers and supporting the development of innovative new financial products designed to mitigate these financial risks of climate change. Though adaptation is a global challenge, it requires local solutions in view of the differences of in risk exposure and market capacity. Insurers are keen to cooperate actively and to find the best way forward to develop valuable, feasible and sustainable solutions.

Annex | Examples of public and private risk mapping and zoning tools

In order to develop flood insurance cover and related climate change incentives, insurance associations and their members playing on the markets need flood hazard zoning data.

In some Member States, depending to the availability of public data, National Associations of insurance have developed their own zoning data sets, sometime in relation with water authorities. Such situations prevail in the Czech, the German and now also the Italian market, as well as currently developed in the Polish market with specific proprietary integrated projects, respectively: named FRAT GIS CAP, ZÜRS, SIGRA and BORK.

In other Member States, National Associations of Insurance have decided to organize appropriate dissemination to their members of the available public flood zoning data sets. Such situations of public private partnership organising access to public data prevail in the French and the United Kingdom[33] markets, with different approaches with public authorities as regards access to insurance companies of the data available.

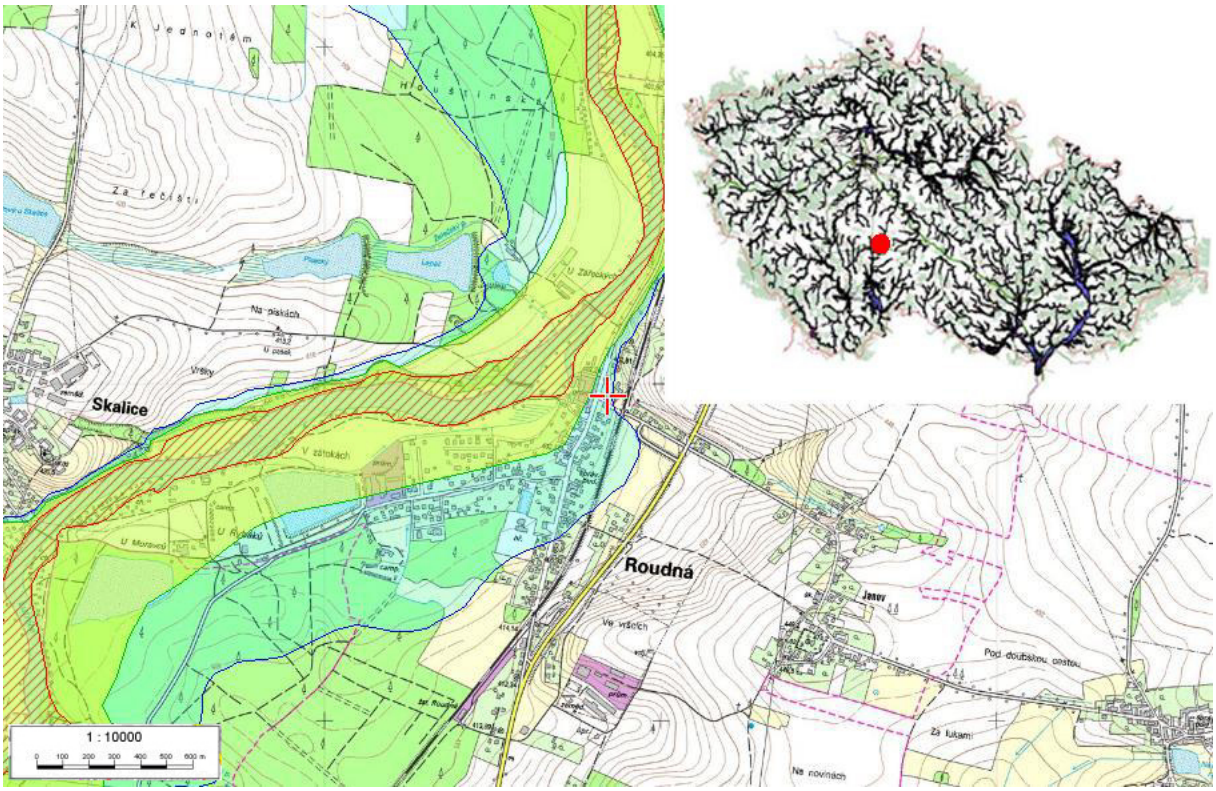
The HORA scheme in Austria appears as a unique case of more integrated public private partnership, from the development of data sets to their dissemination for consultation by the public from the Ministry's website.

