EUROPEAN INSURERS' EXPOSURE TO PHYSICAL CLIMATE CHANGE RISK

Potential implications for non-life business

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CONTENTS

EXECUTIVE SUMMARY

Human activities are already estimated to have caused more than 1°C of global warming above pre-industrial level[1]. Continuing greenhouse gas emissions are likely to cause further long-term warming, and consequences in terms of changes in frequency and severity of natural catastrophes and climate-related extremes are considered almost certain. The effects of these changes are likely to be substantial for a sector whose business model involves offering financial protection against the consequences of such events.

Building on its ambitious agenda for sustainable finance, and in particular on the sensitivity analysis of asset-side transition risks published in 2020, EIOPA launched a follow-up exercise on physical risks in the second half of 2021. This discussion paper presents the first results of this exercise which included a large data collection from industry focused on property, content and business interruption insurance against windstorm, wildfire, river flood and coastal flood risks[2]. These risks have been identified as the most relevant and potentially disruptive on the European property insurance business under a current and forward-looking perspective.

As the field of physical risks and climate change – and its impact on the financial sector – is still maturing, this report aims at contributing to the discussion by providing new key insights and stimulating the discussion. This report should be seen as a first learning exercise, explorative in nature, aiming at understanding the share of the insurance sector's exposure that may be at risk due to potential increase in frequency and severity of climate related hazards such as flood, windstorm or the emergence of new perils which need to be increasingly monitored such as wildfire. The ultimate objective is to improve the understanding of how insurers are exposed to physical climate change risks via their property, content and business interruption insurance contracts. EIOPA therefore plans, based on the feedback on this paper and pursuing discussions, to continue its analytical work in this field with an overall aim of supporting further forward-looking views and analysis of physical risks in light of climate change.

[1] How close are we to reaching a global warming of 1.5°C? | Copernicus

[2] *Windstorms* are meteorological extra-tropical cyclones: type of low-pressure cyclonic system in the middle and high latitudes that primarily gets its energy from the horizontal temperature contrasts in the atmosphere. *Wildfires* are climatological disasters defined as any uncontrolled and non-prescribed combustion or burning of plants in a natural setting such as a forest, grassland, brush land or tundra, which consumes the natural fuels and spreads based on environmental conditions (e.g., wind, topography). Wildfires can be triggered by lightning or human actions. *Coastal floods* are hydrological disasters caused by higher-than-normal levels along the coast and in lakes or reservoirs. *River floods* are hydrological disasters caused by overflow of water from a stream channel onto normally dry land in the floodplain.

This report focuses on assessing the materiality of the insurance sector exposure to physical climate change risk under a financial stability perspective. The first chapter describes the impacts that could arise from both extreme weather events, as well as from gradual global warming and discusses the potential negative consequences on the non-life insurance business. The second chapter presents the approach and methodology adopted, the different data sources used, the perils and the sample relevant for the analysis. Finally, the last chapter presents the main findings based on quantitative and qualitative data from 44 large European groups and solo undertakings active in non-life business and with relevant exposure to fire and other damages to property business. This sample represents at least 50% coverage at country level for 24 jurisdictions. On aggregate, the groups and solos in the sample cover approximately 59% of the EEA-wide market in terms of gross premiums (for direct business) written in 2020 for fire and other damages to property insurance line of business (LoB).

Looking at the consequences of three major European natural catastrophes the report finds that, historically, companies included in the sample have been well placed for handling the pursuing claims[3]. For instance, in relation to the *windstorm Ciara,* companies reported claims amounting to EUR 816 million, of which two thirds arose from residential exposures. The claims were concentrated both geographically, and in a small number of large insurers. While exhibiting some heterogeneity across participants, the event remained manageable for most groups and solos in the sample. The role of reinsurance is significant, especially larger insurers typically exhibit higher shares of ceded premiums, at about 30% of GWP. Correspondingly, the groups and solos that incurred higher losses had also taken up relatively more reinsurance and were thus able to pass on part of their losses.

The *2013 flood* examined in this report was the costliest event for the groups in the sample, totaling EUR 1.4 billion in reported claims. As regards the concentration of claims and use of reinsurance, findings for *Ciara* could be confirmed for the 2013 flood. While the event footprint in terms of affected share of the sum insured was also in line with *Ciara*, the claims intensity was considerably higher for the flood event. Claims related to the *2017 wildfire event in Portugal* amount to EUR 16.3 million. Contrary to *Ciara*, the majority of the claims arose from commercial exposures, and in particular content coverage. This is likely explained by the impact of the event on agricultural production.

The further findings in this report based on insured losses highlight that extra-tropical winter storms are the most damaging events in Europe. While the impact of climate change on storms remains difficult to quantify and current research is not conclusive, it does belong to a group of perils for

[3] Although, it might be a case of survivorship bias (i.e. if these catastrophes caused any undertaking to become insolvent they would not take part to the ad hoc data collection), these findings confirm the conclusions already drawn from the 2018 EIOPA Stress Test (ST). In fact, according to the 2018 ST results, the 25 groups exposed to the events included in the NatCat scenario showed resilience to the shocks with a limited decrease in the EOF (mainly thanks to the reinsurance coverages in place) and changes in the SCR. (please see: EIOPA Report 2018ST (europa.eu))

which the potential impact of future changes is important to understand. Windstorm is already the most insured peril (accounting for EUR 42.6 trillion in terms of exposures for building, content and business interruption – e.g. due to distribution or production chain disruptions), followed by river flood (EUR 28.9 trillion), wildfire (EUR 22.8 trillion) and coastal flood (EUR 9.1 trillion). The future evolution of these events may have major impacts on the (re)insurance sector. On average, only about 1/5th of the gross written premiums are ceded to reinsurance companies. However, reinsurance strategies vary across markets and insurance companies. Moreover, in terms of societal impact, the overall coverage is often relatively limited and most EEA countries do not require mandatory insurance coverage for natural catastrophes.

The insurance sector's ability to continue to offer financial protection against the consequences of these events relies on their ability to understand the likely impact of climate change and adapt their business strategies. Therefore, the data request included a qualitative questionnaire to collect participants' views on the current and expected impact of physical climate change risk on their non-life business for a larger set of climate relevant perils[4]. All property-related line of businesses are expected to be impacted by physical climate change risk and there is an emerging consensus that premiums are likely to increase and that adaptation and mitigation measures will play a crucial role in reducing the risk levels in the future.

However, raising premiums and changes in insurance conditions (e.g. higher deductibles, lower limits and exclusions in risky areas) may lead to detrimental consequences for policyholders and even the insurance sector itself (e.g. in terms of reputational risk). This could have substantial negative impact in terms of insurability and affordability from a societal point of view. EIOPA is therefore also monitoring these trends and the findings of this work will contribute to the future work of EIOPA, including the protection gap dashboard.

Finally, the findings in this report indicate a lot of work still needs to be done in order to prepare for these changes. In particular, results highlight that more than 50% of the participants have not undertaken any climate change analyses so far. A substantial share of the companies were unable to provide a qualitative assessment on global developments and very often struggled to provide data and assessment at a level of granularity required for an in-depth assessment of the risks which are likely to materialise in the coming years. Going forward, EIOPA will therefore continue its work with national competent authorities and the industry to push the sustainable finance agenda forward and continue bringing new results, analysis and policy proposals to the table to help prepare the insurance sector for the effects of climate change, and what is likely to become the "new normal" for the sector.

[4] Wildfire, windstorm, river flood, costal flood, flash flood, droughts, hail and subsidence.

1. CLIMATE CHANGE AND PHYSICAL RISKS: THE "NEW NORMAL" IN THE INSURANCE SECTOR

The impacts of global warming on natural and human systems are already visible today.[5] Warming from anthropogenic emissions are likely to cause further long-term changes such as rising temperatures, sea levels, and increase in frequency, severity and correlation of natural catastrophes and climate-related extremes (e.g. heat waves, heavy precipitation, droughts and storm surges)[6] in many European regions, and worldwide. The effects of these climate-related changes on the pricing and underwriting of risks are likely to be substantial for a sector whose business model involves offering financial protection against the consequences of such events.

Physical climate change risks are the risks that arise from the physical effects of climate change[7]. These can affect both the asset and the liability side of insurers' balance sheet. On the *asset side*, the increase in frequency and severity of extreme weather events across different perils may impact insurers for instance through direct property investments. On the *liability side*, physical risk is likely to have pricing, revenue and claim implications[8]. Higher than foreseen claims would also increase the insurers' underwriting and liquidity risks and put pressure on capital levels.

The impacts of climate change on physical risk could arise from both an increase of extreme weather events (*acute impacts*), as well as from gradual global warming (*chronic impacts*). Table 1 summarises the key impacts. Acute impacts can lead to damage to property, business disruption or reduced productivity.[9] Chronic impacts, particularly from increased temperatures, sea levels rise and precipitation, may affect labor, capital and agriculture productivity.

While progress is being made in terms of understanding the potential consequences of both acute and chronic impacts on the insurance sector, many challenges remain. First, the expected increase in global temperature needs to be translated into changes in frequency and severity of weather-

[5] Summary for Policy Makers of the Intergovernmental Panel on Climate Change (IPCC) Special Report on Global Warming of 1.5ºC, SR15_SPM_version_report_LR.pdf (ipcc.ch)

[6] Climate change, impacts and vulnerability in Europe 2016. EEA Report No 1/2017 and EEA climate state and impact (CLIM) indicators report.

[7] Please see the EIOPA, Opinion on the supervision of the use of climate change risk scenarios in ORSA (2021): https://www.eiopa.europa.eu/sites/default/files/publications/opinions/2019-09-30_opinionsustainabilitywithinsolvencyii.pdf

[8] Please see the EIOPA's report on non-life underwriting and pricing in light of climate change (2021): https://www.eiopa.europa.eu/sites/default/files/publications/reports/report-impact-underwriting.pdf

[9] NGFS Comprehensive report (2019)

related catastrophes as well as in chronic effects such as sea-level rises. Second, these estimations need to be converted into economic impacts on the undertaking's underwriting portfolio in relevant geographical areas. Third, a view and understanding on the relevant time horizons over which climate-related risk are most likely to materialise are essential. Finally, the insurance business is also likely to evolve in the long-term to better adapt to climate change risks and opportunities. For these reasons, an accurate assessment of physical climate-change related risks requires access to a unique set of granular data, scientific and actuarial expertise, new modelling methods as well as a deep understanding of the various business models employed in the insurance sector. While an overall assessment is outside the scope of this discussion paper, the next section explains three key components required for an initial assessment of physical risks in general terms.

Table 1: Examples of chronic and acute climate-related hazards

	Temperature-related	Wind-related	Water-related
Chronic	• Changing temperature (air, freshwater, marine water) • Heat stress • Temperature variability • Permafrost thawing	• Changing wind patterns	• Changing precipitation patterns (rain, hail, snow/ice) • Precipitation and/or hydrological variability • Sea level rise • Water stress
Acute	• Heatwaves • Cold waves/frost • Wildfire	• Tropical cyclone • Windstorm (including blizzards, dust and sandstorms) • Tornado	• Drought • Heavy precipitation (rain, hail, snow/ice) • Flood (coastal, fluvial, pluvial, ground water)

Source: Extract from Final report of the EU Technical Expert Group on Sustainable Finance (TEG, 2020)

1.1. Physical risk analysis in light of climate change

When modelling physical climate-change risks, three key factors need to be considered: *the level of exposure* estimating the potential share and composition of the population or the value and properties of assets at risk, *the hazard* describing the physical characteristics, such as frequency and intensity, of weather-related events and the *vulnerability* of the exposures to weather-related damages. To estimate the level of risk, information on the changes in hazard are combined with the level of exposure and its corresponding vulnerability. Further, an increase in frequency and intensity of weather-related catastrophes alone do not necessary imply an increase in physical risk. If, for

example, there is no property or people living in the affected areas or if there are sufficient preventive measures installed, the damages caused by the event may be limited or negligible.[10]

Figure 1: Elements influencing physical risk for the insurance sector

Source: EIOPA, The pilot dashboard on insurance protection gap for natural catastrophes (2020). Note: In this context, the figure is used to illustrate visually the key elements necessary to assess the physical climate change risk for the insurance sector. These elements are interpreted differently in a physical risk and protection gaps context. On the one hand, insurers may be exposed to physical risk only if an object is insured. On the other hand, to assess the protection gap it is necessary to measure the level of protection or more generally its absence.

Insurers' exposure

The exposure is determined by the presence of people, species or ecosystems, services, infrastructure or any other economic, social, or cultural assets that could be adversely affected by the considered disaster. With regard to non-life property insurance business, insurers' exposure is driven by the overall value of buildings (as determined by their location and replacement value, among other factors). Information related to the location of the insured properties is considered one of the key determinants of the exposure at risk; indeed, a property located in landlocked country will not be exposed to coastal flood risk.

The increase in exposure is one of the main drivers of the growing disaster losses. Among other factors, this trend is driven by increases in property values, economic growth and population

[10] A complex interaction of additional elements should be taken into account when assessing the potential future evolution of physical climate change risks. In the long term, future demographic changes, property price evolution, rapid and unplanned urbanization in risky areas, environmental and climate policies to limit global warming or mitigation and adaptation measures may affect and modify the exposure, hazard and vulnerability components. When dealing with the identification and management of extreme weather-related risks, timing and timescales are important cross-cutting themes. Ideally, climate change scenarios should not only take into account changes hazard for the next 30 or 80 years, but also changes to the underwriting portfolio in terms of vulnerability and exposure based on projected demographic and socioeconomic trends.

dynamics. Further, population migration to more coastal and urban regions may lead to further urbanization and consequent growth of exposures in hazard-prone areas.

Hazard

The hazard describes the probability of occurrence of weather-related events such as windstorms, floods or droughts at a given location as well as their physical intensity or severity. Historical data and scientific principles describing the physical mechanisms that control the occurrence and behavior of natural hazards are generally used to derive probability distributions. Consequently, a large catalog of simulated events is derived using sampling techniques from the defined distribution. For each simulated event, it is then possible to estimate the intensity of the event for each location within the affected area. In the long-term, the recurrence and intensity of catastrophic events may be intensified by climate change or degradation of the ecosystems caused by human intervention.[11] Finally, climate change may also cause more moderate loss events and stronger variability in weather patterns causing significant physical damages.

Vulnerability

Vulnerability can be defined as the propensity of exposed population or physical assets to suffer adverse effects from the impact of natural events. For the non-life property insurance business, the vulnerability refers to destruction rates or damage ratio[12] of the insured properties and their contents. The vulnerability is generally hazard-specific (e.g. infrastructure may for instance be vulnerable to windstorm, but not to floods or wildfire depending on the construction materials employed). When looking at the potential impact on commercial and residential properties, the buildings' vulnerability is a key element to correctly assess the risk link to weather related events as specific characteristics may increase or decrease the severity of the damages caused by the events. The vulnerability component is intrinsically linked to the exposure level as a property cannot be vulnerable if it is not exposed to extreme events. In the long-term, as extreme events become more frequent and intense due climate change, new areas may be identified as hazard-prone revealing underlying vulnerability caused by present conditions.

Insurance coverage

Finally, as shown in Figure 1, the actual insurance coverage in place to insure the objects will determine the final financial and underwriting risk to which the insurance sector is exposed. Historic

[11] IPCC (2018): 2 - Determinants of Risk: Exposure and Vulnerability (ipcc.ch) and IPCC (2021): IPCC_AR6_WGI_SPM_final.pdf

[12] The damage ratio is defined as the ratio of EUR loss to replacement value of the infrastructure.

events and trends discussed later in this report highlight that this coverage varies greatly by region and peril.

1.2. Climate change and non-life insurance business

Over the long term, direct consequences of physical climate change risk are likely to affect insurers' risk management, risk transfer, investment channels and their underwriting and pricing strategies[13]. Physical climate change risks may have different impacts on insurance companies depending on their characteristics such as, for example, their core underwriting and investment allocation strategies, geographic focus, location, or size.

Table 2: Potential negative consequences of physical climate change risk on the Non-Life insurance business

Assets side	Liability side
• Impairment of property due to physical damages related to extreme weather events. • Impairment of asset values due to financial losses affecting the profitability of firms. • Creditworthiness deterioration of counterparties.	Potential impact on several LoBs such as fire and other damages to property, motor property damage, crop damage and marine and aviation, transport (MAT) through for instance: • *reserving risk*; • *pricing risk*; • *underwriting risk* • *reinsurance risk*.

In the case of non-life insurers, direct consequences stemming from physical climate change risks may affect the liability side of (re)insurance firms' balance sheets through several lines of business (LoBs) such as fire and other damages to property, motor property damage, crop damage and marine, aviation and transport (MAT). In addition, natural catastrophes may lead to an increase in mortgage insurance[14] claims. In fact, homeowners' ability to make mortgage payments[15] may

[13] Please see: EIOPA Report on non-life underwriting and pricing in light of climate change | Eiopa (europa.eu)

[14] Mortgage insurance aims at paying off the outstanding debt in the event of the policyholder's death, disability, termination of employment or circumstances—specified in the policy—that may prevent the policyholder from earning income to service the debt.

