Seminar

Climate Change and River Catchment Planning

Dipl.-Ing. Michael Belau

Bavarian Environment Agency

Organisation of the seminar - Timetable

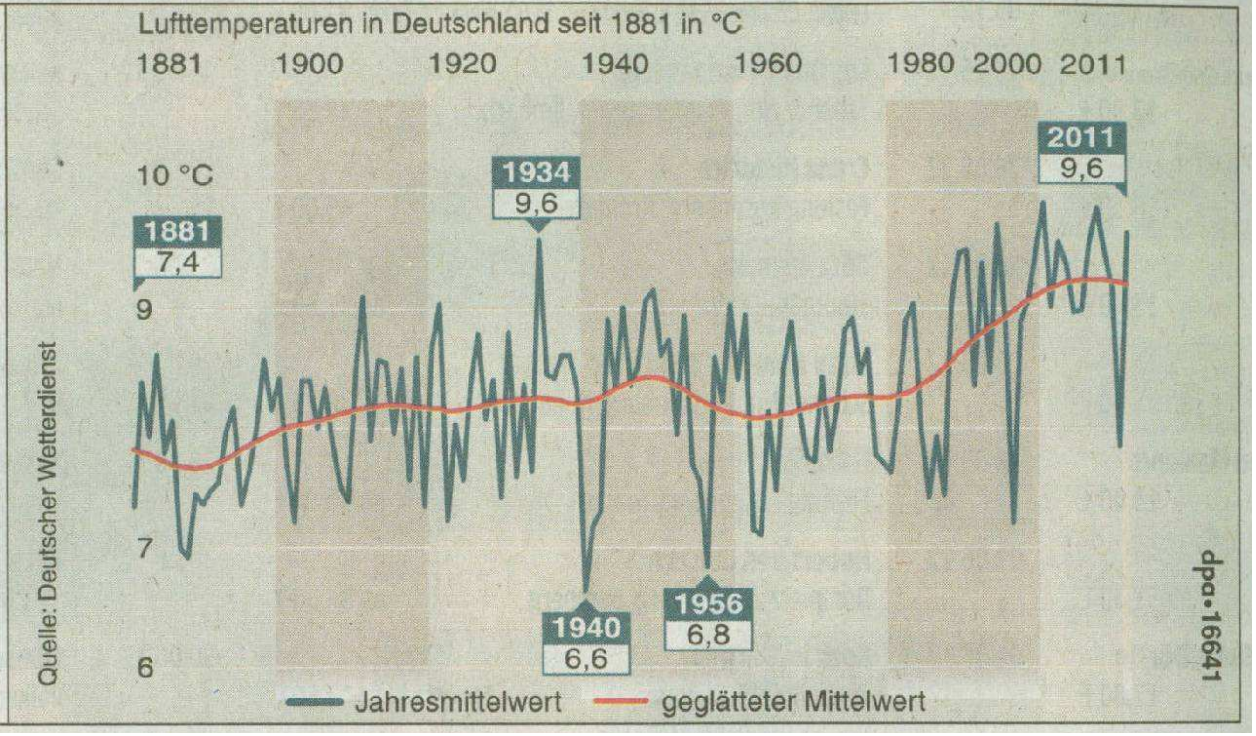
Nr., Termin, Zeit, Ort	Umfang (UE)	Thema / Veranstaltung	Wer?
1 8.5.2012, 13:15 Uni BT, S32	2	Einführungsveranstaltung • Organisatorisches, Zeitplan • Einführungsvortrag • Aufgabenstellung, Fragen	Hr. Belau, WWA Hof
2 15.5.2012, 13:00 Uni BT, S32 und Bayreuth	4	Kick-off vor Ort • Einführung • Exkursion HWS Bayreuth	Hr. Fischer, WWA Hof Hr. Belau, WWA Hof
3 31.5.2012, 14:00 Uni BT, S35	3	Präsentation und Diskussion der Zwischenergebnisse, Vorbereitung der Abschlussveranstaltung	Hr. Belau, WWA Hof
4 28.6.2012, 15:00 Rathaus Bayreuth	3	Abschlussveranstaltung mit Präsentation der Ergebnisse bei der Stadt Bayreuth	NN, Stadt Bayreuth Hr. Fischer, WWA Hof Hr. Belau, WWA Hof Gäste und Presse


