
SCOR
The Art & Science of Risk

GEOLEARNING Seminar

Ecaterina NISIPASU – Chief Risk Knowledge Officer
Henry Bovy - Accumulation Team Property Lead

Mines de Paris - November 2022

SCOR
The Art & Science of Risk

Who are We?

Who are we?

- SCOR, a leading global reinsurer, offers its clients a diversified and innovative range of reinsurance and insurance solutions and services to control and manage risk, thanks to an underwriting policy based on profitability, effective risk management and cautious investment. Applying “The Art & Science of Risk”, SCOR uses its industry-recognized expertise and cutting-edge financial solutions to serve its clients and contribute to the welfare and resilience of society.

- SCOR Group’s strategy is built on a development model based on three entities : SCOR P&C (property and casualty (re)insurance), SCOR L&H (Life reinsurance) et SCOR Investments (assets management), operating in more than 20 countries.

4th
Worldwide reinsurer

3028
Employees

65
Nationalities

38
Offices in the world

What is reinsurance?

- Reinsurance is at the heart of the risk management: it allows insurers to cover their risks by ceding part of them and benefitting from the mutualization of these risks on a worldwide scale. SCOR covers the main P&C risks, notably the large catastrophes (both natural and man-made: huricanes, floods, earthquakes, explosions, fire, plane accidents, etc.), as well as the main biometric L&H risks (mortality or morbidity trends and shocks, etc).

- The objective of the reinsurers is to identify, select, assess and price these risks to ensure that they are always able to absorb them.

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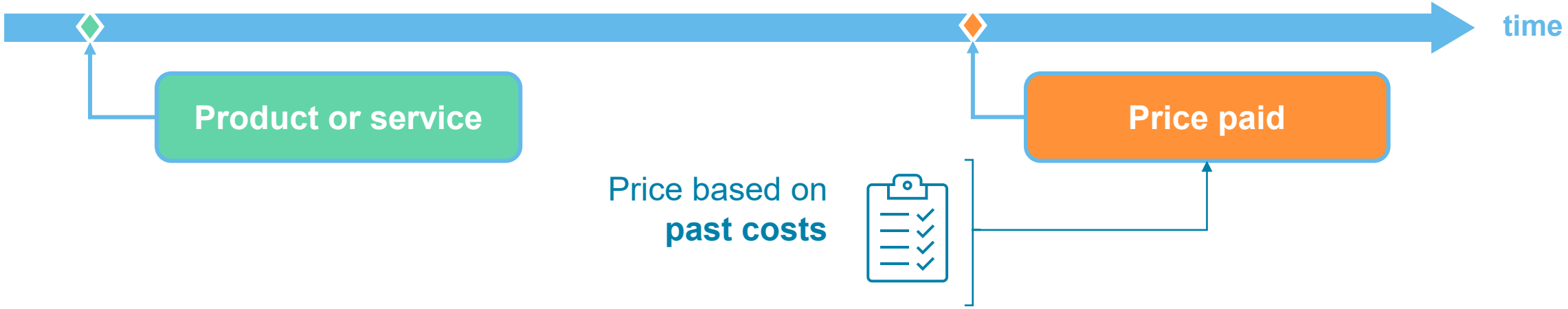
Why is Science important for us?

(Re)Insurance has an inversed cycle.

Classical economic activity



(Re)insurance activity

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Science helps actuaries to predict future losses

In Property and casualty insurance, to predict:

- Occurrence of fire losses, accidents…
- Natural catastrophes: earthquakes, hurricanes
- Personal or professinal liability
- …

In Life and Health insurance,to predict:

- Life expectancy
- Occurrence of a critical illness
- Occurrence and duration of an invalidity, ...

Example of mathematical tools used:

Probability et Statistics

- Bayesian statistics
- Generalized Linear Models, General Additive Models, Random forests, Gradient Boosting Methods, …
- Temporal series, stochastic processes, Partial Derivative Equations…
- Copulas

Algorithms

- Approximations (Monte-Carlo,…)
- Optimisation (Newton,…)

Analysis

- Interpolations, Splines (Bézier curves…)
- Fourier Transforms (FFT)

SCOR stays at the cutting edge of the risk kwoldege

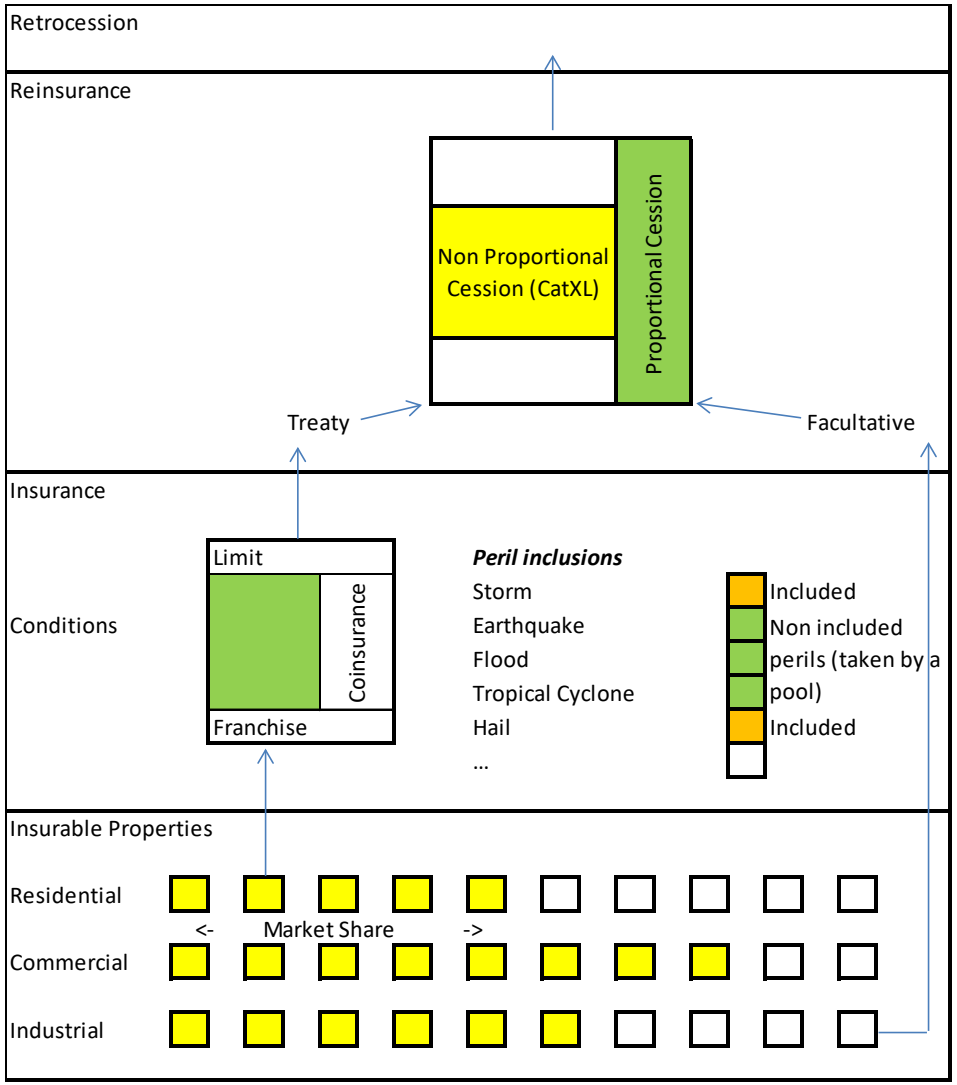
- SCOR group has a long-term commitment to research and the dissemination of risk-related knowledge. This commitment is an integral part of SCOR's DNA, as illustrated by the Group's tagline, "The Art & Science of Risk".

- Risk is at the heart of reinsurance, and SCOR stays at the cutting edge of risk expertise and research through its vast network of academic institutions, as well as through the support it provides, through the SCOR Corporate Foundation for Science created in 2011, to numerous disciplines including mathematics, actuarial science, physics, chemistry, geophysics, climatology, economics, finance, and more.