For practical reasons, some of these projects combine in fact official maps for those rivers documented by public authorities and modelling results for the remainder of watercourses, in order to be able to provide insurers with risk assessment and rating tool for any location in the country. Enclosed hereafter are descriptions of few national situations, illustrated by screenshots of typical maps. Some of them are described with a standard format, as they rely on market operated GIS web services, offering access to more meta data describing the data sets, multi-hazard approaches, mutualised referentials, and geo-localisation functions. It is worth mentioning here that the entry into force of both 'Flood' and 'INSPIRE' Directives[34] would help the insurance markets to make an extended and privileged use of the public data sets available.

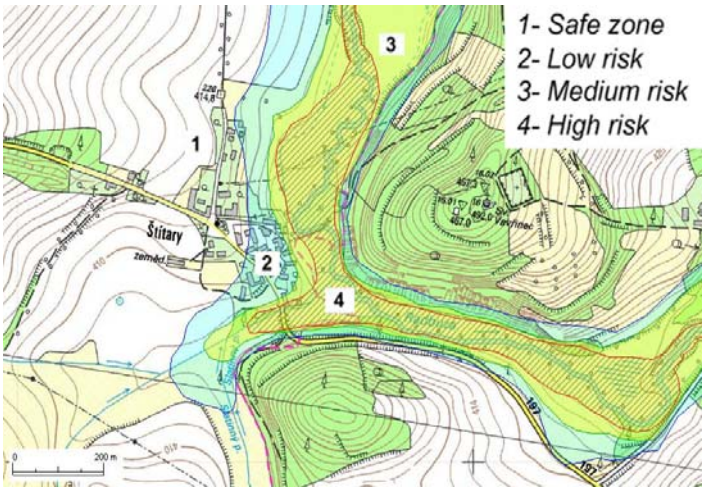
[33] England & Wales

[34] Proposal for a Directive of the European Parliament and of the Council on the assessment and management of floods, COM (2006) 0015 final ; OJ C - 67/38 of 18.03.2006, p. 38.
Directive 2007/6/EC of the European Parliament and of the Council of 14 March 2007 establishing an infrastructure for spatial information of the European Community (INSPIRE), OJ L 108 of 25.04.2007, p. 1-14.

Geographic Information System of the Czech Insurance Association – GIS ČAP



Any map base – in most cases scale 1: 10 000



Description of the zones:

Zone 1 – out of probable max. flood

Zone 2 – up to possible max. flood

Zone 3 – up to average 50 years flood

Zone 4 – up to average 20 years flood

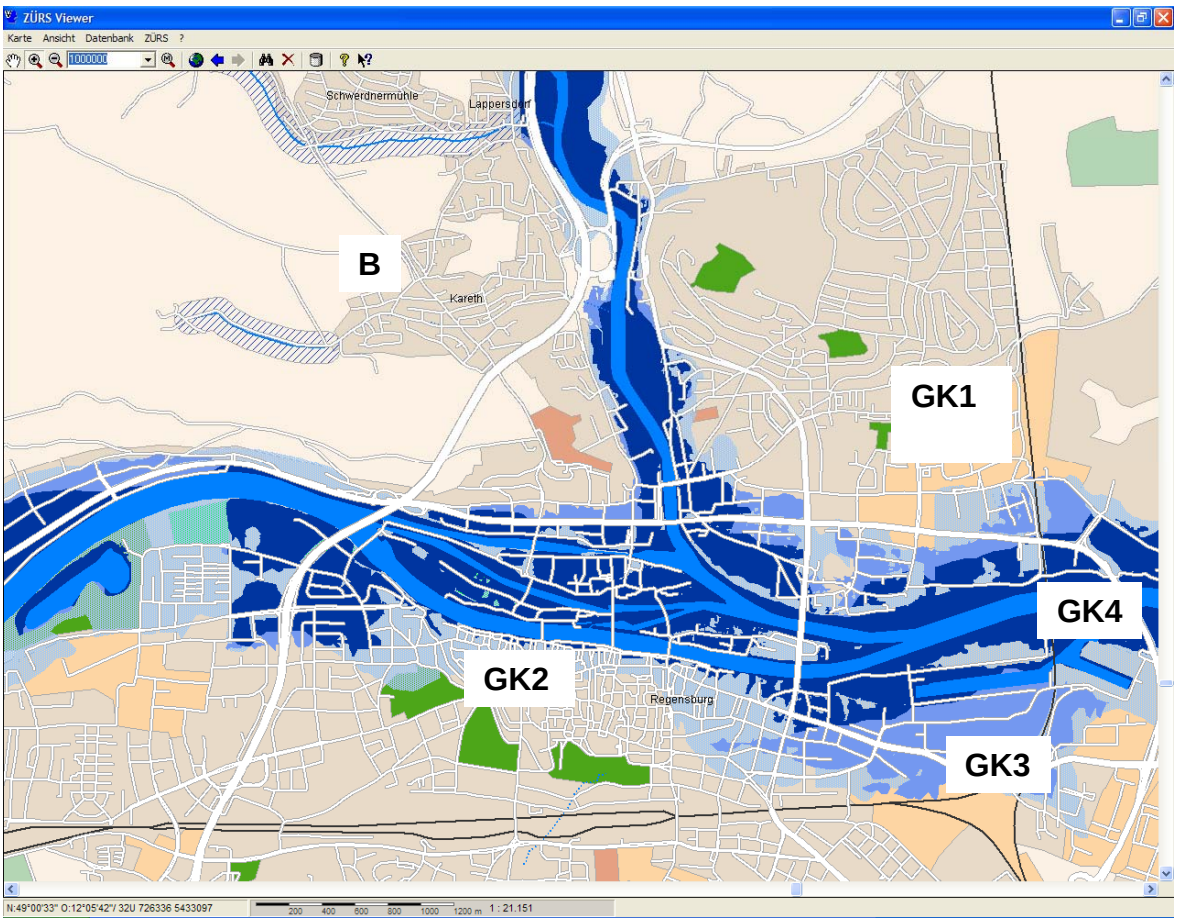
The project is independent without any link to the administration; It has been prepared in a joint venture of Czech Insurance Association and Swiss Re.