Shouldn`t we better save the environment in July?
Stop Global Warming!
Fight against Greenhouse Effect

Frankenpost, 7.5.2012

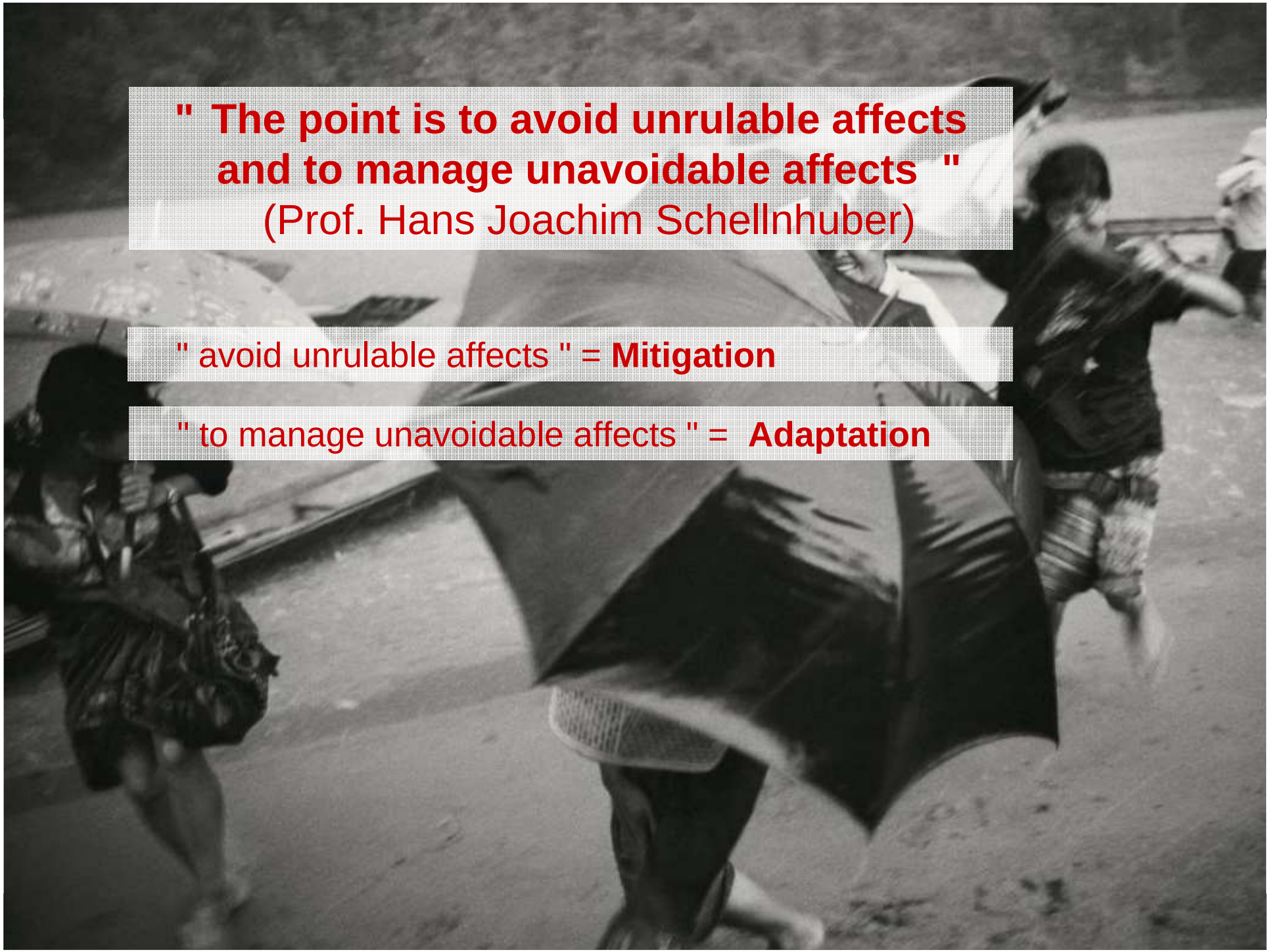
Temperaturen steigen langfristig

Sonne und heftige Gewitter in heißen Sommern, ausgiebiger Niederschlag in milden Wintern – das hält der Klimawandel für Deutschland bereit. Regional werden die Auswirkungen jedoch sehr unterschiedlich sein, bilanzierte der Deutsche Wetterdienst in Berlin. Dort stellte er aktuelle Deutschland-Daten sowie Klimatendenzen auf der Basis von fast zwei Dutzend regionalen Klimamodellen vor, die den Zeitraum von 1951 bis 2100 umspannen. Die meisten davon sagen bis zur Jahrhundertwende einen Temperaturanstieg von drei Grad Celsius voraus.



Agenda

- **Global view: General aspects on climate change**
- National view: climate change – quantifying the impacts for South Germany
  - Knowing what happend – trend-analysis
  - Forecasting what will happen – climate szenario calculation
  - Consequences on water-related issues
