# Reinsurance of Natural Hazards

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Munich Re

Münchener Rück
Munich Re Group

# Geo Risks Research Department
# Organizational Chart

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Munich Re Group

**CUGC 3 - Geo**
**Peter Höppe**

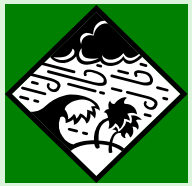
**CUGC 3.1**
**Earthquake and Flooding**

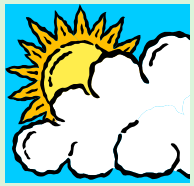
**Head: Anselm Smolka**

NatCat*SERVICE*
CatPML*SERVICE*
*MRHazard*

**CUGC 3.2**
**Storm/Weather/Climate**

**Head: Ernst Rauch**





CatPML*SERVICE*
*MRHazard*

**CUGC 3.3**
**Geoinformatics and Communication**

**Head: Andreas Siebert**

**NATHAN**
**Geocoding**
**Seminars**

**Environment management**

**Head: Claudia Wippich**


**EMS**

# Geo Risks Research Department - Main Tasks

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## *Estimation of loss potentials*

- return period
- accumulation PML‘s
- budgets

## *Hazard and risk assessment*

- rating, tariff zones, tariff scheme
- World Map

## *Loss investigations (after major events)*

- loss/vulnerability functions
- publications