- Example: the project initiated with the Geolearning chair on a better assessment of large climate events using multivariate bias correction methods.

Natural Catastrophy and Climate Change Risk

Risk transfer/Reinsurance and Natural Catastrophy



Country	Thailand	Japan	New Zeland	Chile	US	Cayman	France
Event	Bangkok	Tohoku	Lyttelton	Maule	Katrina	Ivan	Lothar
Year	2011	2011	2011	2010	2005	2004	1999
Peril	FL	EQ	EQ	EQ	HU	HU	WS

Reinsurance Loss

Amount	5,0	25,0	12,5	11,0	24,0	0,9	4,0
Ratio RI/Ins	50,0%	71,4%	83,3%	78,6%	36,9%	60,0%	44,4%

Insured Loss

Amount	10,0	35,0	15,0	14,0	65,0	1,5	9,0
Ratio Ins/Eco	22%	12%	94%	47%	52%	43%	75%

Economical Loss

Amount	45,0	300,0	16,0	30,0	125,0	3,5	12,0
in % of GDP	12,9%	5,40%	10,8%	18,60%	1,10%	186,00%	0,5%

in bUSD

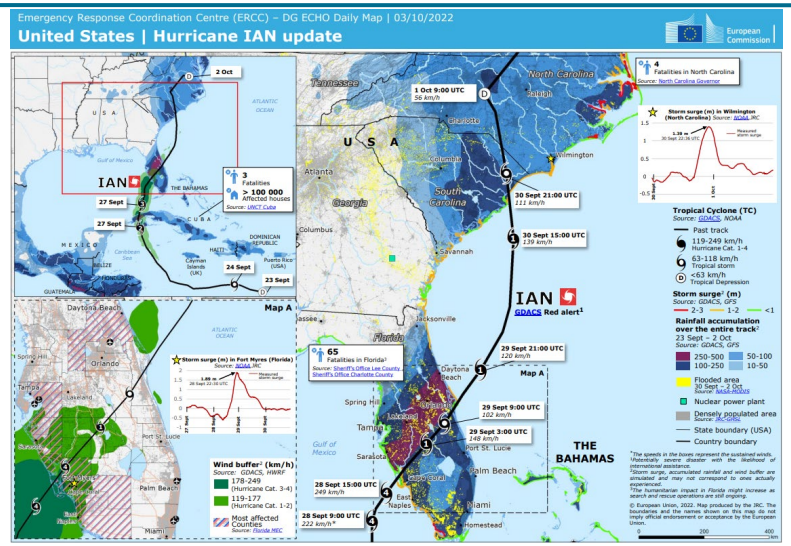
- Relationship between economical, insurance and reinsurance loss for selected events

- Cat exposure evolutions:

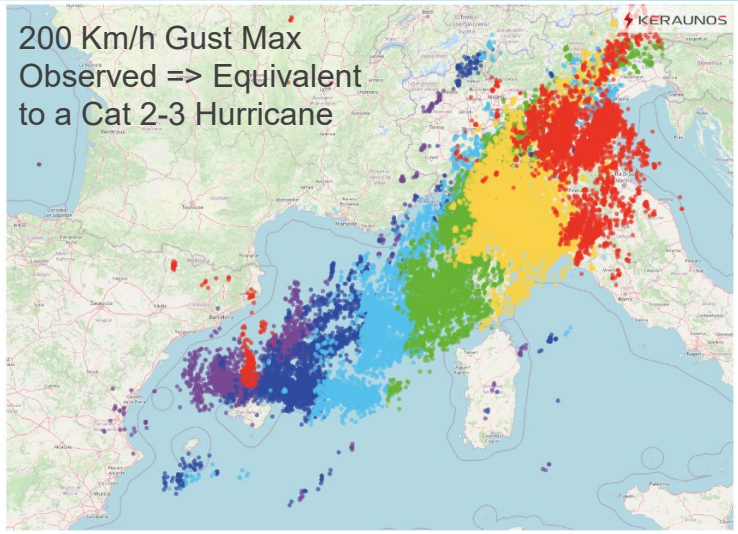
1. Macro economical variation
2. Underlying market share
3. Insurance conditions and coverage (perils)
4. Reinsurance cessions and conditions

Recent Nat Cat Events

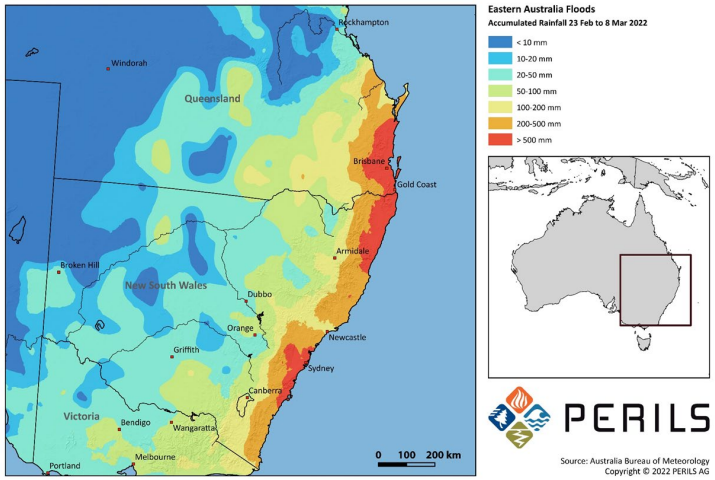
September 22 – Ian Hurricane - $50-70 bn



August 22 – Corsica “Derecho”

