

# Reinsurance of Natural Hazards

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Munich Re Group



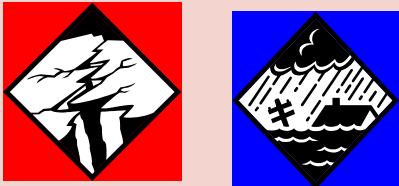


# Geo Risks Research Department Organizational Chart

**CUGC 3 - Geo**  
Peter Höppe

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

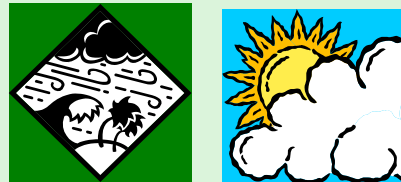
Head: Anselm Smolka



**NatCatSERVICE**  
**CatPMLSERVICE**  
**MRHazard**

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

Head: Ernst Rauch



**CatPMLSERVICE**  
**MRHazard**

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

Head: Andreas Siebert



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

**Environment**  
**management**

Head: Claudia Wippich



**EMS**

## ***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***

- NatCatSERVICE, MRHazard/CatPMLService, NATHAN

## ***Services (internal & external clients)***

- evaluations, presentations, publications

# Development of service-tools

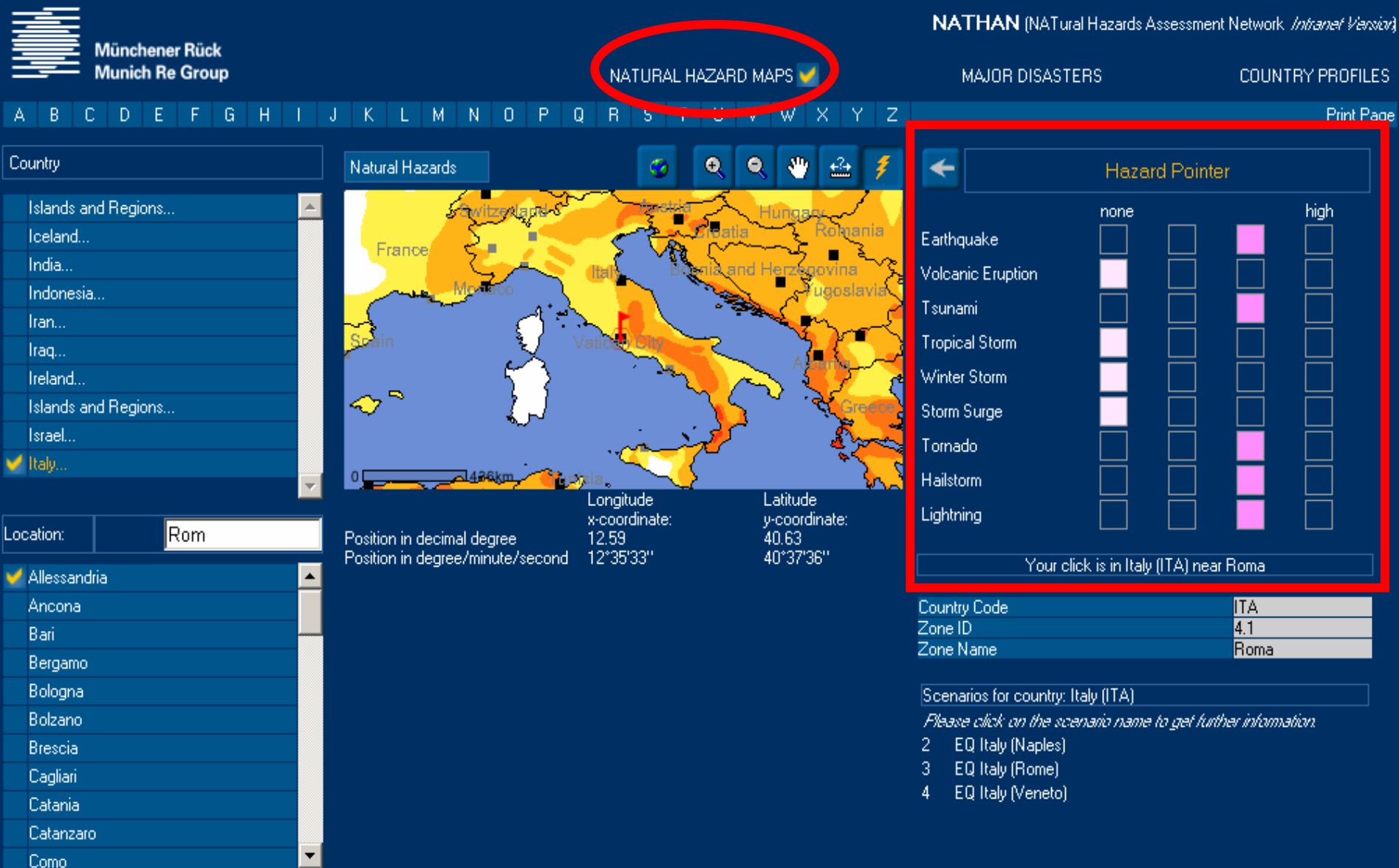
NatCat*SERVICE*

## Largest Database for Natural Disasters



# Development of service-tools

## NATHAN (NATural Hazards Assessment Network)



The screenshot displays the NATHAN web application interface. At the top left is the Münchener Rück Munich Re Group logo. The main navigation bar includes "NATHAN (NATural Hazards Assessment Network - Intranet Version)", "MAJOR DISASTERS", and "COUNTRY PROFILES". A red circle highlights the "NATURAL HAZARD MAPS" menu item. Below the navigation bar is a search bar with a dropdown menu for "Country" and a list of countries including Italy. A central map shows a hazard assessment for Italy, with a red dot indicating a hazard point near Roma. To the right of the map is a "Hazard Pointer" tool with a grid of checkboxes for various hazards (Earthquake, Volcanic Eruption, Tsunami, Tropical Storm, Winter Storm, Storm Surge, Tornado, Hailstorm, Lightning) and a scale from "none" to "high". A red box highlights this tool. Below the map, the position in decimal degree and degree/minute/second is displayed. At the bottom right, a table shows the Country Code (ITA), Zone ID (4.1), and Zone Name (Roma). Below this, a list of scenarios for Italy (ITA) is provided, including EQ Italy (Naples), EQ Italy (Rome), and EQ Italy (Veneto).

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NATHAN (NATural Hazards Assessment Network - Intranet Version)

MAJOR DISASTERS

COUNTRY PROFILES

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

Print Page

Country

Islands and Regions...

Iceland...

India...

Indonesia...

Iran...

Iraq...

Ireland...

Islands and Regions...

Israel...

Italy...