## *Service-Tools*

- NatCat*SERVICE*, MRHazard/CatPML*Service*, NATHAN

## *Services (internal & external clients)*

- evaluations, presentations, publications

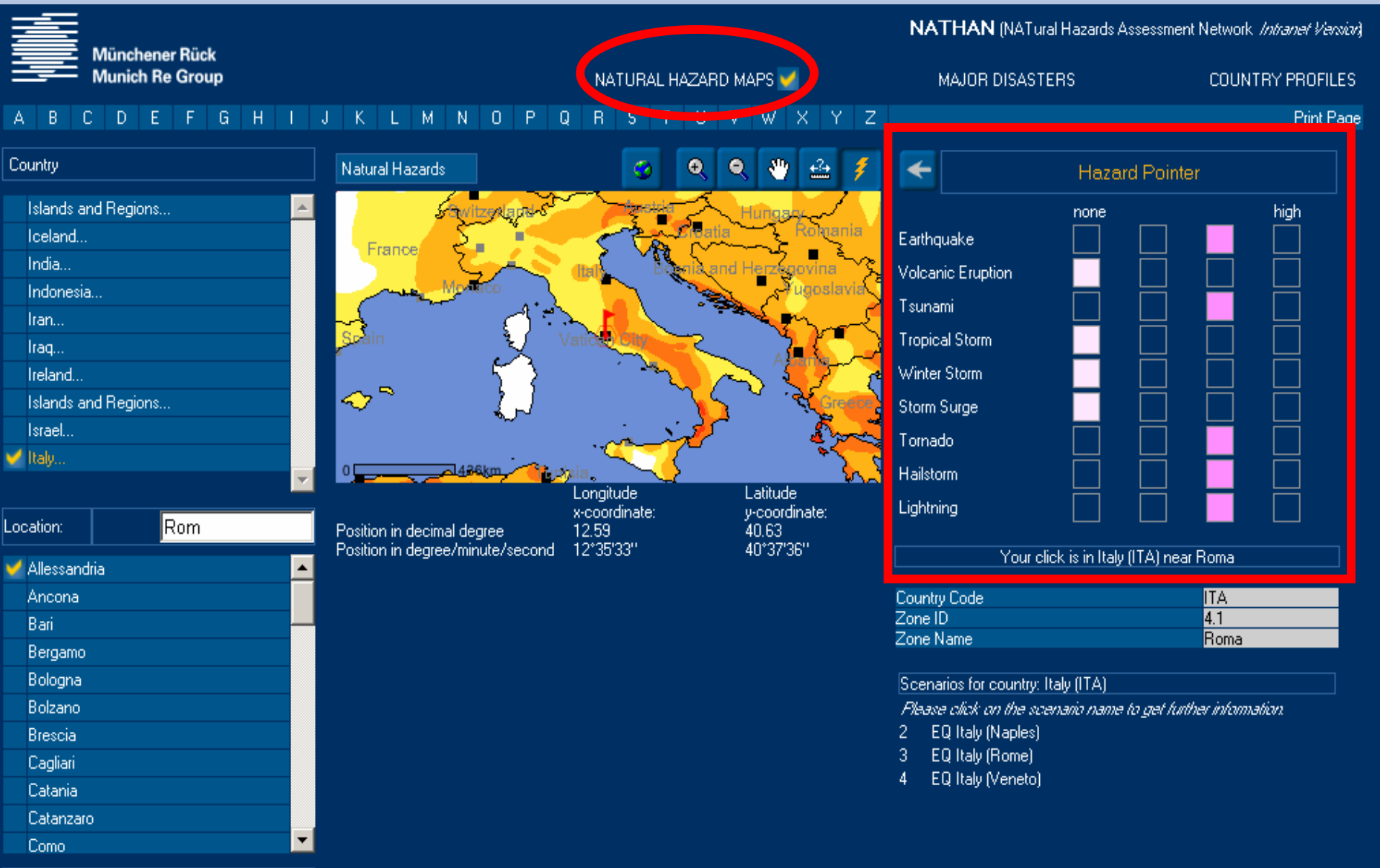
## Development of service-tools

NatCat*SERVICE*

# Largest Database for Natural Disasters

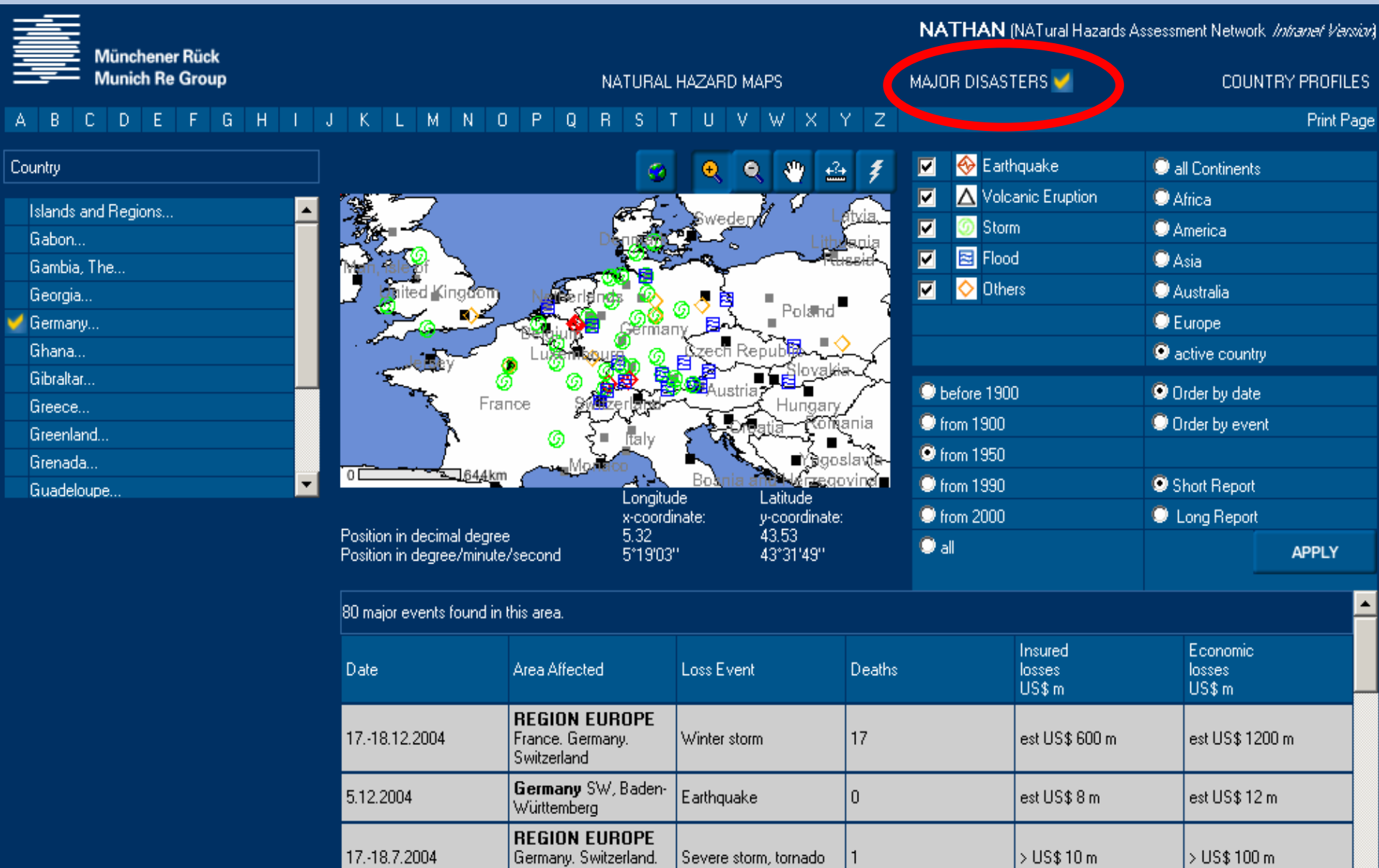
# Development of service-tools

## NATHAN (NATural Hazards Assesment Network)



# Development of service-tools

## NATHAN (NATural Hazards Assesment Network)



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# Importance of Natural Hazards for Munich Re

MRNatCat*SERVICE*®

# World map of natural disasters 2005

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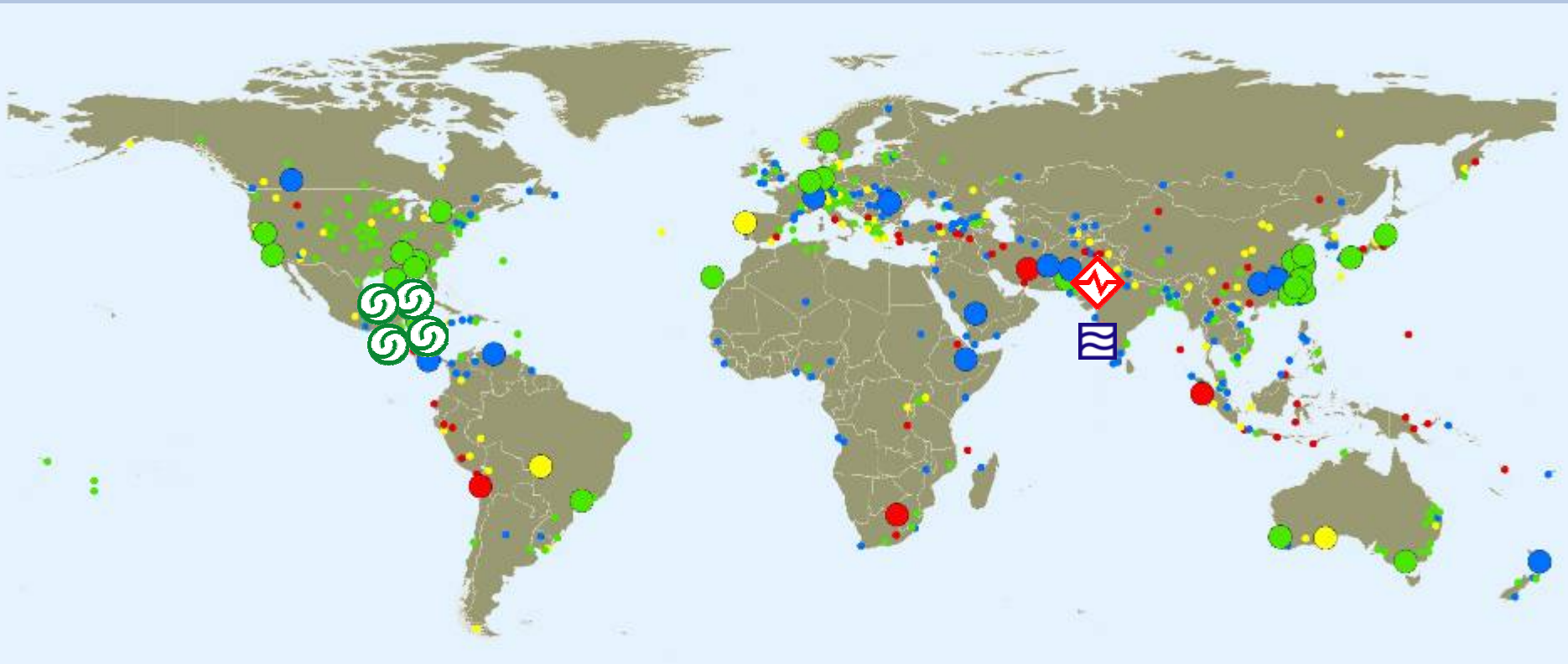

## 2005: 660 natural disasters

- ○ Major natural catastrophe
- ◯ Great natural catastrophe

- Earthquake, tsunami, volcanic eruption
- Windstorm
- Flood
- Temperature extremes (i.e. heat wave, forest fire), Mass movements (i.e. avalanche, landslide)

# Great Natural Disasters 1950 – 2005

## Economic and insured losses

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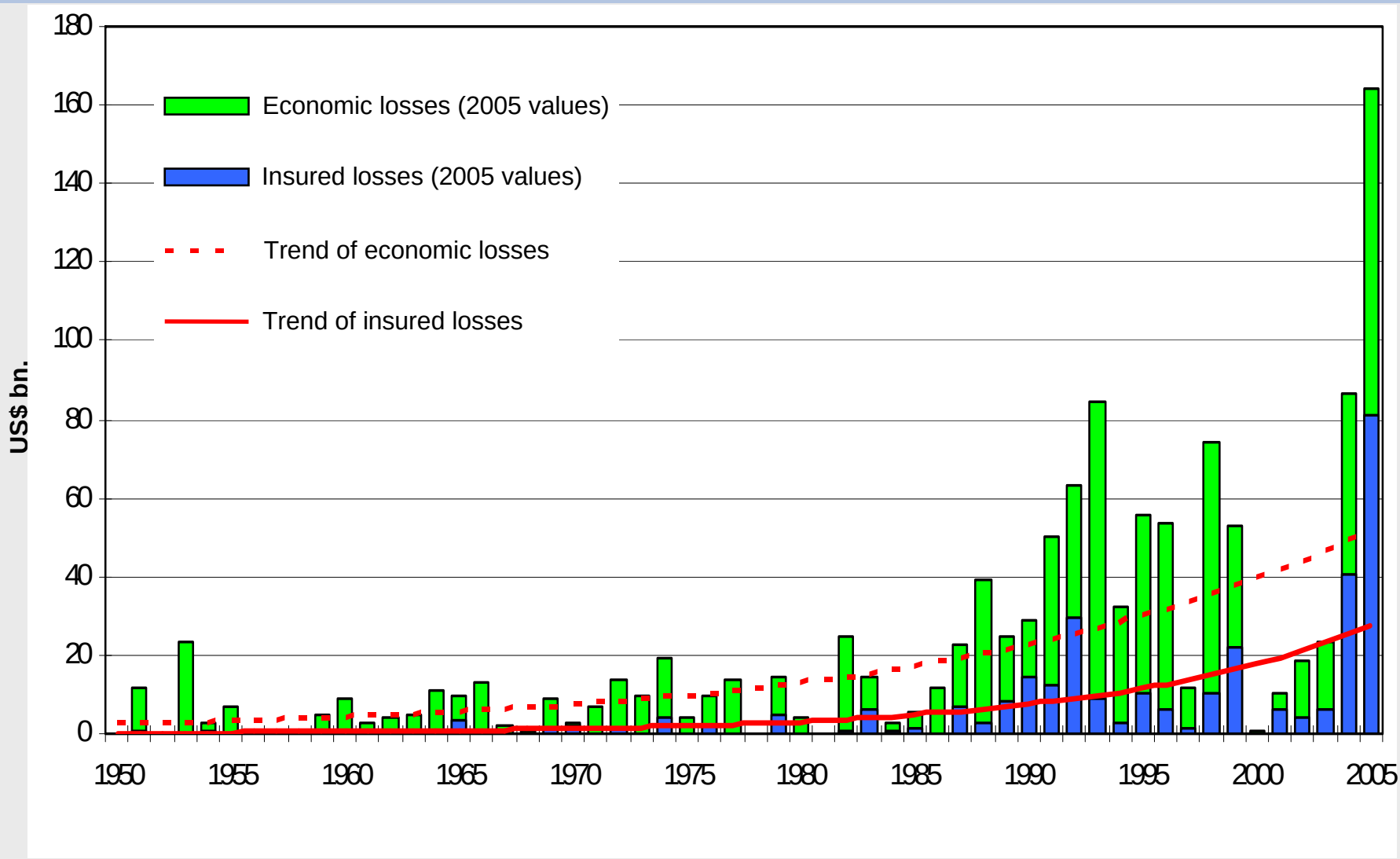