[15] Households may face the double burden of reimbursing a mortgage while also paying the reconstruction costs of their property and potentially facing disaster-related unemployment. Similarly, commercial companies may face business interruption and/or physical

deteriorate after the event leading to high incurred losses and pay-outs by credit insurers. Moreover, insured losses arising from business interruption policies resulting from physical damage to insured property or from insured' inability to continue to operate due to catastrophic events even in absence of physical damages (e.g. Non-Damage Business Interruption) may hit (re)insurers covering these risks. However, property losses may not only relate to physical damages, but also to the exceptional expenses caused by a temporary relocation while the home is being repaired or rebuilt as well as policyholder's income loss.

Climate change impacts are likely to vary significantly across regions. While currently often geographically and sectorally concentrated, the increased frequency and severity of events might lead to a failure in the diversification benefits of (re)insurers' portfolios. Moreover, a knowledge gap, the tendency to project from past data and, in particular, the uncertainties around future climate projections may lead to mispricing and under-reserving. As a consequence of the rising hazard, underwriting strategies may need to be adapted, as areas previously considered at low- or no-risk might be subject to emerging perils, such as wildfire.

While the availability of reinsurance capacity may somewhat mitigate the risks for individual insurers, the increase in frequency and severity of weather events worldwide would eventually also affect the premiums, terms and conditions of reinsurance treaties. Moreover, reinsurers may decide to place specific caps on the reinsured exposures in high-risk areas potentially leading to a reinsurance gap[16]. Consequently, insurance undertakings may see a drastic increase in their reinsurance cost and be forced to increase their premiums or reassess the areas and regions considered insurable. The above would contribute to a widening of the insurance protection gap for natural catastrophes[17], i.e. the difference between the level of insurance coverage (measured by insured losses) and the amount of economic losses caused by natural catastrophes.[18] Only 35% of the total losses caused by extreme weather and climate related events across Europe are insured today.

Through the largely annual basis of insurance contracts, re-pricing allows insurers to adjust the prices of contracts should the risk have changed. In light of climate change, there could however limits to this approach. For example, modelling techniques based on projection from past data may

damage to their properties exacerbating the unemployment risk for individuals leaving in the affected areas due to business interruption. For further information, please see: Scholer M., Schuermans P. (2022) Climate Change Adaptation in Insurance. In: Kondrup C. et al. (eds) Climate Adaptation Modelling. Springer Climate. Springer, Cham. https://doi.org/10.1007/978-3-030-86211-4_22, p. 187-194.

[16] The OECD report found that, relatively high share (10% or more) of reinsured economic losses may speed up the recovery. Please see: OECD (2018), The Contribution of Reinsurance Markets to Managing Catastrophe Risk, http://www.oecd.org/finance/the-contribution-of-reinsurance-markets-to-managing-catastrophe-risk.pdf.

[17] See EIOPA (2020): The pilot dashboard on insurance protection gap for natural catastrophes | Eiopa (europa.eu)

[18] See EIOPA (2019): Discussion paper on the protection gap for natural catastrophes | Eiopa (europa.eu)

not fully capture the emerging climate trends leading to unforeseen severe losses. Moreover, even where re-pricing is possible, insurance coverage could become unaffordable for policyholders. Rising insurance costs possibly paired with an increase in unemployment and poverty, caused by more frequent business disruptions due to climate change may constrain demand for insurance coverage. Changes to underwriting strategies due to rising hazard or unaffordability of insurance due to increases in premiums might widen existing protection gaps or create new ones. This in turn would exacerbate pressures especially for the most vulnerable. In case of large natural disasters, insurance protection can speed up the recovery supporting households and businesses in the reconstruction phase[19]. Therefore, raising premiums or unavailability of insurance protection at an affordable price may also expose insurers to reputational risks and have broader macroeconomic implications.

Insurers might thus need to explore innovative product design, such as *impact underwriting*[20], to keep insurance available and affordable and to avoid the widening of protection gaps. By including and promoting adaptation measures in insurance products (e.g. investments in property-level resilience to perils such as windstorm or flood), insurers could reduce their exposure to physical risk and potential future insured losses, while policyholders would pay a reduced premium thanks to the reduced risk. Through information sharing, both on risk assessment (modelling, pricing) and possible adaption measures (e.g. construction standards), insurers could also play a role in raising public awareness to risks posed by climate change and possible ways to address them.

[19] Von Peter, G., S. von Dahlen, and S. Saxena (2012). Unmitigated disasters? new evidence on the macroeconomic cost of natural catastrophes. BIS Working Papers 394.

[20] Please see: EIOPA Report on non-life underwriting and pricing in light of climate change | Eiopa (europa.eu)

2. APPROACH AND METHODOLOGY

Climate change physical risks are long-term risks for which a standardised methodology for assessment is not yet widely and fully developed. The complexity and uncertainty in terms of time horizons and potential future pathway and developments make it difficult to precisely assess these risks. Therefore, this report should be seen as a first learning exercise, explorative in nature, aiming at understanding the share of the insurance sector's exposure that may be at risk due to potential increase in frequency and severity of climate related hazards such as flood, windstorm or the emergence of new perils which need to be increasingly monitored such as wildfire.

While the increase in frequency and severity of natural disasters may affect both non-life and life companies, and various business lines, the impact of climate change is more directly traceable and potentially significant for the property insurance business. As buildings, content and business interruption (BI) insurance coverages are often sold together, this study focuses specifically on the potential consequences of physical climate change risk on these contracts. Particular attention is paid to property business line as it is the most significant in terms of sum insured. With this discussion paper, EIOPA aims at raising awareness, stimulating the discussion and understanding how insurers are exposed via their buildings, content and business interruption insurance businesses to physical climate change risk. In order to collect feedback for its on-going work and to set its priorities for future analyses on physical climate change risks, the last section of the report discusses the participants' views and expectations on the current and forward-looking impact of climate change on a broader set of climate-relevant perils (e.g. wildfire, windstorm, river flood, costal flood, flash flood, droughts, hail and subsidence) for the entire non-life insurance business.[21]

2.1 Approach and methodology

Assessing physical risk requires granular information on the geo-spatial characteristics of insurers' exposures as well as data on physical risk hazard and vulnerability. Depending on the type of hazard considered, higher- or lower-level resolution data is required to estimate the risk level[22]. Although Solvency II data is a good starting point for an exploratory analysis on the relevance of different perils for standard formula users, additional and more granular information is required to measure, in a comprehensive way, the European insurance sector's exposure to key climate relevant perils

[21] Please see the Annex for further information on the data sources, time horizons, perils and sample used in the report.

[22] In many cases information on the location of the property is only available at an aggregated level, which does not indicate the exact address, but only its postcode.

and assess the potential impact of physical risk under different horizons and scenarios[23]. For this reason, EIOPA launched an ad hoc data collection with specific focus on EEA property insurance[24] to better understand the size and key characteristics of the primary insurance market.

Through this data request, EIOPA collected:

1. Year-end 2020 data on sum insured, number of buildings insured, number of contracts covering business interruption and content related losses, premiums[25], claims and expenses related to insurance contracts covering for European wildfire, windstorm, coastal and river flood risks for residential and commercial buildings[26].
2. Historical information on three diverse European natural disasters in terms of regions impacted, number of countries impacted, year of occurrence (2013, 2017 and 2020) and perils have been gathered to assess past trends and understand if, and how, these events affected insurers' underwriting strategies (e.g. in terms of premiums, underwriting and risk transfer strategies).
3. Insurers' views and expectations for the next 10-20 years on the potential impact of long-term physical risks on their business strategies have been collected through a qualitative questionnaire.

The data collection allows a bottom-up assessment with comparability of results across companies and countries. The results presented in this report are primarily based on the ad hoc data collected from large European insurance groups and solo undertakings. The data has been complemented with Solvency II information collected by EIOPA through the regular reporting, National Competent Authorities (NCAs) insights on the market practices and public datasets and information.

[23] For example, standard formula perils included in the SII reporting do not include wildfire or the split between river and coastal flooding. However, currently there is no standardised reporting on property location in SII to allow for detailed climate related physical risk assessment.

[24] A reduced set of information on non-EEA exposures has been collected to understand the relevance of the UK and CH markets.

[25] The insurance products offered vary from country to country, but generally multiple risks are bundled together. Insurance coverages for natural catastrophe protection are generally part of the fire or property insurance. Therefore, segregated information per peril is not always available. For example, river flood and coastal flood as well as wildfire and fire risks are generally not modelled separately.

[26] Residential refers to buildings that are designed to be lived in. Commercial buildings are much more varied than residential properties. While residential properties are exclusively used for private living quarters, commercial refers to any property used for business activities. For the purpose of this analysis, industrial properties have been included into commercial.

Perils

The analysis focuses on four key weather related perils: windstorm, wildfire and coastal and river flood[27]. These risks have been identified as the most relevant and potential disruptive on the European property insurance business under a current and forward-looking perspective.

Table 3: Current and short-term impact of climate change

Risk	Current impact of climate change		Short term projection	
	Impact	Most affected regions in Europe	Impact	Most affected regions in Europe
Temperature-related				
Wildfire	Yes	Southern, western and central Europe	Yes	Southern, western and central Europe
Wind-related				
Windstorm	No		Yes*	Northern, central and western Europe
Water-related				
Heavy precipitation	Yes	Northern and north-eastern Europe	Yes	Scandinavia and northern Europe in winter
River floods	Yes	North-western and parts of central Europe.	Yes	Most of Europe except of nothern Europea and southern Spain
Hail	Plausible in some regions	Alpine countries including northern Italy and Balkan countries	Yes	Mediterranean, central and eastern Europe
Drought	Yes	Southern Europe	Yes	Most of Europe, especially of southern Europe and except northern Europe
Solid mass-related				
Subsidence	Yes	Soils with substantial fraction of clay (e.g. France)	Yes	Soils with substantial fraction of clay (e.g. France)

Source: EIOPA methodological paper on potential inclusion of climate change in the Nat Cat standard formula, based on climate state and impact (CLIM) indicators published by the EEA and the JRC PESETA IV project (JRC, 2020) and IPCC AR6 report (2021). Note: Limited data and inherent weaknesses in current climate models make projections for extreme wind more uncertain than for other climate hazards.[28]*

While there is a certain level of uncertainty in particular on the impact of climate change on windstorm risk[29], given the relevance of this perils for the insurance sector, it is important to better understand and monitor the evolution of the European exposures towards this risk while new scientific evidence become available. In fact, according to the latest IPCC report, although the mean

[27] Windstorms are meteorological extra-tropical cyclones: type of low-pressure cyclonic system in the middle and high latitudes that primarily gets its energy from the horizontal temperature contrasts in the atmosphere. Wildfires are climatological disasters defined as any uncontrolled and non-prescribed combustion or burning of plants in a natural setting such as a forest, grassland, brush land or tundra, which consumes the natural fuels and spreads based on environmental conditions (e.g., wind, topography). Wildfires can be triggered by lightning or human actions. Coastal floods are hydrological disasters caused by higher-than-normal levels along the coast and in lakes or reservoirs. River floods are hydrological disasters caused by overflow of water from a stream channel onto normally dry land in the floodplain.

[28] Climate state and impact (CLIM) indicators: https://www.eea.europa.eu/data-and-maps/indicators#c0=30&c12-operator=or&b_start=0&c10=CLIM. Note that this summary table is built on the information available in the mentioned reports. It is possible that other literatures deviate from the conclusions derived in the chosen reports. Climate change is an evolving science, it is therefore important to consider new developments.

[29] According to the JRC PESETA IV study, the windstorm projections over European land are uncertain and the expected annual damages might rise mainly due to increasing economic growth and assets value rather than as consequence of climate change.

wind speed is expected to decrease with medium confidence in Northern Europe and with high level of confidence in Southern Europe, an increase in severe wind storm is expected across all European regions[30].

2.2. Sample description

Table 4: Country-specific coverages based on gross written premiums for fire and other damages to property LoB

(% of total GWP for fire and other damages to property LoB)					
AT	52.3%	FI	92.9%	LV	79.0%
BE	58.7%	FR	61.4%	MT	64.1%
BG	61.6%	HR	64.1%	NL	58.1%
CY	55.4%	HU	61.5%	NO	50.8%
CZ	83.2%	IE	48.6%	PL	73.5%
DE	63.6%	IS	57.2%	PT	77.2%
DK	47.9%	IT	62.1%	RO	63.7%
EE	69.5%	LI	8.8%	SE	19.2%
ES	46.2%	LT	75.3%	SI	92.4%
EL	60.1%	LU	43.9%	SK	74.7%
Central Europe		61.1%	Northern Europe		44.9%
Eastern Europe		74.0%	Southern Europe		54.8%
EEA		**58.3%**			

Source: EIOPA Annual Solo, reference date 2020.Note: Figures are based on solos belonging to a group and solos in the sample. GWP as reported in S.05.01. Corrected for cross-border business under freedom of service and freedom of establishment as reported in S.04.01.

The sample includes 35 large European groups active in non-life business and 9 non-life and composite solo undertakings with relevant exposure to fire and other damages to property business[31]. The selection of companies has been based on the annual direct business gross written premiums in 2019 for fire and other damages to property insurance LoB as well as on expert judgment to ensure sufficient sample coverage at country level and encompasses insurers registered in 19 European jurisdictions. Groups and solos in the sample typically write business in multiple countries, thus the selected sample covers all 30 EEA jurisdictions.

The selected sample provides (at least) 50% coverage at country level for 24 jurisdictions. On aggregate, the groups and solos in the sample cover approximately 59% of the EEA-wide market in terms of gross premiums (for direct business) written in 2020 for fire and other damages to property insurance LoB.

[30] See IPCC (2021) IPCC_AR6_WGI_Full_Report.pdf and IPCC WGI Interactive Atlas

[31] The sample comprises of 15 full internal model or partial internal model users, as well as 29 standard formula users.

In 2020, groups and solos in the sample wrote EUR 56.7 billion in premiums for fire and other damages to property business, which accounts for approximately 26% of the undertakings' non-life gross written premiums (GWP). Since 2016, GWP for fire and other damages to property have grown by 27% and thus more than non-life GWP at 23%. Fire and other damages to property business is also relatively more material within the sample compared to the EEA-aggregate. On aggregate, all solos domiciled in the EEA wrote EUR 96.5 billion in premiums for fire and other damages to property business in 2020, accounting for 22% of total non-life GWP. Growth in fire and other damages to property LoB at 22% since 2016 has thereby also been faster than growth in non-life business overall at approximately 18%.

Figure 2: Fire and other damages to property GWP

(in EUR billion)

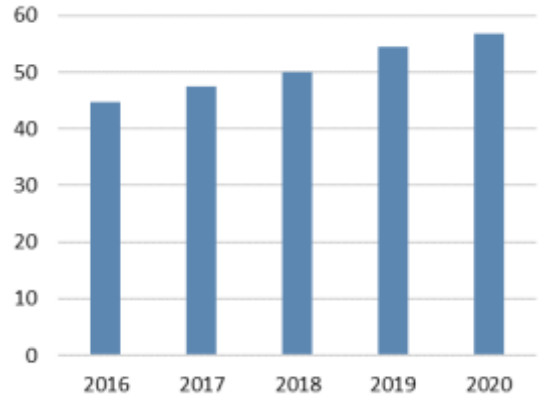
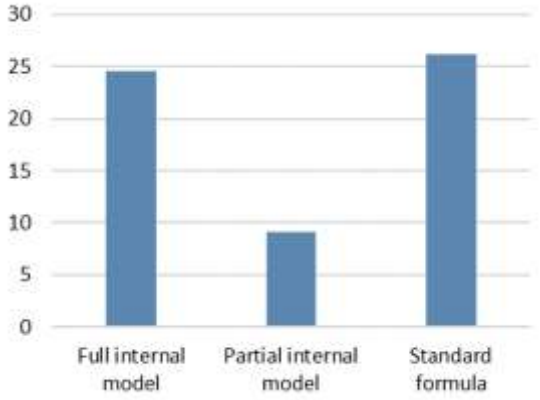


Figure 3: Fire and other damages to property by SCR calculation method

(in EUR billion)



Source: EIOPA, Annual Solo. Reference date: 2020. Note: Figures are reported for solos and solos belonging to a group in the sample.

Looking at the method of SCR calculation, as of 2020 insurers that use a full internal model account for 41% of the fire and other damages to property LoB GWP, while insurers using a partial internal model account for another 15%. Standard formula undertakings make up the rest, i.e. 44% of fire and other damages to property GWP in the sample.

BOX 1: STANDARD FORMULA NATURAL CATASTROPHE RISK CHARGES AND EXPOSURES REPORTED BY GROUPS AND SOLOS IN THE SAMPLE

The standard formula for SCR calculation in its natural catastrophe risk module currently covers earthquake risk, as well windstorm, flood, hail and subsidence risk inside the EEA, as well as UK and CH. For each country of exposure, perils are included in the natural catastrophe risk module using a risk charge that depends on the materiality of those perils. The materiality of a peril for a country is assessed by taking into account the hazard dimension, but also the vulnerability dimension (e.g. whether adaptation measures are in place) and the insurance

penetration for said peril. The charts below are based on the countries in the standard formula and do not always reflect the individual country's exposure to an individual peril. Windstorm risk is included in country charges for 19 EEA countries, as well as UK and CH and is thus the most widely applied peril, followed by earthquake risk and flood risk. Further, the standard formula includes a calibration methodology for non-EEA exposures (i.e. sum insured or insured replacement costs), however insurers with material non-EEA exposures are assumed to use an internal model. Natural catastrophe risk charges and corresponding exposures to the five standard formula perils reported by standard formula users can give a first impression of the geographical distribution and materiality of perils for EEA insurers.