- Local View: Case Study Fränkische Saale (project ESPACE)



" The point is to avoid unrulable affects and to manage unavoidable affects "

(Prof. Hans Joachim Schellnhuber)

" avoid unrulable affects " = **Mitigation**

" to manage unavoidable affects " = **Adaptation**

Increasing extrem-events in the past: Indicator for a changing climate?

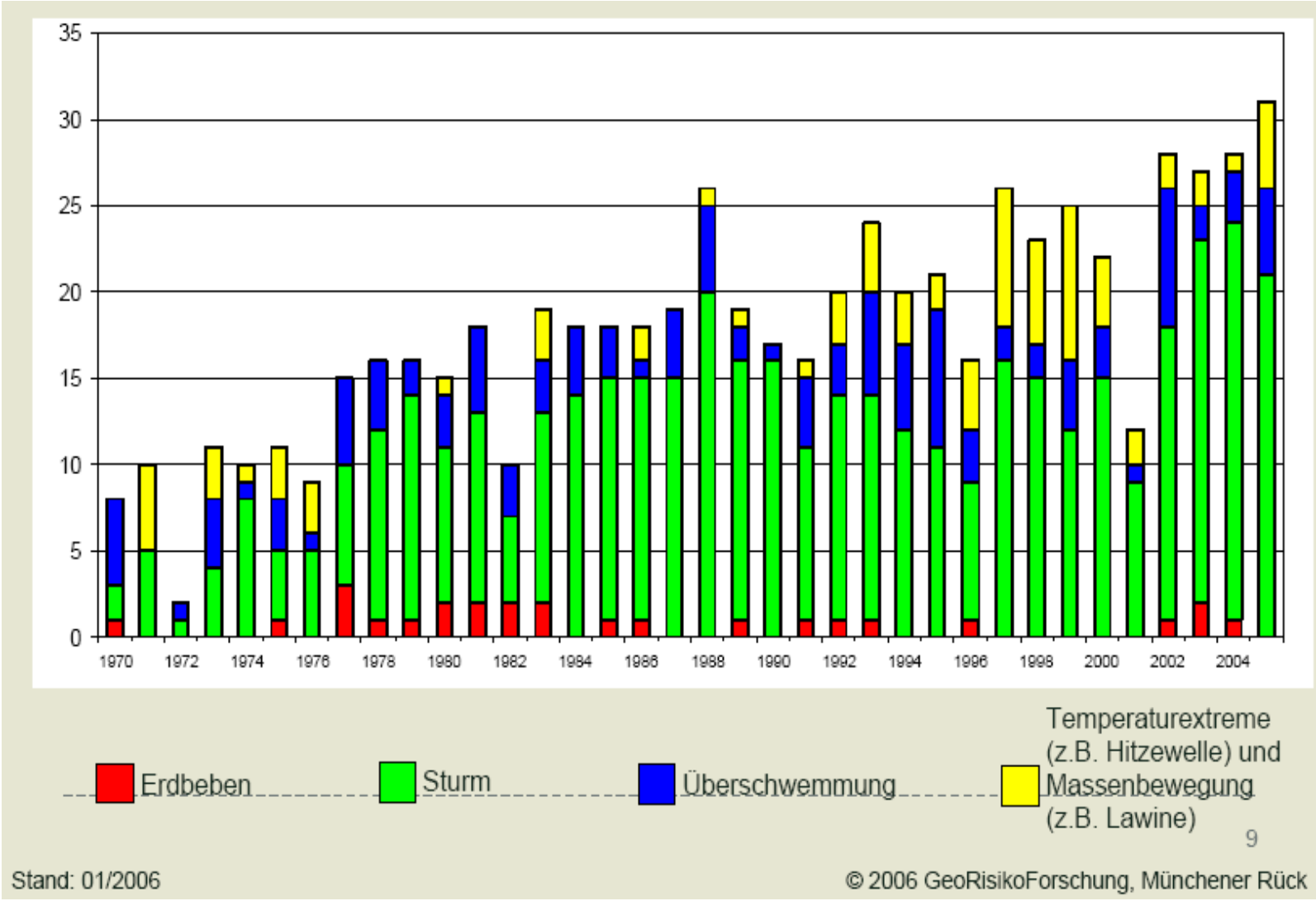
- **Winter** 2005/2006: Too much snow with dramatic impacts
- **April** 2006: "One-hundred-year-flood", Elbe River
- **Early summer** 2006: Low temperatures are stressing the nature
- **Sommer** 2006: Hot and dry
- **Herbst** 2006: Warmest autumn since the beginning of the systematic temperature measuring in 1901
- **November/Dezember** 2006: Much too warm with very little precepitation
- **Dezember** 2006: Orcan "Vera" with wind-speeds up to 191 km/h (in the Harz)
- **Januar** 2007: Too warm and dry, tremendous economic impacts for the nature and the winter-tourism in the Alpes
- Winter 2007/2008: Too warm and dry
- …