History of losses, trends

# 10 Major Natural Disasters 2005

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| Date | Country/region | Event | Fatalities | Economic Loss | Insured Loss |
|---|---|---|---|---|---|
| | | | | US$ m | US$ m |
| August | USA | Hurricane Katrina | 1 300 | 125 000 | 60 000 |
| October | USA, Mexico. Caribbean | Hurricane Wilma | 42 | 16 000 | 11 000 |
| September | USA | Hurricane Rita | 10 | 15 000 | 10 000 |
| January | Western, Northern, Eastern Europe | Winterstorm Erwin | 18 | 5 800 | 2 500 |
| August | Europe, Alps | Flood | 11 | 3 000 | 1 700 |
| July | USA. Caribbean | Hurricane Dennis | | 3 100 | 1 200 |
| July-August | India | Flood | 1 150 | 5 000 | 700 |
| March | USA | Flood | | 1 000 | 655 |
| August | Canada | Thunderstorm, Tornado | | 550 | 350 |
| May | USA | Thunderstorm | | 500 | 300 |

# Outstanding hurricane seasons 2004 and 2005:



## Average season

**10 named tropical cyclones per season in average**
**6 of them having hurricane force**

## 2004: Extreme season

**15 named TCs**
**9 of them having hurricane force**

## 2005: Record season

**27 named TCs** (last record year: 1933 – 21 named TCs)
**15 of them having hurricane force** (last record year 1969 – 12 hurricanes)

# Major Natural Disasters 1950 - 2005
# Percentage distribution worldwide

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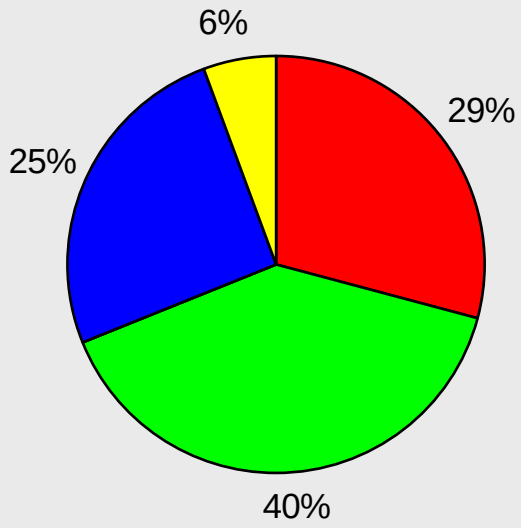
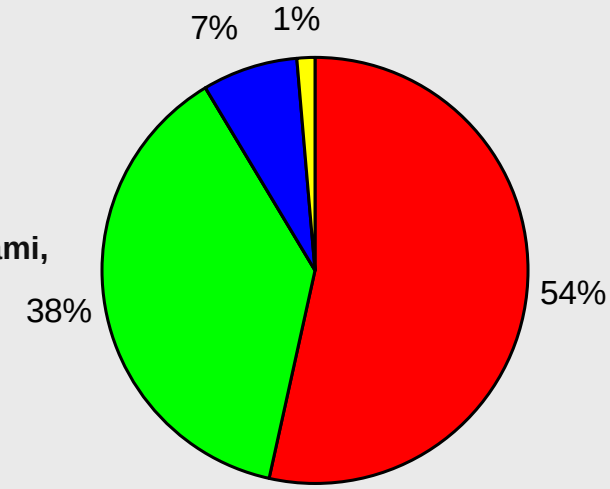
## Number of events: 268