Figure 1.B: SCR standard formula natural catastrophe risk charges before diversification and after risk mitigation
(in % of total natural catastrophe risk charge)

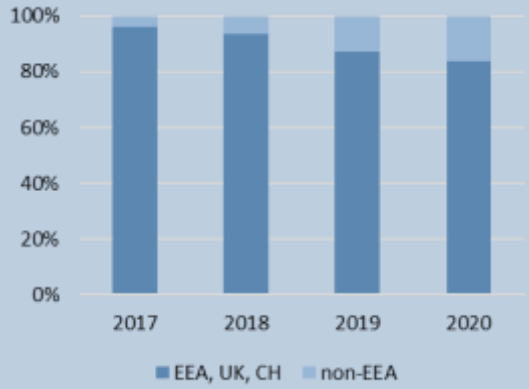
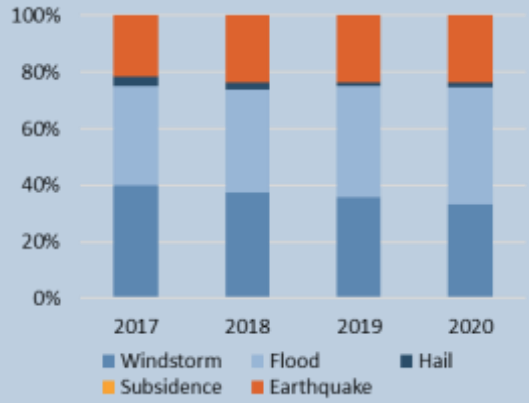


Figure 2.B: SCR standard formula natural catastrophe risk module charges after diversification and risk mitigation by perils
(in % of total natural catastrophe risk charge)



Source: EIOPA, Annual Solo. Reference date: 2020. Note: Figures are reported for solos and solos belonging to a group in the sample using the Standard Formula SCR calculation method. Note: the chart include only perils and countries included in the standard formula. Please see the complete list of countries and perils currently included in the standard formula in the Annex. Diversification refers to diversification effects between perils. Risk mitigation refers to the risk mitigating effect of the undertaking's specific reinsurance contracts and special purpose vehicles.

As of 2020, exposures within the EEA, UK and CH account for 85% of total SCR standard formula natural catastrophe risk charges. The share of non-EEA exposures is thus indeed comparably small at 15%, but has increased from 4% in 2017. Within the sample flood and windstorm risk are the most significant perils, accounting for 74% of the total natural catastrophe risk charge. This share has been largely stable over the last years, the distribution between windstorm and flood charge has however reversed and the flood charge now accounts for the largest individual risk charge at 41%. Hail and subsidence risk together for an additional 2%. Subsidence risk is the smallest individual risk charge, as it is currently only part of the standard formula for exposures in France.

Figure 3.B: Exposures to standard formula perils

(in EUR trillion)

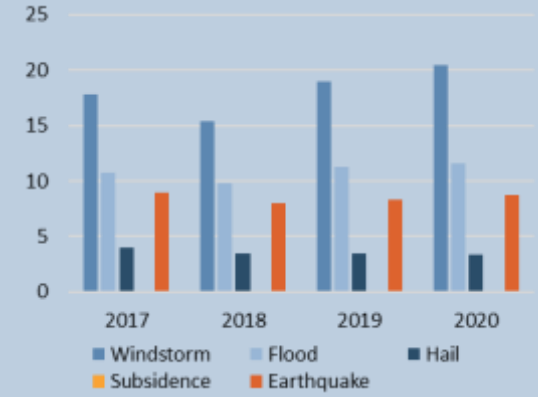
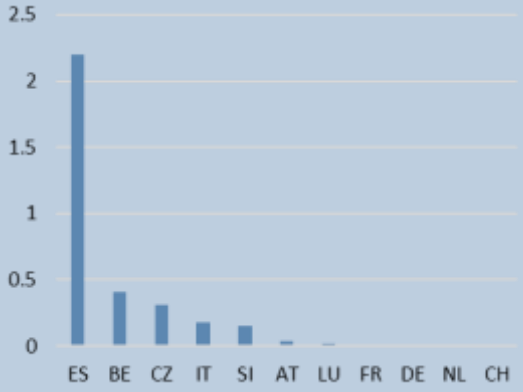


Figure 4.B: Exposures to hail risk by country of exposure

(in EUR trillion)



Source: EIOPA, Annual Solo. Reference date: 2020. Note: Figures are reported for solos and solos belonging to a group in the sample using the Standard Formula SCR calculation method. The country of exposure indicates the location of the risk included in the SII SCR Standard Formula (for a full list of countries please refer to Table 1.A in the Annex). Exposures relate to the sum insured per peril.

Standard formula exposures to windstorm are most significant, amounting to EUR 20.5 trillion and approximately 46% of total exposures. Flood risk exposures are the second largest at EUR 11.6 trillion, together the two perils account for 73% of the total natural catastrophe exposures included in the standard formula. Hail and subsidence risk cover another 7.5%. Exposures to hail risk are concentrated in Spain at EUR 2.2 trillion, which accounts for 66% of hail risk exposures within the sample. Together with Belgium and Czechia the share of total hail risk exposures almost covers 90%.

Figure 5.B: Exposures to windstorm risk by country of exposure

(in EUR trillion)

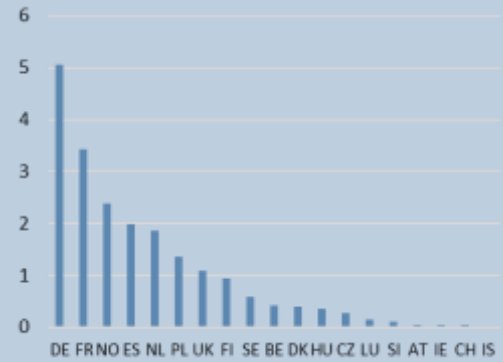


Figure 6.B: Exposures to flood risk by country of exposure

(in EUR trillion)

Source: EIOPA, Annual Solo. Reference date: 2020. Note: Figures are reported for solos and solos belonging to a group in the sample using the Standard Formula SCR calculation method. The country of exposure indicates the location of the risk included in the SII SCR Standard Formula (for a full list of countries please refer to Table 1.A in the Annex). Exposures relate to the sum insured per peril.

Exposures to windstorm risk reported by groups and solos in the sample are concentrated in Germany, France and Norway, which together account for EUR 10.9 trillion in exposures or about 53% of total exposures. A similar geographical concentration can be found for flood risk, where undertakings reported the largest exposures in France at EUR 4 trillion, followed by Germany and Poland. The geographical concentration is more pronounced for flood risk than for windstorm risk; together the three jurisdictions account for 76% of total flood risk exposures.

3. MAIN FINDINGS

3.1. Understanding the European insurance sector exposures

In order to assess the potential future impact of physical climate change risk on the insurance sector, it is essential to understand the materiality of the current exposure to climate related perils and the specificities of different markets and risks. Primary insurance conditions for natural perils coverage vary across markets and within each country[32].

Damages contracts are often multi-risk and cover all or a subset of the perils considered in this paper. In some countries extratropical cyclone, flood and wildfire coverages are included in the property fire insurance coverage by market practices or by law. In addition, building, content, and business interruption can be covered by a combined policy with the same deductibles and loss limits, while in other cases these risks are insured separately. Therefore, the estimation of the insurance conditions for the European market can be challenging.

Currently, most EEA countries do not require mandatory insurance coverage for natural catastrophes. However, in some countries[33] specific risks or type of buildings require a mandatory fire insurance coverage (including NatCat coverage). In other cases, accessible prices for NatCat coverage are guaranteed at National level[34] for properties for which there is no cover on the market, or for which cover is available only at excessively high prices (in premiums or in deductibles) due to a high-risk exposure. The insurance models vary widely across countries, from national systems[35] to semi-voluntary scheme[36] to risk-based premium voluntary systems[37].

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[32] Characteristics such as size of the insured risk and occupancy type may lead to differences in the insurance offer for property fire insurance. Going forward, the changing climate conditions and circumstances may increase the need for new, tailor-made insurance products (e.g. for emerging climate related risks such as crop insurance against drought) or for risk-based incentives in insurance products or insurance services aiming at limiting losses upon the occurrence of a natural disaster.

[33] For example, in FR multi-risk damage insurance coverage is mandatory by law for renters and shared spaces (in the case of co-ownership arrangements). Insurance coverage against wildfire, windstorm and river flood is mandatory in LI for commercial and residential properties. Similarly, in RO, insurance coverage against river flood and subsidence for residential properties are mandatory.

[34] The results included in this sections do not include information on NatCat coverages guaranteed at National level.

[35] i.e. Spain, France, Iceland and Romania.

[36] i.e. in Denmark a share of the fire premium is used to finance the national fund which compensate insured in case of 20 year events or over, storm/flood and windfall events.

[37] As described in the EIOPA Opinion on Sustainability within Solvency II (2019), some respondents to the public call for evidence (answered by 33 stakeholders) claim that the absence of such schemes (public system of reinsurance) could cause higher premiums for customers and that an important number of properties could be uninsurable in a scenario above 2 degrees without such public system of reinsurance. Moreover, some argue that the existence of public schemes may distort risk perception or even artificially lower

BOX 2: NATIONAL INSURANCE SCHEMES AND PRODUCTS' CHARACTERISTICS

While this report focuses on risks for the insurance sector, a more complete picture of the national schemes and market practices in place to mitigate the consequences of large disasters for society, policyholders and insures is required in order to interpret the figures on the property insurance correctly.

For example, although in Belgium the fire insurance coverage is not mandatory, affordable tariffs are ensured for property fire insurance for simple risks[38] including a mandatory protection against natural catastrophes (i.e. earthquake, flood, overflow or blockage of public drainage, landslides and subsidence, storm, hail and weight of ice or snow). In Spain, although there is no legal requirement for households to insurance their properties, all private insurance policies written by insurers for risks located in Spain must include a mandatory clause covering extraordinary risks (flood, earthquake and strong wind). A public entity, the Consorcio de Compensación de Seguros (CCS), assumes those risks from insurer undertakings and reimburses the damages caused by extraordinary catastrophic events. A similar structure applies in Iceland, where all buildings and movables that have fire insurance are insured with the Natural Catastrophe Insurance of Iceland (Náttúruhamfaratryggingar Íslands). NCI is a public institution whose role it is to compensate for damage caused by earthquakes, volcanic eruptions, landslides, avalanches and floods. Insurance companies receive a fee for collecting catastrophe cover premiums alongside fire premiums. However, unlike of the Spanish situation, fire insurance is mandatory by law.

In France, a compensation scheme in the form a public-private partnership was developed 40 years ago to ensure adequate high coverage of natural disasters risks. On the contrary of the Spanish and Icelandic cases, the Caisse centrale de réassurance (CCR) does not provide direct reimbursement to policyholders, but, acting as state-backed reinsurer, it offers stop-loss contracts to insurance companies in case of extreme weather events (i.e. floods, droughts, cyclonic winds with average wind speed greater than 145 km/hour over 10 minutes or gusts of 215 km/hour, earthquakes, volcanism, tsunamis and avalanches officially recognized as a NatCat event at a local level). Insurance coverage is mandatory for renters and for shared spaces, in the case of co-ownership arrangements, but not for property owners (outside shared spaces). The multi-risk natural disaster coverage is compulsory included in all property

commercial prices. The availability of insurance without the "real" price might lead, for example, to continued building in areas with high risks for flooding or investments in more resilient/energy efficient housing might be postponed.

[38] Simple risks are defined as any property or group of properties whose insured value does not exceed 1.741.000 euros or 56 million euros for other group of properties in which commercial premises do not account for more than 20% of the building's total accumulated area (e.g. premises for cultural, social activities…).

insurance policies. In Norway, natural perils insurance is a compulsory cover linked to fire insurance and all insurers providing fire cover in Norway must be members of the Norwegian Natural Perils Pool (NNP). All perils, except for wildfire, are covered as part of the NNP. The Pool is a mechanism whereby claims and costs are distributed between members in proportion to their market share. Finally, in Romania, earthquake, river flood and subsidence for residential property are covered based on a special law, making their coverage mandatory and implementing a fixed premium and a fixed sum insured (all other risks are not mandatory and their tariffs are driven by the market).

Table 5: Flood insurance arrangements by country

Table 1. A summary of the stylized flood insurance arrangements to which European countries are allocated.

Structure Group	Sector Covering Flood Risk	Common Market Features	Countries Allocated
M1. Solidarity public structure	Public	- Mandated purchase requirement - Premiums unconnected to risk - Very high penetration rate (100%) - Government support for extreme losses	France; Belgium; Spain; Romania
M2. Semi-voluntary private market	Private	- Purchase is connected to mortgage lender conditions - Premiums are risk-based - High penetration rate (75–100%) - Damage to buildings is more often insured than contents due to mortgage requirements - No government support for extreme losses	Sweden; Ireland; Hungary; Finland
M3. Voluntary private market	Private	- No government mandated purchase requirement (voluntary) - Premiums are risk-based - Medium to low penetration rates (25–60%) if government support is uncertain (e.g., Germany) - Very low penetration rates (0–25%) if government support is certain (e.g., Austria) - Possible government reinsurer rather than government compensation	Austria; Netherlands; Germany; Italy; Portugal; Luxembourg; Greece; Poland; Czech Republic; Slovakia; Slovenia; Croatia; Bulgaria; Latvia; Estonia; Lithuania
M4. Voluntary PPP market	Public-Private	- Voluntary market - Government reinsurer for extreme risk - Other characteristics are the same as M3	Hypothetical market structure
M5. Semi-voluntary PPP market	Public-Private	- Semi-voluntary market - Government reinsurer for extreme risk - Other characteristics are the same as M2	Hypothetical market structure
M6. Public-Private Partnership (PPP) market	Public-Private	- Purchase is connected to mortgage lender conditions - Premiums are partially connected to risk - High degree of loss sharing - High penetration rate (75–100%) - Damage to buildings is more often insured than contents (due to mortgage requirements) - Government reinsurer rather than government compensation	UK

Notes: Romania displays many of the criteria of M3 with the exception of the insurance penetration rate being less than 20% due to poor enforcement of the purchase requirements. Therefore, it has been placed within M1 as a stylized market structure. Source: Hudson et al. [28].

Source: Tesselaar, M.; Botzen, W.J.W.; Haer, T.; Hudson, P.; Tiggeloven, T.; Aerts, J.C.J.H. Regional Inequalities in Flood Insurance Affordability and Uptake under Climate Change. *Sustainability* 2020, *12*, 8734. https://doi.org/10.3390/su12208734

As mentioned in the previous section, the analysis focuses on groups and solo undertakings highly active in the EEA countries. Groups' figures are usually aggregated and presented at EEA level as each company is usually operating in multiple countries[39]. However, given the importance of

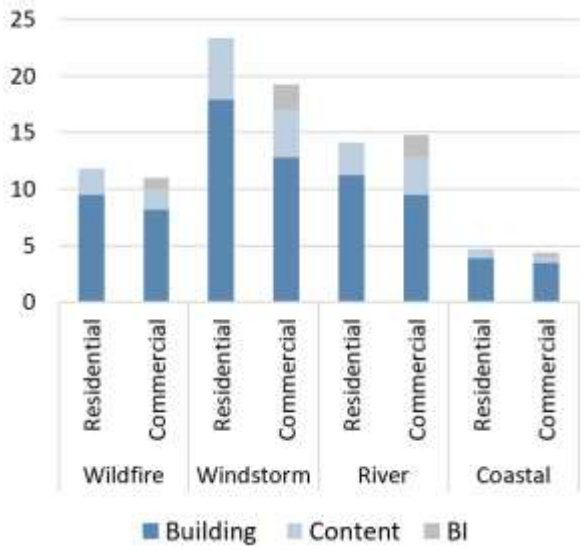
[39] The figures presented in this report are based on the data collected from groups and solo undertaking in the sample; data on national systems is not included.

geographical element for assessing these risks, the data is shown by geographical region and peril in this report. In some cases, due to a limited number of observation available for specific breakdown (i.e. locations and perils), the results are aggregated per region to ensure the anonymity of the data. The results are disentangled based on the location of the property insured.[40] Finally, the results should be interpreted with care as there may be a risk of underestimation, due to sample and data limitations.

Comparing building, content and BI insurance coverages against weather-related natural catastrophes in terms of sum insured at EEA level across perils, windstorm is the most insured peril (EUR 42.6 trillion for building, content and BI), followed by river flood (EUR 28.9 trillion euros), wildfire (EUR 22.8 trillion) and coastal flood (EUR 9.1 trillion)[41]. On the one hand, the prominent relevance of windstorm can be explained by the fact that, historically, extratropical cyclones represent one of the biggest climate-related threats for the European countries. The losses resulting from these windstorms can reach billions of euros and affect the European insurance sector. An analysis, based on 200 historical European windstorms, conducted in 2018 by Perils, on the frequency and severity of such events, reveals that the average annual insured losses are EUR 2.6 billion accounting for approximately 0.0048% of insured values.