… will the weather continue like this?

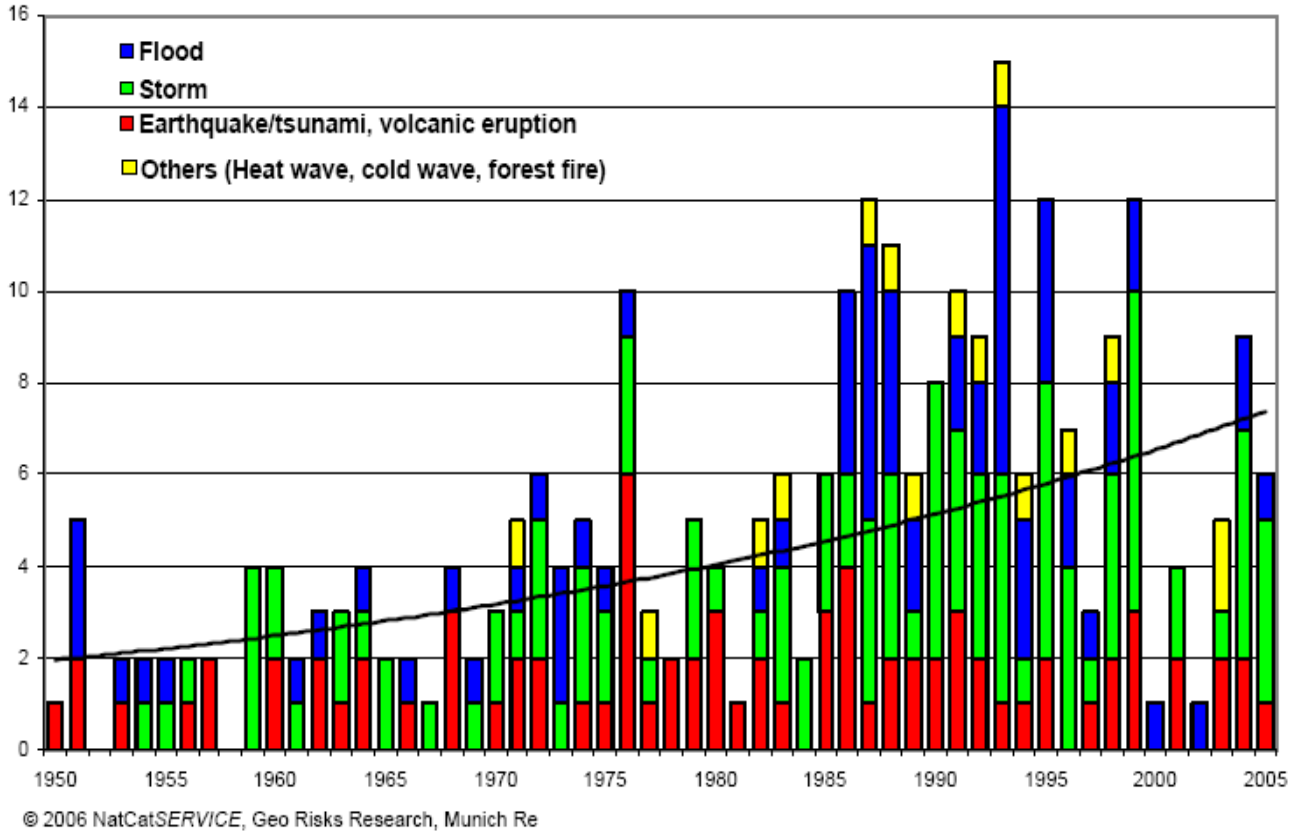
Orkan „Kyrill“, January 2007

" Heavily storms caused high damages...with seven peaple died. The fish-market in Hamburg is under water…"

Number of natural hazards in Germany (1970 – 2005)

