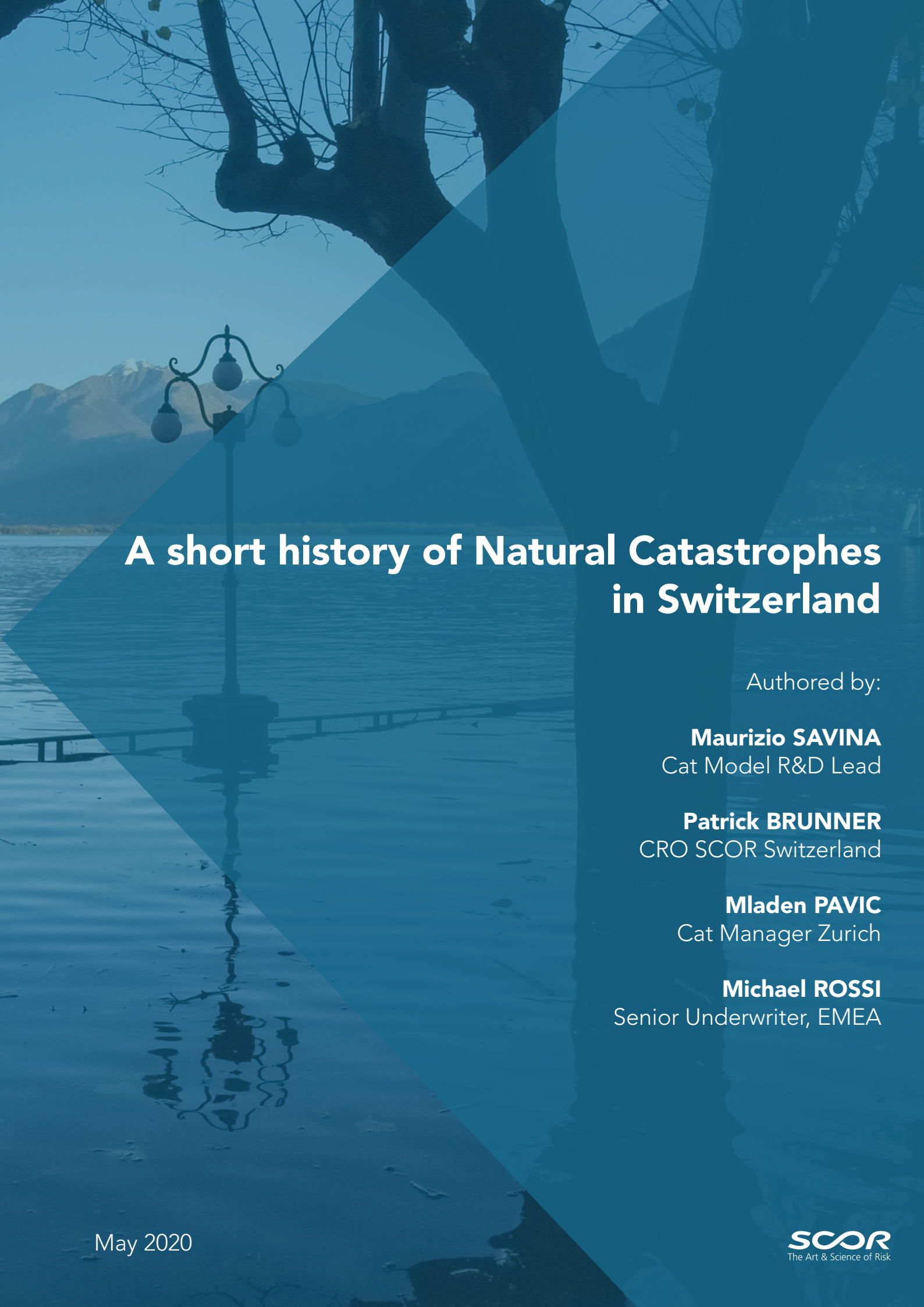

A short history of Natural Catastrophes in Switzerland

Authored by:

Maurizio SAVINA
Cat Model R&D Lead

Patrick BRUNNER
CRO SCOR Switzerland

Mladen PAVIC
Cat Manager Zurich

Michael ROSSI
Senior Underwriter, EMEA

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SCOR
The Art & Science of Risk

A Short History of Natural Catastrophes in Switzerland

Summary

1 - INTRODUCTION

Switzerland has always been impacted by frequent and sometimes very large Natural Catastrophes (or Nat Cats). These events have been and continue to be a source of economic disruption and general social disturbance. Dealing with natural hazards has had a major impact on the way prevention is implemented, the way legislation at cantonal and national levels is shaped, and the insurance landscape overall.

In the late middle ages and early modern times, reconstruction after a disaster was primarily managed by families and neighbors. Communities issued begging letters for victims, authorizing them to collect donations door-to-door. For major damage, communities based their reconstruction efforts on the principles of mutuality and solidarity in the form of labor, cash and natural resources. The former Swiss Confederation also supported victims by liaising with allied towns and regions after major disasters (e.g. 1713 after the Stans fire).

Under the old regime, the Church was in charge of communication after catastrophes. It ordered days of repentance and prayer, which enabled the clergy to interpret the events and make collections. Until the 18th century, catastrophes were interpreted as warning signs and/or as God's punishment for sins, while science saw them as an expression of insufficiently controlled forces of nature.

Since the 19th century, disaster management has also helped to promote integration and national identity. For example, the Goldau rockfall of 1806 (see Chapter 5), marked the first time that all Swiss cantons helped with post-disaster management.

The most successful action was triggered after the floods of 1868, when for the first time the federal council visited the impacted areas and decided to intervene by sending soldiers and launching a national donation campaign, under the slogan *"All for one, one for all"*. The funds collected were given predominantly to poorer areas and peripheral regions, which helped to strengthen the union of the Swiss Confederation.

In the early 20th century, natural disaster and catastrophe management was institutionalized through the establishment of natural hazard pools working alongside a well-established private market, as we explain later in this publication.

SCOR is celebrating its 50th anniversary in 2020. The Group has been present in Switzerland throughout the greater part of this period, providing significant reinsurance capacity to the Swiss market and in particular supporting protection against natural catastrophes. SCOR's ability to diversify such risks on a global scale supports their insurability on a local level, as well as the financial management of catastrophic events. Today, SCOR works in close cooperation with all the major insurance carriers in the Swiss market, including the two natural catastrophe pools that are a key feature of the local insurance landscape.