Figure 4: EEA sum insured for commercial and residential buildings by coverage type and peril

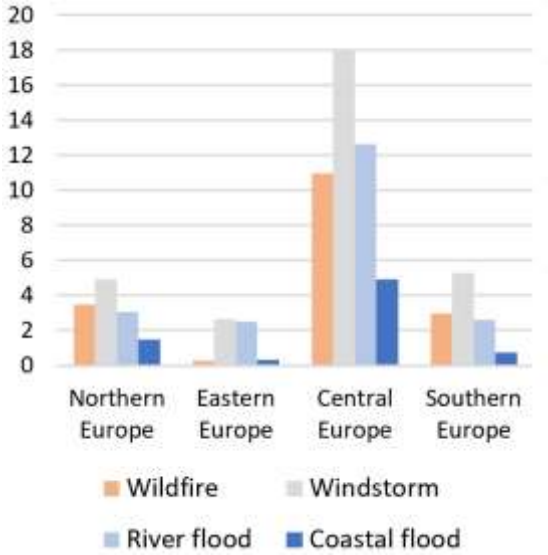
(in EUR Trillion)



Source: EIOPA. Reference date: 2020.

Figure 5: Sum insured for commercial and residential buildings by region and peril

(in EUR Trillion)



Source: EIOPA. Reference date: 2020.

[40] The list of countries included in each region can be found in the List of Abbreviations.

[41] However, the figures for coastal flood should be interpreted with care as some companies were not able to provide data separately for coastal and river flood.

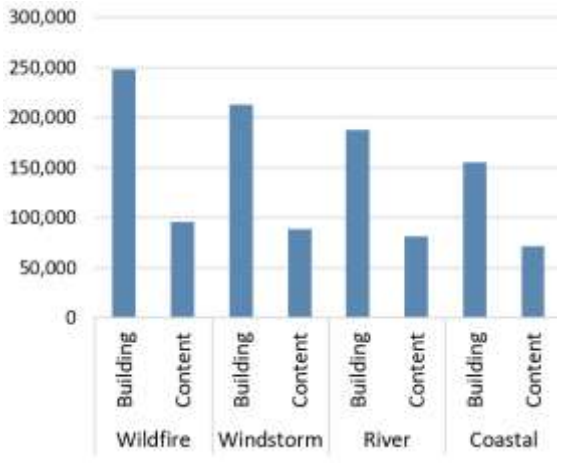
Taken at face value, the largest residential and commercial buildings exposure insured against windstorm are registered in Central Europe. The figures might be driven by several factors: the inclusion in the sample of several large German- and France-based insurers highly active in their local markets and the difference in the national real estate market prices. In fact, the average price per square meter calculated for a 120-sq. m. apartments located in the center of the most important city (i.e. administrative capital; and/or financial capital)[42] is slightly above EUR 3,000 in Eastern European and is more than double in Central Europe (around EUR 6,900 per sq.m.).

In absolute terms, at EEA level, the insured replacement value for residential properties (including building and content exposures) is slightly higher than the commercial exposures (including buildings, content and BI exposures) insured against wildfire, windstorm and coastal flood risks. The residential replacement costs vary across perils between 52% and 55% of the overall sum insured. Only for river flood risk, the residential insured value is just slightly below 50%.

There is a large disparity in the number of contracts stipulated for residential and commercial buildings. In fact, the number of contracts stipulated to cover damages to residential buildings caused by weather related natural disasters are generally 4 to 5 times higher than those covering losses to commercial buildings. The number of residential buildings covered against wildfire, windstorm, river of coastal flooding ranges between 25 and 84 million, while the number of commercial buildings insured against those risks varies between 6 and 16 million.

Figure 6: EEA average sum insured per *residential* building

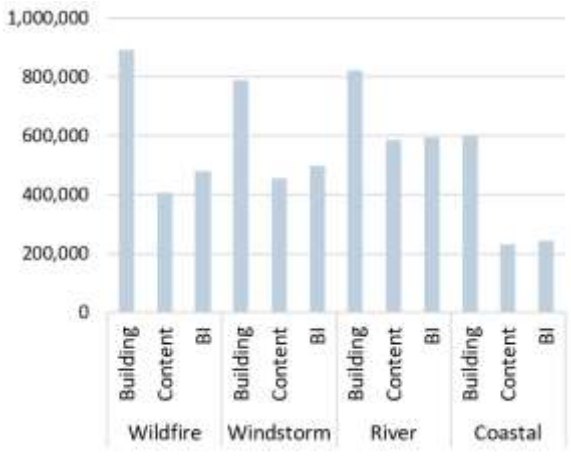
(in EUR)



Source: EIOPA. Reference date: 2020.

Figure 7: EEA average sum insured per *commercial* building

(in EUR)



Source: EIOPA. Reference date: 2020.

However, when looking at the sum insured per buildings, the commercial values are four times the residential average exposures. Moreover, the sum insured against content-related losses for

[42] Source: NUMBEO, GlobalProperty guide and EIOPA calculations.

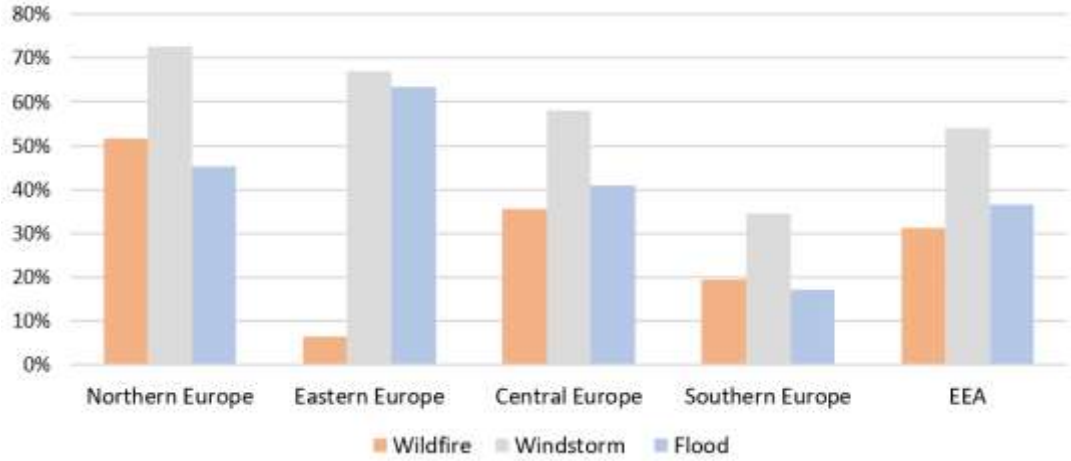
commercial buildings are 3 to 7 times the residential exposures. As consequence, even localized weather-related disasters occurring in highly industrial and insured areas could cause significant losses to the insurance sector.

Building, content and business interruption (BI) insurance coverages are often sold together. However, insurance products vary widely across perils and markets. The content and business interruption exposures represent 12%-22% of the overall commercial exposures and between 17% and 23% of the residential exposures. Moreover, BI ranges between 8-13% of the commercial underwriting portfolio. Approximately between 44% (coastal flood) and 73% (windstorm) of contracts insuring residential buildings offer additional protection against content related damages. The average insured value for residential content related losses is below EUR 100,000 per contract. The shares of commercial buildings insured against this risk are generally lower ranging between 39% and 54%.

When comparing the reported data with the total exposure estimated based on EFEHR Risk Maps data[43] and LitPop[44], the insured share varies between 31% for wildfire and 54% for windstorm, but there is significant variability across regions and perils. However, these figures taken at face value do not fully reflect the actual insurance penetration as the individual policy conditions (e.g. deductibles, ceilings etc.) may have a significant impact on the quality of insurance and the consequent protection in case of natural catastrophes.

Figure 8: Sum insured for *residential* and *commercial* buildings by region and peril

(in % of total estimated building value in the region)



Source: EIOPA, EFEHR Risk Maps data, LitPop. Reference date: 2020. Note: current estimates may be influenced by the sample selection.

[43] European Exposure Model Viewer - Gridded Data (eucentre.it): EFEHR Risk Maps - European Exposure Model Viewer - Gridded Data (eucentre.it)

[44] Global Exposure Data for Disaster Risk Assessment - Research Collection (ethz.ch): LitPop: Global Exposure Data for Disaster Risk Assessment - Research Collection (ethz.ch)

Although Eastern European countries seems to have relatively high level of insurance coverage against windstorm and river flood risk, the levels of insured economic losses related to weather- and climate-related extreme events (occurred between 1980 and 2020) are relatively low in most Eastern European countries[45]. In Czechia, Hungary, Poland and Slovakia the levels of flood insurance coverage have recently improved thanks to the governments' commitment to raise risk awareness after major flood events (occurring in 1997 and 2001), the spreading of insurance requirements for mortgage lending, the improved distribution and marketing capabilities of local insurance companies[46].

In Northern Europe, slightly more than 70% of (commercial and residential) buildings are insured against windstorm risk. While, in Southern Europe, only 35% of the buildings are insured against this risk. The insurance penetration is generally higher for commercial buildings rather than residential buildings (two to three times depending on the region and peril) across all countries except for Central European countries where both shares are relatively similar. This could be explained by different risk awareness levels between home owner and owners of commercial buildings. Different factors may influence the market penetration levels of insurance coverage for NatCat risks. For example, affordability and availability issues, lack of risk awareness or households' expectations related to ad-hoc compensation in case the risks materialize may reduce the insurance penetration, while the presence of legal or mandatory requirements to have an insurance coverage (i.e. bank requirement in relation to mortgage and security) may have an opposite effect.

The overall sum insured against windstorm, for residential and commercial buildings together, amounts to EUR 30.7 trillion. Close to 30% of the EEA insured exposures are located in Germany, followed by France (18%) and Italy (9%)**.** However, when comparing the absolute figures across countries it should be considered that the differences are also driven by the national real estate market prices.

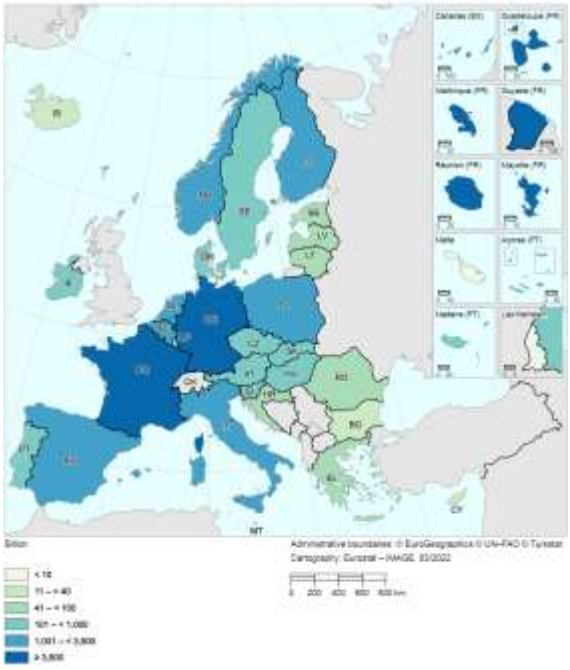
River flood is the second most important peril in terms of sum insured. At European level, residential and commercial properties worth EUR 20.8 trillion are insured against this risk. The insured properties located in France and Germany account for more than 50% of the overall insured value.

[45]The insured shares are below 5% in BG, HU, RO and SK, below 20% in CZ and PL while are between 35% and 50% in Slovenia. Source: EEA (2022) Economic losses and fatalities from weather- and climate-related events in Europe — European Environment Agency (europa.eu)

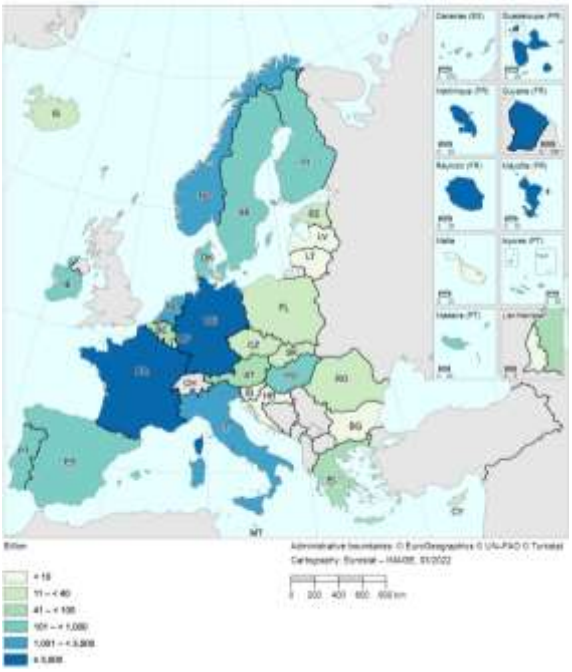
[46] For further details see: World Bank Document

Figure 9: Sum insured by country for *residential* and *commercial* buildings

Windstorm exposures
(in EUR Billion)



Wildfire exposures
(in EUR Billion)



Source: EIOPA. Reference date: 2020.

For wildfire, the relative distribution of the sum insured across the EEA countries is similar to one observed for windstorm. At European level, the replacement cost for the properties insured against wildfire is estimated around EUR 17.7 trillion. More than 30% of the overall EEA sum insured against wildfire risk is located in Germany. This result could also be partially explained by the fact that this risk is covered under the widespread fire insurance policy as well as by the relevance of the property sector. France and Italy follow in terms of relevance of insured exposures accounting for 22% and 10% of the European insurance market for wildfire risk. Finally, the property insured against coastal flood in France accounts for more than 50% of overall insured properties value at EEA level (EUR 7.4 trillion). When looking at other countries, 12% of the exposure are located in Norway and 10% in Germany.

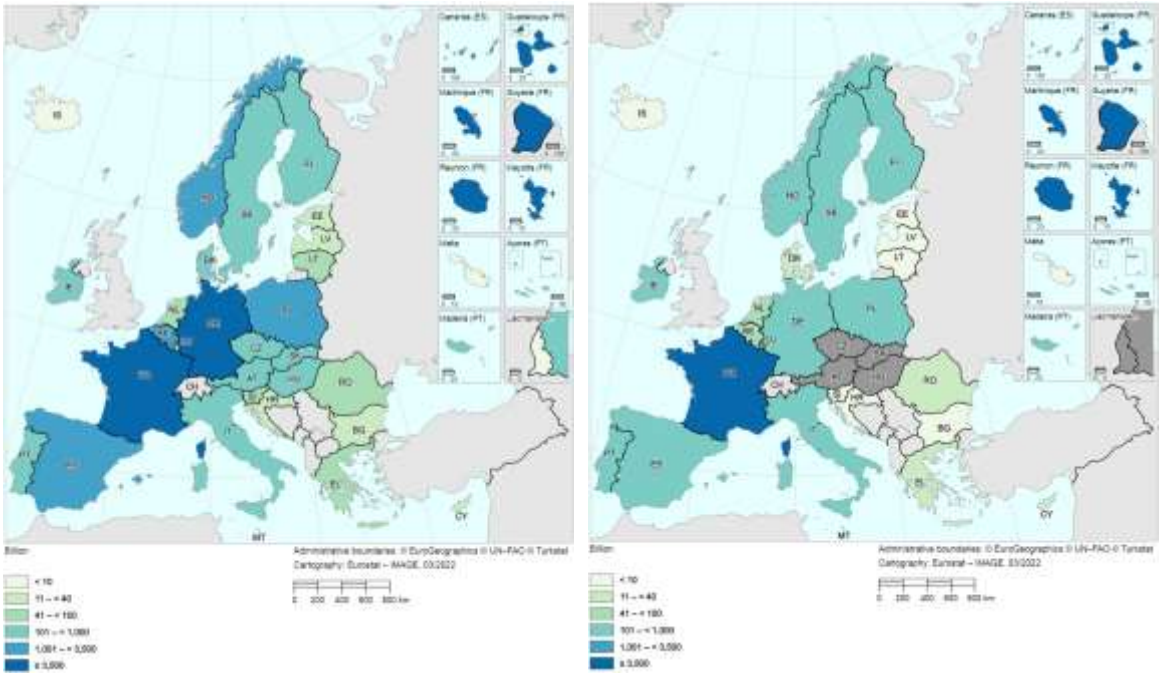
Different market practices as well as national schemes (as those described in Box 2 on *National insurance schemes and product characteristics*) can partially explain the level of insurance observed for a specific European country across different perils. For example, comparing the overall sum insured for residential and commercial buildings located in the Netherlands across all four perils it is possible to notice that the replacement values for properties insured against river and coastal flood risk is lower than the sum insured against windstorm and wildfire. In fact, flood risk is usually excluded from insurance policies in the Netherlands. In particular, flooding caused by failures of major dykes are generally not covered, while flooding caused by smaller rivers may be covered by

some insurance companies. Finally, losses related to river or coastal flooding, for which no insurance exists and officially declared as national disaster, may be partially compensated by the government through the "Reimbursement for damages due to disasters Act" (Wet tegemoetkoming schade bij rampen – Wts)[47] on ad hoc basis.

Figure 10: Sum insured by country *residential* and *commercial* buildings

River flood exposures
(in EUR Billion)

Coastal flood exposures
(in EUR Billion)



Source: EIOPA. Reference date: 2020.