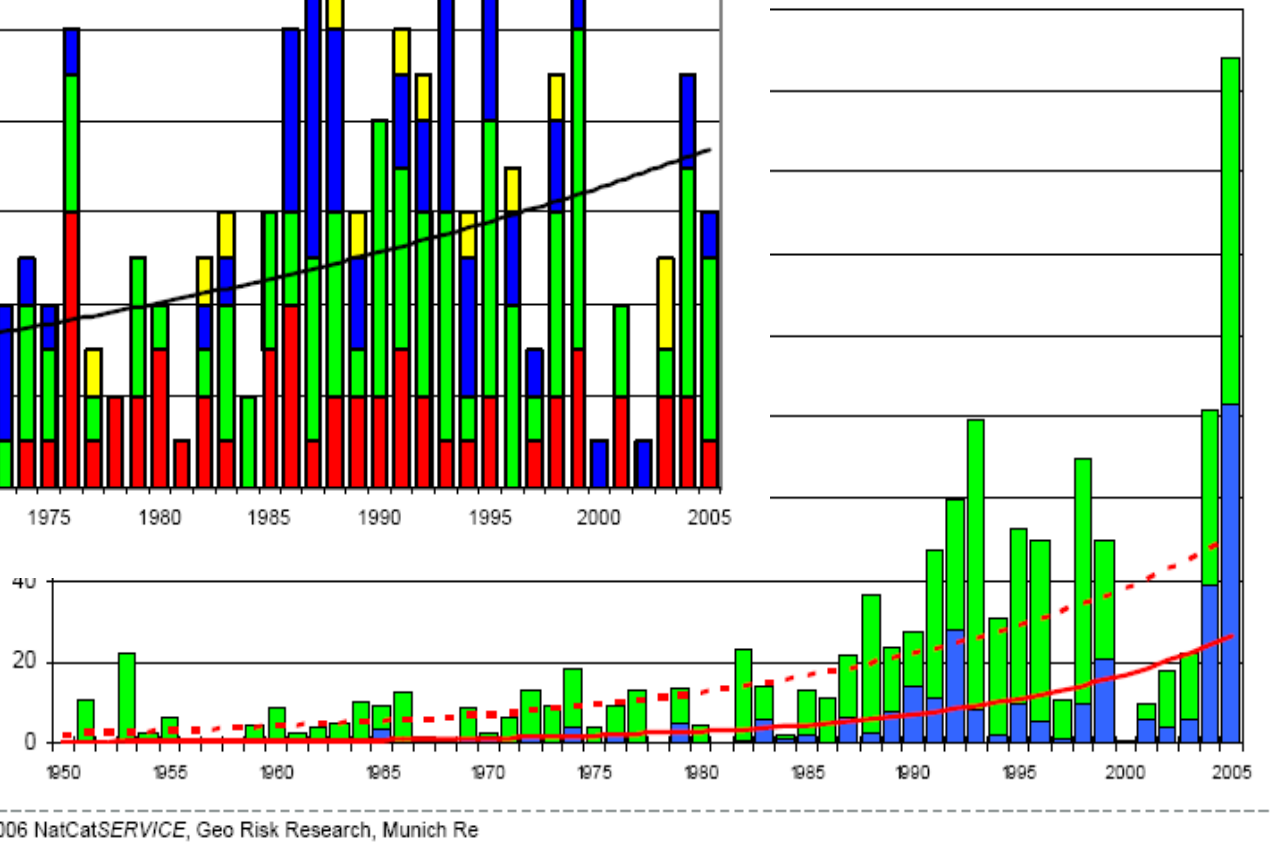


… and natural hazards at the global scale (1950 – 2000)