Location: Rom

Allessandria

Ancona

Bari

Bergamo

Bologna

Bolzano

Brescia

Cagliari

Catania

Catanzaro

Como

Natural Hazards

Longitude x-coordinate: 12.59  
Latitude y-coordinate: 40.63  
Position in decimal degree  
Position in degree/minute/second: 12°35'33" 40°37'36"

Hazard Pointer

	none		high	
Earthquake	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Volcanic Eruption	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Tsunami	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Tropical Storm	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Winter Storm	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Storm Surge	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Tornado	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Hailstorm	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Lightning	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Your click is in Italy (ITA) near Roma

Country Code	ITA
Zone ID	4.1
Zone Name	Roma

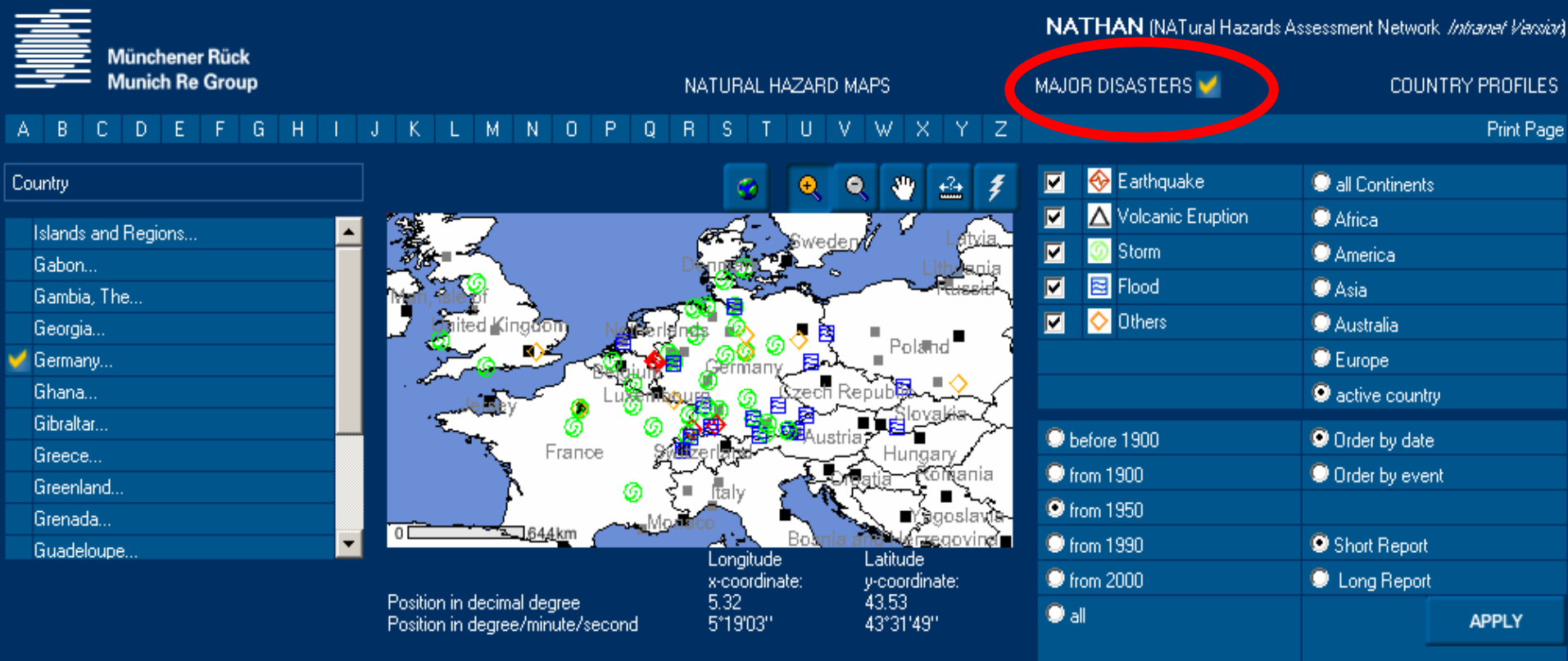
Scenarios for country: Italy (ITA)

Please click on the scenario name to get further information.

- EQ Italy (Naples)
- EQ Italy (Rome)
- EQ Italy (Veneto)

# Development of service-tools

## NATHAN (NATural Hazards Assessment Network)



NATHAN (NATural Hazards Assessment Network - Intranet Version)

NATURAL HAZARD MAPS

MAJOR DISASTERS

COUNTRY PROFILES

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z Print Page

Country

Islands and Regions...  
Gabon...  
Gambia, The...  
Georgia...  
 Germany...  
Ghana...  
Gibraltar...  
Greece...  
Greenland...  
Grenada...  
Guadeloupe...

Longitude x-coordinate: 5.32  
Latitude y-coordinate: 43.53  
Position in decimal degree  
Position in degree/minute/second 5°19'03" 43°31'49"

Earthquake  all Continents  
 Volcanic Eruption  Africa  
 Storm  America  
 Flood  Asia  
 Others  Australia  
 Europe  
 active country

before 1900  Order by date  
 from 1900  Order by event  
 from 1950  
 from 1990  Short Report  
 from 2000  Long Report  
 all

APPLY

80 major events found in this area.

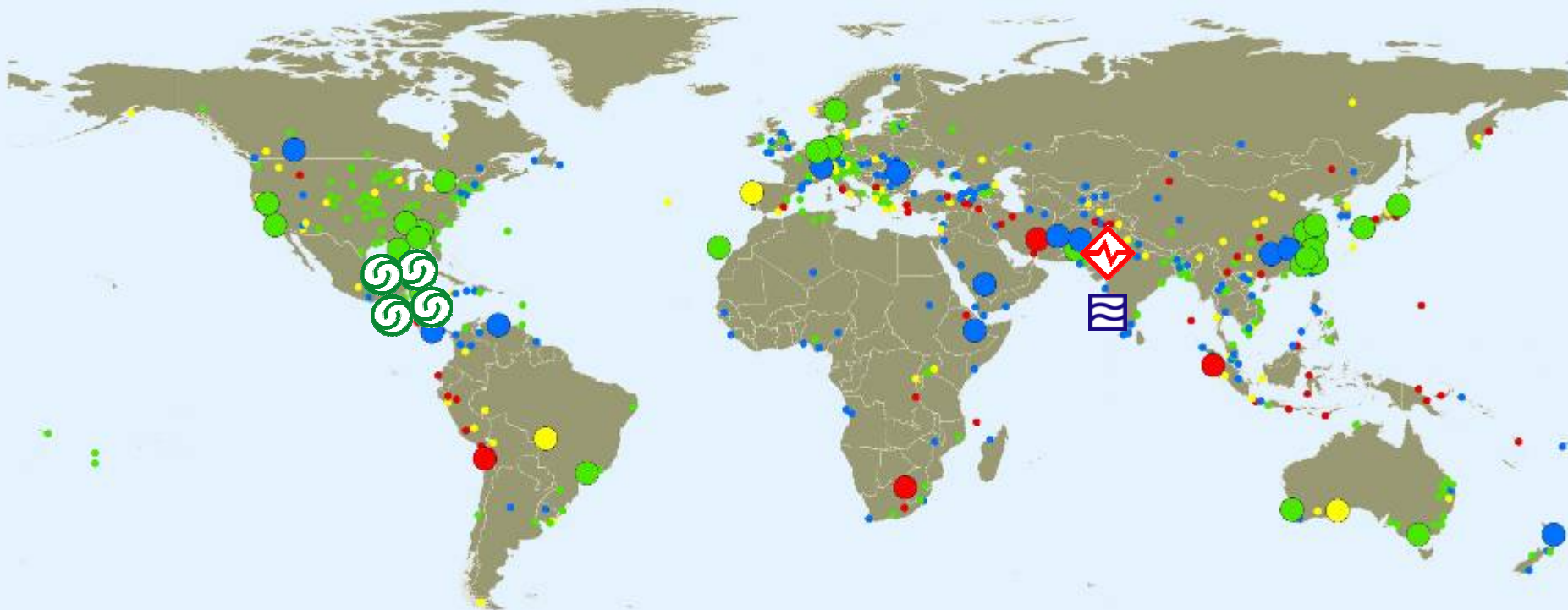
Date	Area Affected	Loss Event	Deaths	Insured losses US\$ m	Economic losses US\$ m
17.-18.12.2004	<b>REGION EUROPE</b> France, Germany, Switzerland	Winter storm	17	est US\$ 600 m	est US\$ 1200 m
5.12.2004	<b>Germany</b> SW, Baden-Württemberg	Earthquake	0	est US\$ 8 m	est US\$ 12 m
17.-18.7.2004	<b>REGION EUROPE</b> Germany, Switzerland	Severe storm, tornado	1	> US\$ 10 m	> US\$ 100 m