This publication aims to provide a short overview of the natural perils impacting Switzerland, as well as the structure of the Swiss (re)insurance system for Natural Catastrophes.

2 - NATURAL CATASTROPHES IN SWITZERLAND

Switzerland is frequently affected by floods, debris flows, landslides, fall processes (rockfall and rock avalanches), avalanches, hail and storm events. Forest fires do occur and, although very rare, strong earthquake events can happen too, with the potential for significant devastation.

Moreover, the impacts of climate and exposure changes are expected to lead to an increase in extreme natural events.

Due to potential changes in snow/rainfall patterns, more frequent and severe flooding can be expected. Landslides and debris flows are also expected to become more common in the future. One reason for this is the thawing of the permafrost and the associated destabilization of rock faces and loose rock slopes.

Natural hazards are expected to increase in areas and at times of the year that were previously spared by such damaging events.

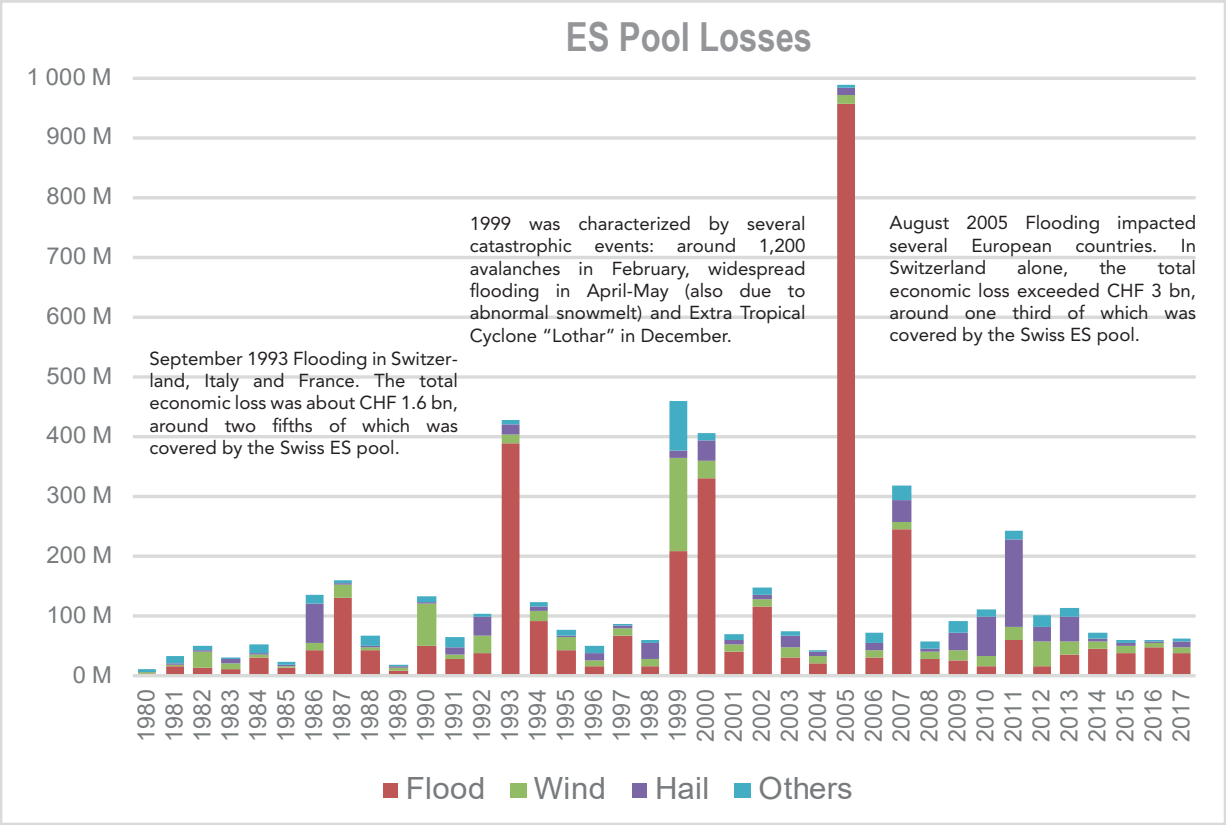

Figure 1. Losses to the Swiss ES pool (see section 3.2.1 for more information about the Swiss ES Pool)

Source: internal

In a (re)insurance context, earthquake risk drives high-severity, low-frequency losses, while climate hazards (flood, windstorm, hail, etc.) can drive losses within a broad frequency-severity range, as reported in Figure 1.

A curious but possibly important fact to consider is that, despite being an alpine country, Switzerland can also be impacted by tsunami (see chapter 2.3).

The following paragraphs give an overview of flood, atmospheric perils, earthquake and tsunami risks.

2.1 - FLOOD

Among the principal climate-related perils, flood events are the most frequent and can range from local to regional in scale. On a regional level, widescale, intense flooding can be caused by correlation due to both meteorological forcing (rainfall, snowmelt, etc.) and hydrological forcing (steep topography leading to fast catchment response and rapid generation of rainfall run off, accumulation of hazards within floodplains, etc.). This was what happened in August 2005, when the most severe flooding (and the largest natural catastrophe) recorded in recent Swiss history led to economic losses of more than CHF 3 billion, of which around CHF 2.5 billion was insured. In addition to the 2005 event, the major historic flood events are as follows (more events are mentioned in Chapter 5).

•**1999 -** Extensive flooding occurred in late spring, due to the combination of abundant snowmelt and extreme rainfall. The economic loss reached around CHF 580 million (unadjusted).

•**1993 -** Extensive alpine flooding occurred in September. The total economic loss was around CHF 1.6 billion (unadjusted).

•**1987 -** Flooding caused by extreme rainfall impacted a large part of the Swiss Alps. Economic losses exceeded CHF 800 million (unadjusted).

•**1868 -** The 1868 flood occurred in October, after an extremely wet period which exacerbated the overall extent of the flood. Unfortunately, there is no quantitative information characterizing this flood, but it is considered to be "the flood that changed Switzerland".

Often, when a large flood occurs in Switzerland, some of the surrounding countries are also expected to experience flooding. For example, in the Summer of 2005 there were also floods in Austria, the Czech Republic, Germany, Hungary, Poland, Romania and Slovakia.