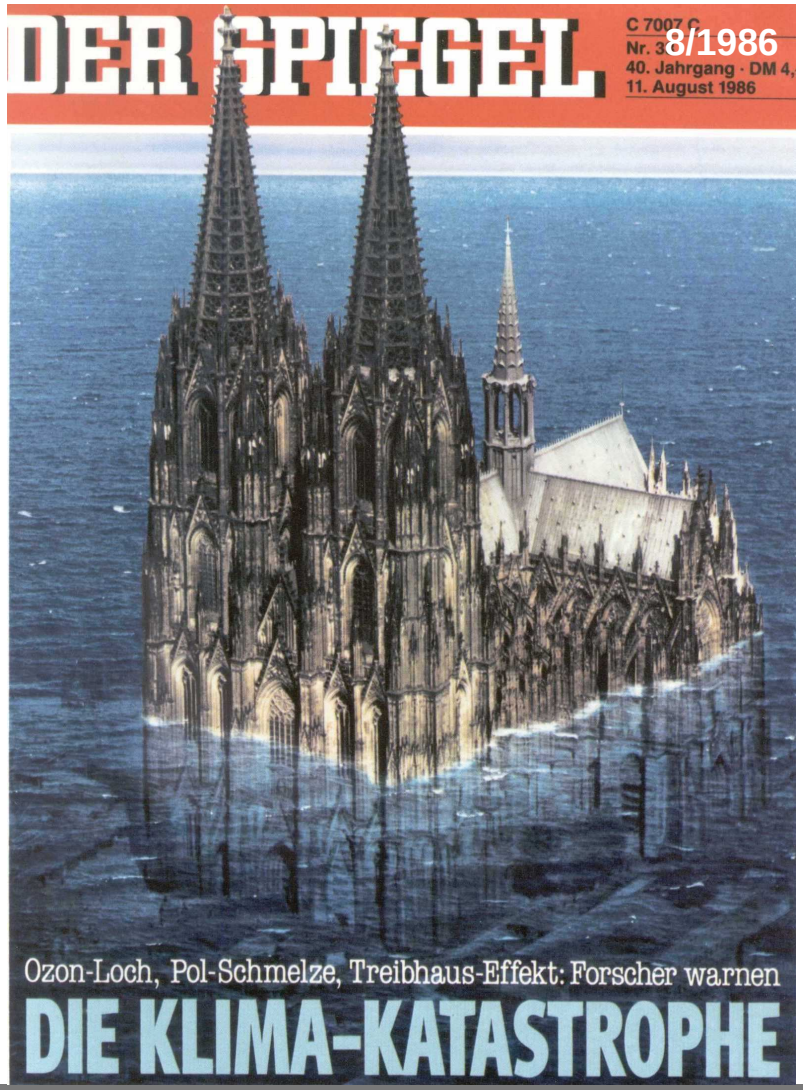


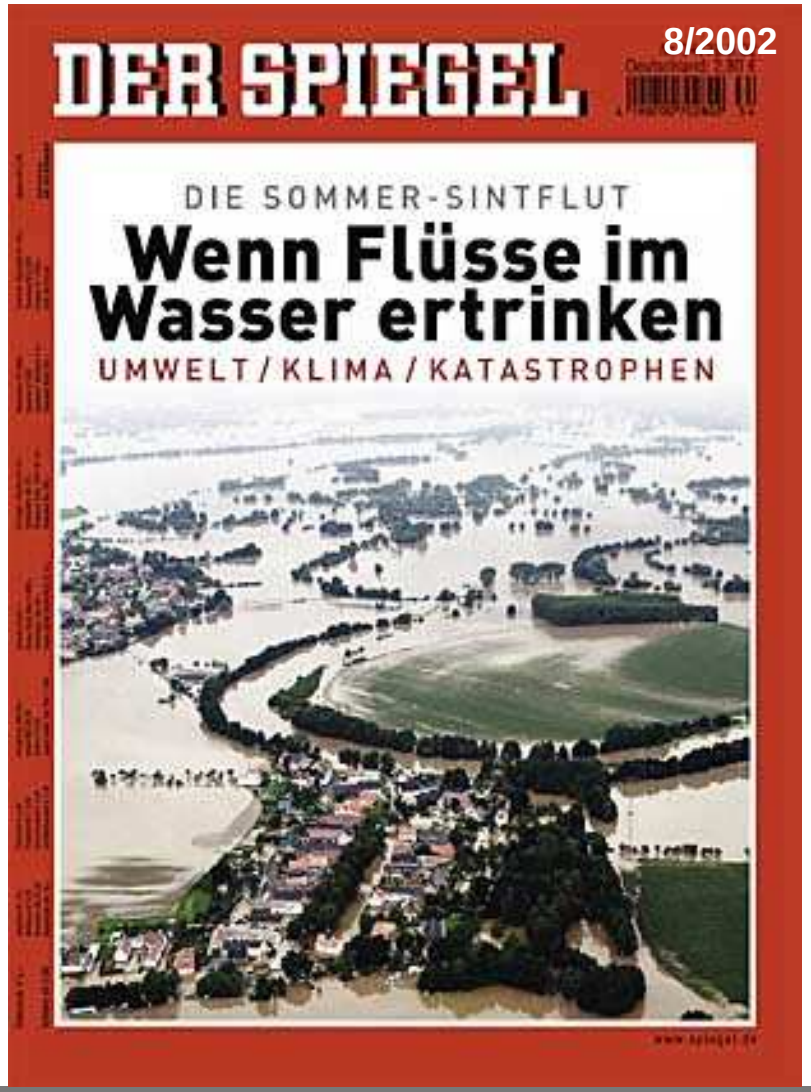
Above:
Number of natural hazards

Below:
Economic damages



Climate Change – not a brandnew discussion





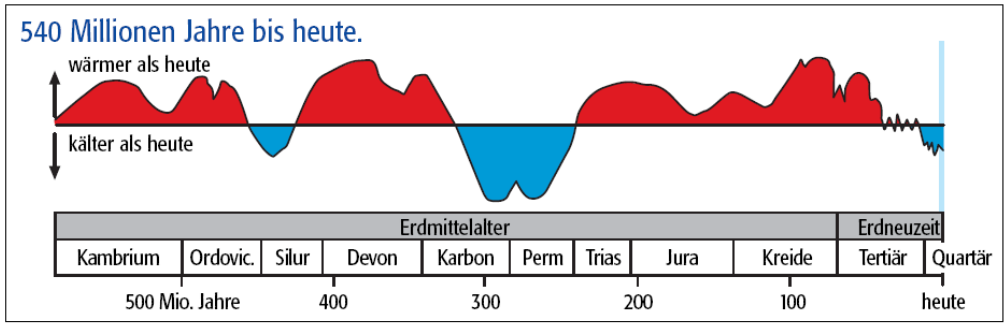
Climate Change and underwear – what is equal?