Zones have been created by mathematical modelling, based on the satellite photographs of the profile of the Czech Republic.

Technology: MaGis, Aquarius.NET and other applications according to the needs of the member companies.

GIS ČAP was realized in 2003. Necessary upgrade and refinement is going on according to the new findings (new catastrophic events). The system serves to the internal needs of the member companies.

Numeric tool for classification of flood zones developed by German Association of Insurance (GDV) - ZÜRS Project



a) Map Title: **classification of flood zones update ZÜRS[35] 2006 – area of Regensburg**

b) Type of map: "Flood hazard zoning map, produced and used by the insurance market in Germany"

c) Responsible authorities / sources:

- waterway-data by the German water authorities;
- maps by "NAVTEQ";
- flood-zoning by "IAWG",
- programming and additional data by "ESRI", "con-terra" and "geomer";
- supervisor and project manager: "German insurance association, GDV"

d) date of publication: ZÜRS Version 2.0.12; released August 2006

e) scale: 1:21.151 (scale of this special map as seen on the maps footer, ZÜRS-maps are freely scalable)

f) explanation of legend:

- GK 4, high hazard: flood at least once in 10 years
- GK 3, moderate hazard: flood at least once in 10-50 years
- GK 2, low hazard: flood at least once in 50-200 years
- GK 1, very low hazard: flood rare than once in 200 years or never
- B, additional information: small river

g) stage of program: first release of ZÜRS in 2001, ZÜRS 2.0.12 is the fourth release since then

[35] Zonierungssystem für Überschwemmung, Rückstau und Starkregen

Numeric tool for classification of flood zones and risk assessment developed by Italian insurance association (ANIA) – SIGRA Project

a) map title: flood hazard zoning map

b) type of map: flood extension according to different flood probabilities produced/used by the insurance market

c) responsible authority / sources of data:

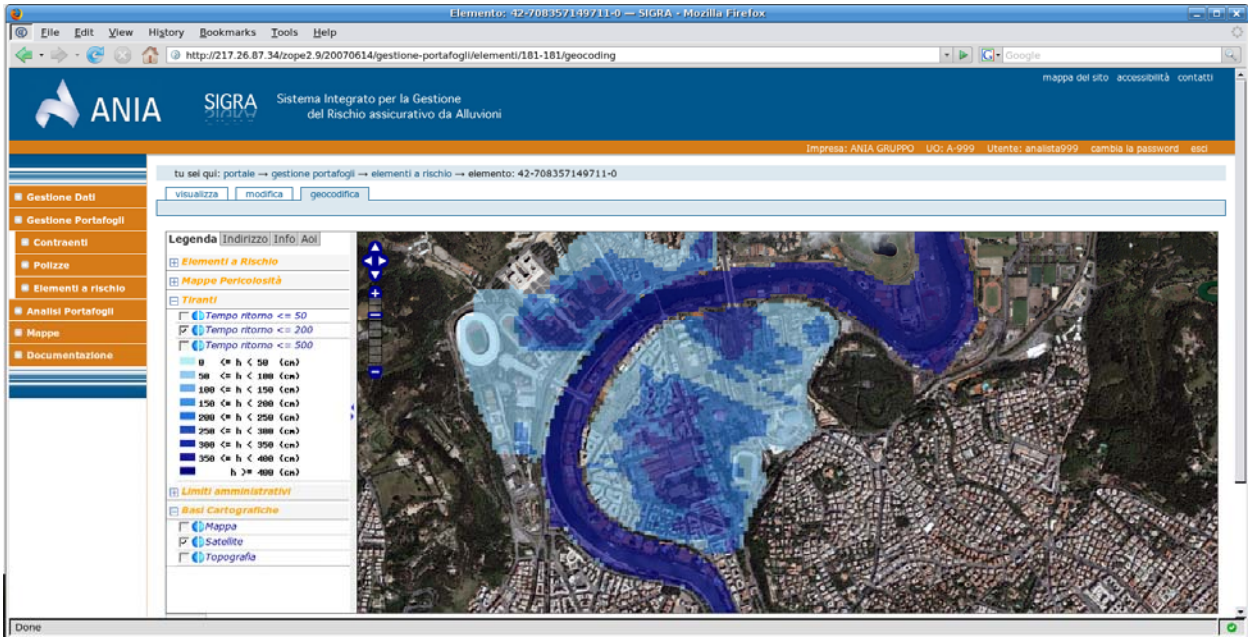
- Flood zones:
  - Public Basin Authorities for all maps elaborated started by Basin Authorities studies and maps. (Reviewed by Sigra Team: Telespazio- Agriconsulting- CIMA))
  - ANIA for all maps elaborated ex-novo by SIGRA Team. The temporary business association of Telespazio and Agriconsulting is in charge of the maps production for SIGRA Project. SIGRA Project covers a set of selected flood risks areas all over the whole Italian territory. If the selected areas are not studied by basin Authorities the Project Team produces the flood hazard maps.
- Geographic reference data :
  - Street and City Licence by Teleatlas (se example 3)
  - Topography Licence by IGM (see example 1)
  - Landsat Licence by Telespazio (see example 2)

d) date of publication : date of official release to ANIA member companies is June 2007. Up to now, there is no public access foreseen.

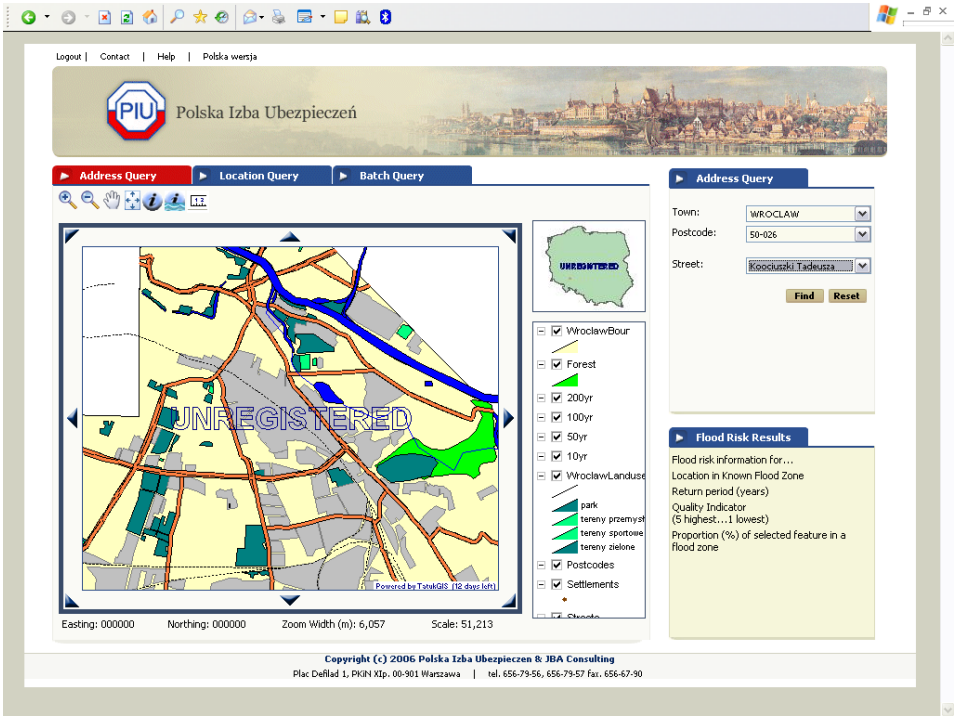
e) scale, the project scale is 1:25.000, the ex-novo maps produced by project are at scale 1:5.000