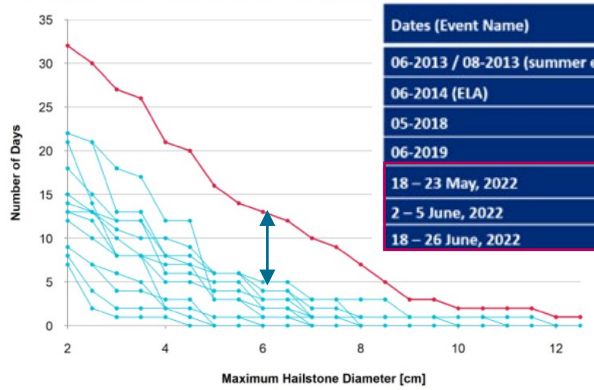


Feb 22 - Australian flood - €4 bn



May-July 22 – Hail In France – 3,5-4 bn€

Large hailstone frequency in France

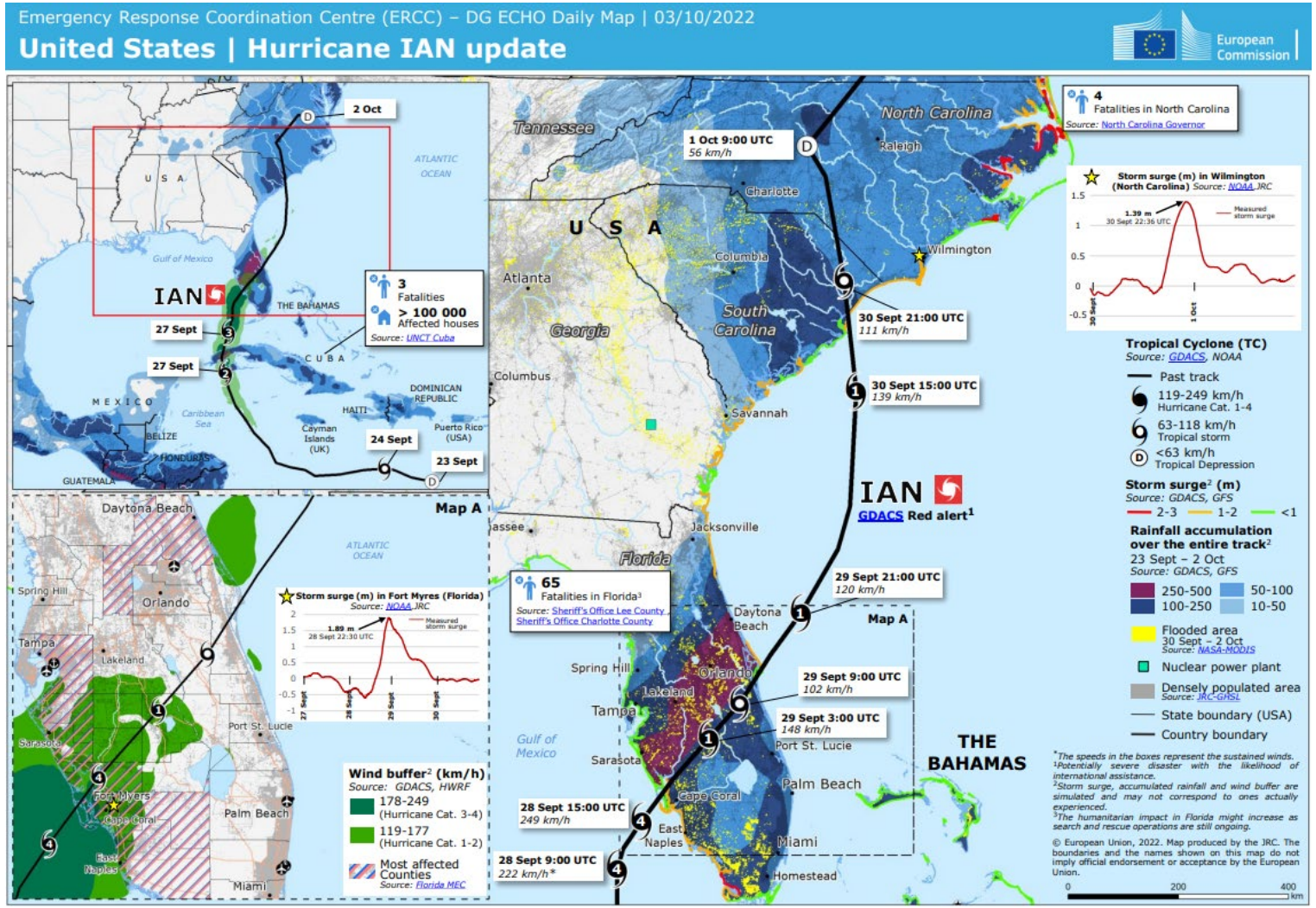


Number of days with maximum observed hailstone diameter above a threshold (in cm) for May to August 2022 (red line) and for the previous years since 2009 (blue lines). Source: data from ESWD

Source: Data from ESWD

Dates (Event Name)	Claim Amount in Millions EUR
06-2013 / 08-2013 (summer events)	850
06-2014 (ELA)	850
05-2018	430
06-2019	585
18 – 23 May, 2022	323 (as of 13 June)
2 – 5 June, 2022	940
18 – 26 June, 2022	2,400

Recent Nat Cat Events: September 22 – Ian Hurricane - $50-70 bn



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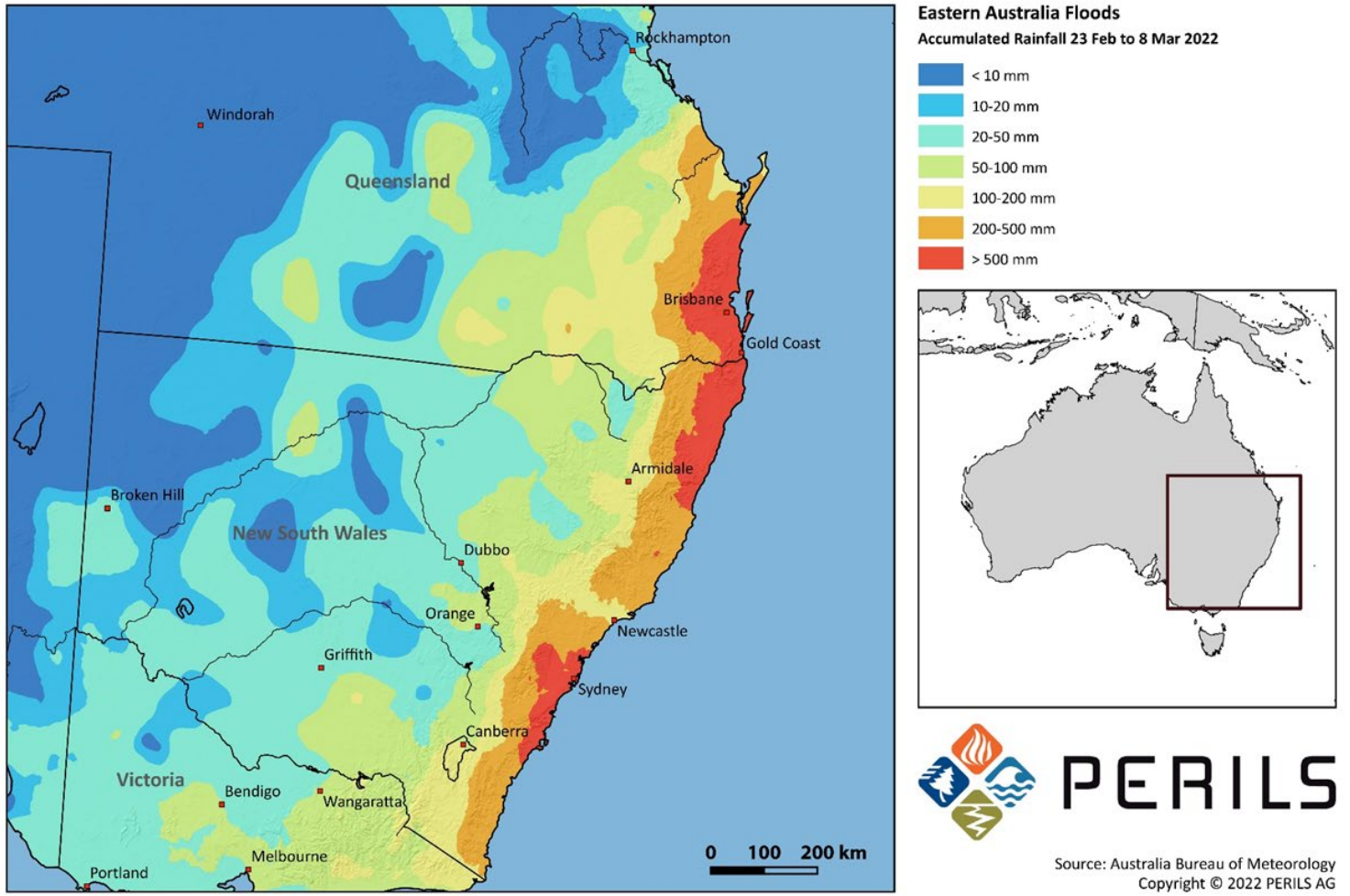