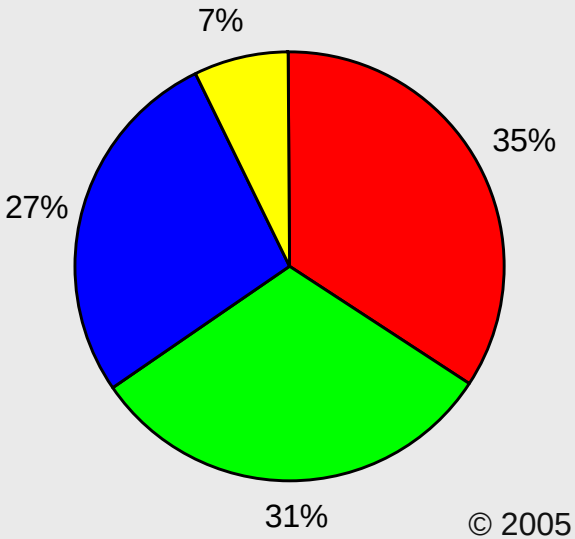



## Deaths: 1.7 Mill.

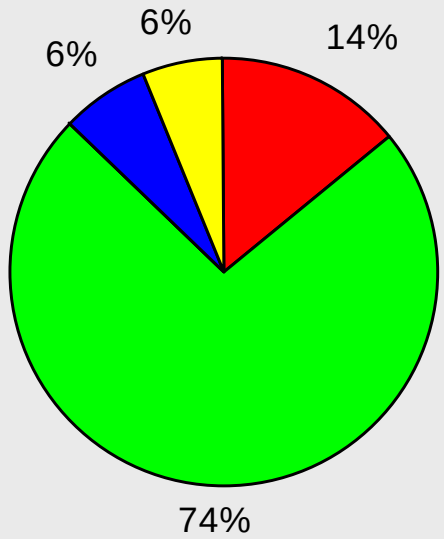



Earthquake/tsunami, volcanic eruption
Windstorm
Flood
Others

## Economic Losses: 1,400 bn US$




## Insured Losses: 230 bn US$



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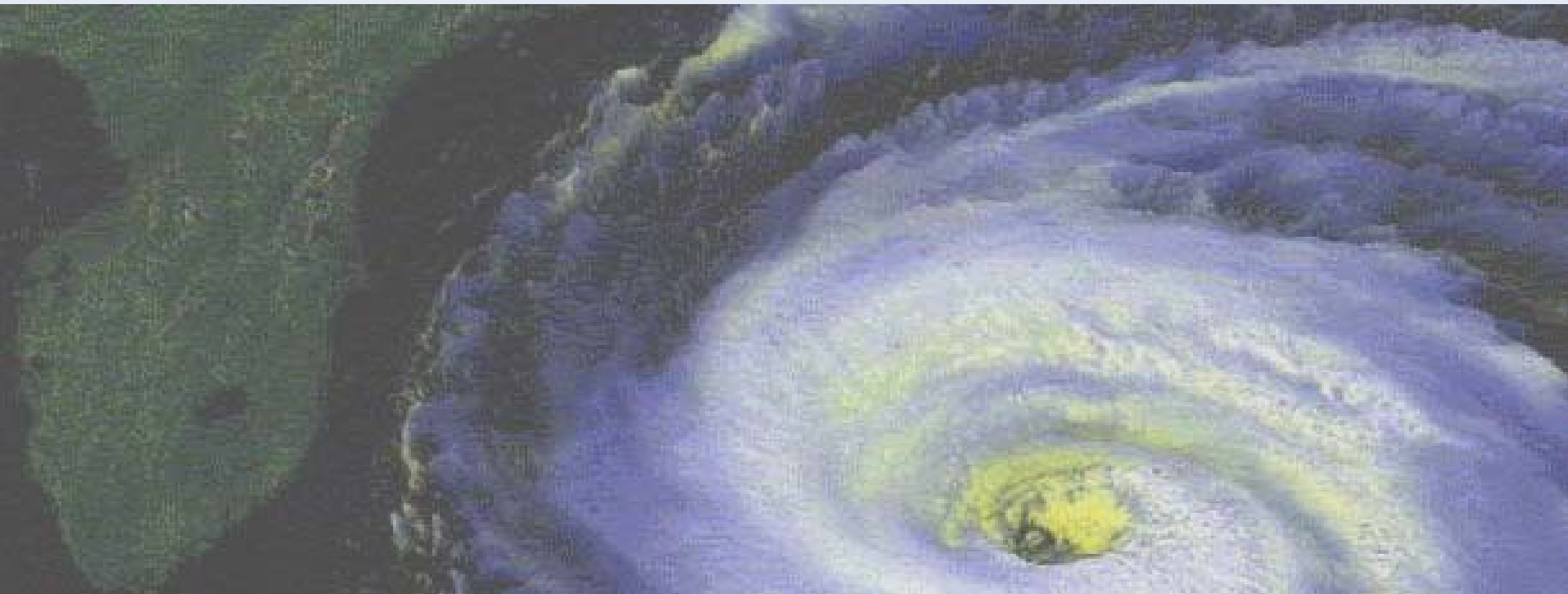
# Tropical Cyclone



# Tropical Cyclone (Hurricane, Typhoon, Cyclone)

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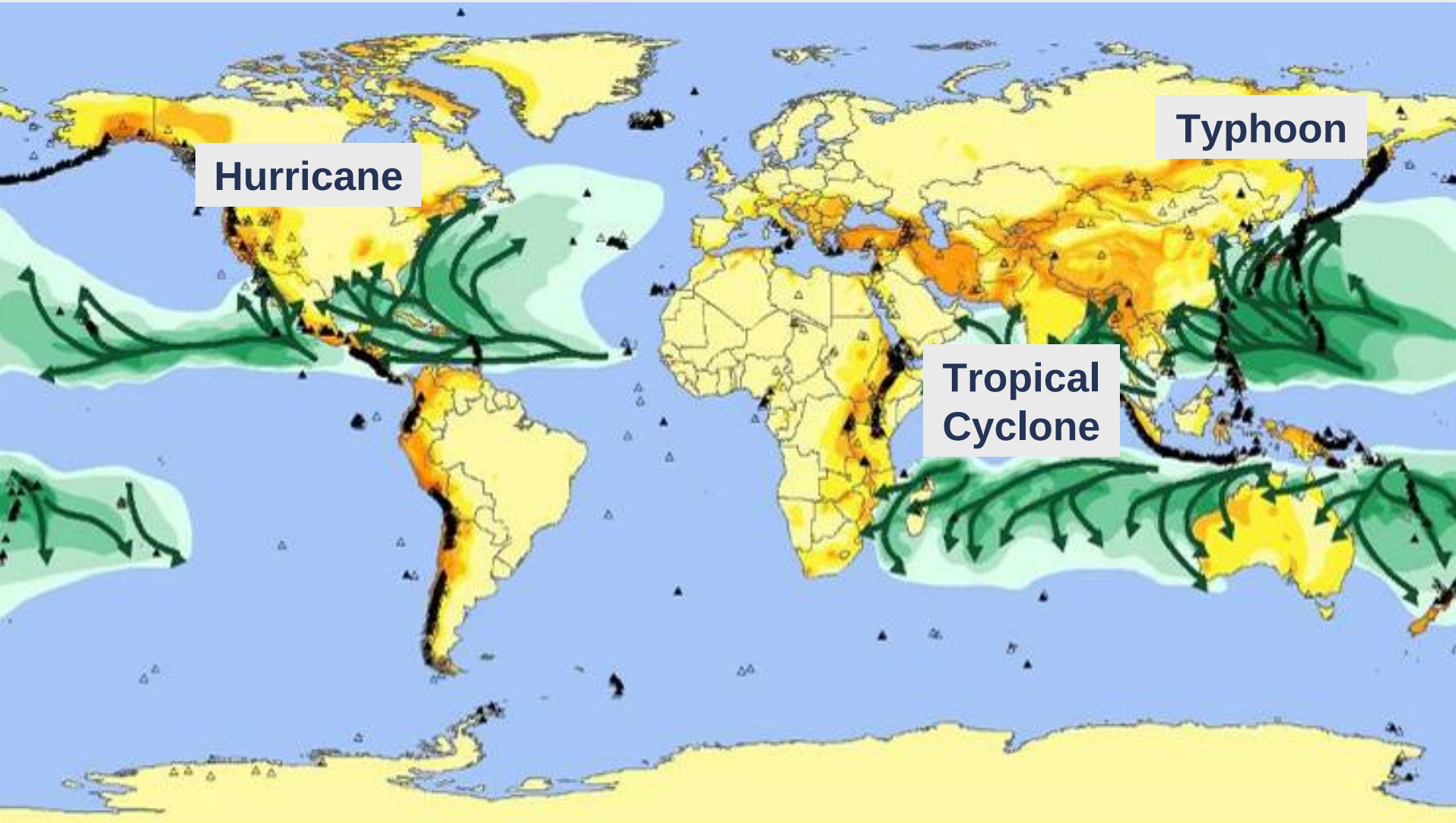

# Tropical Cyclone (Hurricane, Typhoon, Cyclone)

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| | | |
|---|---|---|
| – Length of track | : | 5 000 - 15 000 km |
| – Life span | : | 5 - 15 days |
| – Speed of movement | : | 10 - 50 km/h |
| – Maximum wind speed | : | 300 - 380 km/h |
| – Source regions | : | Tropical seas (surface water temperature > 27°C; between 5° and 35° latitude) |
| – Season | : | summer and autumn |