## Importance of Natural Hazards for Munich Re





# World map of natural disasters 2005

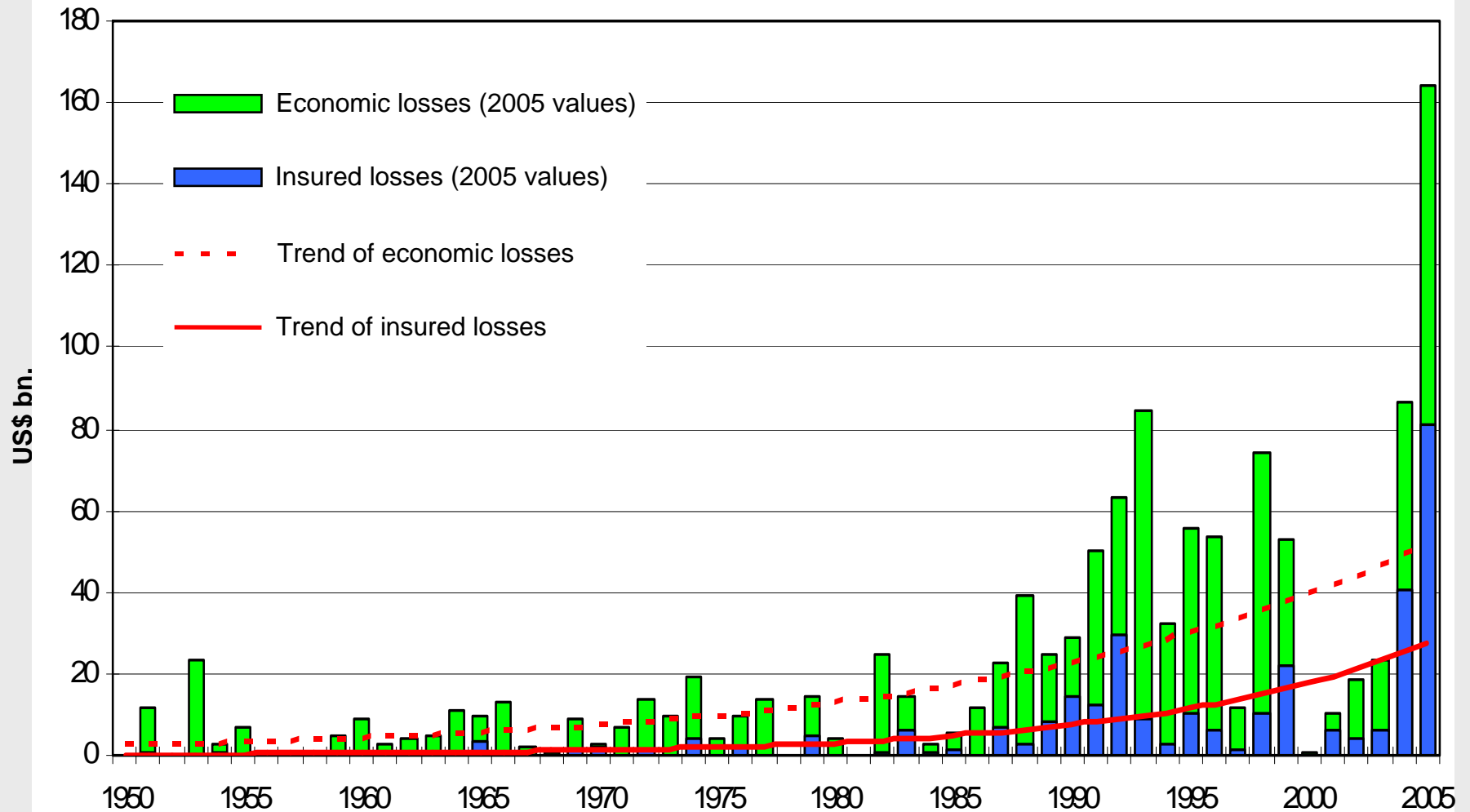


## 2005: 660 natural disasters

- 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



# 10 Major Natural Disasters 2005

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**

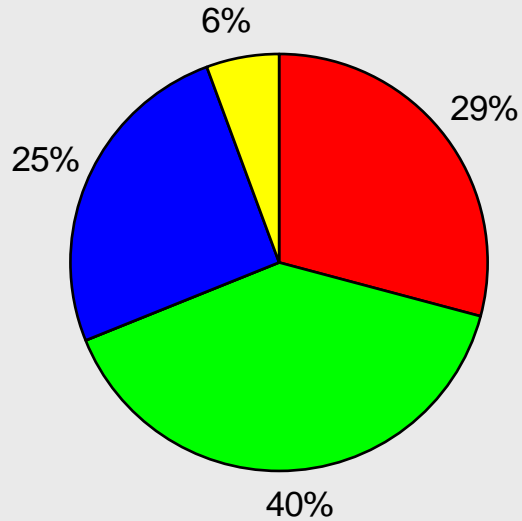
## 2005: Record season

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

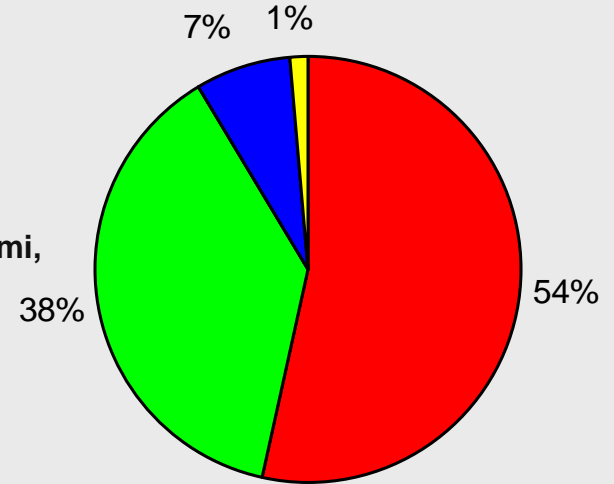
# Major Natural Disasters 1950 - 2005

## Percentage distribution worldwide

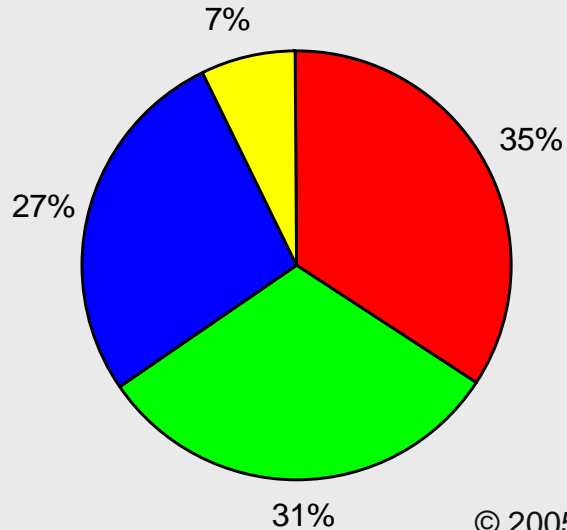
**Number of events: 268**



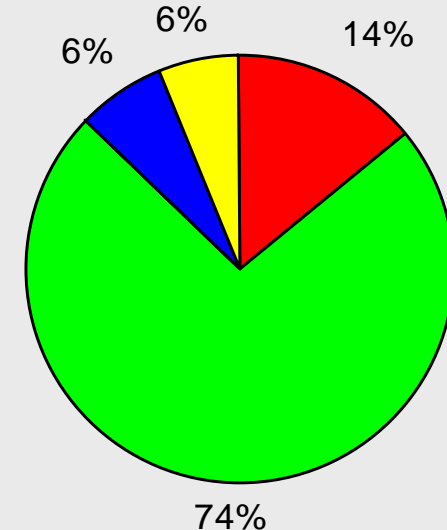