Eastern Australia Floods

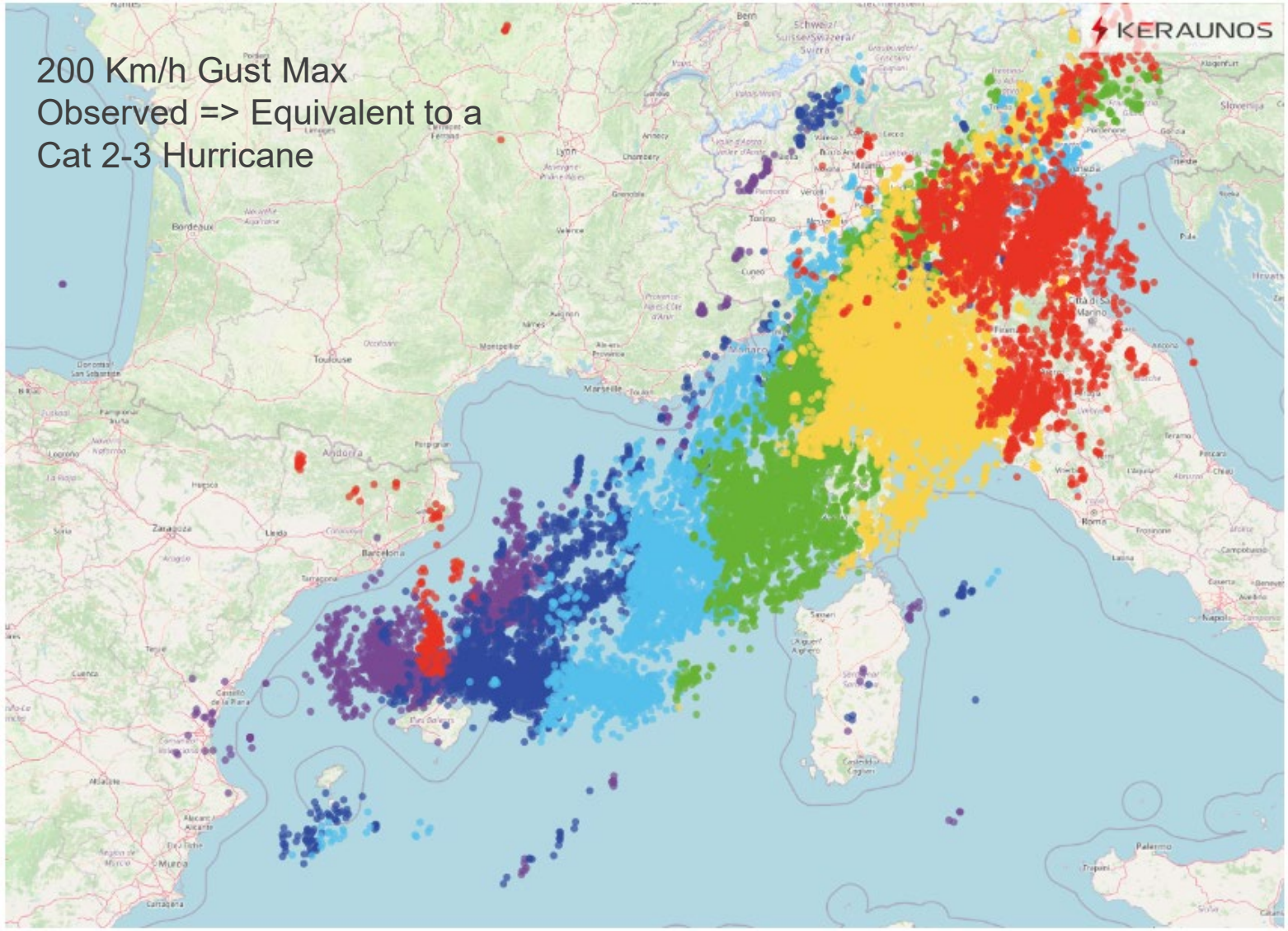
Accumulated Rainfall 23 Feb to 8 Mar 2022

- < 10 mm
- 10-20 mm
- 20-50 mm
- 50-100 mm
- 100-200 mm
- 200-500 mm
- > 500 mm

PERILS

Source: Australia Bureau of Meteorology

Recent Nat Cat Events: August 22 – Corsica “Derecho”



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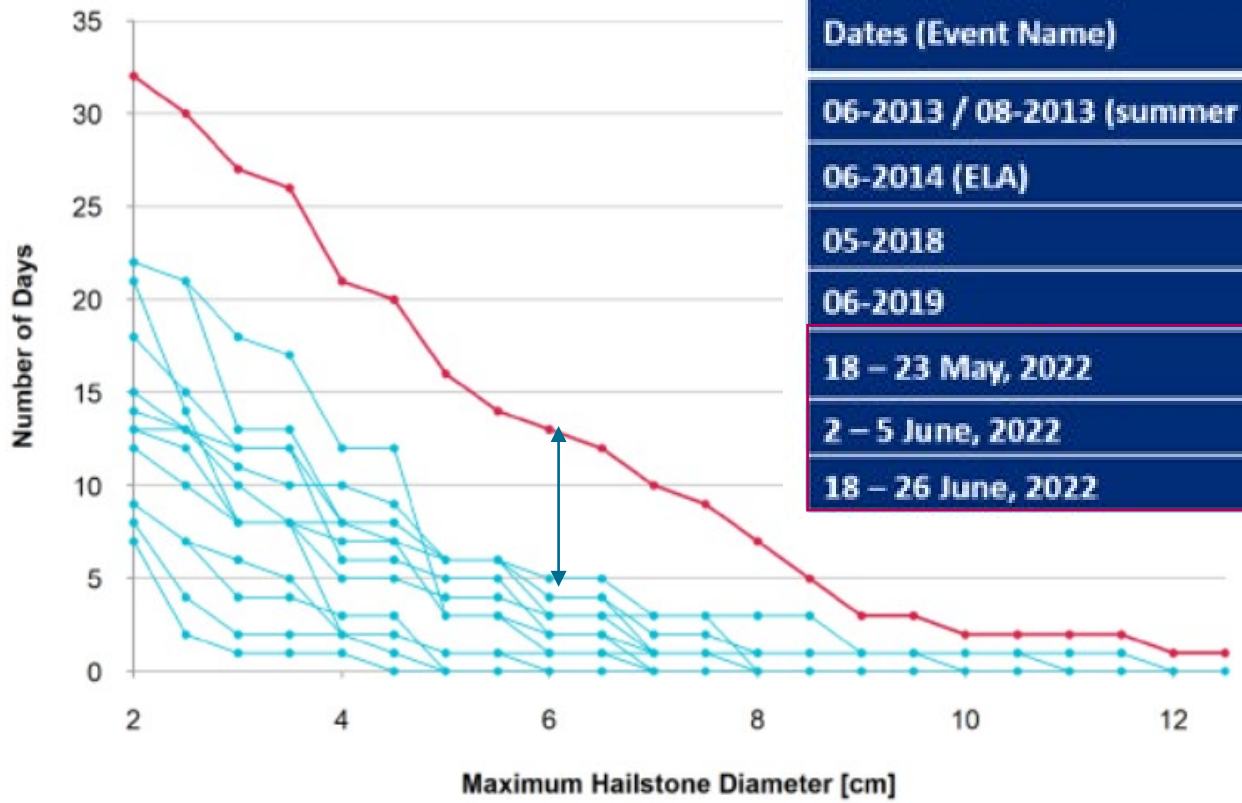

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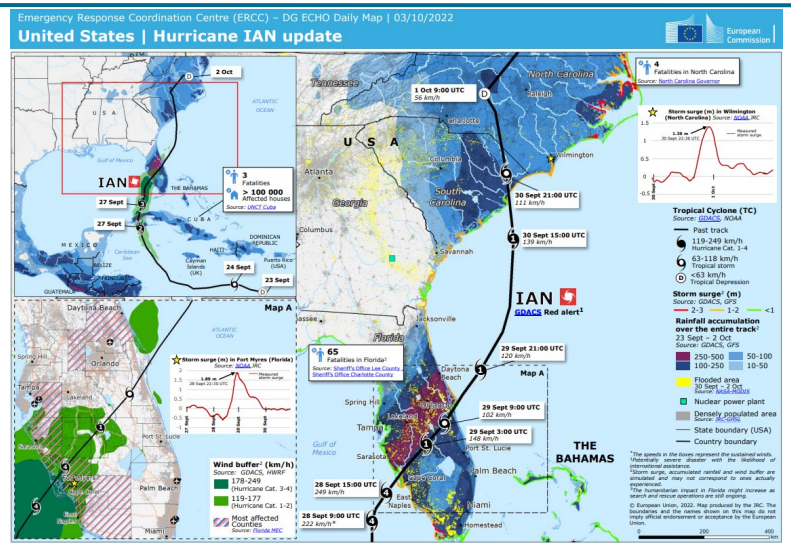