f) Legend : Green return period = 50 years
Blue return period = 200 years
Red return period = 500 years

g) is this map an example of an existing programme, and if so, in what stage is this programme? Yes, the map is an example of an existing programme, the programme ends by June 2007

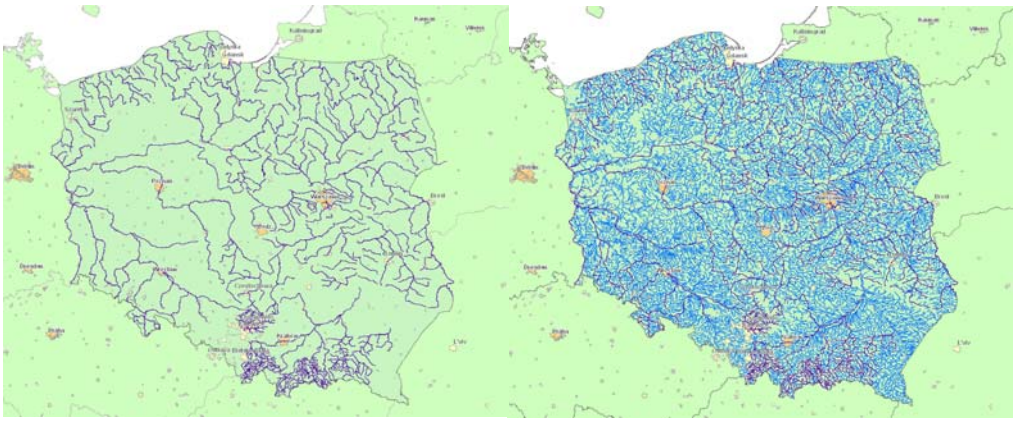


Numeric tool for classification of flood zones and risk assessment under development by Polish Insurance Chamber– BORK Project



The BORK project, prepared by the Polish Chamber of Insurance, is defined by a Steering Committee with insurance companies representatives participation.

Especially the participation in the consortium of contractors of the Meteorological Institute was a success granting the inclusion of very detailed official flood maps for 23.000 km of rivers prepared in recent years by the Regional Water Boards (map on the left).



Less detailed modelling still to be developed by sub contractors, including scenario definition and PML calculation. This should achieve a coverage of 80.000km of rivers in Poland for all rivers with a catchments area >20km2 (map on the right).

Geodetic Survey very detailed DTM (.7m vertical accuracy, 5mx5m cells) purchase negotiated, in addition city maps with exact addresses (doorstep) for approx. 50% of the population to be bought.

System functionalities shall have two components: single risk underwriting and accumulation.
Software to be installed on BORK project servers, access via internet, or for interested companies, on their own server.
The decision to proceed on the project will to be taken by mid 2007.

Public natural hazard maps disseminated to French insurance companies, by Mission Risques Naturels (MRN), a dedicated technical body of French insurance association (FFSA)

An intranet web service has been developed for dissemination and use by insurance companies of public natural zoning data, by MRN, an organization dedicated to natural risk knowledge and prevention, for the whole French insurance market. The information is available for consultation of exposed asset location with GPS coordinates or postal address on one side or in order to download the public datasets with relevant metadata. Further treatment of the data for more industry specific use of the public zoning is under development at the level of the organization and/or at the level of each company. Depending to the existing public data on each location, the flood extension reflects either the highest historical one or classified in terms of floods being 'exceptional', 'frequent' or 'very frequent' without details on actual return periods, if not delivered by public authorities.

The objective is to provide insurers with a tool to help them assessing the exposure of one individual asset location to any natural / weather related hazard.