**Deaths: 1.7 Mill.**



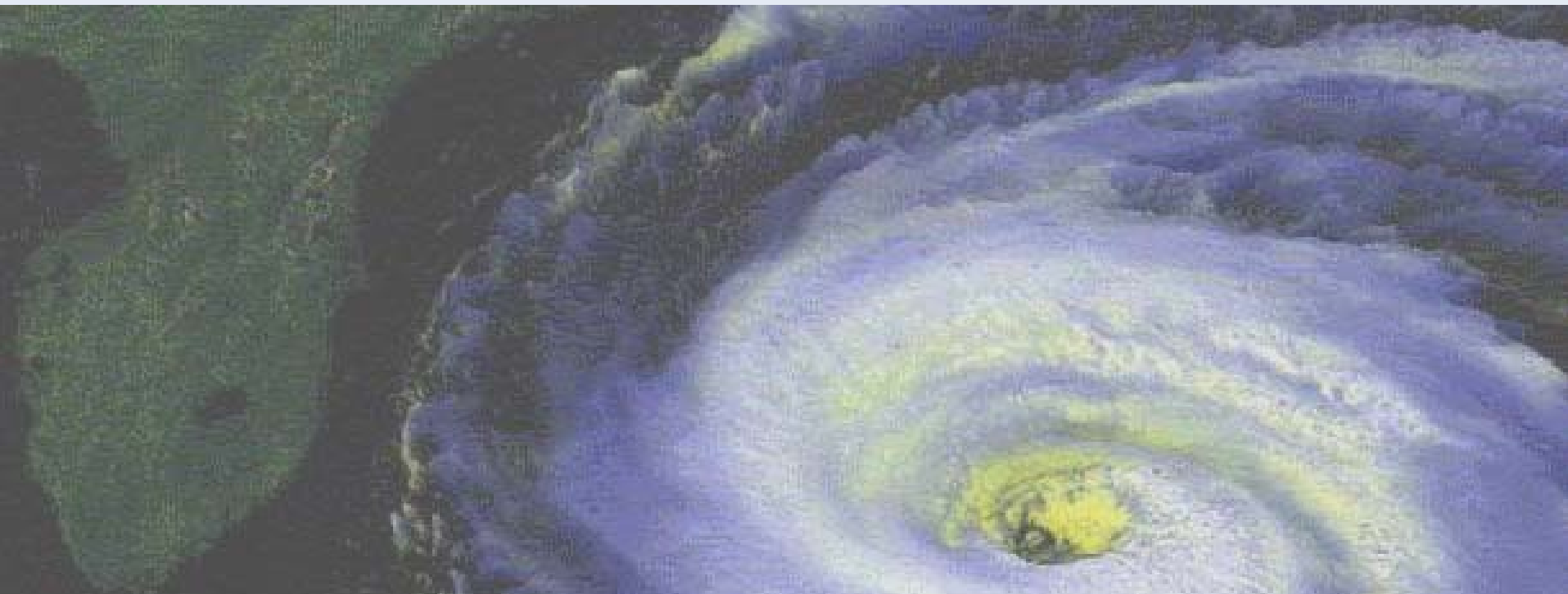
**Economic Losses: 1,400 bn US\$**



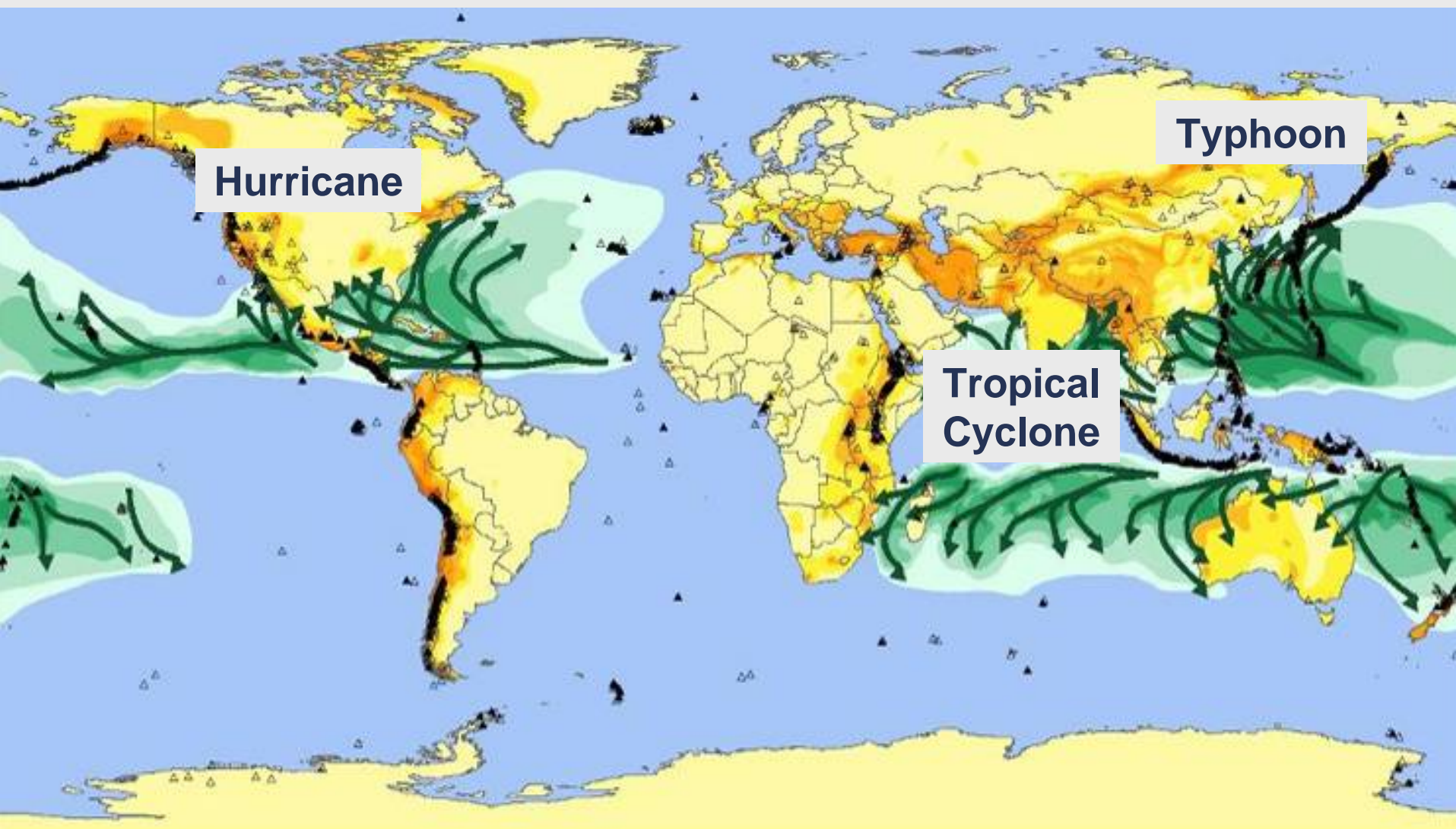
**Insured Losses: 230 bn US\$**



# Tropical Cyclone



# Tropical Cyclone (Hurricane, Typhoon, Cyclone)



# Tropical Cyclone (Hurricane, Typhoon, Cyclone)

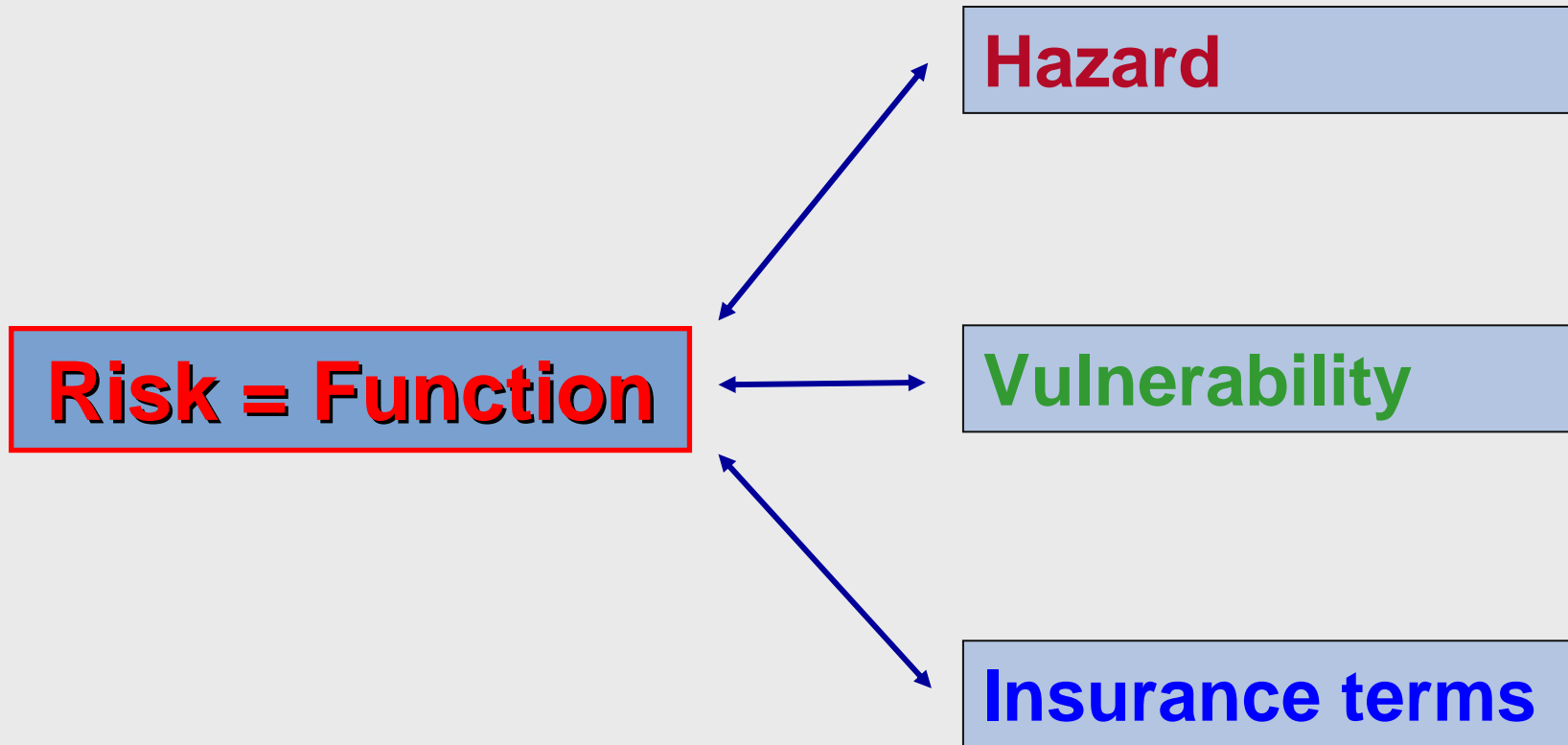
- Length of track : 5 000 - 15 000 km
- Life span : 5 - 15 days
- Speed of movement : 10 - 50 km/h
- Maximum wind speed : 300 - 380 km/h
- Source regions : Tropical seas (surface water temperature > 27°C; between 5° and 35° latitude)
- Season : summer and autumn