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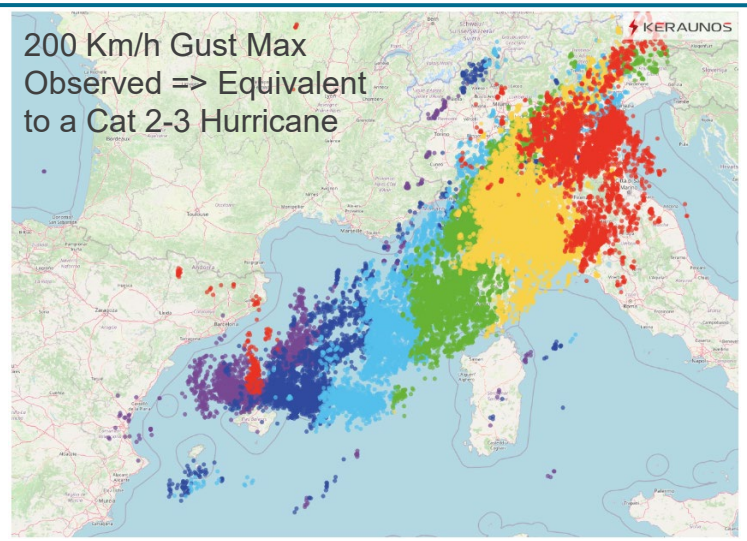

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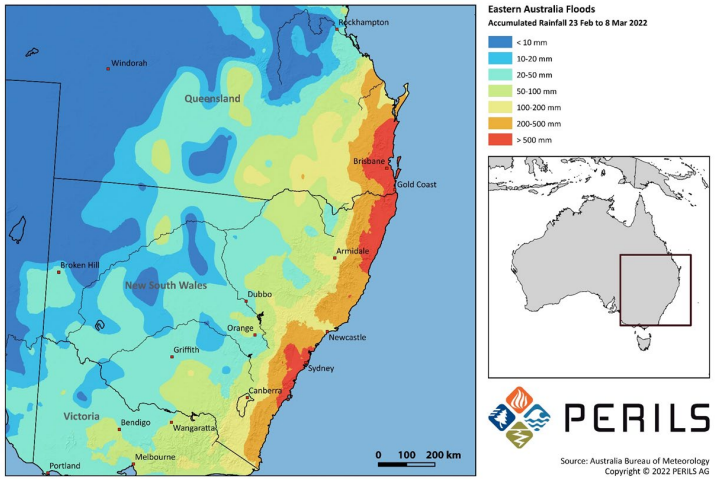

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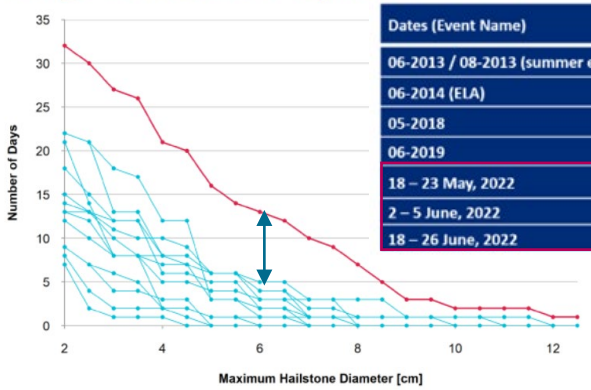

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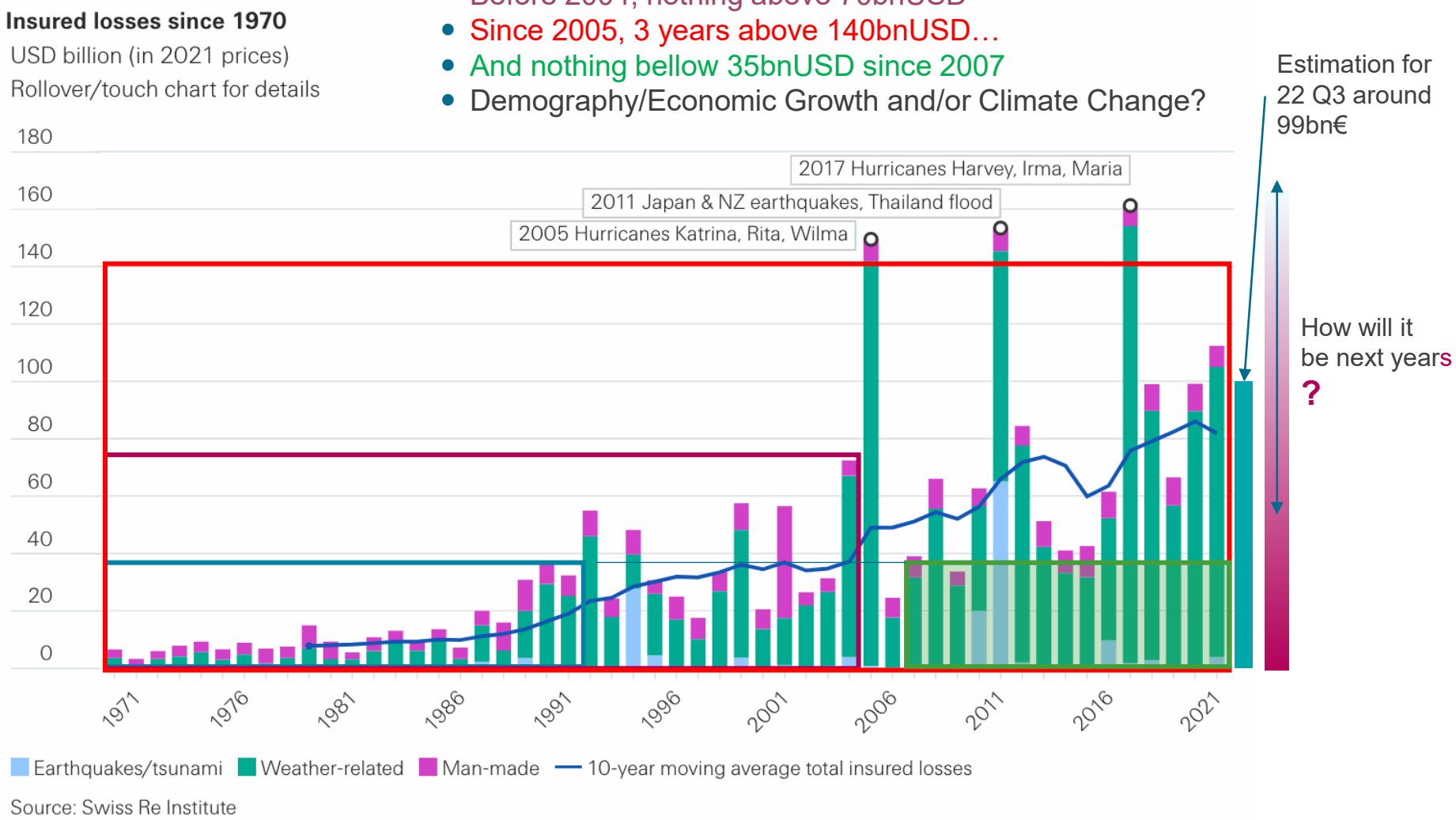
Past: Nat Cat market insured loss

- Before 1992 nothing above 35bnUSD
- Before 2004, nothing above 70bnUSD
- Since 2005, 3 years above 140bnUSD…
- And nothing bellow 35bnUSD since 2007
- Demography/Economic Growth and/or Climate Change?