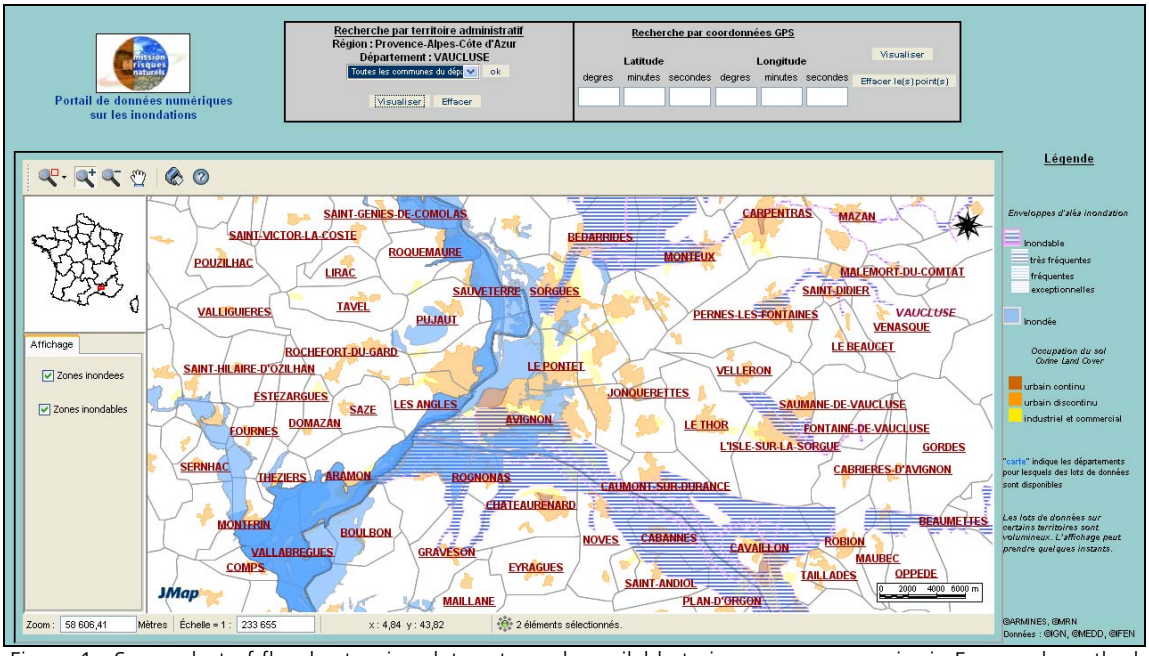


Figure 1 - Screenshot of flood extension data sets made available to insurance companies in France.: here the large area of Avignon, mainly on the Rhone river, indicating the urban areas affected.

a) Map Titles: classification of flood zones

b) type of map: "Flood hazard zoning map, to be used by French insurance market"

c) Responsible authorities / sources :

- Flood extension data sets: "waterway-data by the services of the French Ministry of Ecology and Sustainable development water authorities;
- Referentials : selected themes of CORINE Landcover, streets and cities: licence by Navtech, with other referentials to be added according to specific needs,
- Intranet geoservice developer ; ARMINES on JMap by Kheops
- Project manager : MRN for French insurance associations

d) date of publication: MRN intranet geoservice in operation since mid 2006, with steady upgrade with new public data according to their availability

e) scale: maps are freely scalable on the screen according to data sets scale

f) explanation of legend: according to public data sets

g) stage of program: further development for added value services in process, linked to the future evolution of insurance scheme.