The average sum insured per residential building varies significantly across country and peril depending on the market and national practices. For example, in Germany the perils of fire and storm/hail are standard components in building insurance as well as the content insurance. On the contrary, other natural hazards such as floods and earthquakes are generally sold separately. As a result, their market penetration is somewhat lower[48].

For windstorm, the minimum replacement value per insured residential property (around EUR 26,000 per property) is registered in Bulgaria, while the maximum value is registered in Sweden (EUR 600,000 per property). In Eastern Europe, the average sum insured per residential property is below EUR 70,000, while the average values in other regions vary between 236,000 €/property in

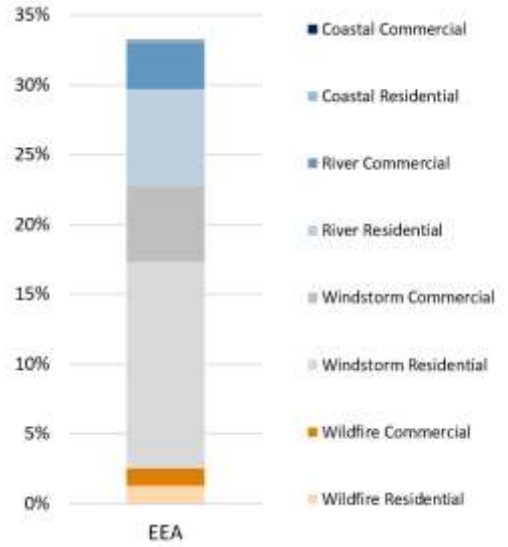
[47] Reimbursement for damages due to disasters | Business.gov.nl

[48] The market penetration for the peril fire is estimated to be around 100% and around 90% for storm risk. While, for the perils earthquake and flood, it is close to 50%.

Southern Europe and 267,000 €/property in Northern Europe. At EEA level, the average sum insured per commercial property is almost 4 times the average value for residential properties ranging between 543,000 €/property in Eastern Europe to more than EUR 1.7 million in Northern Europe.

Figure 11: EEA property GWP for climate related events by peril

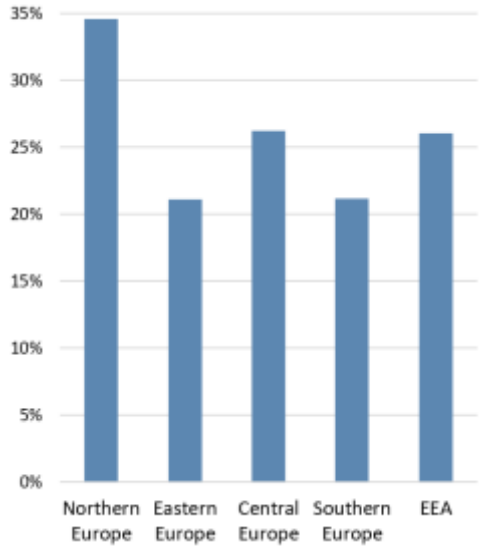
(in % of GWP for fire and other damages to property LoB)



Source: EIOPA. Reference date: 2020.

Figure 12: Direct GWP written for fire and other damages to property LoB by region

(in % of as share of Non-Life GWP)

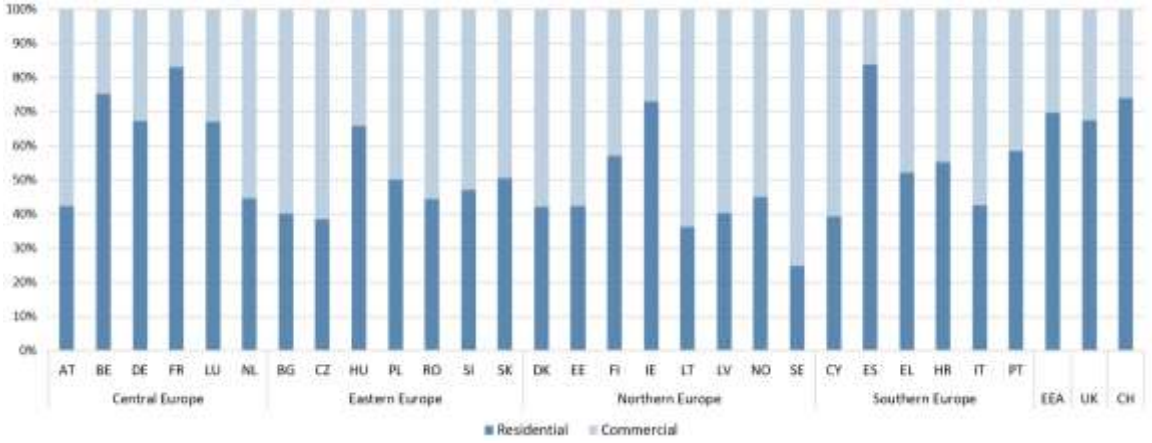


Source: EIOPA, Annual Solo. Reference date: 2020. Note: Figures are based on solos belonging to a group and solos in the sample.

As described at the beginning of the chapter, insurance coverages for natural catastrophe protection are generally part of the fire or property insurance. Looking at Solvency II data, the gross written premiums for fire and other damages to property account for more than 25% of non-life business written by the insurance companies included in the sample. The products offered on the markets vary from country to country, but generally multiple risks are bundled together. Therefore, segregated information on GWP per peril is not always available (especially if the risk is not modelled separately). However, in order to be able to compare different European markets and put into perspective the information collected on the insured exposures, groups and solo undertakings participating in the ad hoc data collection were asked to provide an estimation on the relevance of the weather related perils in terms of premiums. In particular, participants highlighted difficulties in providing exposure and premiums data for coastal and river flood separately or in identifying the wildfire figures as this risk is covered under the fire cover without a separate allocation of premium. Moreover, wildfire risk is often considered a minor risk and is therefore not modeled separately. Where possible, companies provided estimates based on the properties' locations (i.e. coastal regions, distance from the sea, and degree of urbanisation…), risk indexes, actuarial assumptions or technical expert judgment. Therefore, especially wildfire and coastal flood figures should be interpreted with care and rather be seen as lower bounds rather than exact figures.

Figure 13: Property GWP for climate related events for *residential* and *commercial* buildings by country

(in % of total GWP for climate related events)



Source: EIOPA. Reference date: 2020. Note: LI, IS and MT were removed from the chart due to insufficient observations. UK and CH are shown for completeness as a significant share of the property GWP for climate related events is written in these countries.

In most EEA countries (60%-70%), the premium is risk-based and generally its calculation is not restricted by the national regulation[49]. At EEA level, the overall gross written premiums against extreme climate events amount to EUR 19.3 billion accounting for 9% of the non-life business of the sample. In line with the previous observations, the largest premium volume is registered for residential buildings and content insurance coverages (EUR 13.5 billion) of which the large majority is written in Central Europe. The overall commercial premiums collected are less than one third of the EEA GWP. The UK is an important market for European insurance companies covering climate related events. Overall, groups and solos in the sample are writing more than EUR 3.7 billion in United Kingdom and Switzerland. In general, insurance coverage against extended weather related hazards costs less than 90 euros a year per property for homeowners, with the most expensive coverages observed in Central European countries and the cheapest in Eastern Europe[50].

At EEA level, 19% of the GWP collected for climate events are ceded to reinsurance companies. Reinsurance treaties usually cover multiple perils and line of businesses. Generally, ceded shares are higher for commercial rather than residential properties. The highest values are registered for wildfire risk (34% for commercial contracts and 21% for residential), followed by river flood (23%),

[49] Except for FR (12% of additional premium is mandatory by law), LI (premiums as statutory percentage of the total value insured), IS (premiums covering perils insured by the state owned NCI (flood) are set by law), RO (river residential), ES (windstorm and river) and NO (wildfire, windstorm and flood).

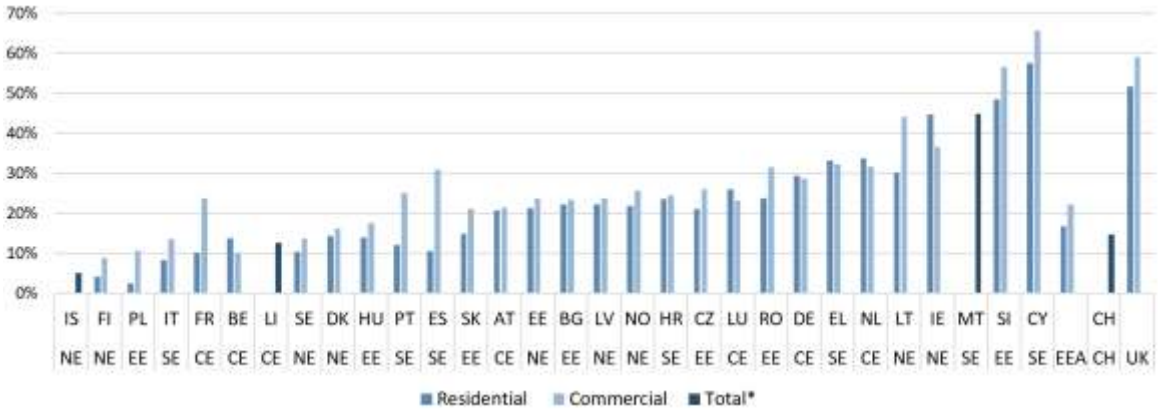
[50] The aggregated GWP as share of number of insured residential properties is around 90 euros in Central European countries and around 30 euros in Eastern European countries. However, average figures vary substantially across country and peril. Furthermore, the results should be interpreted with care as the number of insured properties and the GWP figures have been often estimated using company-specific assumptions.

coastal flood (23% for commercial and 14% for residential) and windstorm risk (19% for commercial and 15% for residential).

Insurance prices are typically influenced by the several factors such as expected damage costs, damage frequency and damage amount, disasters and accumulation losses, underlying risk location and building characteristics, insured risks (storm, hail, flood…), consumers' trends, terms and conditions, reinsurance and capital costs, expenses and investment returns and profit margins. As described in the first chapter, climate change has a direct impact on the frequency and extent of damage from natural disasters and extreme weather events. As catastrophe risks are usually ceded to reinsurance, an increase in extreme weather events, but also a change in accumulations, can lead to greater demand for reinsurance capacity and higher reinsurance prices causing an increase in insurance tariffs, changes in reinsurance conditions and potential affordability and availability issues. Therefore, it is not only essential to monitor this risk and potential markets' reactions to it, but also explore the most cost-effective loss prevention measures to adapt to the effects of climate change.

Figure 14: Ceded premiums as share GWP for climate events for *residential* and *commercial* buildings by country

(in %)



Source: EIOPA. Reference date: 2020. Note: Residential and Commercial figures are shown as total in case of insufficient observations. Legend: EE (Eastern Europe); NE (Northern Europe), CE (Central Europe), SE (Southern Europe). UK and CH are shown for completeness as a significant share of the property GWP for climate related events is written in these countries.

3.2. Current trends in the insurance sector in light of climate change

As discussed in first chapter, climate change is exacerbating the frequency and severity of weather related events. In particular, global warming is influencing weather related hazards such as

heatwaves, wildfire, droughts, extreme precipitation, and storms in certain regions.[51] Nonetheless, while it is not always straight-forward to trace a specific weather event to climate change, it is possible to affirm that climate change increases the occurrence's probability of extreme weather events in specific regions.

The historical trends analysis of temperature and precipitation related variables reveals that negative consequences of climate change are already visible today. In particular, according to the IPCC report[52], the frequency and intensity of heavy precipitation events have increased worldwide since the 1950s over most land areas, while agricultural and ecological droughts have amplified in some regions. Moreover, weather conditions that promote wildfires have become more probable in southern Europe, northern Eurasia, the USA, and Australia over the last century. When looking at the European observations, the report reveals different trends depending on the season and region considered. In particular, an increase in pluvial flooding is observed in Northern European countries, Western and Central Europe are characterized by an increasing trend in river flooding, while Mediterranean countries experienced an increase in agricultural and ecological droughts.

The identification of such trends is not trivial due to the complex interplay of socio-economic and natural factors. For example, precipitation levels, soil moisture, snowmelt, the occurrence of persistent weather patterns, as well as the level of urbanisation and land use can influence the floods' severity. However, global warming, and the consequent increase in the water evaporation and water-holding capacity of atmosphere, is increasing the likelihood of heavy precipitation and consequently exacerbating flood risk especially in highly urbanised or flood-exposed and low-elevation areas. Similarly, a combination of human and weather related factors may exacerbate wildfire risk and its predictability. Among those, climate change consequences such as extremely high temperatures and dry conditions, together with low level of humidity and strong winds allow the fire to spread rapidly.

Globally, both total economic losses and insured losses, caused by weather related events, have been on an upward trajectory in the last decades. However, historical data alone, and more precisely statistics based on incurred losses, may not fully capture the evolution of extreme weather events in light of climate change due to data gaps, and improved recording methods developed in the recent years. Moreover, the occurrence of a rare and disruptive event (i.e. characterized by a long

[51] "Current and short-term impact of climate change" EIOPA methodological paper on potential inclusion of climate change in the Nat Cat standard formula, based on climate state and impact (CLIM) indicators published by the EEA and the JRC PESETA IV project (JRC, 2020).

[52] According to the latest IPCC report, since the mid-20th century, human activities have likely increased the chance of concurrent extreme weather conditions contributing to societal or environmental risk. As for example, the increases in the frequency of simultaneous heatwaves and droughts, compound fire weather conditions (i.e., a combination of hot, dry, and windy conditions) in some regions and compound flooding (e.g., a storm surge in combination with extreme rainfall and/or river flow) in some locations. For further information, please see: IPCC report (2021): Sixth Assessment Report (ipcc.ch)

return period) may skew the historical trends based on relatively short time horizons. According to the EEA indicators[53], weather-related events occurred between 1980 and 2019 accounted for more than 80% of total economic losses caused by natural hazards in the EEA member countries. Due to the high variability from year to year caused by low frequency and high severity events (i.e. 3% of the events accounts for more than 60% of the total losses), the relative short time series and the lower reliability of the historical data, it is difficult to identify such a clear trend at European level.

2020-2021 insured claims: most affected regions and perils

Extra-tropical winter storms are the most damaging events in Europe. The EEA claims, reported by the sample in 2020 for all perils and type of coverages (building, content and BI), amount to almost EUR 4.1 billion, 68% of which was linked to residential properties or content losses. Additional EUR 0.3 billion in claims were registered in UK and Switzerland. Overall, windstorm claims in 2020 account for close to 70% of the total, followed by river flood claims (23%), wildfire (6%) and coastal flood (1%). However, the results should be interpreted with care due to limitations in the data collected. In particular, the recording of historical loss data does not follow a standardised approach among insurers. Historical data is generally stored in the insurers' systems with different levels of granularity. In some cases, only large events with the potential of breaching the CAT annual aggregate treaty franchise are recorded in the system. In other cases, historical claims data is not recorded separately by peril or by risk type (i.e. building, content and business interruption).

Across all perils, residential claims related to damages to buildings account for more than 90% of the overall residential losses (i.e. buildings and content) registered in 2020. For windstorm and flood, at least 80% of commercial losses can be attributed to damages to buildings, while the remaining insured losses come from content (~15%) and business interruption related damages (~5%). For wildfire, similarly to what has been already observed for the Portuguese disaster, the relevance of the insured claims for commercial buildings is lower than for other event types. The replacement costs for commercial building account for only 60% of the total commercial claims, while claims for content insurance and business interruption reach 25% and 15% respectively.

Central and Southern European countries were the most impacted due to high windstorm and wildfire losses. In particular, in Southern Europe, commercial losses due to extratropical storms reached 22% of the premiums written in the region, while wildfire losses account for 6%. Due to the high variability from year to year caused by low frequency high severity events, this metric cannot be used to assess the profitability of the NatCat business over the long term, but it is useful to put into perspective the insured losses occurred in 2020.

[53] Economic losses from climate-related extremes in Europe — European Environment Agency (europa.eu)

Finally, according to the Swiss Re Institute[54], in 2021 natural catastrophes caused severe economic and insured losses worldwide, accounting for more than EUR 211 billion and EUR 88 billion respectively. At European level, the highest damage was caused by the exceptionally severe summer floods that hit Central European countries with overall losses amounting to approximately EUR 46 billion (of which only around EUR 11 billion were insured[55]). Total estimated losses in Germany account for two thirds of the total damages, i.e. around EUR 33 billion of which 25% (8.2 billion) were insured. This event is considered the costliest natural disaster both in Germany and at European level. As natural disaster insured losses in 2021 are significantly higher than in the previous years, extreme weather events continue to put significant pressure on non-life insurers and are expected to become more frequent and severe due to climate change.

3.3. Historical consequences of major natural catastrophes in light of climate change

This section explores in details the historical consequences of major natural catastrophes in terms of claims and premiums evolution on the selected sample and its indirect impact on the insurance business. Three natural disasters have been selected using different sources[56] to ensure a good coverage in terms of perils, regions impacted, magnitude of the event, year of occurrence, insurance penetration of the regions affected and number of countries affected.

1. The first event considered is the windstorm *Ciara* (also known as Elsa or Sabine, from now on referred to as *Ciara*) that hit large parts of central Europe in early February 2020. It was among the costliest natural disaster in Europe in 2020 causing an estimated insured loss of EUR 1.6 billion. With winds of up to 200 km/h, it caused business interruption losses due to the cancellation of flights and major events as well as a breakdown of the power supply.