Thanks to intensive planning and the implementation of flood mitigating systems, the risk associated with river flooding tends to be less frequent today than in the past. However, due to urbanization and its impact in terms of reducing the retention of catchment-level rainwater, in addition to the growth of the values at risk and possible weather extremization, an increase in surface water flooding events has been observed in recent years (e.g. 2018, 2017, 2014, 2011, 2007).

2.1 - ATMOSPHERIC PERILS

Of all the atmospheric perils impacting Switzerland, the most frequent and damaging are extra tropical cyclones (ETC, also known as winter storms or simply windstorms) and hailstorms.

Due to its distance from coastal areas, and its complex topography which acts as a shield for part of the country, the Swiss territory is relatively well protected against large-scale windstorms. Nevertheless, recent history has shown that major winter storms can occur, such as Vivian in February 1990 and Lothar in December 1999. These two events caused major disruption and damage to infrastructure, buildings and forests. In particular, Lothar, (which is considered to be one of the most severe windstorms to impact Europe in the last 50 years) caused damage to buildings and forests amounting to more than CHF 500 million (unadjusted) in Switzerland alone.

Hail is one of the most frequent atmospheric hazards in Switzerland. Hail events normally occur in summer and are characterized by localized spatial footprints. However, under particular atmospheric conditions, hailstorms can also span large territories. This was the case with Wolfgang, the hail event that occurred across the Swiss Alps in July 2009 and caused more than CHF 300 million in insurance claims.

The most vulnerable lines of business to hail are motor, crop, greenhouses and, more generally, buildings. The fact that motor business deals with movable objects means that the time of day (and even the day of the week) when hail occurs can lead to significant variability in the overall event loss, with maximum vulnerability arising during commuter rush hours to and from large city centers.

2.2 - EARTHQUAKES

Earthquakes are rare in Switzerland, but they have the greatest damage-causing potential of all the natural hazards.

Compared to other countries in Europe, Switzerland's level of seismic hazard is moderate. Strong earthquakes up to a magnitude of 7 are possible, however they are significantly less frequent in Switzerland than in areas of high seismicity like Italy and Turkey. As Figure 2 shows, earthquakes can occur across the whole of Switzerland and there are no areas where the risk can be ignored.

On average, around 500 to 800 earthquakes are recorded in Switzerland every year. However, only 25 to 40 of these tremors (5%) with magnitudes of around 3 are perceptible to humans.

Over a period of 50 years, the probability of a magnitude 5.5 earthquake causing local damage is considered to be 80%, the probability of a magnitude 6 earthquake causing damage on a regional scale is around 40%, and the probability of a magnitude 7 earthquake causing supra-regional damage is around 5%.

Twelve documented earthquakes causing major damage have occurred in Switzerland since the 13th century. Historical examples include the series of earthquakes in the Canton of Obwalden in 1964 (magnitude 5.3), the Siders earthquake in 1946 (magnitude 5.8), the Visp earthquake in 1855 (magnitude 6.2) and the Basel earthquake in 1356 (magnitude 6.6). To give an idea of the magnitude of potential losses, a repeat of the Basel 1356 earthquake today would be expected to cause losses of between CHF 50 billion and CHF 100 billion. A repeat of the Visp earthquake of 1855 could cost up to CHF 5 billion.

In general, the canton of Valais, the Basel region, the Rhine valley, the Bernese Oberland, the Engadin and parts of central Switzerland have an higher earthquake risk compared to other regions (see Figure 2.).

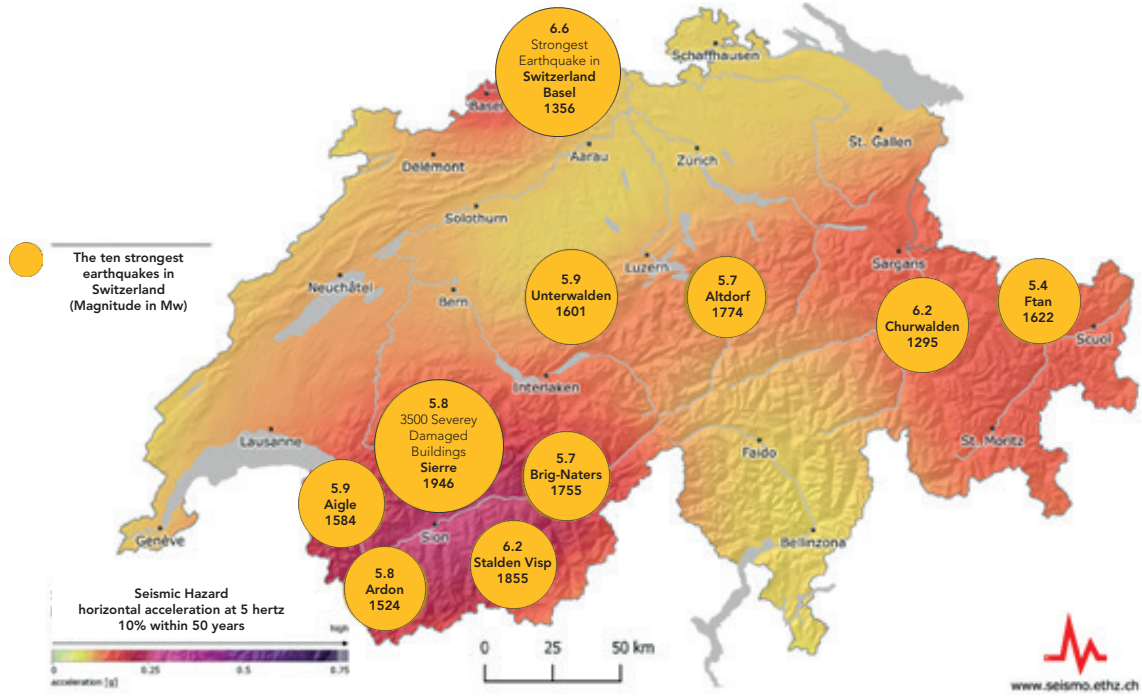

Figure 2. Geography of the ten strongest Swiss historic earthquakes overlaid to the spatial distribution of earthquake potential hazard across Switzerland. Source: Swiss Seismological Service at ETH Zurich

Note: On an intensity-based scale, earthquake intensities of V and below are noticeable but usually cause no damage. Intensity VI causes minor damage to buildings, whereas intensities of VII and above cause serious damage, which may include the collapse of buildings.