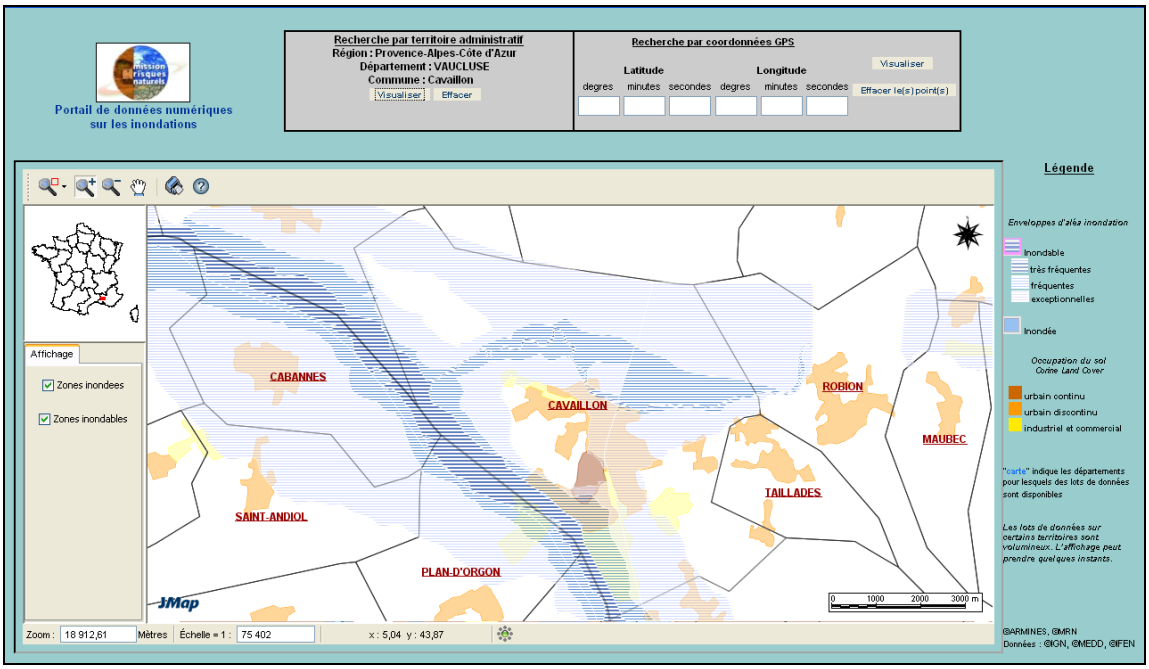


Figure 2 - Screenshot of flood extension data sets made available to insurance companies in France: here three flood occurrence zones displayed for the area of Cavaillon, indicating the urban areas affected.

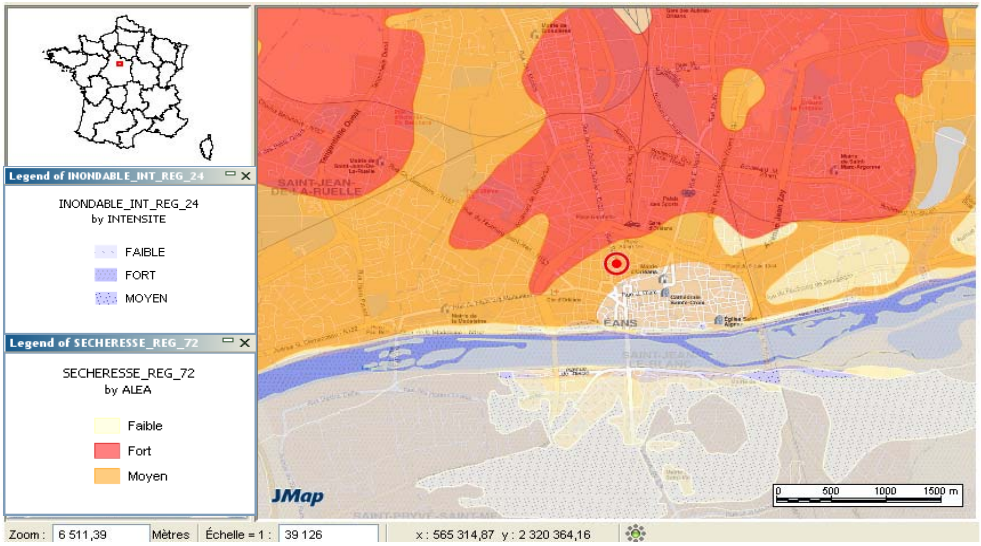


Figure 3 - Screenshot of flood and subsidence extension data sets in Orléans city.

Public flood hazard maps disseminated to England and Wales insurance companies, by the Association of British Insurers (ABI)