2. Further, data was collected on the catastrophic forest fire that broke out in Portugal in June 2017. This event is considered the deadliest wildfire event in Portugal's history[57] and the most severe wildfire event ever occurred in Europe. Estimates for the total economic losses range from EUR 200 million to more than EUR 890 million, while the insured losses are

[54] For further details, please see: Global insured catastrophe losses rise to USD 112 billion in 2021, the fourth highest on record, Swiss Re Institute estimates | Swiss Re

[55] Source MunichRe: NatCat world map 2021 (munichre.com), Hurricanes, cold waves, tornadoes: Weather disasters in USA dominate natural disaster losses in 2021 | Munich Re

[56] i.e.: EM-DAT and JRC databases, Munich RE and Perils reports and discussions with the JRC experts and the Cat Expert Network members (network of insurers, scientists, modelers and reinsurers).

[57] According to the International Federation of Red Cross, more than 60 people were killed and 200 were injured, for further details see: IB3_Portugal_Spain_forest_fires_29062017.pdf (ifrc.org)

estimated between EUR 200 million (for the entire season, including another severe wildfire in October 2017) and more than EUR 445 million.

3. The last event considered is a flood that affected Czechia, Germany, Switzerland, Hungary and Austria in June 2013. This event is among the costliest flood event that affected European regions since 1980. The losses caused by the flood were estimated between EUR 11.7 billion and EUR 16 billion, of which only EUR 2.4 to 3.8 billion were insured. The heavy rainfall and consequent flooding forced thousands of people from several parts of central Europe to evacuate and disrupted essential services, including telecommunications and electricity.

The data collected focuses on claims in relation to the events and is split between residential and commercial exposures. Participants were further asked to distinguish the claims incurred by type of coverage, i.e. between coverage for buildings and other claims. It is assumed that coverage for buildings would be typically be the most material type of claim, while other claims could arise from business interruption or content coverage. Aside from claims, the data collection also encompassed the total sum insured, number of buildings insured, as well as premiums collected both before and after the event.

Table 6: Event-specific coverages

		Commercial		Residential		Total reported claims (mn EUR)
		Claims reported (mn EUR)	Number of insurers	Claims reported (mn EUR)	Number of insurers	
Windstorm (Ciara/Elsa/Sabine) *07.02.2020-11.02.2020*						
	EEA	**261.4**	**27**	**554.7**	**26**	**816.1**
Top 3 countries	DE	165.2	12	304.6	11	469.8
	FR	35.7	8	112.0	6	147.7
	BE	21.8	7	71.7	4	93.5
	UK/CH	11.7	9	9.5	8	21.3
Wildfire - *17.06.2017-21.06.2017*						
	PT	12.4	4	3.8	5	16.3
Flood - *28.05.2013-18.06.2013*						
	EEA	645.2	11	762.0	11	1,407.1

Source: EIOPA. Reference date: 2013, 2017 and 2020. Note: For the most recent event, the table shows country figures for the 3 most affected EEA countries.

The data reported in relation to the *windstorm Ciara* offers the best coverage and depth for a more detailed analysis of the impact on insurers and countries involved in the event. Claims were concentrated both geographically, as Germany, France and Belgium account for almost 90% of total claims reported in relation to *Ciara*, and within a small number of groups, as five groups account for 54% of total claims reported in relation to *Ciara*. The materiality of claims related to the event remained broadly contained, ranging from <1% to 12% of claims incurred under fire and other

damages to property LoB within the same year. The use of reinsurance is significant, especially larger insurers exhibit higher shares of ceded premiums, at about 30% of GWP. Correspondingly, participants which incurred larger losses, had taken up more reinsurance and were thus able to pass on part of said losses.

The *2013 flood* examined in this report was the costliest event for the groups in the sample, totaling EUR 1.4 billion in reported claims by 11 insurers. As regards the concentration of claims and use of reinsurance, findings for *Ciara* could be confirmed for the 2013 flood. While the event footprint in terms of affected share of the sum insured was also in line with *Ciara*, the claims intensity was considerably higher for the flood event. This becomes evident in higher loss ratios, surpassing 100% of previously collected GWP for two participants. Claims related to the *2017 wildfire event in Portugal* were reported by 5 distinct insurers in the sample and amount to EUR 16.3 million, which account for 86% of the total estimated insured loss. Contrary to *Ciara*, the majority of the claims arose from commercial exposures, and in particular content coverage. This is likely explained by the impact of the event on agricultural production.

Windstorm (Ciara)

Figure 15: Claims for *residential* and *commercial* exposures by type of claim
(in EUR Million)

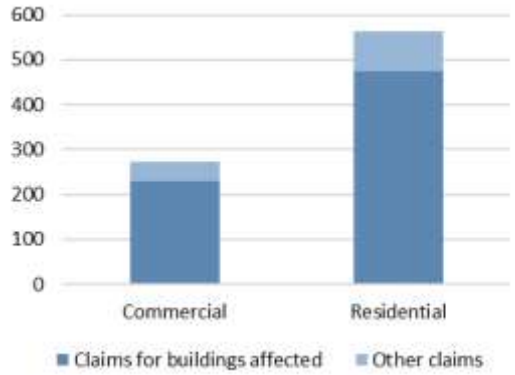
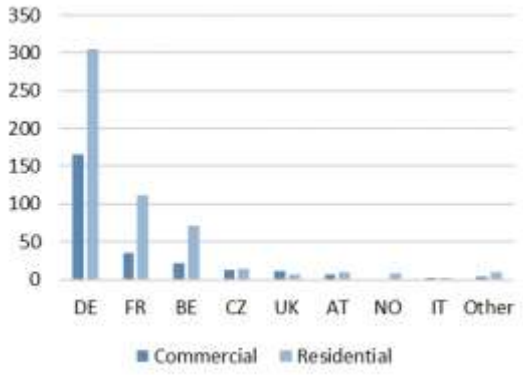


Figure 16: Claims for *residential* and *commercial* exposures by country
(in EUR Million)



Source: EIOPA. Reference date: 2020. Note: Due to the event footprint claims were also reported for UK and CH. Countries have been aggregated to 'Other' if less than three insures reported claims in either residential or commercial exposures in said country.

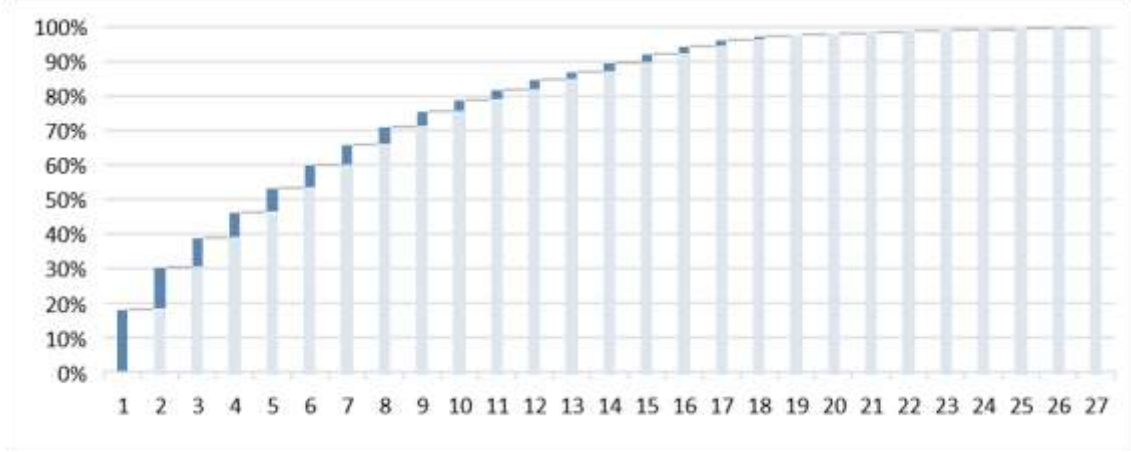
Claims related to *Ciara* were reported by 27 distinct insurers in the sample and amount to EUR 816.1 million. The reported claims are concentrated in Germany, France and Belgium, which account for almost 90% of total claims reported. About two thirds of the claims reported in the sample arose from residential exposures. Further, 9 companies reported claims in UK and Switzerland totaling EUR 21.3 million. Despite a comparably high number of groups and solos reporting exposures in UK or Switzerland, actual claims are relatively small. In relation to *Ciara*, exposures of EEA-domiciled insurers in the sample are thus largely concentrated within the EEA.

The claims related to *Ciara* can largely be attributed to the coverage for buildings and amount to approximately 84% for both commercial and residential exposures. Other claims reported were most frequently related to content, vehicle insurance and business interruption. Further claims were recorded for machinery, electronics, builder's risk insurance, agriculture, transport liability and bank all-risk insurance. These figures could however overestimate the share of claims reported to coverage for buildings, as not all participants were able to provide a breakdown of claims by type of coverage.

Ciara - Concentration and materiality of claims

Figure 17: Total claims reported per group/solo in the sample

(in % of total reported claims)

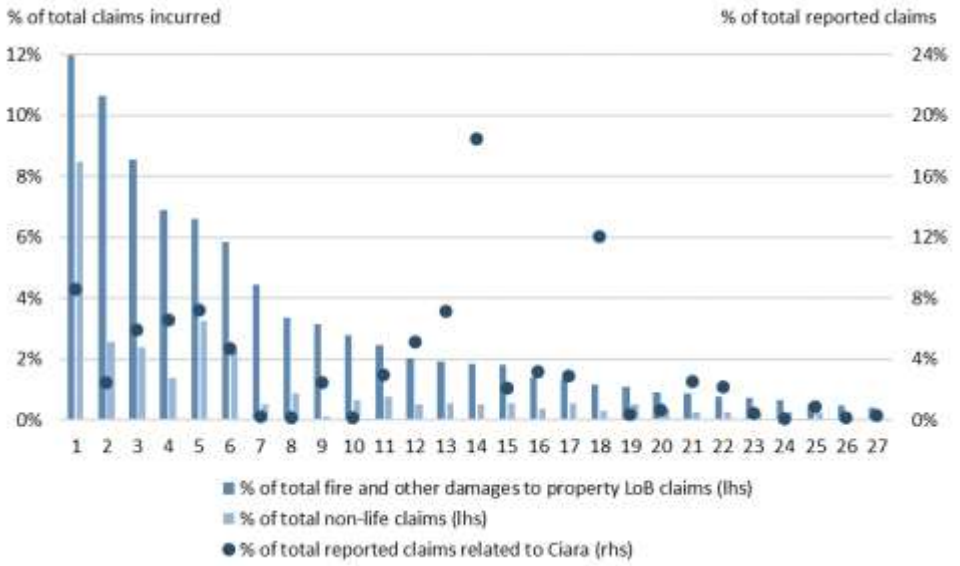


Source: EIOPA. Reference date: 2020. Note: Dark blue bars denote individual insurers' shares of total reported claims, sorted in ascending order. Light blue bars denote the aggregated shares of previous insurers.

A large part of the claims related to the event are concentrated in a small number of insurers. Out of 27 groups and solos reporting claims related to the event, five companies account for 54% of total claims reported. Given the presence of several large insurance companies in the sample, as well as the relative geographic concentration of claims this could be expected.

The materiality of claims related varies across the sample, but remains broadly contained. For most groups and solos the claims related to the event do not surpass 7% of total claims incurred under fire and other damages to property LoB and 3% of total non-life claims in 2020, respectively. For two insurance companies the claims related to the event account for more than 10% of total claims in 2020 under fire and other damages to property LoB. The results point to overall manageable losses for the companies in the sample, but also highlight that a single event can nevertheless have a material impact on an insurer's annual claim structure.

Figure 18: Claims reported per group/solo in the sample relative to total fire and other damages to property LoB claims and to total non-life claims



Source: EIOPA. Reference date: 2020. Note: Mid blue bars denote insurers' reported claims as share of their total claims incurred under fire and other damages to property LoB. Light blue bars denote insurers' reported claims as share of their total claims incurred under non-life business (upper panel). Dark blue dots denote insures' shares of total reported claims.

Ciara – Impact on the sample

In order to obtain consistent aggregates, the following analysis relies on a subsample of groups and solo undertakings that were able to provide complete data on sum insured, number of buildings, as well as premiums collected before and after the event. For commercial exposures the sample encompasses 21 insurers, which account for 76% of total commercial claims reported, while for residential exposures the sample contains 20 companies accounting for 63% of total residential claims reported.

For commercial exposures, the estimated sum insured of affected properties in the sample amounts to EUR 225 billion, i.e. 3.4% of the total sum insured before the event. For residential exposures, the estimated sum insured of affected properties in the sample amounts to EUR 222 billion, i.e. 2.8% of the total sum insured. Claims related to the event amount to EUR 208.5 million for commercial exposures, which is equivalent to 0.09% of the affected sum insured and 0.0032% of the total sum insured. For residential exposures, claims amount to 0.16% of the affected sum insured and 0.0045% of the total sum insured. Based on the past 39 windstorm seasons, Perils[58] estimates the average annual loss costs at 0.0048% of the total sum insured. Although figures for *Ciara* might be small compared to total sum insured, they amount to almost an average year's loss.

[58] See: PERILS-Newsletter-1-2018.pdf

Table 7: Impact of Ciara on the sample

	Before the event			Affected by the event			After the event		
	Sum insured (bn EUR)	Number of buildings	GWP (bn EUR)	Sum insured (bn EUR)	Number of buildings	Claims (mn EUR)	Sum insured (bn EUR)	Number of buildings	GWP (bn EUR)
Commercial	6,580.4	6,180,461	6.6	225.6	86,416	208.5	6,696.9	6,318,918	5.6
Residential	7,778.2	25,262,883	5.1	222.1	432,837	351.9	8,194.0	29,315,862	5.5

Source: EIOPA. Reference date: 2020. Note: Before the event is defined as the calendar year prior to the occurrence of the event (e.g. for 05.06.2013: 01.01.2012-31.12.2012).After the event is defined as the calendar year after the occurrence of the event (e.g. for 05.06.2013: 01.01.2014-31.12.2014).

Comparing figures before and after the event, both the number of insured properties and its sum insured exhibit a slight increase for commercial exposures, while residential exposures experience a more pronounced increase. This is in line with the overall development of the property LoB, as well as participants' assessment of windstorm as expanding business.

Figure 19: Distribution of reinsurance ratio by building type per group/solo

(in %; median, interquartile range)

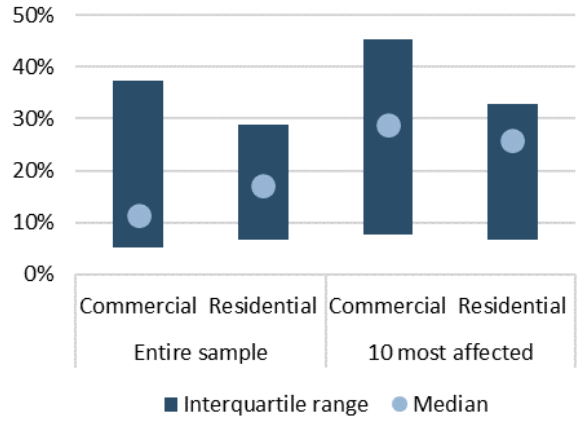
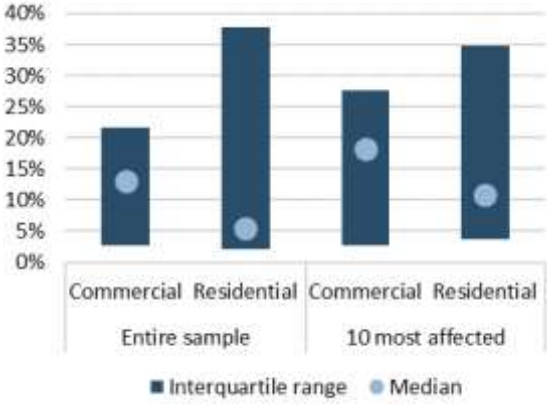


Figure 20: Distribution of loss ratio by building type per group/solo

(in %; median, interquartile range)



Source: EIOPA. Reference date: 2020. Note: reinsurance ratio is calculated as ceded premiums over total gross written premiums per insurer. Loss ratio is defined as claims over gross written premiums per insurer.

Within the subsample and in relation to *Ciara*, on aggregate 35% of commercial GWP were ceded, while only 20% were ceded for residential exposures. The median ratio of ceded premiums however only amounts to 11% for commercial exposures, while for residential exposures it amounts to 17%. The distribution for use of reinsurance across participants is skewed towards large insurers, as they typically exhibit higher shares of ceded premiums. Correspondingly, the ten most affected insurers have a median ratio of 30% for commercial exposures and 26% for residential exposures. Heavily impacted insurance companies are therefore able to pass on part of their losses due to reinsurance agreements.

The median loss ratio for commercial exposures amounts to 13%, while the median loss ratio for residential exposures is only 6%. The distribution for residential exposures is however more dispersed, as the 75th percentile loss ratio amounts to 36%, compared to 27% for commercial exposures. In absolute terms, the 10 most affected insurers for both commercial and residential exposures exhibit a higher median loss ratio than the overall sample, at 18% and 11%, respectively. Although claims for residential property are lower at median level, the aggregate average loss ratio is higher for residential exposures at 7% than for commercial exposures at 3%. This is also evident in the distribution of the residential loss ratio, as the interquartile range is wider, for both the overall sample and the 10 most affected insurance companies.