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## Risk Assessment

# How can we assess the expected loss?

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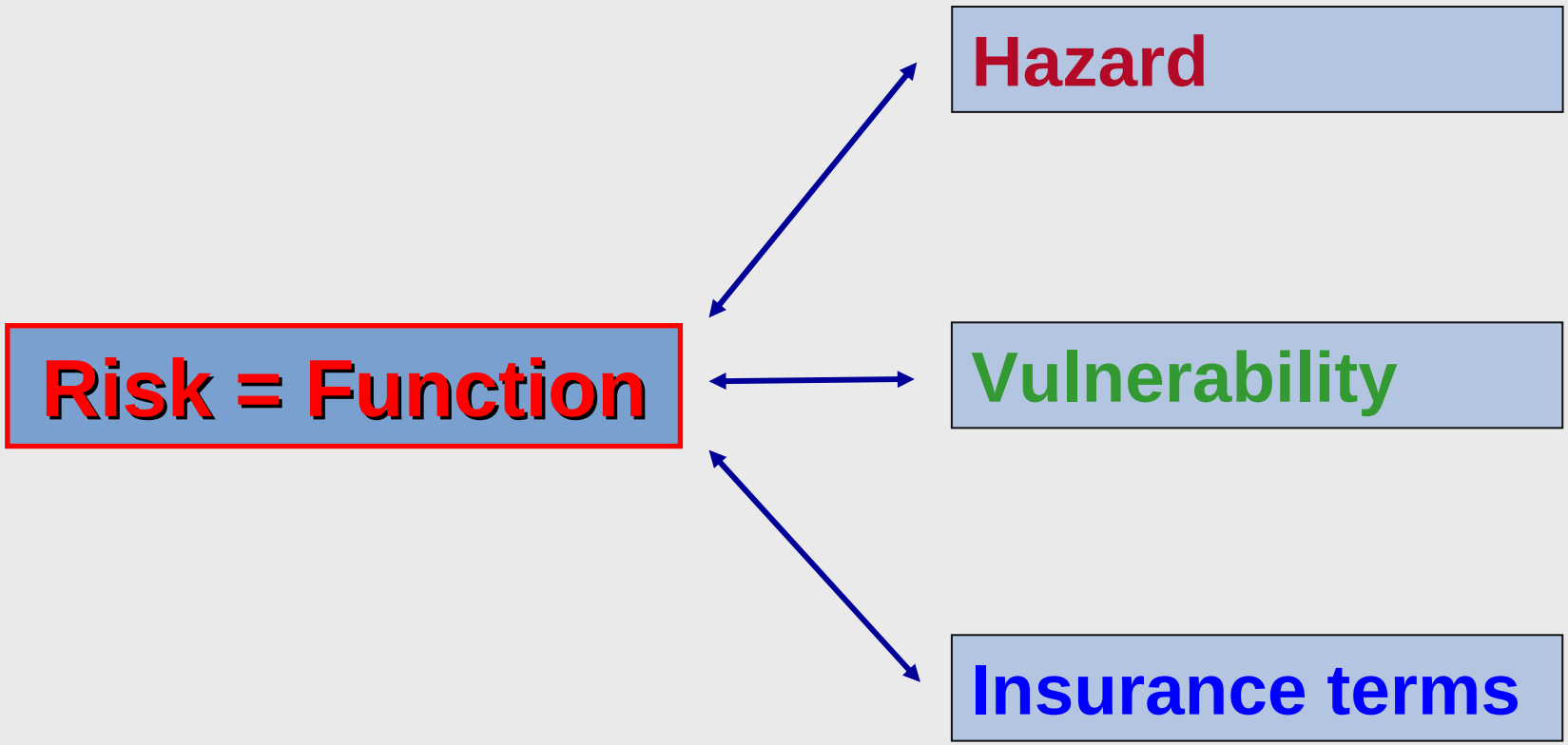

# How can we assess the hazard?

## Example: Tropical Cyclone

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- **Records of Tropical Cyclones (Hurricanes, Typhoons) are just available for a very limited time period**
- **Inconsistencies: early, historical records are incomplete**

**Solution:**

**Development of a stochastic model to expand the existing historical records of tropical cyclone tracks.**

# Gefährdung
# Modellierung eines stochastischen Eventsets

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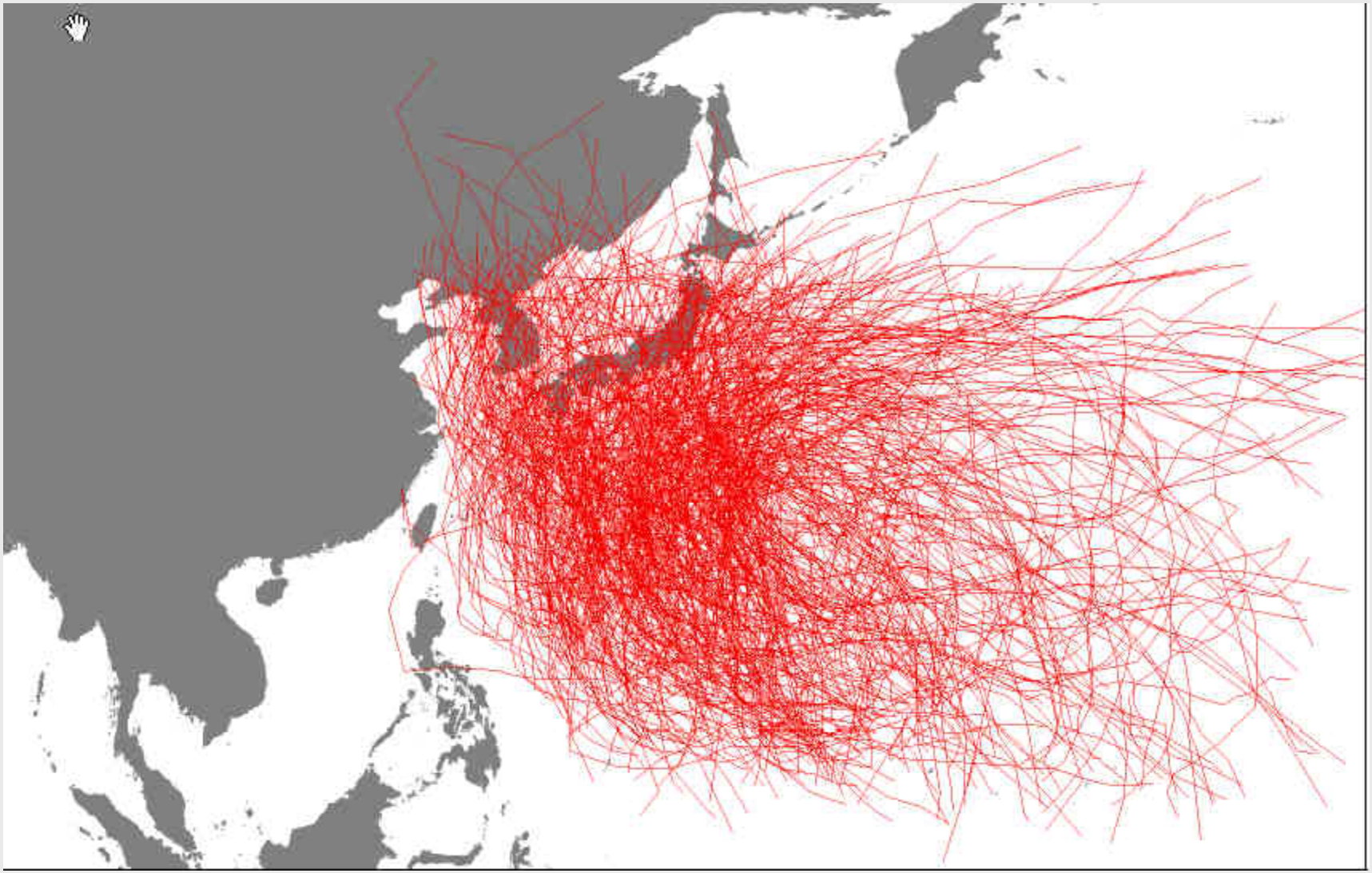

Quelle: Jonas Rumpf, Universität Ulm, Abteilung Stochastik

# Hazard



- **In modelling losses from storm events, the hazard is presented by wind fields**

- **Wind fields show the maximum wind gust for every point in the area during the passage of the storm**