## Risk Assessment



# How can we assess the expected loss?



# How can we assess the hazard?

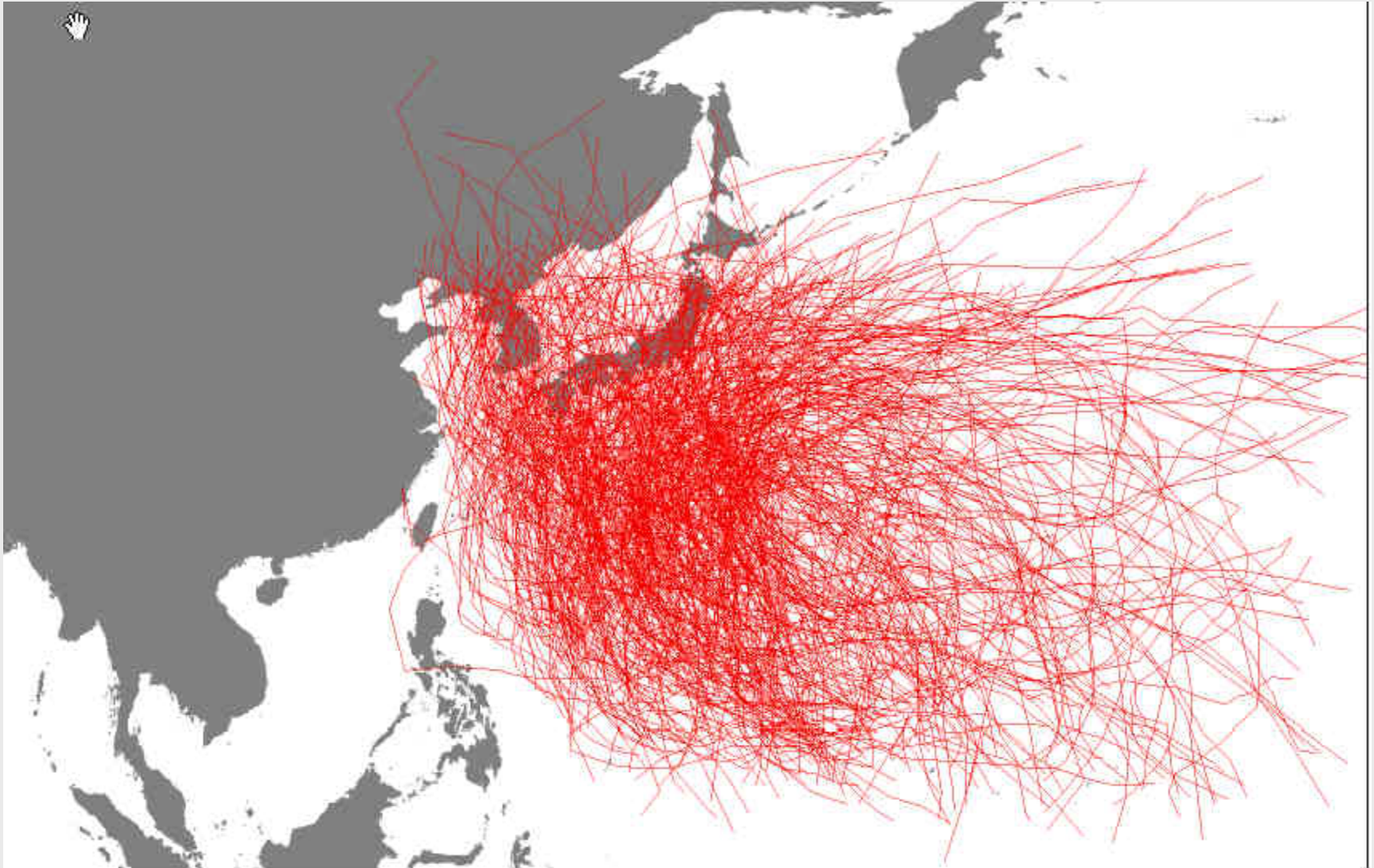
## Example: Tropical Cyclone

- **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.**

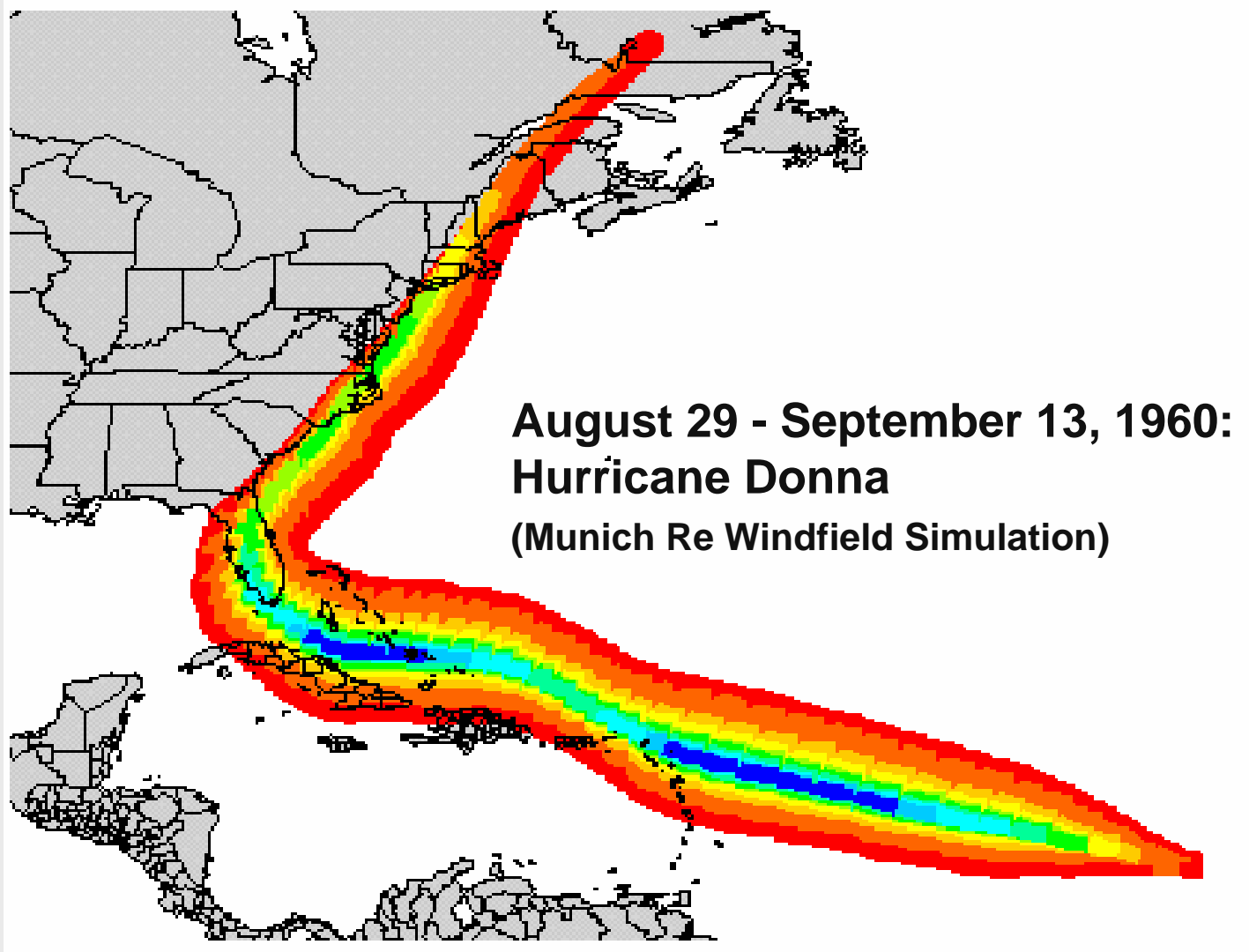
# Gefährdung Modellierung eines stochastischen Eventsets





- **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)