Wildfire

Claims related to the *2017 wildfire event* in Portugal were reported by five distinct insurers in the sample and amount to EUR 16.3 million. Approximately 76% of the claims related to this event arose from commercial exposures.

Figure 21: Claims for *residential* and *commercial* exposures by type of claim

(in EUR Million)

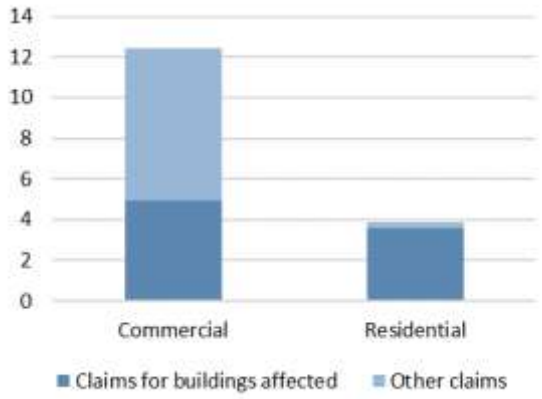
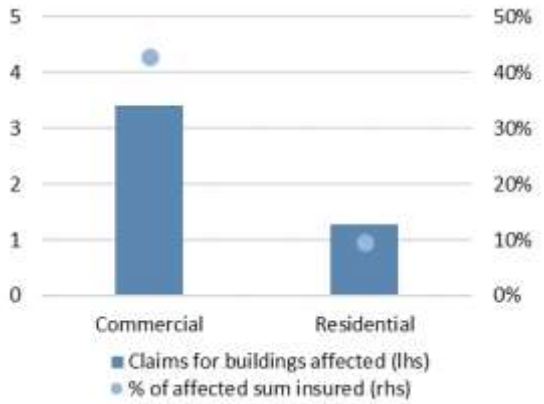


Figure 22: Claims for *residential* and *commercial* buildings in most affected CRESTA-zone

(lhs: in EUR Million, rhs: in %)



Source: EIOPA. Reference date: 2017. Note: Right panel: Most affected CRESTA-zone is PRT-32.

The majority of the commercial losses are thereby not attributed to building coverage, but rather to other claims, which are described as content coverage and account for 60% of total commercial claims. As the wildfire struck in a more rural area residential properties were less affected, most of the property destroyed belonged to companies or agricultural businesses.

The claims related to the wildfire are strongly concentrated on a local level. The most affected CRESTA-zone accounts for 69% of commercial claims to buildings and 36% of claims to residential exposures, as reported by three participants. Within this CRESTA-zone, claims for commercial exposures amounted to 43% of the affected sum insured, and 9% for residential exposures.

Flood

In total, 11 groups and solo undertakings reported claims related to the *2013 flood*, which amount to EUR 1.4 billion. Thus, it represents the costliest event for the groups and solos in the sample. Residential exposures account for approximately 55% of total claims reported. Considering type of coverage, claims can largely be attributed to the coverage for buildings and amount to approximately 81% for commercial exposures and 76% for residential exposures. Other claims reported were most frequently related to content and business interruption, as well as vehicle insurance. The claims related to the *2013 flood* are concentrated in Germany which accounts for 74% of total claims reported, while claims in Czechia and Austria account for another 25%. Claims in remaining countries (Hungary, Slovakia, and Switzerland) are not material.

Figure 23: Claims for *residential* and *commercial* exposures by type of claim

(in EUR Million)

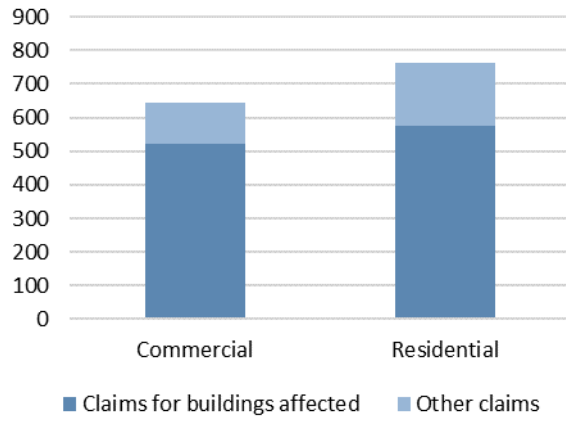
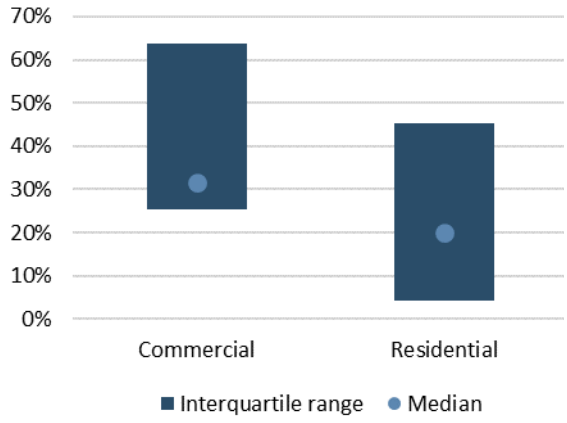


Figure 24: Distribution of loss ratio by building type as claims over gross written premiums per group/solo

(in %; median, interquartile range)



Source: EIOPA. Reference date: 2013.

In the following, a subsample of eight participants that were able to report complete data on sums insured and premiums written is considered. These eight participants account for 70% of reported claims for commercial exposures related to the flood and 76% for residential exposures. In terms of total sum insured, the affected properties account for 3.1% of commercial exposures and 1.1% for residential exposures. While this is in line with the figures for *Ciara*, the claims intensity is higher for the flood event. Claims related to the event for commercial exposures amount to approximately 1% of the affected sum insured, and 3% for residential exposures. For both commercial and residential exposures related claims are equivalent to 0.03% of the total sum insured. The higher claims intensity is also evident in the loss ratio for the event, which on aggregate amounts to 30% of GWP for commercial exposures and 31% for residential exposures. For two insurers the loss ratio surpasses 100% of previously collected GWP, underlining the severity of the event for participants.

3.4. Current physical risk and forward-looking expectations

This section summaries the qualitative information collected from participants on observed developments, relevant for their non-life business more broadly, and their future expectations in light of climate change in relation to a broader set of weather-related hazards[59]. In particular, participants were asked to provide information on observed trends attributable to climate change (e.g. increasing frequency, severity of weather related disasters and/or magnitude of the insured losses) and if, and how, those trends have impacted or are expected to impact their non-life business.

The results highlight that more than 50% of the sample has not undertaken any climate change analyses yet. Participants that did not yet carry out any analyses account for about 30% of total GWP for fire and other damages to property LoB in the sample, indicating that especially smaller insurers still need to build expertise. Depending on peril and time horizon, between 27% and 40% of the companies were unable to provide a qualitative assessment on global developments. However, participants were able to provide detailed estimates for the most relevant markets and territories[60]. In general, more information was provided in relation to their forward-looking expectations[61] rather than on the already observed trends. Some insurers relate their relatively lower ability to provide information on current trends compared to forward-looking views to the complexity of the phenomenon and the difficulty of extrapolating climate change signals among generally volatile phenomena even without the additional impact of climate change[62]. Moreover, few participants highlighted the challenges linked to a still evolving subject under a scientific and analytical perspective. In fact, increase in frequency and severity of the weather related events cannot be directly translated into insurance effects as long-term business developments, changes to reinsurance and product strategies may influence the final impacts. Currently, these factors are not always considered in the analysis. Given the great uncertainty tied to the impact of climate change, scenario analyses and assessment tools are expected to improve as new evidence and techniques emerge.

Among all non-life business lines, participants expect that property will likely be the most affected line of business by climate change. However, climate acute and chronical impacts are envisaged to affect non-life LoBs differently depending on the peril and the geographical area considered.

[59] Wildfire, windstorm, river flood, costal flood, flash flood, droughts, hail and subsidence.

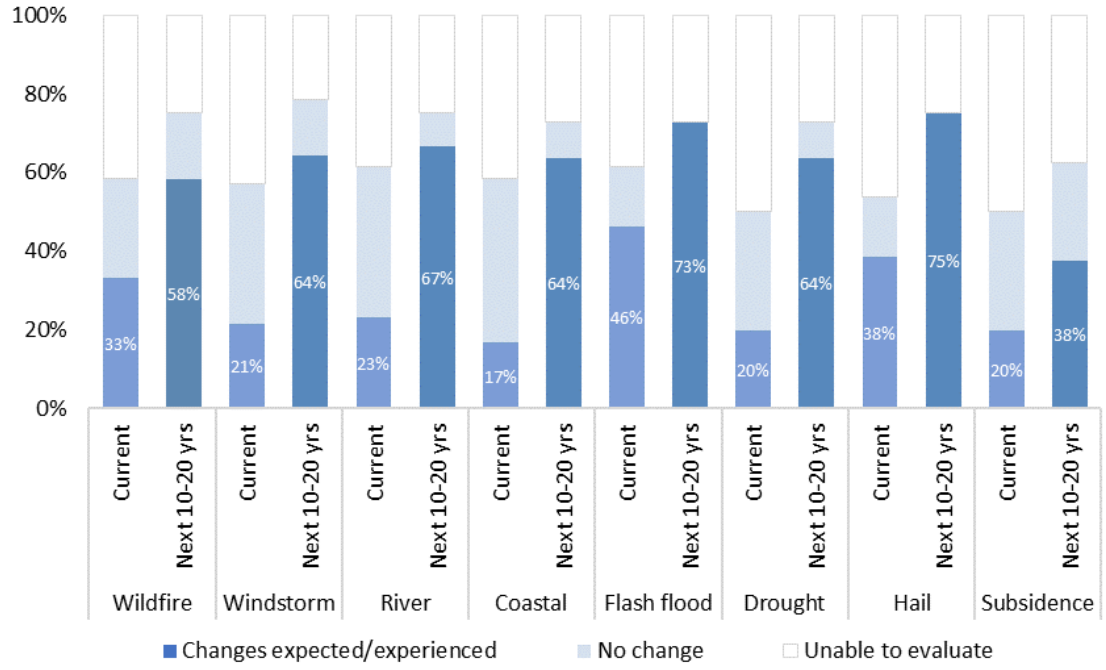
[60] A maximum of 14 replies were received per peril and geographical location.

[61] Participants were asked to assess where climate change has already impacted their business or whether it is likely to have an impact in the future.

[62] Although, attribution research made recently a lot of progress.

Figure 25: Observed and expected climate change impact at global level by peril

(% of positive answers)



Source: EIOPA. Reference date: 2020. Note: The white bars show the share of participants that were unable to provide a qualitative assessment on the current and forward-looking impact of climate change on their business by hazard. The light blue bars represent the share of companies that did not experience any consequences of climate change on their business yet (or they do not foresee an impact in the next 10 to 20 years). While the dark bars represent the share of participants that have already experience an impact on their business due to climate change (purple bars) or will likely experience changes in the next 10 to 20 years (dark blue bars). Results represent participants' views and should be interpreted with care due to the limited sample size.

In line with the most recent scientific development, insurers highlighted that there is high level of uncertainty with regards to the future development of windstorm risk and the potential effect of climate change on this peril. Due to its large variability, more clear signals are expected to emerge towards the end of the century. Although, participants do not foreseen an increase in storms frequency, storm strength is expected to increase over the North Sea with potential negative consequences on Northern European exposure (particularly, in UK, Denmark, Finland, Ireland, Norway, Belgium and Luxemburg). Moreover, economic and insured damages caused by windstorm events might increase because of changes in other factors such as the rise of water levels in the winter and generally growing exposure. In a long-term, there is a risk of increased claims payments. All property-related line of businesses are expected to be impacted, in particular property, motor, forestry, infrastructure and transport. For these reasons, insurance companies are already closely monitoring (or planning to monitor) the potential evolution of this risk in most EEA countries. The large majority of the participants operating in Czechia, Finland and Luxemburg have already increased their premiums (under consideration in Cyprus). While additional actions are envisaged by companies operating in Finland (i.e. policyholders' awareness, re-insurance policy, higher

deductibles). Similarly, in France, groups and solo undertakings are already raising (or planning to) policyholder awareness.

With regards to river flood, participants expect an increase in frequency in most European regions, with potential negative consequences on the insurance portfolio in terms of higher claims payments. Raising property, content and motor claims may impact several LoBs (e.g. Fire and other damages to property and Other Motor) and, if premiums are not adjusted accordingly, it could cause profitability issues. Moreover, in the long term, poor risk management may result in uninsurable properties and geographical areas. Given the relevance of this peril in terms of exposures, the effects of climate change on this hazard are actively monitored (particularly in Belgium, Czechia, France, Ireland, Italy and Luxemburg). Several insurers report that they have already taken actions (or are currently under consideration) to limit the impact on the non-life insurance portfolio and business. For example, premiums have been increased (or under consideration) in Italy, Ireland and to a lower extent in Germany, Greece and Cyprus; risk selection process have been modified in Belgium, Czechia and Ireland (and changes are planned in Cyprus, Greece and Italy). Moreover, changes to re-insurance agreements are under consideration in Belgium, Czechia, Germany, France, Ireland, Luxemburg and Iceland. Insurers operating in Italy are also considering to incentivise mitigation policies, apply higher deductibles/lower limits or policy restrictions as well as raising policyholders' awareness (also in Luxemburg). As mentioned, insurance companies may decide to rise their risk-based premiums consequence to counterbalance the increase in flood risk caused by climate change. Consequently, the uptake of flood insurance may decline substantially and worsen problems with the affordability of coverage especially for low-income households (in particular in voluntary markets[63]) leading to a potential increase in uninsured households or companies' properties in risky area and of vulnerable segments of society.

Even if, at the European level, insurers do not consider wildfire a material peril for their underwriting portfolios, increasing trends have been experienced in the last 5-10 years in Southern European countries. In addition to the property business, insurance companies expect substantial increase in frequency and impact on agriculture, forestry insurance, fire and other damage to property and BI for both commercial and residential businesses particularly in Southern European countries (i.e. Portugal, Italy, Spain, Cyprus, Greece, Malta and France). This risk is already actively monitored especially in Greece and Cyprus, where insurance companies increased (or are planning to increase) their premiums and introduced new policy restrictions. Finally, as wildfire risk is generally covered by general fire or property insurance, an increase in risk may lead to changes to the underwriting or pricing practices. However, several insurers mentioned that it was not possible to identify the policies located in forest areas subject to wildfire. Therefore, a first important step towards the

[63] For potential disadvantages related to public system or ad hoc compensations please see footnote 23.

understanding of the potential implications of global warming on this peril would be to collect granular geospatial information at policy level.

Although, agricultural insurance is a relative niche product, more frequent and prolonged dry periods characterised by the lack of precipitation caused by global warming may negatively impact the agricultural, crop insurance portfolios. Therefore, the assessment of drought risks in light of climate change is gaining more and more importance for the insurance sector even if on a much lower level compared to windstorm or flood risks. This peril is monitored especially in France and Belgium (under consideration in Cyprus), where some companies have already taken additional management actions to limit their exposures (i.e. premiums increase, changes in the re-insurance agreements and risk selection process and rising policyholders awareness). Another risk that may be intensified by prolonged and severe drought conditions caused by global warming is the risk of downward-settling of the ground's surface. Subsidence is generally not covered or not evaluated by insurance companies in the sample. However, according to a SwissRe study[64], shifting weather patterns over Europe may not only increase the level of risk, but also expose more regions to soil movements. Large parts of France and the UK, but also Germany, Spain, Italy and Eastern European countries, will see a very significant increase in subsidence risk. According to the EIOPA's Methodological paper[65], subsidence risk is not considered relevant in Spain as the regions at risk of subsidence are historically known. Consequently, infrastructures are usually not built in such areas. From an insurance standpoint, subsidence is neither material in Italy nor Germany. However, as no model is available to make proper assessment of this risk, subsidence is one of the emerging peril to be monitored in the context of climate change. Participants expect substantial changes in France and minor in Belgium. Few companies already took actions to reduce their exposures as modifying their insurance agreements and risk selection processes, raising policyholder awareness or adjusting their premiums. This risk is also monitored in Denmark, Italy and the Netherlands.

According to the participants, considerations on the potential impact of climate change, are generally part of the regular pricing, underwriting and risk management insurance processes. In particular, in response to heightened physical risks caused by climate change, insurance companies are considering, or planning to intensify, several management actions. The main actions foreseen include a mixture of changes to the pricing, underwriting and reinsurance strategies, including premium increase and changes in deductibles or limits. In addition, insurance companies plan to continue to expand their internal capabilities and know-how to better understand and monitor the implications of climate risk developments on their business (through integration of climate model outputs into their NatCat models or more granular recording of exposure characteristics). Moreover, in some cases, insurers plan bilateral information exchange with policyholders to share insights on

[64] The hidden risks of climate change: An increase in property damage from soil subsidence in Europe, SwissRe (2011)

[65] EIOPA methodological paper on potential inclusion of climate change in the Nat Cat standard formula.

current and future risk landscape and collect information on adaptation measures incentivising the installment of new protections where needed.