The level of seismic safety in 85-90% of existing buildings and facilities in Switzerland is currently unknown or insufficient. The relatively high vulnerability of existing buildings means that considerable damage may be expected in the event of an earthquake. Due to the concentrated insured values, earthquake risk is mainly concentrated in urban centers. The risk is particularly high when these are located on poor geological terrain in which earth tremors are most strongly amplified.

The ten major historical Swiss earthquakes are (in order of magnitude, also see Figure 2):

•**1356** - Basel with strong aftershocks, magnitude 6.6, intensity IX

•**1295** - Churwalden (GR), magnitude 6.2, intensity VIII

•**1855** - Stalden-Visp (VS) with strong aftershocks, magnitude 6.2, intensity VIII

•**1584** - Aigle (VD) with strong aftershocks, magnitude 5.9, intensity VIII

•**1601** - Unterwalden (NW), magnitude 5.9, intensity VIII

•**1524** - Ardon (VS), magnitude 5.8, intensity VII

•**1946** - Sierre (VS) with strong aftershocks, magnitude 5.8, intensity VIII

•**1755** - Brig-Naters (VS), magnitude 5.7, intensity VIII

•**1774** - Altdorf (UR), magnitude 5.7, intensity VII

•**1622** - Ftan (GR), magnitude 5.4, intensity VII

2.3 - TSUNAMI

It may sound strange for an alpine country like Switzerland, but Tsunamis are part of the pool of perils that can cause local natural catastrophes. Tsunamis can be triggered by events such as earthquakes and rockfalls, which, when causing the rapid movement of large volumes of water (basically, if impacting lakes) could provoke small to large scale inundation of surrounding coastal regions.

The major known Swiss tsunamis are:

•**563** - Massive rockfall at the eastern end of Lake Geneva caused part of the Rhone delta to collapse and slide into the lake, triggering a tsunami that caused considerable destruction around the lake.

•**1584** - Earthquake near Aigle in the canton of Vaud in the Rhone Valley damaged villages along the north-eastern shore of Lake Geneva, causing a rockfall that killed 320 people and a tsunami that reportedly flooded shorelines in Villeneuve, Lausanne and Geneva.

•**1601** - On September 16, a magnitude 5.9 underwater earthquake in Lake Lucerne triggered huge waves which left parts of the city of Lucerne under water.

•**1687** - Spontaneous collapse of the Muota river delta near Brunnen triggered a five-meter tsunami, which caused widespread flooding around Lake Lucerne.

•**1806** - On September 2, a huge rockfall from the Rossberg mountain in central Switzerland destroyed the village of Goldau, claiming 457 lives. The easternmost part of the rock mass hit Lake Lauerz, triggering a 15-metre-high tsunami. Around ten people died in the resulting flood on the southern shores of the lake.

3 - SWISS NAT CAT INSURANCE

3.1 - OVERVIEW

Switzerland is exposed to a broad range of natural perils, as described above. These have a major impact on the current shape of the Swiss insurance landscape. Since the early 20th century, it has been evident that natural hazards are only insurable at sustainable and affordable premiums if both insurers and insureds show solidarity and agree to jointly bear the associated risks. This mechanism of pronounced solidarity still forms the basis of the current structure for the insurance of natural perils in Switzerland. Today, almost 100% of all buildings and contents in Switzerland are insured against natural hazards including flood, windstorm, landslide, falling rock, avalanche, hail and weight of snow, which are also referred to as "elemental perils". Insurance against the risk of earthquake is not compulsory and as such this risk is not automatically covered (except in the canton of Zurich).

There are two main schemes in place to insure buildings and contents against fire and elemental perils. In the cantons of Geneva, Uri, Schwyz, Ticino, Appenzell Innerrhoden, Valais and Obwalden (the so-called GUSTAVO cantons), fire and elemental perils insurance for buildings and contents is provided by private sector insurers. In the remaining majority of cantons, insurance coverage of buildings is provided by Cantonal Building Insurers (kantonale Gebäudeversicherer or KGVs) which are governed by public law. In their respective cantons, KGVs are monopolistic providers of obligatory building only insurance against fire and elemental perils. Contents insurance in the KGV cantons is provided by private sector insurers, except in Vaud and Nidwalden.

3.2 - ELEMENTAL PERILS INSURANCE - TWO APPROACHES

3.2.1 - "ELEMENTARSCHADEN-POOL" APPROACH

In the GUSTAVO cantons, fire policies for buildings and contents are provided by private insurance companies and must be extended to elemental perils by law. For example, homeowners who buy building and contents insurance automatically get an excess policy to cover flood, windstorm, landslide, falling rock, avalanche, hail and weight of snow.

To share the risk of elemental perils, Swiss private insurance companies founded the "Elementarschaden - Pool" (Natural Hazard Pool or ES-Pool) in 1953.

This is a voluntary association of private insurers who share the risk between them. The ES-Pool enables its participants to offer elemental perils insurance at affordable and uniform premiums. This benefits consumers in the regions of Switzerland most exposed to avalanches and floods, such as alpine regions. As a result, natural hazards insurance for the GUSTAVO cantons in Switzerland is based on twofold solidarity:

Solidarity among Policyholders

The insurance pricing for natural hazards is identical for all holders of a policy. The law prohibits insurers from asking for higher premiums in particularly risky regions. The insurance premium for house-owners is set according to the value of the house, while the specific exposure of the location is not taken into account. Otherwise, in high-risk areas, protection against natural hazards would become unaffordable. Thanks to the extensive solidarity between less exposed consumers and those exposed to major natural peril risks, a sustainable and affordable insurance system becomes possible.

Solidarity among Insurers

Losses due to elemental perils are also spread among insurers according to their market share, thereby ensuring that risks in especially exposed regions remain insurable.

Mechanism

Private insurers retain 20% of a given loss from the ground up and cede 80% to the ES-Pool. The pool's own retention is apportioned among private insurers depending on their market share. Furthermore, in the KGV cantons the ES-Pool provides cover for contents only (except in Nidwalden and Vaud). The ES-Pool does not cover business interruption.

To improve capital efficiency and to mitigate risk, the ES-Pool buys reinsurance protection from the private reinsurance market. The aggregate reinsurance program purchased protects the pool against large and multiple smaller or midsized events, which could otherwise cause the pool and its members financial difficulties.