Current :
Potential Nat Cat insured loss

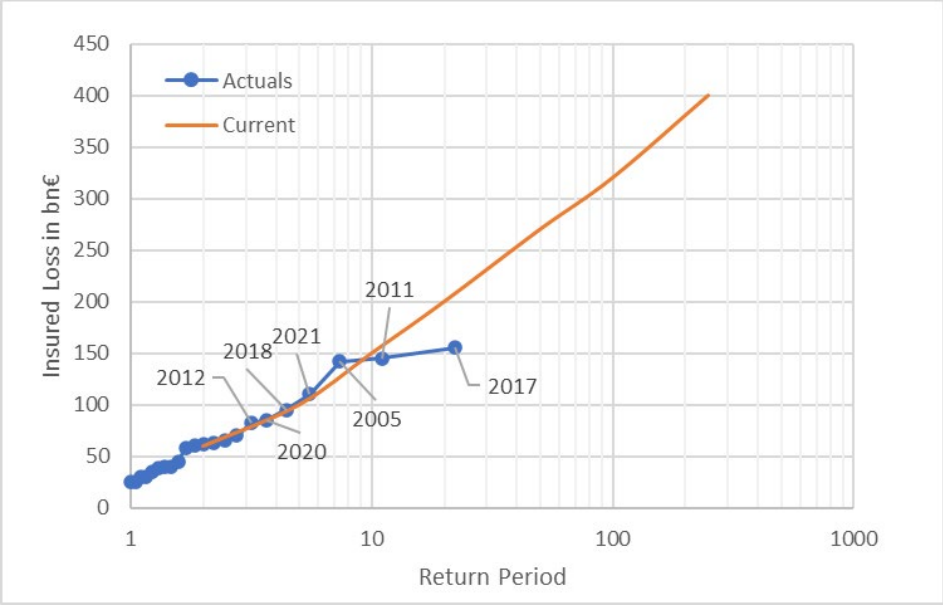
- Usage of Cat model enable to estimate/evaluate the potential risk at various return period that could occur « next year »

- Reinsurance company need to ensure adequate:
  - Profitability : Premium vs Average potential losses
  - Capital adequacy : Enough Financial strength to cope with extreme events

This is why reinsurer need to have a deep understanding of nat cat perils

Table 2. AAL and EP metrics, by region, based on AIR's global suite of models, including those introduced or updated in 2020. (Source: AIR)

Region	AAL (USD Billion)		Aggregate EP Loss (USD Billion)			
			1.0% (100-year return period)		0.4% (250-year return period)	
	Insured	Insurable	Insured	Insurable	Insured	Insurable
Asia	15.1	71.4	70.9	578.4	95.4	868.4
Europe	16.6	25.6	69.9	127.9	89.5	170.4
Latin America (the Caribbean, Central America, South America)	5.6	12.8	47.3	109.6	67.6	144.0
North America (Canada, the United States, Bermuda, Mexico)	66.0	100.5	262.8	376.0	343.1	504.3
Oceania	3.0	3.4	19.9	21.8	30.3	31.8
All exposed areas*	106.3	216.4	320.5	767.0	397.0	1055.6



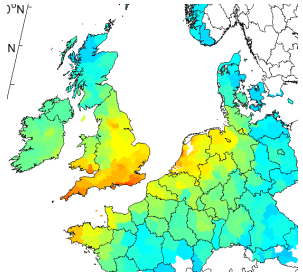
Catastrophe Models to quantify risks

Basic Structure

HAZARD MODULE

Stochastic Event Set

Local Intensity Calculation



Define:
- Peak gust
- Rate of arrival
- Clustering

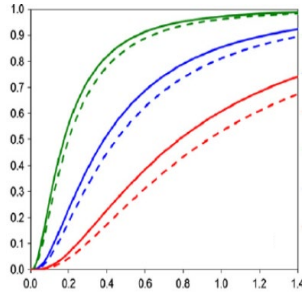
Generate:
- Probable Events

Assess:
- Local wind intensity
- Site conditions

VULNERABILITY MODULE

Exposure

Vulnerability Curves

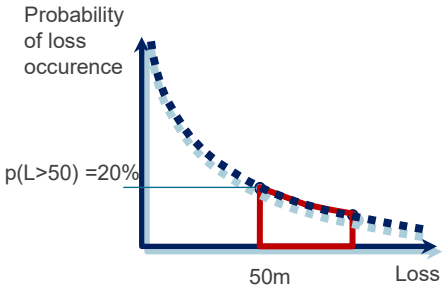


Input:
- Exposure data

Calculate:
- Exposure at risk
- Mean damage ratio (MDR) and coefficient of variation (CV)
- Damage (ground-up)

FINANCIAL MODULE

Insured Loss

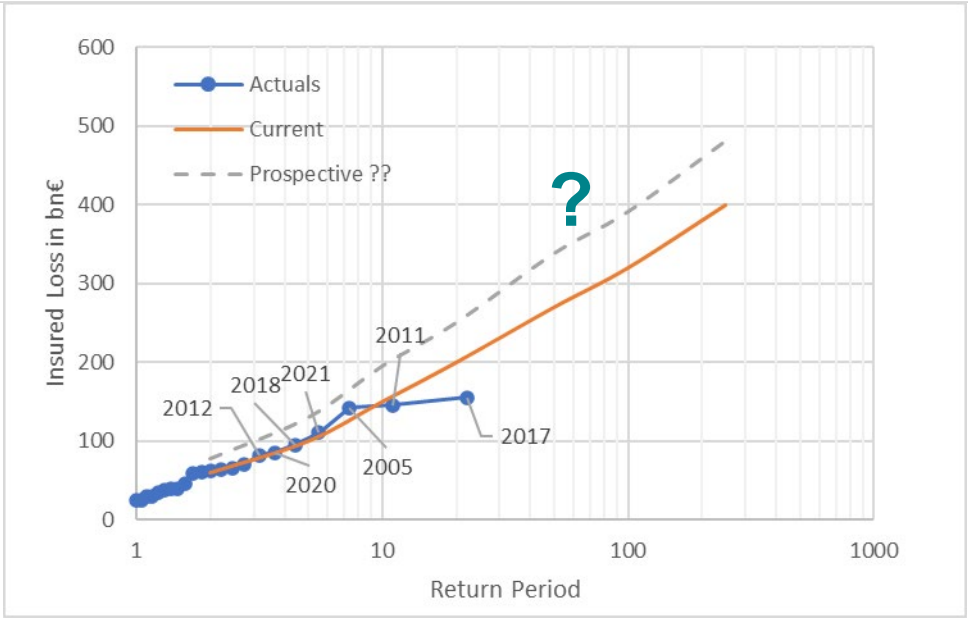


Input:
- Policy conditions

Quantify:
- Monetary loss
- Insured loss

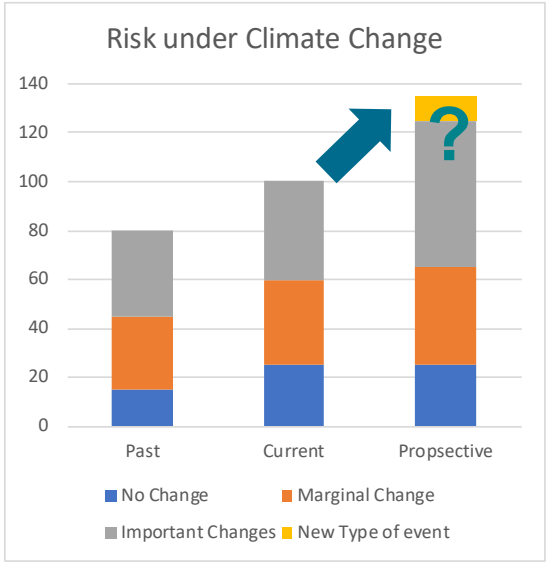
Prospective : Quantify nat cat risk under climate change

- **Current Modelling** enable to have our current view of the Nat Cat risk with our understanding/knowledge of the hazard, vulnerability and exposure
- This view can be **backtested with past events** to ensure adequacy/reliability of the model
- **Prospective modelling** aim to quantify/estimate how such risk could evolve in futur considering **climate change**
- Currenlty a consensus that hazard will change under climate change, but difficulty to quantify to which extent extreme will evolve:
  - Geographies
  - Severity
  - Frequencies