# Tropical Cyclone (Hurricane, Typhoon, Cyclone)

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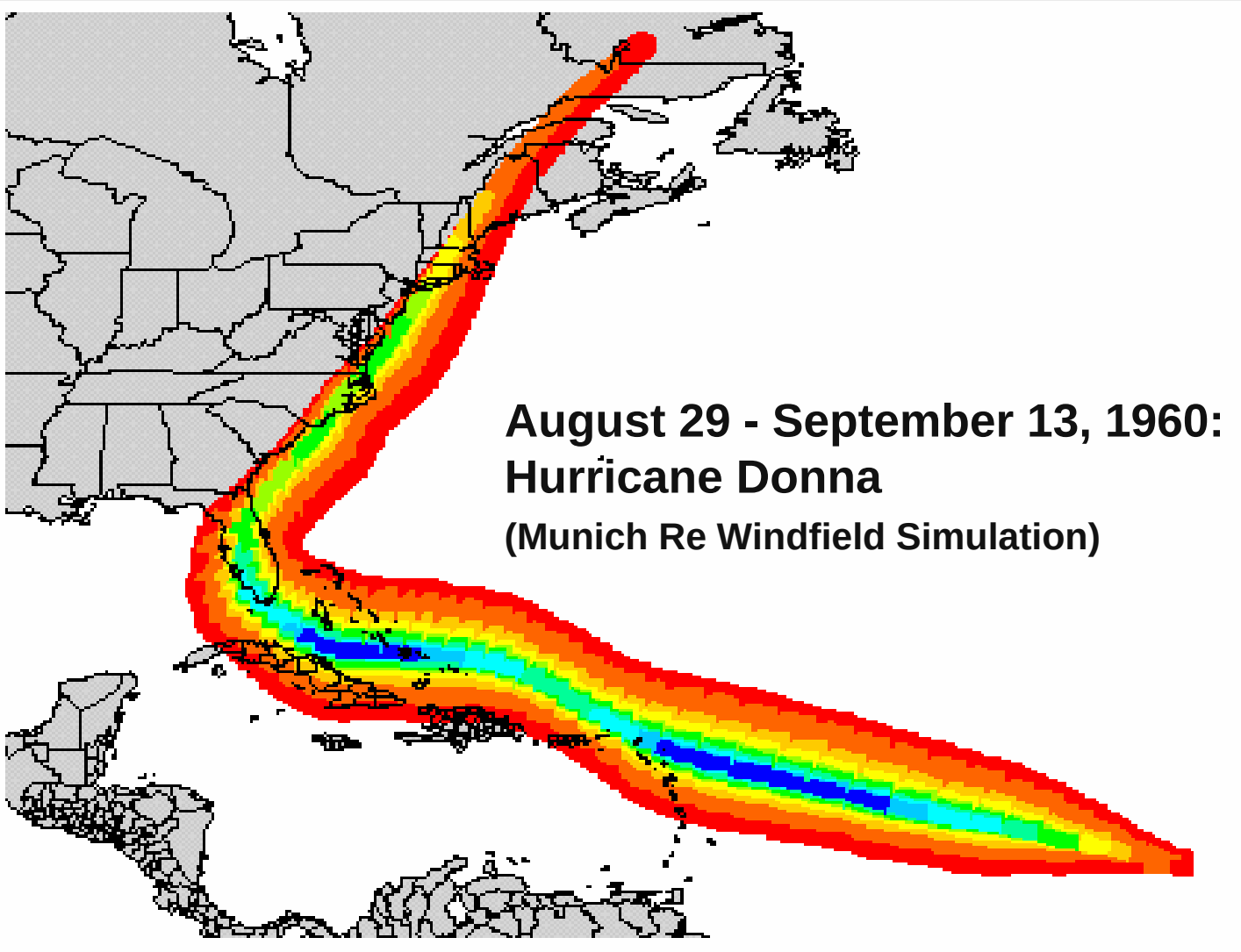

# Hazard

## Wind field

## Track Tropical Cyclone

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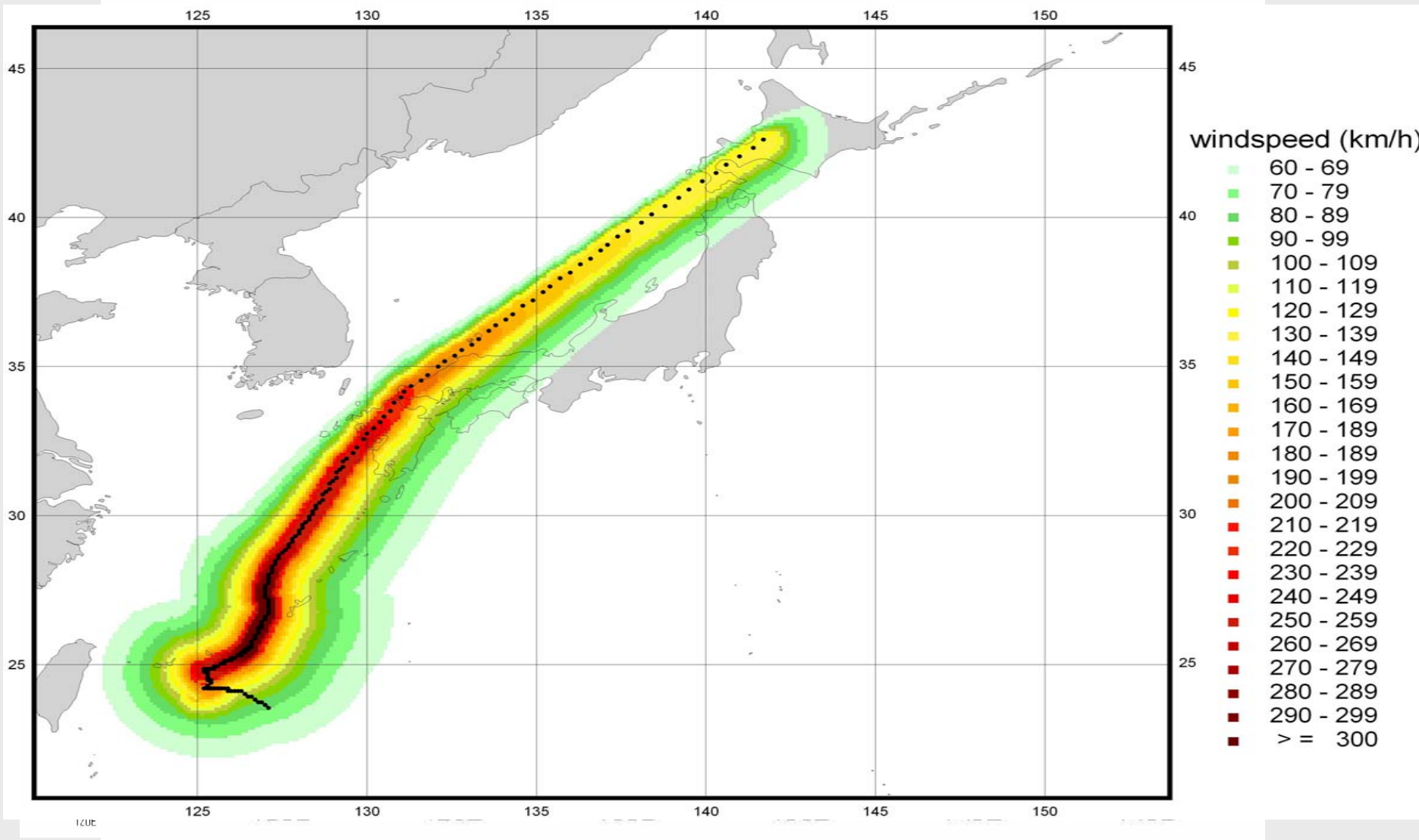


# Vulnerability



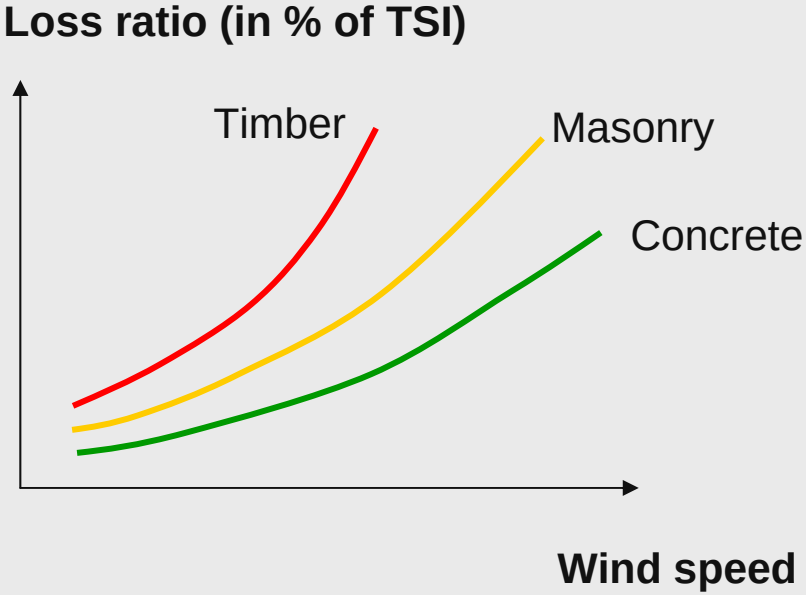
**Loss ratio (LR) = Losses per liability zone /sum insured**