3.2.2 - IRV/IRG APPROACH

In 19 of 26 cantons and half-cantons, compulsory building insurance, including coverage of elemental perils and damage prevention, is provided by KGVs, the local cantonal building insurers. Established and governed by public law, KGVs exclusively offer building insurance against elemental perils and fire (excluding business interruption) to everyone in their respective cantons.

In 1910, the KGVs formed the Interkantonale Rückersicherungsverband (IRV, Intercantonal Reinsurance Association) with the aim of sharing the risk of elemental perils and fire between KGVs in Switzerland. The IRV currently offers reinsurance services for fire and elemental perils to its 18 members. As an inter-cantonal, public corporation, the IRV is not profit-oriented and works exclusively for its members. At the heart of this organization is the Intercantonal Risk Community (IRG). The IRG protects members (KGVs) against elemental perils by pooling their exposure above a maximum damage threshold (Grossschadengrenze) which is determined individually by each KGV. The exposure below this threshold is protected by the IRV. In addition, both the IRG and the IRV protect themselves (and by extension their members) by employing substantial external reinsurance capacity on an aggregate basis from major reinsurance carriers, including SCOR.

3.3 - EARTHQUAKE INSURANCE

Earthquakes in Switzerland are rare yet potentially devastating events. Earthquakes such as the Basel earthquake of 1356 would cause losses of between CHF 50 billion and 100 billion today. The 1855 earthquake in Visp, if it happened now, would cause CHF 2 – 5 billion of damage to buildings and contents. As mentioned previously, earthquakes in Switzerland are not considered an elemental peril, and as such are not automatically insured other than within the canton of Zurich, where earthquake insurance is required by law as part of the building insurance.

The potentially devastating impact of a significant earthquake has led the KGVs to establish the Schweizerischer Pool für Erdbebenversicherung - the Swiss Earthquake Pool. Founded in 1978 and managed by the IRV, this Pool provides coverage in case of an earthquake to a rather limited extent. GUSTAVO cantons are not members of the Swiss Earthquake Pool and as such would not benefit from the Swiss Earthquake Pool if there were an earthquake event. This is where private insurance steps in.

The Swiss Confederation and the cantons recognize that today's earthquake coverage in Switzerland is insufficient. Nevertheless, the efforts to date to introduce compulsory earthquake insurance on a nationwide basis have so far not found the necessary political and economic support.

SWISS EARTHQUAKE POOL

At present, the Swiss Earthquake Pool covers CHF 2 billion per event (max. CHF 4 billion per annum) only for those cantons with a building insurance monopoly (KGVs). Given the huge concentration of building values in the respective cantons, this earthquake capacity is rather limited. It may not ensure full coverage for building owners if a significant event occurs.

CANTON OF ZURICH EARTHQUAKE FUND

GVZ, the building insurance company for the canton of Zurich, has legally anchored mandatory and automatic earthquake insurance for over 70 years. Earthquake damage is insured if the quake reaches at least a magnitude of VII on the MSK 1964 seismic intensity scale. Due to its limited capacity (CHF 1 billion per event, max. CHF 2 billion per annum) this coverage may not fully compensate homeowners in the case of a significant event.

PRIVATE INSURANCE PRODUCTS

To bridge the protection gap, private insurance companies step in by offering earthquake insurance throughout Switzerland, including cantons with compulsory building insurance. Currently the take-up rate of earthquake insurance offered by private insurance carriers in Switzerland is less than 10%. However, at SCOR we see an increasing demand from consumers for earthquake protection. Many private insurers have responded to this by providing specific earthquake insurance products, which can be purchased in addition to the existing building policies offered by local KGVs or private insurers (depending on the canton concerned).

4 - SCOR IN THE SWISS MARKET

The reinsurance industry is all about combining technical expertise with scientific and technological innovation. As a Tier 1 reinsurer, SCOR uses catastrophe models that incorporate the latest scientific advances on hazards and on engineering components such as building stock and general exposure vulnerability. The tools we use to conduct our activities (models, databases, pricing tools, reserving tools, and so on) are combined with human expertise and expert judgments, which we call the art of underwriting.

Our Nat Cat models extend the catalogue of observed events to several thousands of unobserved but plausible events, such as tail events driven by cross-country correlation, for example when a windstorm hits several countries at the same time.

SCOR actively supports observed consumer demand for private insurance by providing cover to cedants and pools.

5 - LIST OF HISTORICAL EVENTS

Based on a high-level analysis, the list of relevant historical events in Switzerland is unsurprisingly dominated by flood, avalanches, rockfalls and landslides, with a higher frequency of events in recent history. There are two main reasons for this higher frequency: general under-reporting in older periods and increase in population and assets in more recent times. It should be noted that this list does not include events triggered outside Switzerland, despite having an impact within Swiss territory (e.g. a volcanic eruption abroad).

January 2018 – Winterstorm Burglind / Evi

Winter storm Burglind swept through Switzerland and led to forest damage in all cantons except Ticino. The subsequent storm depression Evi also caused further damage. The amount of wood thrown to the ground totaled around 1.3 million cubic meters, corresponding to a quarter of the country's annual wood use. By way of comparison, storm Lothar in 1999 destroyed around 10 times more.

September 02, 2017 – Flood East Switzerland

The flood was caused by about 48 hours of continuous rainfall, particularly concentrated in eastern Switzerland. The flooding caused small landslides and disruption to roads and train tracks, as well as local damage to properties.

August 23, 2017 - Rockfall in Bondo

More than three million cubic meters of rock fell from the Pizzo Cengalo to the underlying glacier. This caused glacier ice to melt, which turned into a debris flow carrying boulders all the way to Bondo. Despite this type of event being very rare, the village and surroundings were protected by an effective mitigation system and no major damage to property was reported. Unfortunately however, because of the sudden nature of the event, eight tourists were killed.

March 05, 2017 – Landslide Maderanertal

A landslide spilled over the road to Bristen (Glarus Alps). The road was severely damaged, isolating the village of Bristen for a few weeks.

December 2016 – Forest fire Misox and Tessin

On the southern side of the Alps, there has been a severe drought since mid-November. This led, among other things, to a forest fire in the Misox valley (also known as Mesolcina, Grisons). The source of the fire was about 500 meters from the villages of Mesocco and Soazza. The fire continued to spread the following night due to the wind. The fire area grew from 200 by 600 meters to 600 by 1200 meters. On December 28, another fire broke out in the Calanca Valley, north of the village of Braggio, burning an area of approximately 200 by 300 meters.