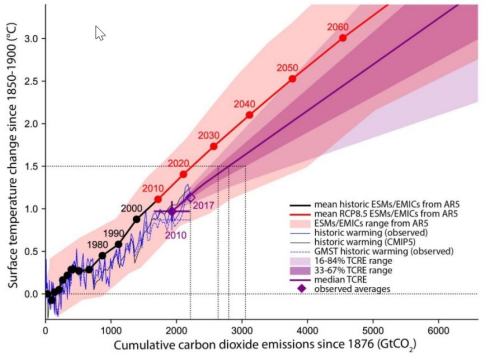
Change Typolgy	Past	Current	Propsective
No Change	15	25	25
Marginal Change	30	35	40
Important Changes	35	40	60
New Type of event			10
Total	80	100	135

Change Typolgy	Description/example
No Change	Earthquake/Geophysical Risk
Marginal Change	European Storm
Important Changes	Flood, Heat Wave, Convective Storm
New Type of event	Hazard occurring in new geographies (Tropical cyclone moving poleward, Excess rainfall)

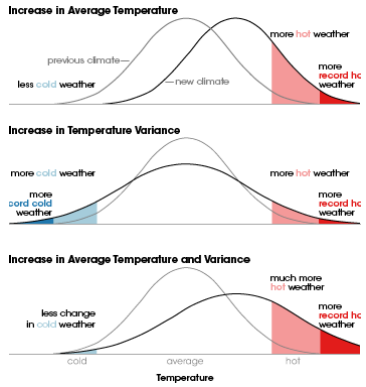


From climate change to loss distribution impact and adaptation

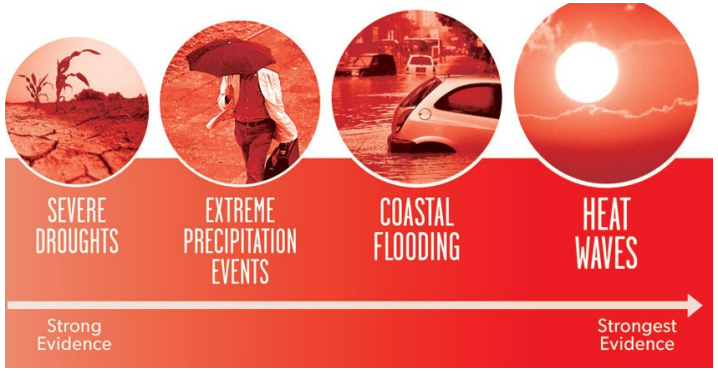
Various CO_2 scenarii



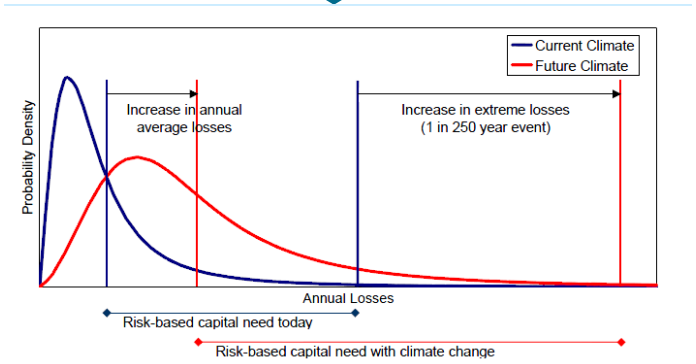
Weather distribution impact



Nature perils Impact



Impact on Loss distribution



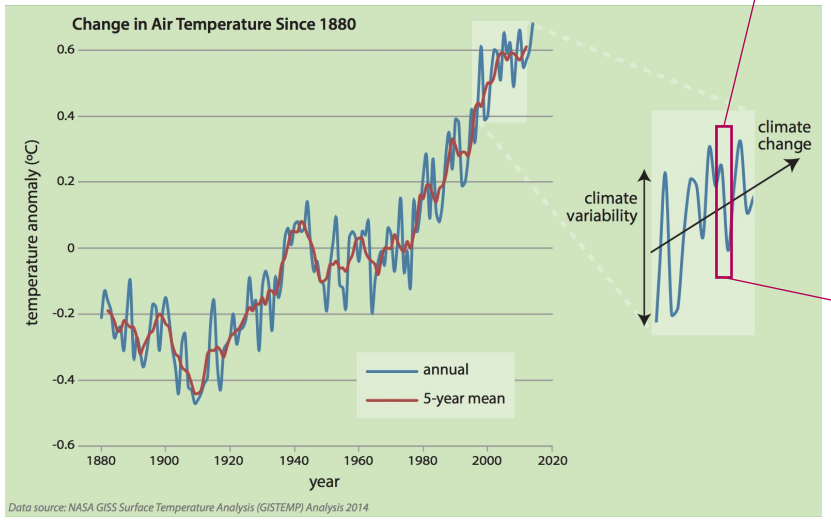
Adaptation to reduce the risk

Resilience measure

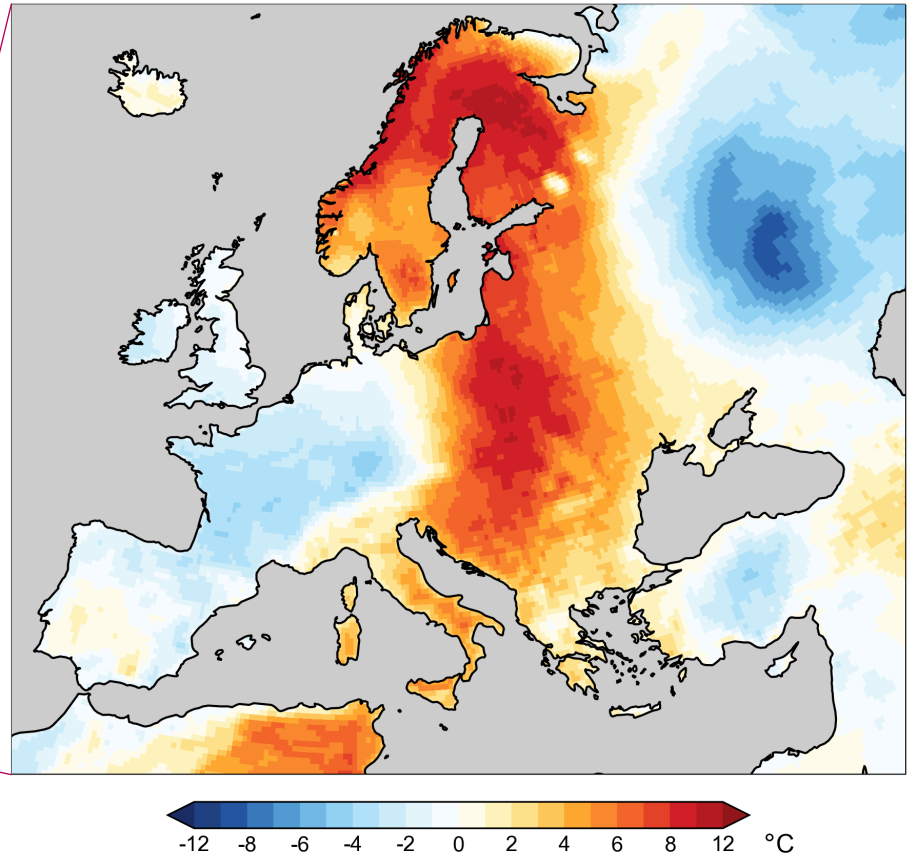
Change in land planning use

Climat Change, Climate Variability and Catastrophies

- Climate Change: Long term change due to Human Induced Activity
- Climate Variability: Consequence of the Climate Change at higher frequencies
- How does it translate in term of Natural Catastrophe Weather Perils:
  - Perils occuring in new geographies
  - Change in Severity/Area impacted
  - Changed in Frequency, Frequency Pattern
  - Compound events