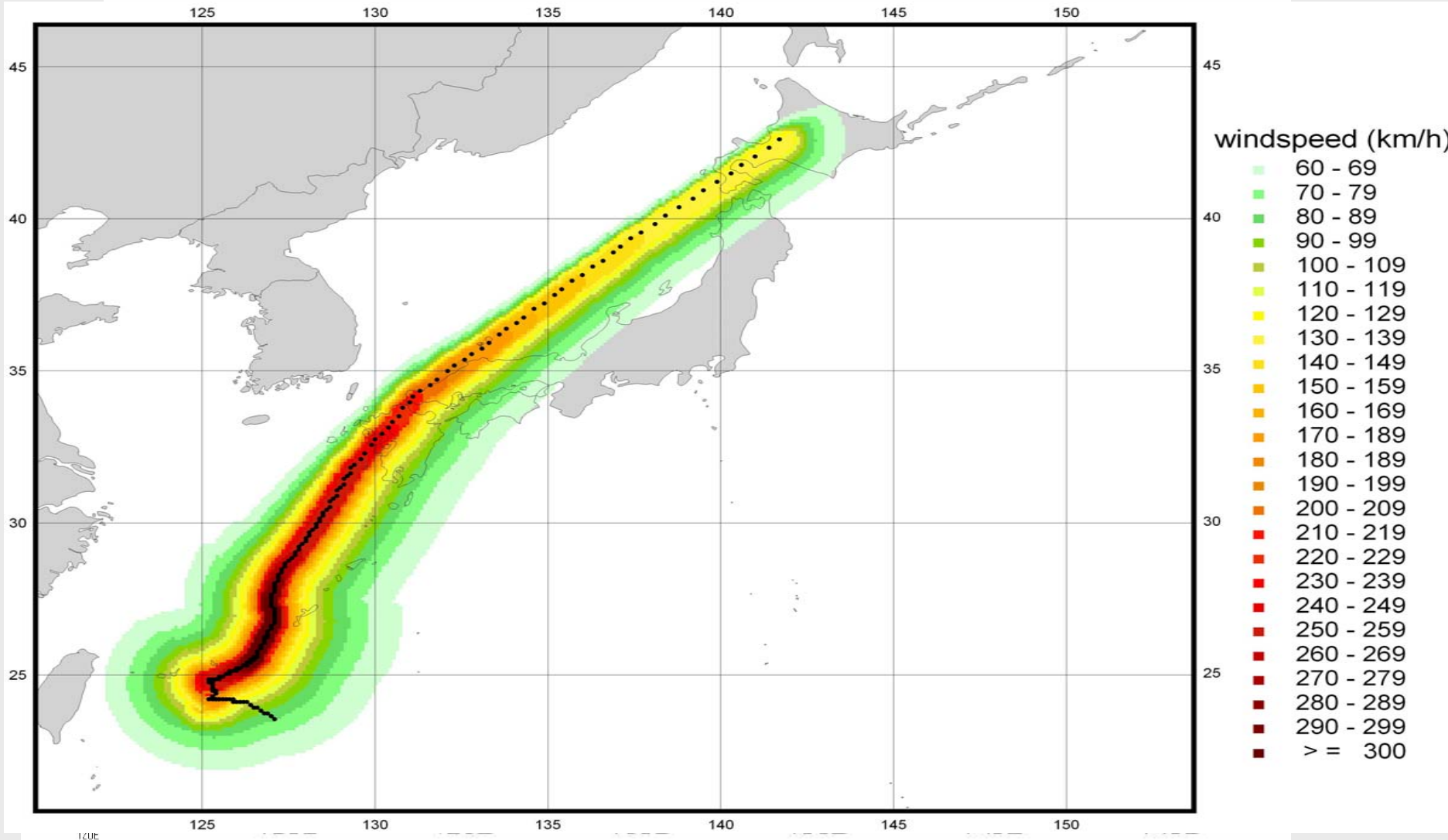


# Hazard

## Wind field Track Tropical Cyclone



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

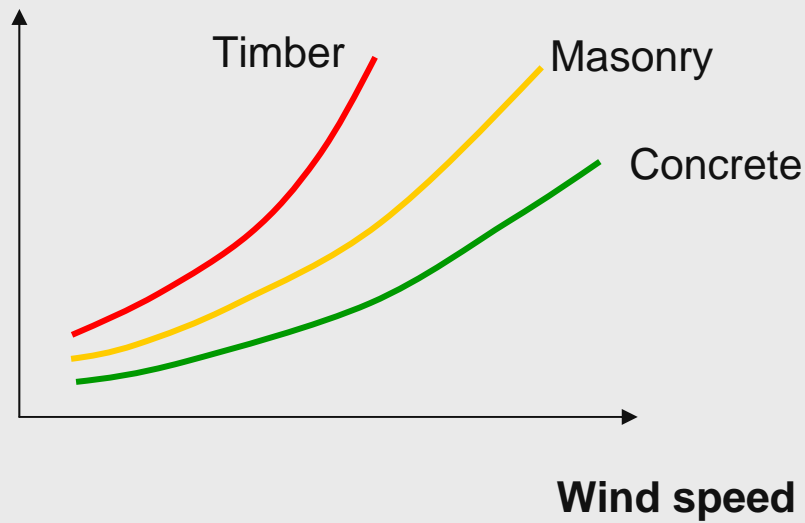
**Loss ratios are generated mainly empirically by analysis of historic losses. Partly (especially earthquakes) also by an approach of engineering technics.