July / August 2014 - Flood in Switzerland

Heavy rainfalls across the northern side of the Swiss Alps caused widespread and locally severe surface water and river flooding. In July rainfall records reached around three times the climatic average, with peak intensities of 100 mm of rainfall recorded in just three hours. The area most severely impacted was the canton of Bern.

October 10/11, 2011 - Flood event in the berner oberland, in Central Switzerland and Valais

A rapid temperature oscillation resulted in an unusual combination of abundant snowfall (about 50 cm) followed by rapid snowmelt and subsequent intense local rainfall (up to 160 mm in 12 hours), leading to widespread Alpine flooding in the Bernese Oberland, central Switzerland and the canton of Valais.

April 26, 2011 - Forest fire Visp

Following an extraordinarily dry spring, on April 26, 2011, about 100 ha of forest burned in the area of Visp (Valais). Strong winds helped to spread the fire and, according to eyewitnesses, the flames were up to 40 meters high. The fire was extinguished thanks to the intervention of the Swiss army and 10 helicopters. This forest fire was larger than the forest fire in Leuk (Valais) in 2003.

July 23, 2009 - Hail from the Canton of Vaud to lake Constance

As a result of Foehn wind conditions a severe convective storm swept across the cantons of Vaud, Fribourg, Bern, Lucerne and Nidwalden and continued outside the Swiss boundary to Austria. This event was named "Wolfgang" and spanned an unusually large geographical area for severe convective storms. Damage amounting to more than CHF 300 million was caused by hail in particular, and to a lesser extent by storm winds and flooding. Gusts reached speeds of over 100 km/h. Hailstones the size of tennis balls (> 5 cm, large enough to cause damage to buildings as well as vehicles) fell in French-speaking Switzerland.

August 08/09, 2007 - Flooding in Switzerland

The persistent rain on August 8 and 9, 2007, gave rise to critical situations and flood damage in many cantons of northern Switzerland. The intensive precipitation caused a rapid increase in discharge in the river Aare and its tributaries, and both above and below the Jura lakes (Lake Biel, Lake Neuchâel and Lake Murten). Very high discharge volumes were generally recorded in the river Emme, the Aare from its confluence with the Emme to the river Rhine, and in Birs and Ergolz. Lake Biel reached a record high for the period after the second Jura water correction. The scope for regulation of the Jura lakes reached its limits. Total loss estimates reached CHF 500 million.

July 13, 2006 - Eiger Rockfall

On July 13, 2006, approximately 500,000 m³ of rock broke off from a large, vulnerable rock mass on the Eiger above Grindelwald and fell onto the Lower Grindelwald Glacier. The piece of rock on the eastern flank of the Eiger fell onto the glacier in three sections. The splitting of the mountain rock was clearly caused by stresses discharged following the retreat of the Grindelwald Glacier.

May 31, 2006 - Rockfall in Gurtnellen

On the morning of May 31, 2006, a rockfall event occurred to the south of the Güetli tunnel affecting the A2 motorway and the cantonal road. A total of around six boulders, each approximately 10 m³ in size, fell onto the roads. Two trucks and one car were hit, both of whose passengers were killed. The further risk of rockfall in the location was averted by blasting.

August 21/22 , 2005 - Floods in Switzerland

In August 2005, the northern slopes of the Alps were impacted by record breaking rainfall. The levels of several lakes reached record highs and river flow exceeded local standard protection, causing widespread and very severe flooding. In addition to inundation, the main damage processes were erosion, overbank sedimentation, landslides and debris flows. The event impacted 900 municipalities, claimed the life of six people and caused material damage exceeding CHF 3 billion. This was the most severe flooding recorded in recent Swiss history.

August 1 , 2003 - Leuk forest fire (Valais)

During the heatwave summer of 2003, a forest fire broke out in a forest above Leuk in the canton of Valais. Intense winds fueled the rapid spread of the fire in the arid forest. The villages of Albinen, Leuk and some hamlets were at risk from the fire and people had to be evacuated. The fire destroyed approximately 450 ha of forest. The fire area extended from 800 m above sea level to the forest line at 2,100 m above sea level. Approximately 60 ha of the affected forest provided avalanche and rockfall protection to Leuk and the road to Leukerbad.

May-October 2003 - Heatwave Summer 2003

As in most of Europe, the summer of 2003 was one of the hottest of the past century. In Switzerland, the air temperatures recorded for the meteorological summer (average value in June, July and August) were 4-5.5°C higher than the long-term mean value for the period 1864-2003. The drought of 2003 was not a phenomenon limited to summer, it started in February and continued until October. The heatwave caused about 1,000 fatalities in Switzerland alone (about 35,000 across Europe). Other effects of the heatwave included: low harvest, minimal groundwater / streamflow causing crisis to surrounding ecosystems, and thawing of permafrost, resulting in several rockfall events.

October 14/15, 2000 - Storm in Valais

Three days of torrential rain in the canton of Valais led to severe flooding and several landslides. Sixteen people died, including 13 in the village of Gondo. On October 14, Gondo was hit by a landslide that swept away houses, the school, and a few shops and roads. The cost was estimated to be about CHF 500 million.

December 26, 1999 - All over Switzerland, storm "LOTHAR"

On December 26, 1999, storm "Lothar" raged all over Switzerland. The damage just to buildings exceeded CHF 500 million. The strong wind reaching 200 km/h flattened 12.7 million cubic meters of timber (source SLF), causing damage to forestry of around CHF 1 billion. The Cantons of Berne and Nidwalden were the most severely hit by this storm. Due to the huge expanse of the storm, almost all Cantonal Building Insurance cover sustained very high storm damage claims. Before impacting Switzerland, Lothar caused widespread damage to France and southern Germany.

May 1999 - Flooding throughout Switzerland

Following several days of persistent rainfall in the German-speaking part of Switzerland (around 2.5 times the monthly climatic average) and sudden snowmelt in the surrounding alpine regions, several rivers breached flood protections leading to widespread flooding. The cost of the event was estimated at around CHF 580 million.

February 1999 - Avalanche winter

The month of February was characterized by the occurrence of around 1,200 avalanches, a very extreme number. The cause was an abnormal amount of snowfall (almost five meters), widespread between lower Valais and Nordbünden. The avalanche claimed 17 lives and caused material damage to properties and infrastructures. The overall cost was estimated to exceed CHF 600 million.