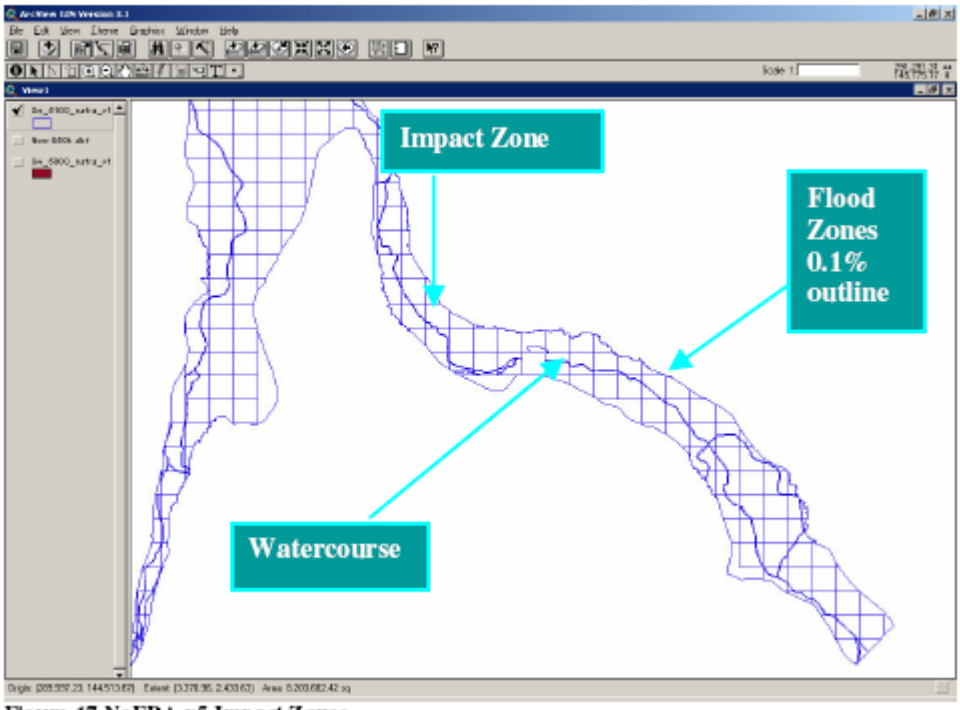


Figure 17 NaFRA v5 Impact Zones

a) Map title: National Flood Risk Assessment 2006 Postcode Flood Likelihood Category Database

b) type of map: Flood risk/probability

c) responsible authority: Environment Agency

Currently the Environment Agency has indicative floodplain maps on the internet, publicly available. The Agency has made available to insurers a database that assesses flood risk on a postcode basis, according to three categories of risk (greater than 1.3 %, 0.5 – 1.3 %, less than 0.5 %). This takes into account the standard and condition/age of defences. This information was provided to the insurance industry at a cost.

This database should only be used to guide insurers about the availability of flood cover, and ABI encourages its members to use other information (past claims, their own maps, other data providers) to inform their decisions about pricing.

d) date of publication : Jan 2007

e) scale: national scale, based on assessments undertaken for 85 river catchments and coastal cells, where a cell is an area of land measuring 100m by 100m.

The Map enables a comparison of the relative risks and their distribution within each of these catchments, rather than a detailed, local assessment of the risk at a specific location. The calculations provide an indication of the likelihood of flooding at the centre of each cell.

Cooperation between State authorities and the National Association of Insurance (VVO) for the production and dissemination of flood maps in AUSTRIA - The HORA system

HORA is an example for successful public private partnership (PPP) on flood risk zoning and mapping

Following massive damages after heavy rainfalls and flooding in summer 2002 in Austria, insurance industry and public authorities in Austria under guidance of the ministry of agriculture (Lebensministerium) and the Austrian Insurance Association signed a PPP-contract (available in German and English) stating a common project for the development of a public, common and admission-free risk zoning tool (internet access via Lebensministerium).

Common goal was to create an open risk zoning platform for flood and earthquake. public authorities were delivering GIS basis data, modelling and development was done by insurance and reinsurance industry. no direct exchange of any sort took place, the common result is open to the public since June 1st 2006.
There are more then 15 million "hits" to the homepage www.hochwasserrisiko.at up to now, and improvements and development (hail) are still under process.

Local risk zoning and mapping is for several regions already available on the HORA system as well**.** One can choose the option under "Legend", if more detailed public information (than probabilistic zoning for 25000 km in HORA) is already existing and HORA has got public access to this local or regional zoning-information (e.g. for the region of Carinthia). There one can see the risk zones in different colours (yellow and red instead of blue).

From the point of view of the insurance industry, at a later stage, HORA is expected to develop into a PML-assessment system for underwriters and risk managers.
The fully working public system will be dedicated for individual information (and work for insurance industry as a second source of risk information)

HORA IV level for Hail risk zoning is also online since mid June 2007.

CEA

CEA is the European insurance and reinsurance federation. Through its 33 member bodies comprising of national insurance associations, CEA represents all types of insurance and reinsurance undertakings, be they pan-European companies, monoliners, mutuals or SMEs. CEA represents undertakings which account for approximately 94% of total European premium income. Insurance makes a major contribution to Europe's economic growth and development. European insurers generate premium income of €978bn, employ over one million people and invest more than €6,300bn in the economy.

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