Surface temperature anomaly for 01 July 2022

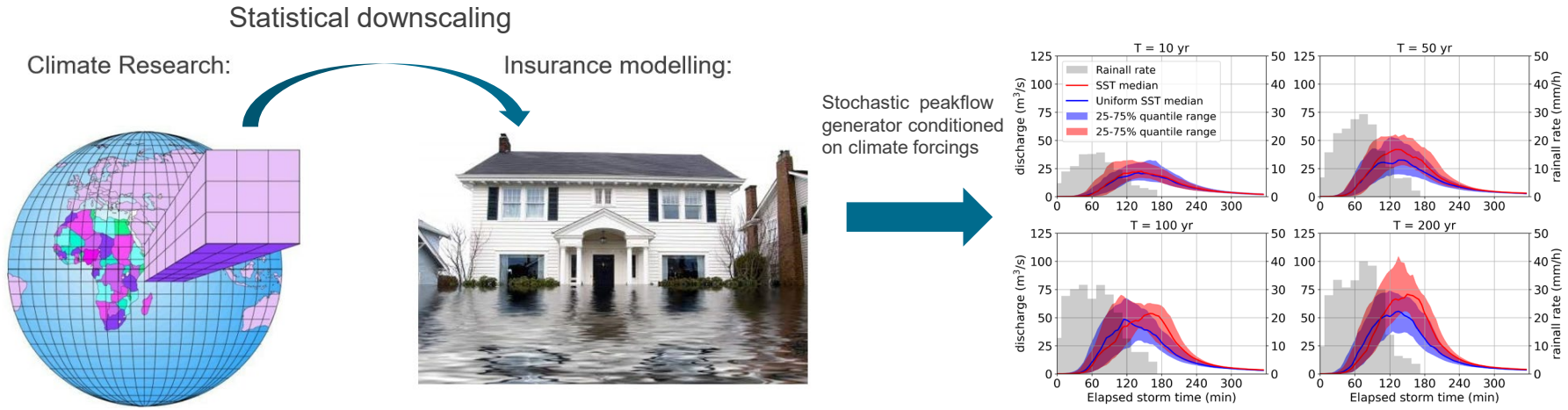


Reference period: 1991-2020 • Data: ERA5 • Credit: C3S/ECMWF

PROGRAMME OF THE EUROPEAN UNION
opernicus
IMPLEMENTED BY ECMWF
Climate Change Service

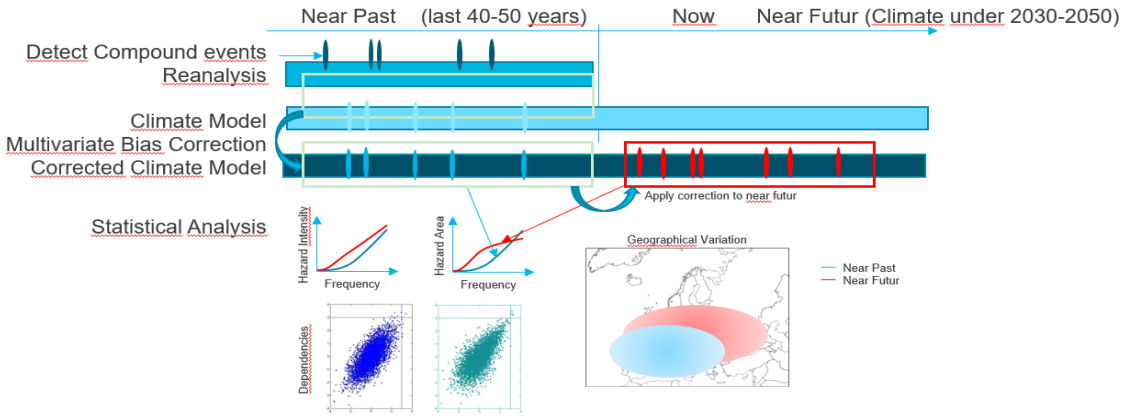
Partnership with Mines Paris Tech in the chair in Geolearning

Extreme-value modeling and projection of flood risk across river networks under climate change



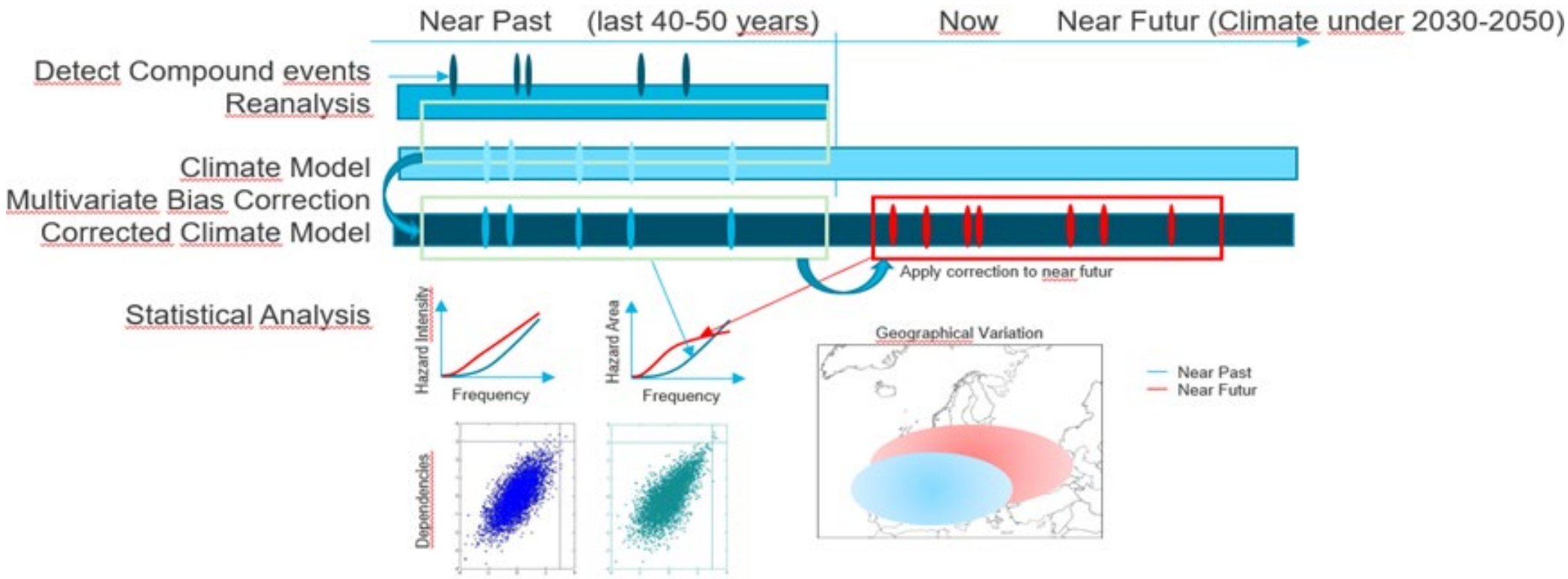
Improved quantification of devastating climate events through novel multivariate bias correction methods

- Sequence of several weather perils may cause significant losses when occuring simultaneously or during a short period of time
- Such weather events, referred to as compound events, can be seen as pattern of climate variables
- build a statistical relationship between extreme CEs and large-scale structures that are necessary conditions to trigger those CEs and project into the future.



Improved quantification of devastating climate events through novel multivariate bias correction methods

- Climate Model have bias: Remove Multivariate Bias Correction
- Detect Compound events in the near past and in the corrected climate model
  - Analyse changes in term of frequency (Clustering), Severity/Intensity and Geographical pattern and Composition of the compound event



The Art of Science and Risk

- Research needed for SCOR
- Topic of climate change is fundamental to us
- We invest resource and funding to deepen our understanding
- If you were to embark, you would be very marketable with competitive academic and scientific skills set
- Important high profile subject for the future

Thank you for your attention

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Henry Bovy - Accumulation Team Property Lead

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