**

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



# Vulnerability

Loss ratio (in % of TSI)

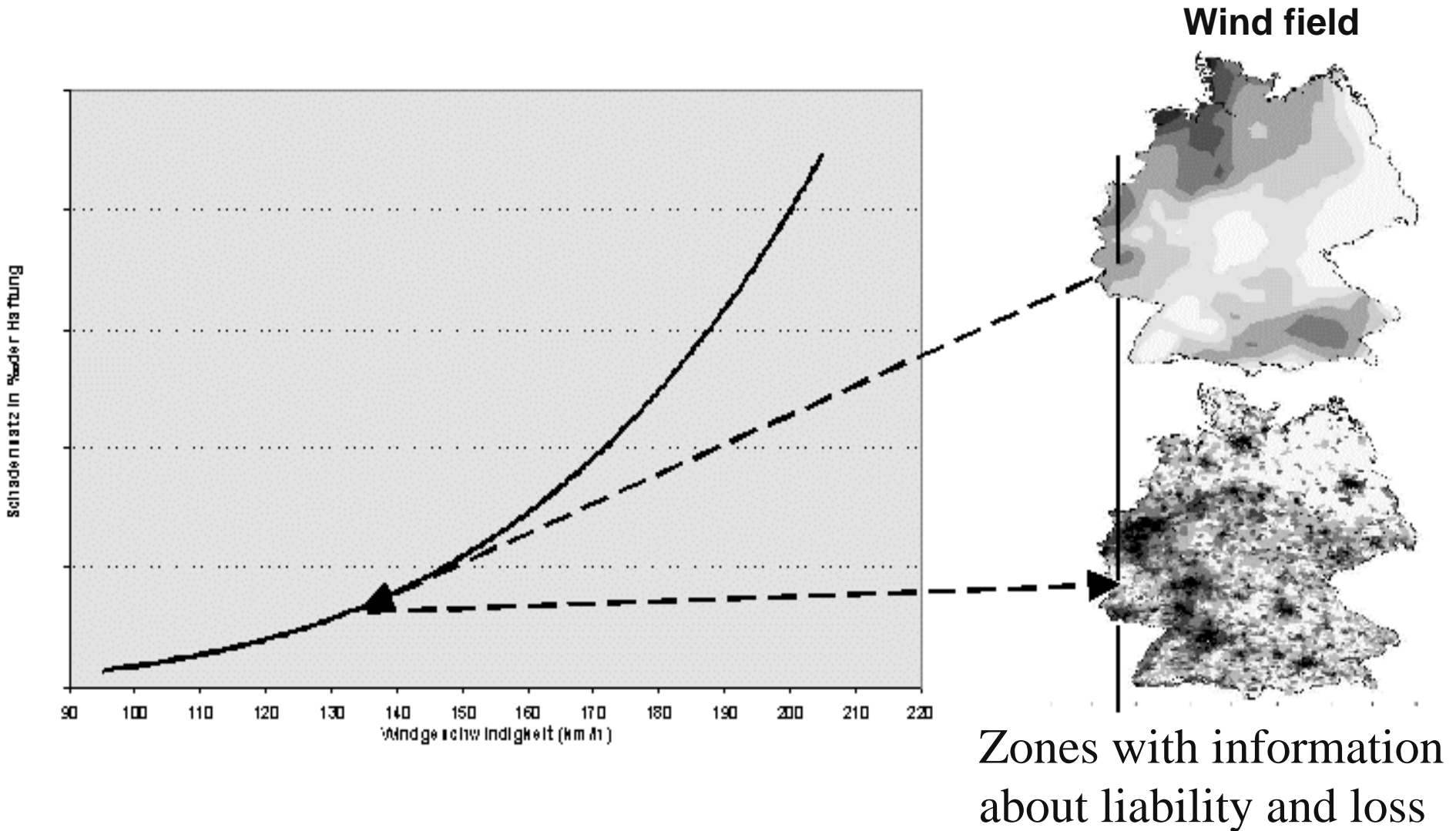


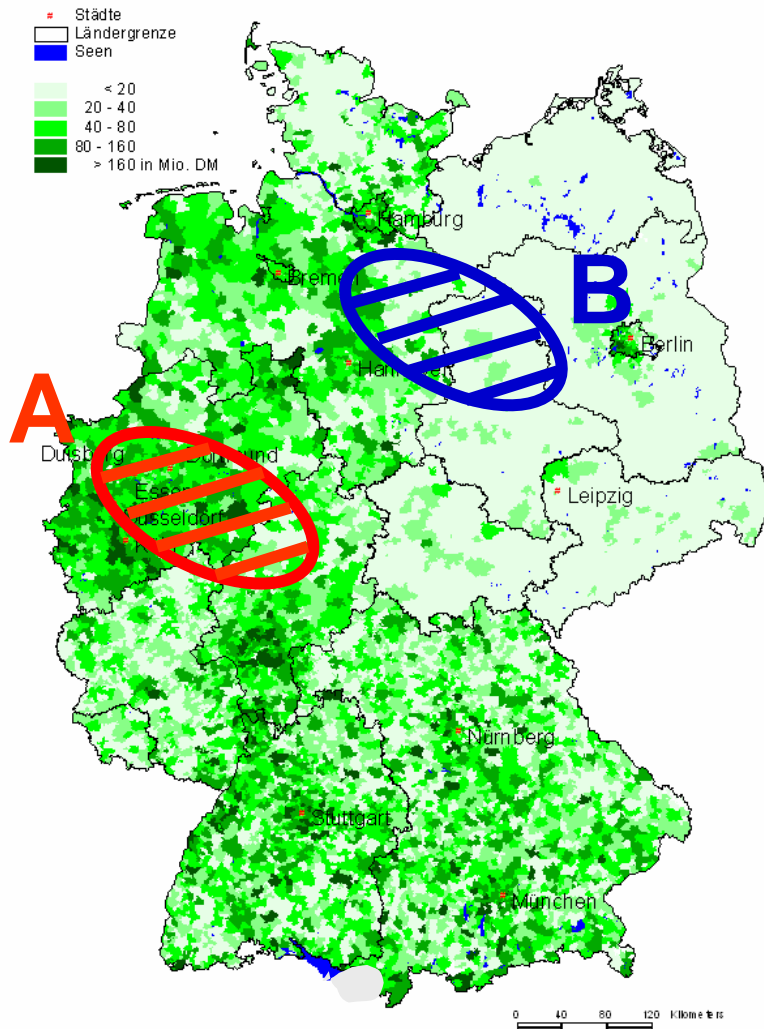
Germany



USA

# Vulnerability



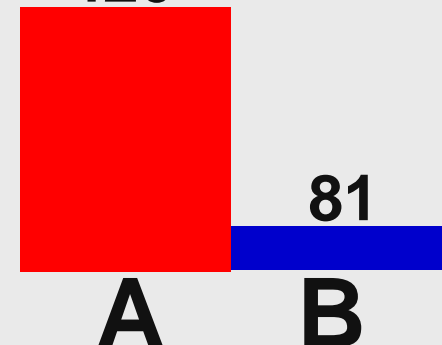


Sum insured per liability zone (here zip code)