**Loss ratios are generated mainly empirically by analysis of historic losses. Partly (especially earthquakes) also by an approach of engineering technics.**

**Analysis is executed mainly after events causing great losses (e.g. Lothar 1999) with detailed information about the loss.**

# Vulnerability



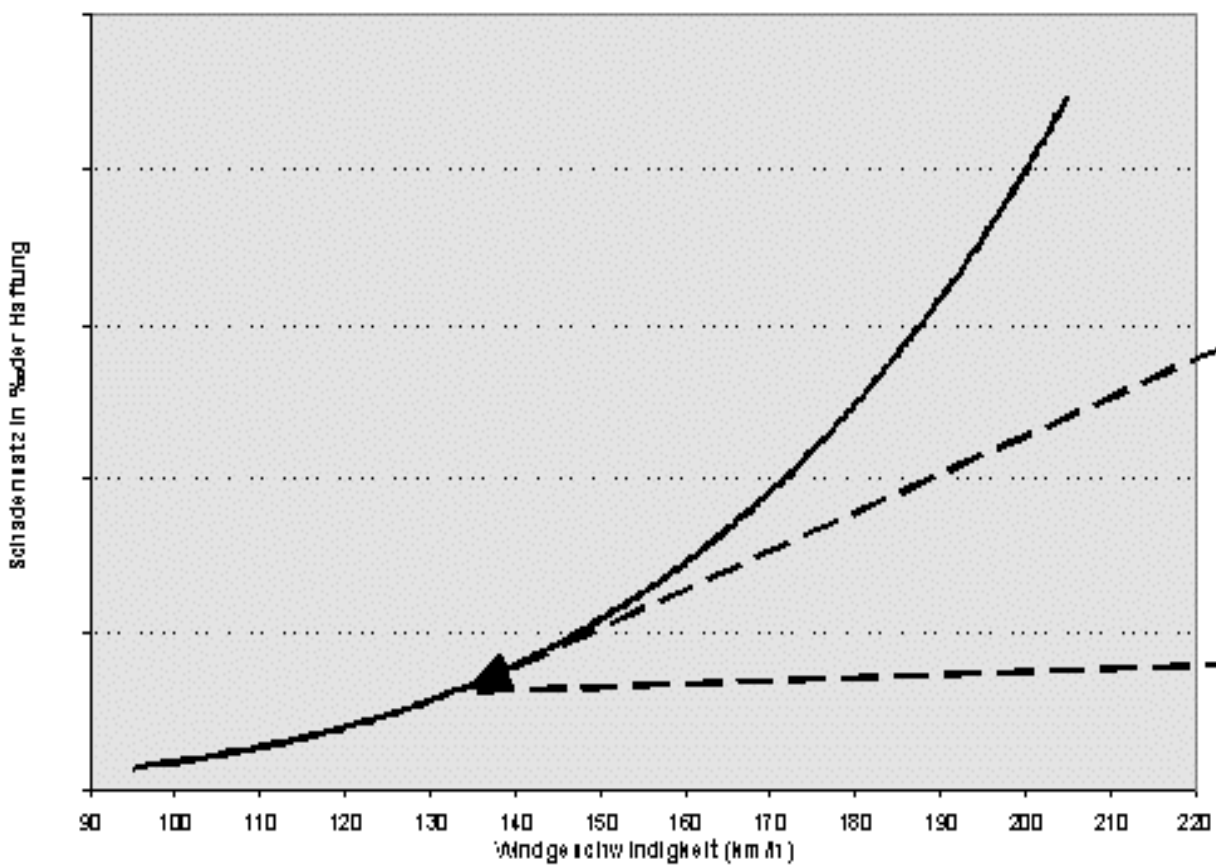



Germany

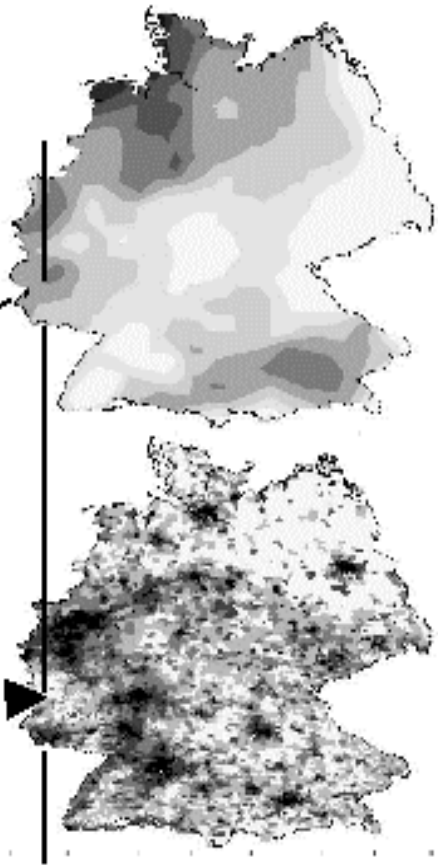

USA

# Vulnerability





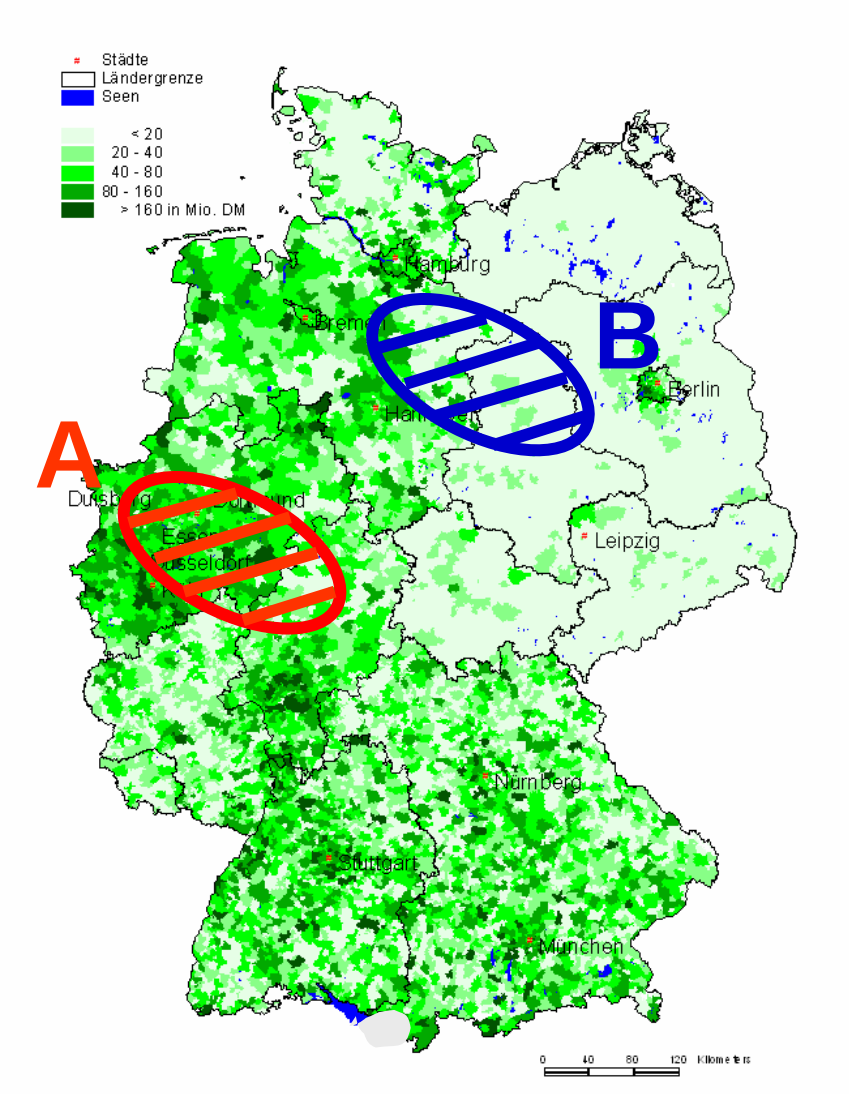

**Wind field**



Zones with information about liability and loss

# Insurance terms

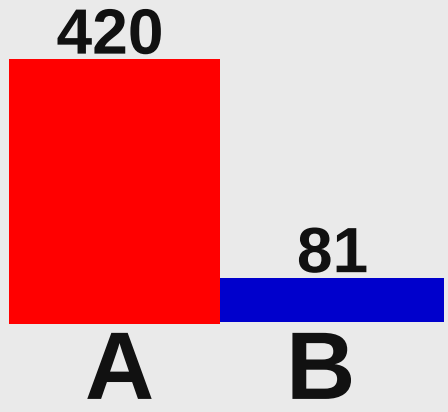





**Sum insured per liability zone (here zip code)**

- **< 1 Mio. €**
- **1.0 – 2.0 Mio. €**
- **2.1 – 3.0 Mio. €**