4. CONCLUSION AND NEXT STEPS

This report presents and discusses the current trends in underwriting practices that are likely to be affected by climate change. The insurance sector, with its NatCat expertise and diversification mechanism, can play a key role in reducing risk exposures, raising risk awareness and fostering adaptation. Further, insurance coverage in case of large natural disaster can speed up the recovery helping households and businesses better endure the post-catastrophe disruption and underpin the reconstruction phase.

Looking at three recent events, selected for their coverage, impact and magnitude, the report finds that the insurers in the sample historically have been well positioned to handle the pursuing claims. However, due to the increase in the probability of compound events, insurance companies may experience an increase in the magnitude and frequency of their NatCat claims[66]. Future changes in particular affecting insured losses for flooding and windstorm will require adaptation of underwriting and re-insurance practices.

The insurance sector's ability to continue to offer financial protection against the consequences of these events relies on their ability to understand the likely impact of climate change and adapt their business strategies. All property-related line of businesses are expected to be impacted by physical climate change risk (e.g. property, motor, forestry, crop, infrastructure and transport) and there is an emerging consensus that premiums are likely to increase and that adaptation and mitigation measures will play a crucial role in reducing the risk levels in the future. This is particularly evident for river flood where the effects of climate change are actively monitored in several European countries and many insurers are already reporting actions taken to limit the impact on their business. For example, premiums have been increased (or under consideration) in Italy, Ireland and to a lower extent in Germany, Greece and Cyprus. Insurers in several countries report that the risk selection process has already been modified and that changes to re-insurance agreements are under consideration. Some insurers are also considering to incentivise mitigation policies, apply higher deductibles/lower limits or policy restrictions as well as raising policyholders' awareness.

While this report mainly discusses the direct impact of physical climate change risk on the insurance sector due to an increase in magnitude and frequency of weather related claims, the potential indirect consequences on their non-life business should not be neglected. In fact, raising premiums, changes in insurance conditions (e.g. higher deductibles, lower limits and exclusions in risky areas)

[66] Compound extreme events are the combination of multiple hazards (e.g. concurrent heatwaves and droughts, compound flooding: a storm surge in combination with extreme rainfall and/or river flow, compound fire weather conditions: a combination of hot, dry and windy conditions, or concurrent extremes at different locations.

may lead to detrimental consequences for policyholders and even the insurance sector itself (e.g. in terms of reputational risk). This could have substantial negative impact in terms of insurability and affordability from a societal point of view. EIOPA is also monitoring these trends and this work will feed into future work of EIOPA, including the protection gap dashboard.

The findings in this report indicate that a lot of work still needs to be done to prepare for these changes. Climate change related risks are long-term risks for which a standardised methodology for assessment is not yet widely and fully developed. The complexity and uncertainty in terms of time horizons and potential future pathway and developments make it difficult to precisely assess and quantify them. This report should therefore be seen as a learning exercise aiming at understanding the insurance sector's exposures that are most likely to be affected due to potential increase in frequency and severity of climate related hazards such as flood, windstorm and wildfire.

The survey results presented in this report highlight that more than 50% of the participants have not undertaken any climate change analyses yet. A substantial share of the companies were unable to provide a qualitative assessment on global developments and very often struggled to provide data and assessment at a level of granularity required for an in-depth assessment of the risks which are likely to materialise in the coming years. Going forward, EIOPA will therefore continue its work with national competent authorities and the industry to push the sustainable finance agenda forward and continue bringing new results, analysis and policy proposals to the table to help prepare the insurance sector for the effects of climate change. Concretely, based on the feedback on this paper and pursuing discussions, EIOPA plans to continue its analytical work in this field with an overall aim of supporting further forward-looking views and analysis of physical risks in light of climate change.

LIST OF ABBREVIATIONS

Countries	
AT	Austria
BE	Belgium
BG	Bulgaria
CY	Cyprus
CZ	Czechia
DE	Germany
DK	Denmark
EE	Estonia
FI	Finland
FR	France
ES	Spain
EL	Greece
HR	Croatia
HU	Hungary
IS	Iceland
IE	Ireland
IT	Italy
LV	Latvia
LI	Liechtenstein
LT	Lithuania
LU	Luxembourg
MT	Malta
NL	Netherlands
NO	Norway
PL	Poland
PT	Portugal
RO	Romania
SK	Slovakia
SI	Slovenia
SE	Sweden
CH	Switzerland
UK	United Kingdom

Non-Life business	
Assistance	Assistance
C&S	Credit and Suretyship insurance
Casualty Reins	Casualty non-proportional reinsurance
Fire Prop	Fire and other damage to property insurance
Gen Liability	General liability insurance
Health Reins	Health non-proportional reinsurance
Inc Protect	Income protection insurance
Legal Exp	Legal expenses insurance
MAT	Marine, aviation and transport insurance
MAT Reins	Marine, aviation and transport reinsurance
Med Exp	Medical expense insurance
Misc Fin	Miscellaneous financial loss
Motor Liab	Motor vehicle liability insurance
Other Motor	Other motor insurance
Property Reins	Property non-proportional reinsurance
Workers Comp	Workers' compensation insurance

Regions	
Northern Europe (NE)	DK
Northern Europe (NE)	EE
Northern Europe (NE)	IS
Northern Europe (NE)	IE
Northern Europe (NE)	LV
Northern Europe (NE)	LT
Northern Europe (NE)	NO
Northern Europe (NE)	SE
Northern Europe (NE)	FI

Regions	
Eastern Europe (EE)	BG
Eastern Europe (EE)	CZ
Eastern Europe (EE)	HU
Eastern Europe (EE)	PL
Eastern Europe (EE)	RO
Eastern Europe (EE)	SK
Eastern Europe (EE)	SI

Regions	
Central Europe (CE)	AT
Central Europe (CE)	BE
Central Europe (CE)	FR
Central Europe (CE)	DE
Central Europe (CE)	LU
Central Europe (CE)	NL
Central Europe (CE)	LI

Regions	
Southern Europe (SE)	HR
Southern Europe (SE)	EL
Southern Europe (SE)	IT
Southern Europe (SE)	PT
Southern Europe (SE)	ES
Southern Europe (SE)	CY
Southern Europe (SE)	MT

General	
BI	Business interruption
CCR	Caisse centrale de réassurance
CCS	Consorcio de Compensación de Seguros
EEA	European Environment Agency
EIOPA	European Insurance Occupational Pension Authority
EM-DAT	Emergency Events Database
GHG	Greenhouse gas
GWP	Gross written premiums
IM	Internal Model
IPCC	Intergovernmental Panel on Climate Change
JRC	Joint Research Centre
LoB	Line of business
NatCat	Natural catastrophe
NCA	National Competent Authority
NCI	Náttúruhamfaratryggingar Íslands
NNP	Norwegian Natural Perils Pool
RoW	Rest of the world
SCR	Solvency Capital Requirement
SF	Standard Formula
WHO	World Health Organization

NatCat	
Droughts	An extended period of unusually low precipitation that produces a shortage of water for people, animals and plants. Drought is different from most other hazards in that it develops slowly, sometimes even over years, and its onset is generally difficult to detect. Drought is not solely a physical phenomenon because its impacts can be exacerbated by human activities and water supply demands. Drought is therefore often defined both conceptually and operationally. Operational definitions of drought, meaning the degree of precipitation reduction that constitutes a drought, vary by locality, climate and environmental sector.
Hail	Storm with hailstones as dominant type of precipitation. A hail storm is a type of storm that is characterised by hail as the dominant part of its precipitation. The size of the hailstones can vary between pea size (6mm) and softball size (112mm) and therefore cause considerable damage.
Subsidence	Subsidence refers to the sinking of the ground due to groundwater removal, mining, dissolution of limestone (e.g. karst, sinkholes), extraction of natural gas, and earthquakes.
River floods	Type of disaster: Hydrological. Overflow of water from a stream channel onto normally dry land in the floodplain.
Coastal flood	Type of disaster: Hydrological. Higher-than-normal levels along the coast and in lakes or reservoirs (coastal flooding).
Flash Flood	Rapid inland floods due to intense rainfall A flash flood describes sudden flooding with short duration. In sloped terrain the water flows rapidly with a high destruction potential. In flat terrain the rainwater cannot infiltrate into the ground or run off (due to small slope) as quickly as it falls. Flash floods typically are associated with thunderstorms. A flash flood can occur at virtually any place.
Windstorm	Type of disaster: Meteorological. Only extra-tropical cyclones: Type of low-pressure cyclonic system in the middle and high latitudes that primarily gets its energy from the horizontal temperature contrasts in the atmosphere.
Wildfire	Type of disaster: Climatological. Wildfires are defined as any uncontrolled and non-prescribed combustion or burning of plants in a natural setting such as a forest, grassland, brush land or tundra, which consumes the natural fuels and spreads based on environmental conditions (e.g., wind, topography). Wildfires can be triggered by lightning or human actions.
Residential versus commercial	Residential refers to buildings that are designed to be lived in. Commercial buildings are much more varied than residential properties. While residential properties are exclusively used for private living quarters, commercial refers to any property used for business activities. Industrial should be included into commercial.
Building, Content, BI	Property insurance covers buildings, the contents within those buildings, and loss of income (business interruption) if the policyholder is out of business due to a claim.
Bundling	Bundling is the process of merging different forms of insurance into a single policy.

ANNEX

Table 1.A: List of countries and perils currently included in the standard formula natural catastrophe SCR module

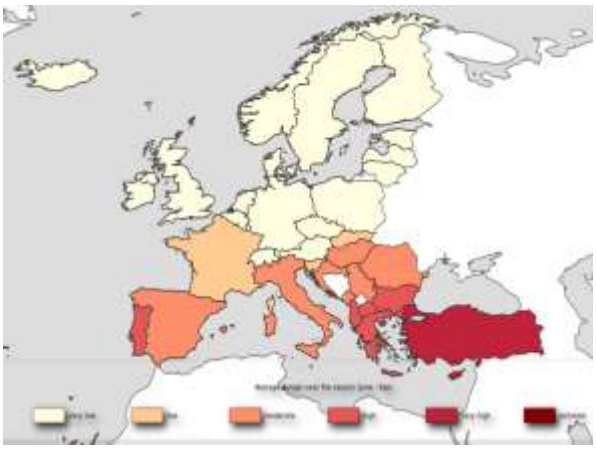
	Windstorm	Earthquake	Flood	Hail	Subsidence
AT	■	■	■	■	
BE	■	■	■	■	
BG		■	■		
CY		■			
CZ	■	■	■	■	
DE	■	■	■	■	
DK	■				
ES	■			■	
FI	■				
FR	■	■	■	■	■
GR		■			
HR		■			
HU	■	■	■		
IE	■				
IT		■	■	■	
IS	■				
LI	■	■	■	■	
LU	■			■	
MT		■			
NL	■			■	
NO	■				
PL	■		■		
PT		■			
RO		■	■		
SE	■				
SI	■	■	■	■	
SK		■	■		

Source: EIOPA methodological paper on potential inclusion of climate change in the Nat Cat standard formula.

Table 2.A: Current and forward-looking risks

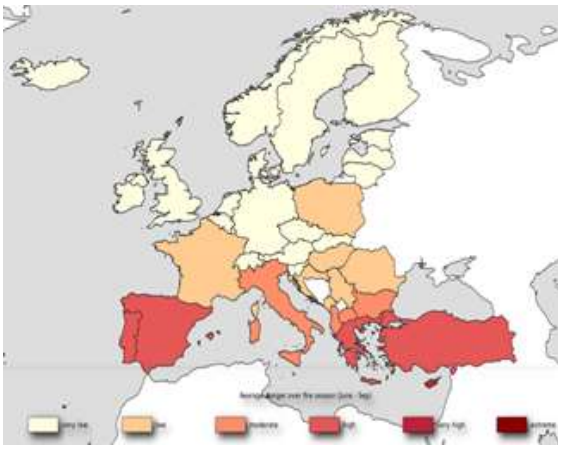
Current risk

Wildfire



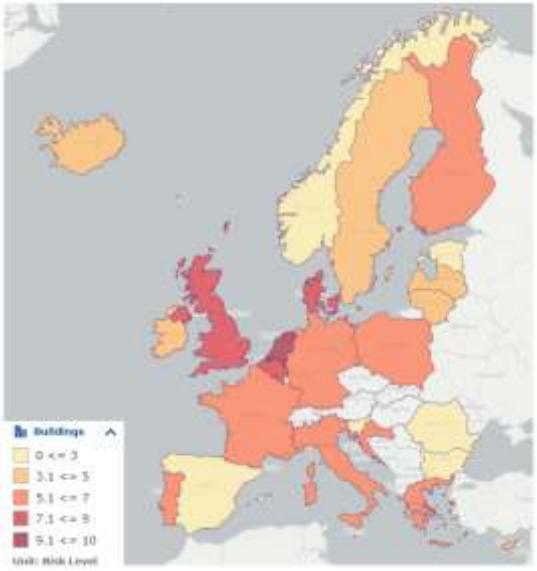
Forward-looking risk

Wildfire

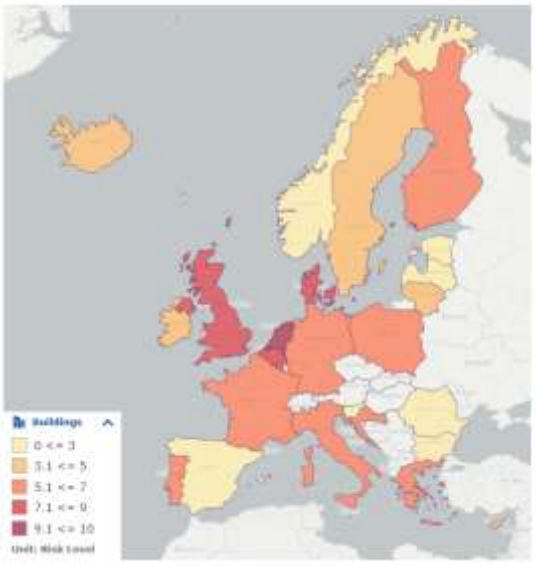


Source: Copernicus. Note: the panel on the right includes the wildfire projections for mid-century.

Coastal flood

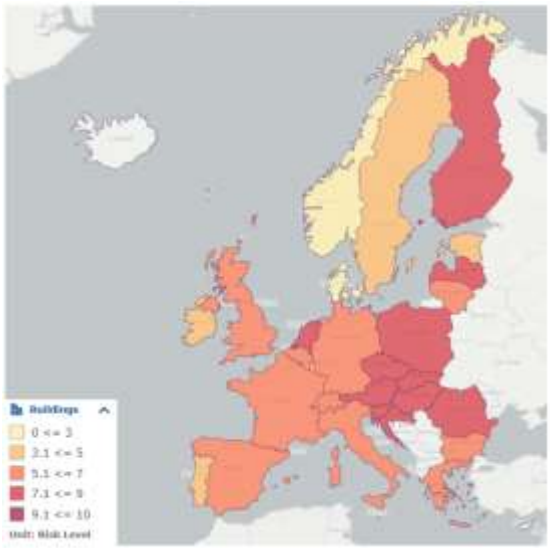


Coastal flood

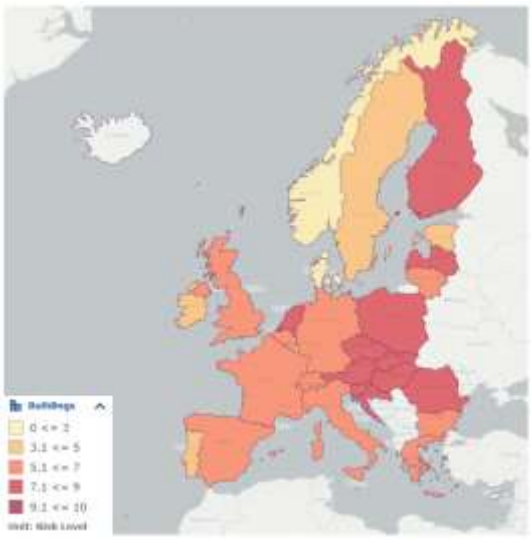


Source: Risk Data Hub (buildings). Note: the panel on the right includes the coastal flood projections for mid-century.

River flood



River flood



Source: Risk Data Hub (buildings). Note: the panel on the right includes the river flood projections for mid-century.

Table 3.A: Data, sample and perils covered in the analysis

Section, part	Sample	Perils	Business lines/contracts	Countries	Reference period
Box 1 *Standard formula NatCat risk charges and exposures*	*Solos and solos belonging to a group in the sample using the Standard Formula SCR calculation method*	*Standard formula perils (see Table 1.A)*	*All Non-life LoBs*	*Standard formula countries (see Table 1.A)*	*2016-2020 SII Annual reporting*
3.1-3.2	*Groups and solos in the sample*	*Windstorm, wildfire, river flood and coastal flood*	*Non-life, property, content and BI insurance coverages*	*EEA (+ CH and UK for GWP related figures)*	*2020, ad hoc data collection and public available information*
3.3	*Groups and solos in the sample*	*Wildfire, river flood and windstorm*	*All Non-life LoBs*	*EEA + CH and UK*	*2013, 2017, 2020, ad hoc data collection*
3.4	*Groups and solos in the sample*	*Windstorm, wildfire, river flood, flash flood, and coastal flood, Hail, Drought, Subsidence*	*All Non-life LoBs*	*World, EEA, + CH, UK and RoW*	*2020, ad hoc data collection*

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