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

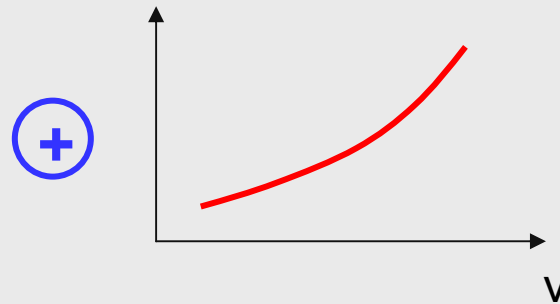
420



## Distribution of liabilities

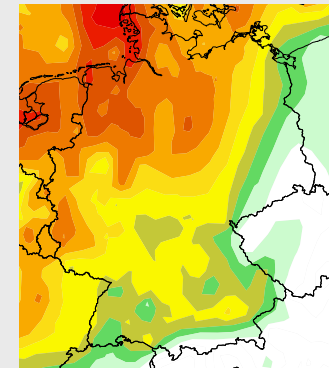


## Vulnerability

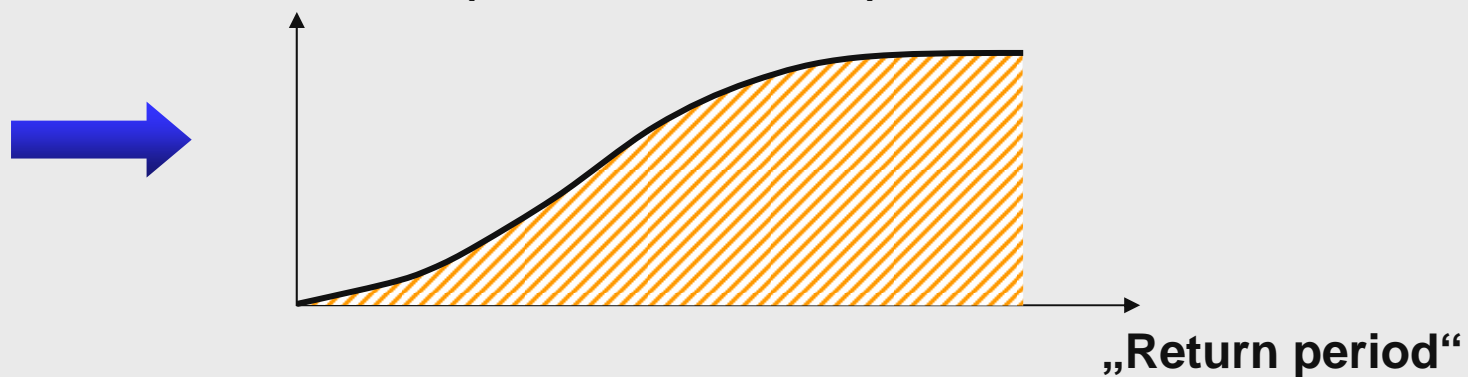


## Hazard information

### Storm scenarios

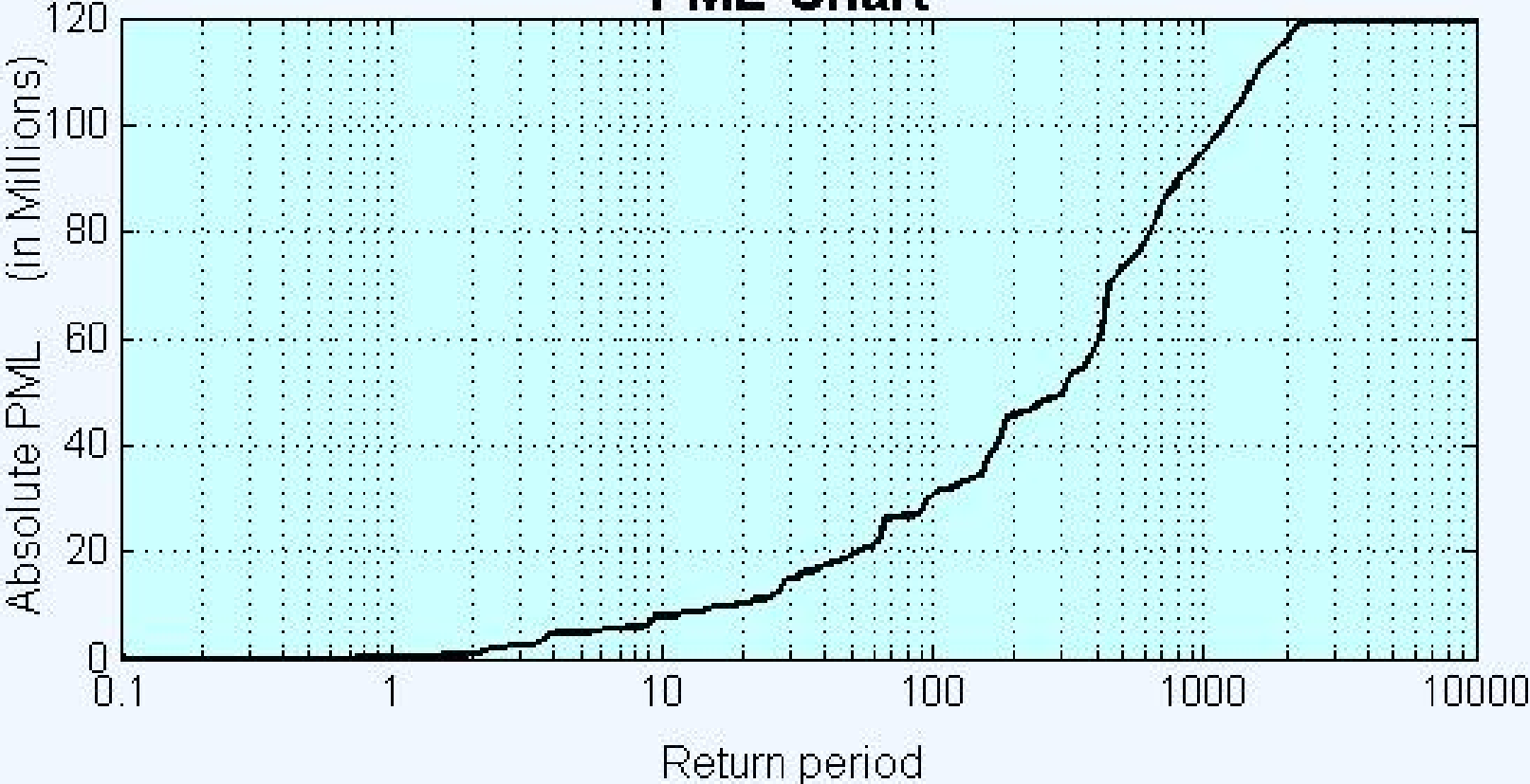


## „PML curve“ (Loss in ‰ of TSI)



# PML Curve

### PML-Chart



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



**Münchener Rück**  
**Munich Re Group**