- **3.1 – 4.0 Mio. €**
- **> 4 Mio. €**

**Liabilities (affected) (Sum insured in m. €)**



# Estimation of loss potentials

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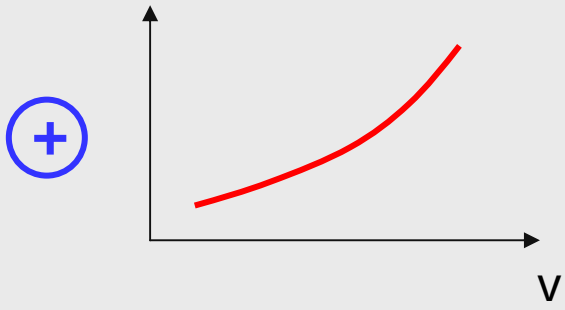
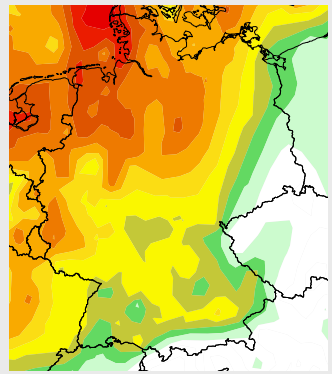
**Distribution of liabilities**

**Vulnerability**

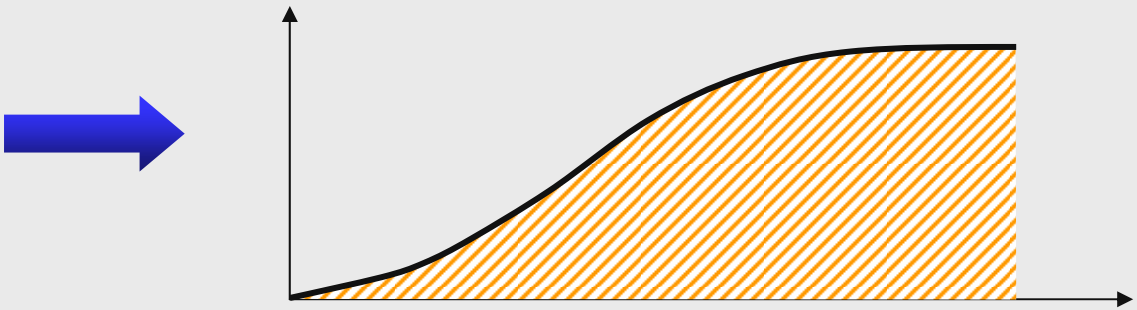



**Hazard information**

Storm szenarios



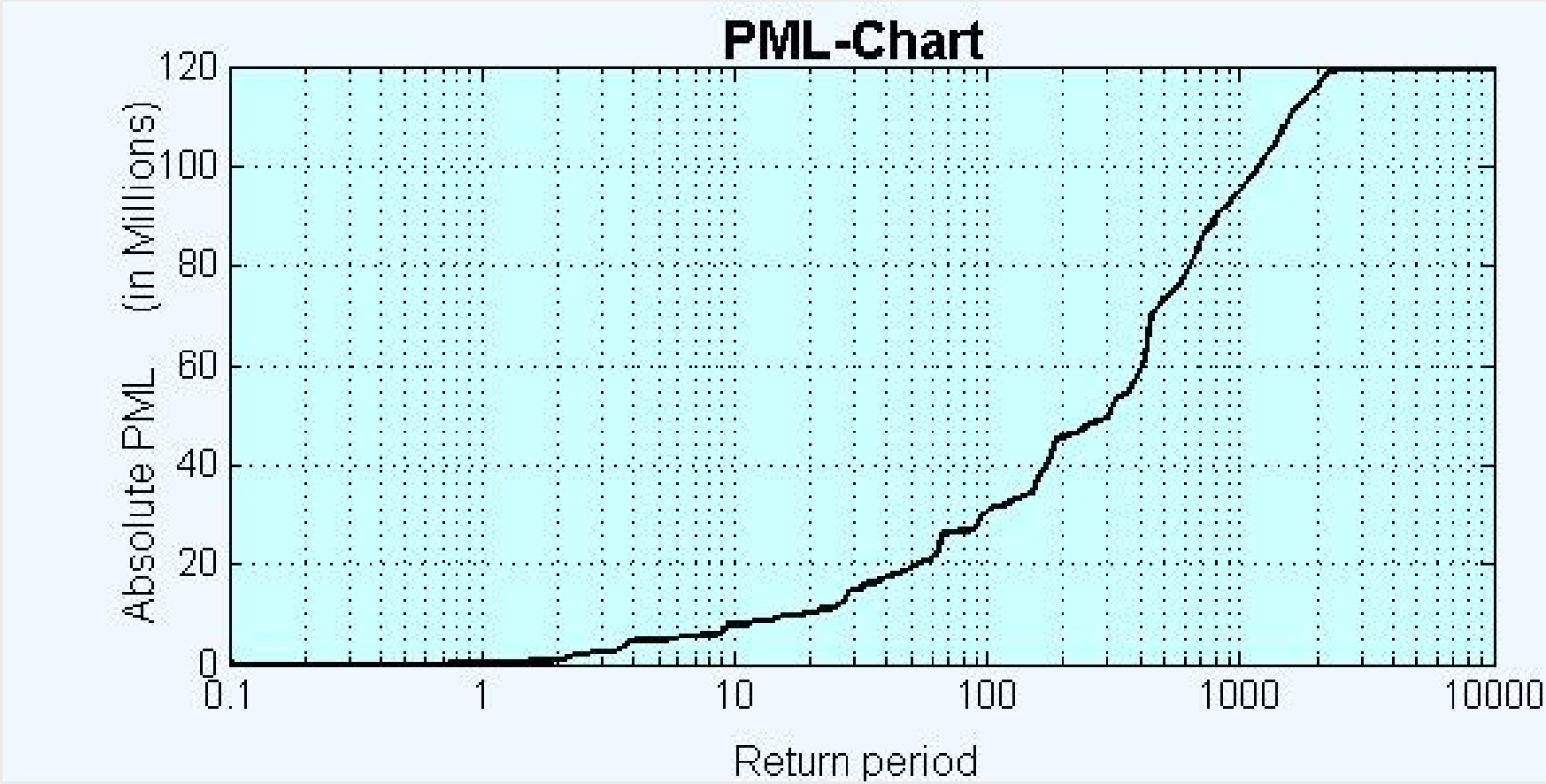
**„PML curve“ (Loss in ‰ of TSI)**



**„Return period“**

# PML Curve




PML-Chart
Absolute PML (in Millions)
120
100
80
60
40
20
0
0.1
1
10
100
1000
10000
Return period

**Thank you very much for your attention!**

**Helga Weindl**

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