August 1994 - Landslide in Falli-hölli (Fribourg)

More than 30 holiday homes were partly or completely destroyed by a landslide with a volume of 40 million m3 and a surface of 2 km2. Damage amounted to around CHF 20 million.

September 24, 1993 - Flood in Brig (Valais)

About 150 mm of rainfall fell in a few hours, generating a flash flood event that impacted Brig (Valais). The river Saltina breached its banks and flooded several properties, leaving roads with a few meters of debris. Two people lost their lives. The total cost was estimated at CHF 1.6 billion.

April 18, 1991 / May 9, 1991 - Debris avalanche in Randa (Valais)

Two avalanches with a total volume of 30 million m^3. Railway and road connections to Zermatt were disconnected; the river Vispa was dammed with debris. As a consequence, Randa was flooded during rainstorms in June and August 1991.

24 -25 August, 1987 - Storm disaster in the Alps

Heavy rainfall in many regions caused one of the worst storm disasters in the Alps. Damage amounted to some CHF 800 million (Uri CHF 500 million, Valais CHF 115 million, Ticino CHF 120 million). In Gurtnellen (Uri) the river Reuss washed away the tracks of the Gotthard Railway; the international transit route was disconnected for 18 days.

January 19-22, 1951 - Avalanche winter

Following an extraordinary long snowfall event, large parts of the Swiss Alps were affected by disastrous avalanches. Approximately 1,500 avalanches claimed 98 lives and caused extensive material damage. The avalanche winter of 1951 is considered to be a 100-year event.

January 25, 1946 - Earthquake in Sierre (Valais)

This is the most recent severe earthquake to hit Switzerland. Its estimated magnitude (Mw) was 5.8. About 3,500 buildings were damaged, including the church of Sierre, which lost the top of its tower. Four people were killed.

August 24, 1944 - Backwater of the River Linth

After incense local thunderstorms a debris flow was triggered in the Durnagel Creek near Linthal (Glarus). About 450,000 m3 of debris produced a backwater of the Linth. The torrent-like burst of that debris mass caused devastation to riparian areas down to the Walensee Lake. Damage amounted to CHF 2 million.

December 28, 1898 - Disastrous debris flows in Airolo (Ticino)

In Airolo, several debris flows, caused by severe thunderstorms, destroyed 10 houses, 15 barns and 30 hectares of forest and land. Three people were killed.

February/March 1888 - Avalanches in the Alps

In the Canton of Berne, the Grisons, Saint Gall, Ticino, Uri and Valais, a grand total of around 1,100 avalanches caused serious damage. In total, 49 people and 700 head of livestock died, while 850 buildings and 1,325 hectares of forest were destroyed.

July 5, 1887 - Sub-aquatic slide in Zug

Two dozen houses sank into the lake. Some 43 other buildings were so badly damaged that they were subsequently torn down. 11 people were killed.

September 11, 1881 - Debris avalanche near Elm (Glarus)

As a consequence of incessant rainfall, about 10 million m^3 of rock fell, destroying 83 buildings, 4 bridges and 90 hectares of arable land, and killing 115 people.

1868 - Flood, most of Switzerland was impacted

The 1868 flood occurred in October, after an extremely wet period which exacerbated its overall extent. In today's values, the cost of the flood would be about CHF 1 billion, however accounting for population and asset growth the cost would amount to several billions. This event is considered to be "the flood that changed Switzerland": for the first time the federal government decided to intervene by sending in solders and launching a national donation campaign, under the slogan "All for one, one for all". For the first time in Switzerland, as a consequence of this flooding, federal and cantonal authorities started the planning and construction of flood barriers along main river stretches.

1857 - Large-scale landslide in campo-valle Maggia/ Ticino

A slide mass of more than 100 million m^3 destroyed 10 houses and several barns.

July 25, 1855 - Earthquake in Visp (Valais)

On July 25, 1855, a strong earthquake struck the middle Valais region, causing widespread damage. Its estimated moment magnitude (Mw) was 6.4. A similar event would cause estimated costs of between CHF 2 and 4 billion.

December 11 – 13, 1808 - Avalanches in the Alps

Several snow avalanches killed 42 people in the eastern Bernese Oberland. In the Grisons 24 people, 355 head of livestock, 9 houses and 81 barns were buried under the snow mass.

September 2, 1806 - Debris avalanche of Goldau (Schwyz)

After two rather wet years, 1804 and 1805, as well as heavy rainfall in July and August 1806, between 35 and 40 million m^3 of rock slid off the Rossberg on a marl layer. The villages of Goldau, Roethen and Businger were buried underneath those masses. A tsunami was generated in Lake Lauerz, devastating the village of Lauerz. A total of 953 people, 395 head of livestock, 183 households, 126 occupied houses, 85 barns and other buildings were wiped out. This was the worst debris avalanche on record.

July 1778 - Flood disaster in Kuesnacht near Zurich

The village of Kuesnacht was severely hit by a flood. In total 63 people died, 15 houses and several other buildings were destroyed, and 8 bridges were carried away by the water.

1774 – Earthquake in Altdorf (Uri)

With an epicenter near Altdorf, a magnitude 5.7 earthquake generated widespread damages.

June 1770 - Rockfall in Praettigau (Grisons)

Following a period of incessant wetness, heavy rainfall and deforestation, the village of Monbiel near Klosters was badly hit by a rock fall. 13 houses were destroyed, and 17 people lost their lives.

December 9, 1755 - Earthquake in Brig (Valais)

With a magnitude of 5.7 and a maximum intensity of VIII, this earthquake caused severe damage in Brig, Naters and Glis, where several houses collapsed. Almost all chimneys collapsed in Brig; a part of the vault of the Jesuit Church caved in; not one single house remained unaffected. In Naters the vault of the Parish Church collapsed. In Glis a huge part of the church tower fell onto the church vault, which collapsed and destroyed the altar.

August 6 – 7, 1748 - Flooding in the region of Basel and Aargau

As a consequence of "dreadful cloudbursts", Magden (Aargau) was destroyed: "...44 people, 140 head of livestock, 14 houses and 17 barns fell victim to the water...". In Rheinfelden 32 people lost their lives.

December 28, 1720 - Storm in Schaffhausen

The storm was so severe that it caused an approximately 40-meter-long stretch of the western flank of the Munot fortification in the canton of Schaffhausen to collapse. The wall was around one meter thick and eight meters high. The section of wall that collapsed was rebuilt in 1721.

February 1720 - Avalanche in Obergesteln (Valais)
Between 50 and 90 people were killed, as well as some 400 head of livestock. About 120 buildings were destroyed.

1687 – Tsunami on Lake Lucerne
The spontaneous collapse of the Muota river delta near Brunnen triggered a five-meter tsunami, which caused widespread flooding around Lake Lucerne.

July 1629 - Destruction of Alt-giswil (Obwalden)
On July 13 the collapse of a large landslide dam buried the village Alt-Giswil (Obwalden) under some 40 meters of debris.

1622 – Earthquake in Ftan (Grisons)
With an epicenter near Ftan (Grisons), a magnitude 5.4 earthquake generated widespread damage.

September 18, 1601 - Earthquake in central Switzerland
With an epicenter in the canton of Unterwalden, an underwater magnitude 5.9 earthquake, along with associated landslides and debris avalanches, destroyed several houses. A rock mass falling into Lake Lucerne set off a tsunami that flooded the city of Lucerne.

May 2, 1595 - Flood in the valley of Bagnes (Valais)
A huge ice avalanche from the Giétroz glacier dammed the Drance de Bagnes river into a lake. When the ice dam melted, a sudden collapse was followed by a torrent-like emptying of that lake. As a consequence of this flash flood, 140 people drowned, more than 500 buildings were destroyed, and the entire valley of Bagnes down to Martigny was devastated.

1584 – Earthquake and tsunami in Aigle (Vaud)
With an epicenter near Aigle (Vaud), a magnitude 5.9 and intensity VIII earthquake generated widespread damage along the north-eastern shore of Lake Geneva. In addition, the earthquake caused a rockfall that killed 320 people and a tsunami that reportedly flooded shorelines in Villeneuve, Lausanne and Geneva.

1524 – Earthquake in Ardon (Valais)
With an epicenter in Ardon, a magnitude 5.8 and intensity VII earthquake generated widespread damage.

May 29 and 30, 1515 - The Biasca flood wave
On September 30, 1512, a rockfall from Monte Crenone blocked the river Brenno in the Blenio Valley and caused it to form a lake. Three years later, an outburst of the landslide dam caused the torrent-like emptying of the "lake". The flood wave wreaked destruction downstream in the Biasca valley as far as Lake Maggiore, destroyed part of the Murata (defense wall) of Bellinzona and swept away the new stone bridge over the river Ticino. 500 people were killed.

October 18, 1356 – Earthquake in Basel
With a magnitude of 6.6 and a maximum intensity equal to or larger than IX, this earthquake destroyed most of the churches, castles and fortresses within a radius of around 30 km from the epicenter. After the earthquake, a fire raged in the city for 8 days. Almost everything with the city walls – mostly wooden houses - burnt down completely. According to several sources, the number of victims may have reached 2,000 people. In Berne, the cathedral was severely damaged. In the Jura Mountains there were apparently fifty debris avalanches. This is the strongest known earthquake north of the Alps in that millennium. A repeat of this event today could cost between CHF 50 and 100 billion.

September 3, 1295 – Earthquake Churwalden GR
With an estimated maximum intensity of VIII and a magnitude of 6.2, the 1295 earthquake is the largest known earthquake in south-eastern Switzerland. The three main sources mention damage and destruction in Churwalden and to between 5 and 20 castles in the diocese of Chur.

563 – Rockfall lake Geneva
Massive rock fall at the eastern end of Lake Geneva caused part of the Rhone delta to collapse and slide into the lake, triggering a tsunami that caused considerable destruction around the lake.

154 – Earthquake Aigle
An earthquake near Aigle in the canton of Vaud in the Rhone Valley damaged villages along the north-eastern shore of Lake Geneva, causing a rockfall that killed 320 people and a tsunami that reportedly flooded shorelines in Villeneuve, Lausanne and Geneva.

~ 8,000 years ago – Rockfall Davos GR
Rockfall from the Totalp (Parsenn area) dumped onto today's Wolfgang Pass, with an estimated mass of more than 0.3 km^3.

~10,000 years ago - Debris avalanche in flims (Grisons)
On an inclined geological layer, around 13 km^3 of rock (800 m long, 3 km wide) slid into the valley. The rock masses spread across an area of 51 km^2.

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Maurizio SAVINA
CAT Model R&D Lead , Actuarial Pricing & Catastrophe Risk Management
msavina@scor.com
+41 44 639 99 63

Maurizio joined SCOR in 2019 as Cat Model R&D Lead and is based in Zurich. His main focus is the design and development of new solutions to optimize SCOR global Cat risk modelling practices.
Prior to SCOR, Maurizio spent seven years at RMS, where as Director of Model Product Management he focused on translating (re)insurance market needs into model improvement initiatives. One of his passions is providing insight into risk modelling to optimize client experience and industry understanding of modelling results. Maurizio holds an MSc in Civil Engineering from the Polytechnic University of Turin and a PhD in Hydrology from ETH Zurich.

Patrick BRUNNER
CRO SCOR Switzerland
pbrunner@scor.com
+41 44 639 95 41

Patrick joined SCOR in 2003, prior to which he held information technology-related roles in Insurance, Banking and software start up. He has served as Chief Risk Officer for Switzerland and Head of P&C Risk Analysis and Reporting since 2014. He holds a diploma in Business & Computer Science.

Mladen PAVIC
CAT Manager Zurich , Actuarial Pricing & Catastrophe Risk Management
mpavic@scor.com
+41 44 639 91 14

Mladen joined SCOR eight years ago and leads the Zurich Nat Cat Treaty team to support treaty underwriting based in Zurich, by providing operational support for pricing and accumulation. He holds a Master's in Actuarial Sciences and is a member of the Swiss Actuarial Association (SAV).

Michael ROSSI
Senior Underwriter, EMEA
mrossi@scor.com
+41 44 639 97 14

Michael joined SCOR in 2008 as Senior Underwriter / Market Manager TTY P&C. His focus is about providing leadership and coordination in all aspects of the underwriting including strategic book positioning and portfolio management. Michael joined SCOR from RMS in London where he held a position as Product Manager. Prior to this, he spent 4 years with Partner Re focusing on pricing and accumulation support. Michael is a Swiss Citizen and holds a Master of Science (M.Sc.) degree in Geography and an Executive MBA. A native German speaker, he also speaks English and French.

SCOR SE
5, avenue Kléber - 75795 Paris Cedex 16
France
scorglobalpc@scor.com

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