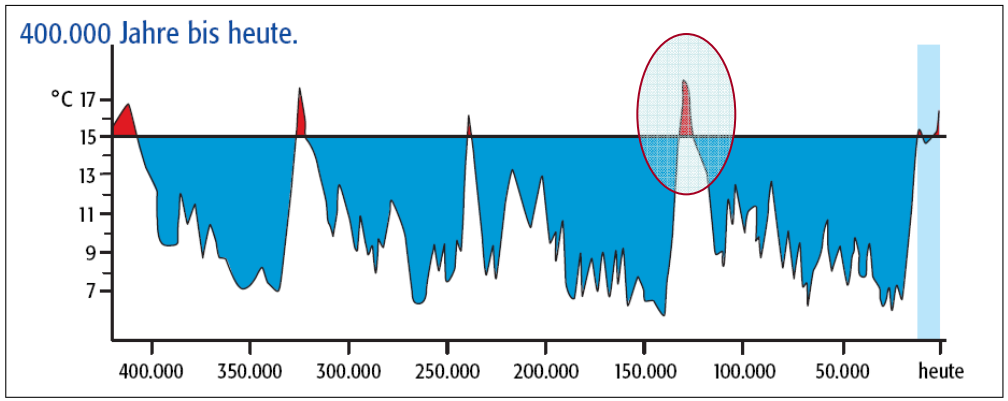
Climate History

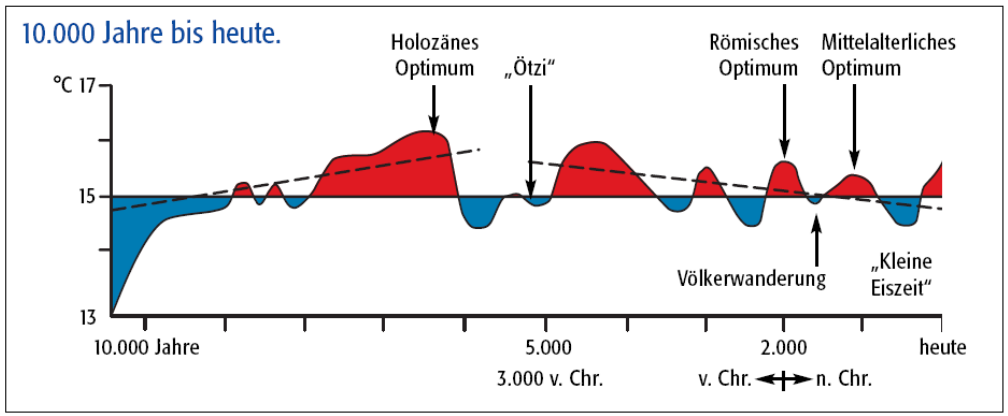
Affects of warm periods in the past:

Paläoklimatische Informationen stützen die Interpretation, dass die Wärme des letzten halben Jahrhunderts für mindestens die letzten 1300 Jahre ungewöhnlich ist. Das letzte Mal, als die Polargebiete für längere Zeit signifikant wärmer waren als heute (vor etwa 125'000 Jahren), führten die Rückgänge der polaren Eismassen zu einem Meeresspiegelanstieg von 4 bis 6 Metern. {6.4, 6.6}

Quelle: IPCC 2007

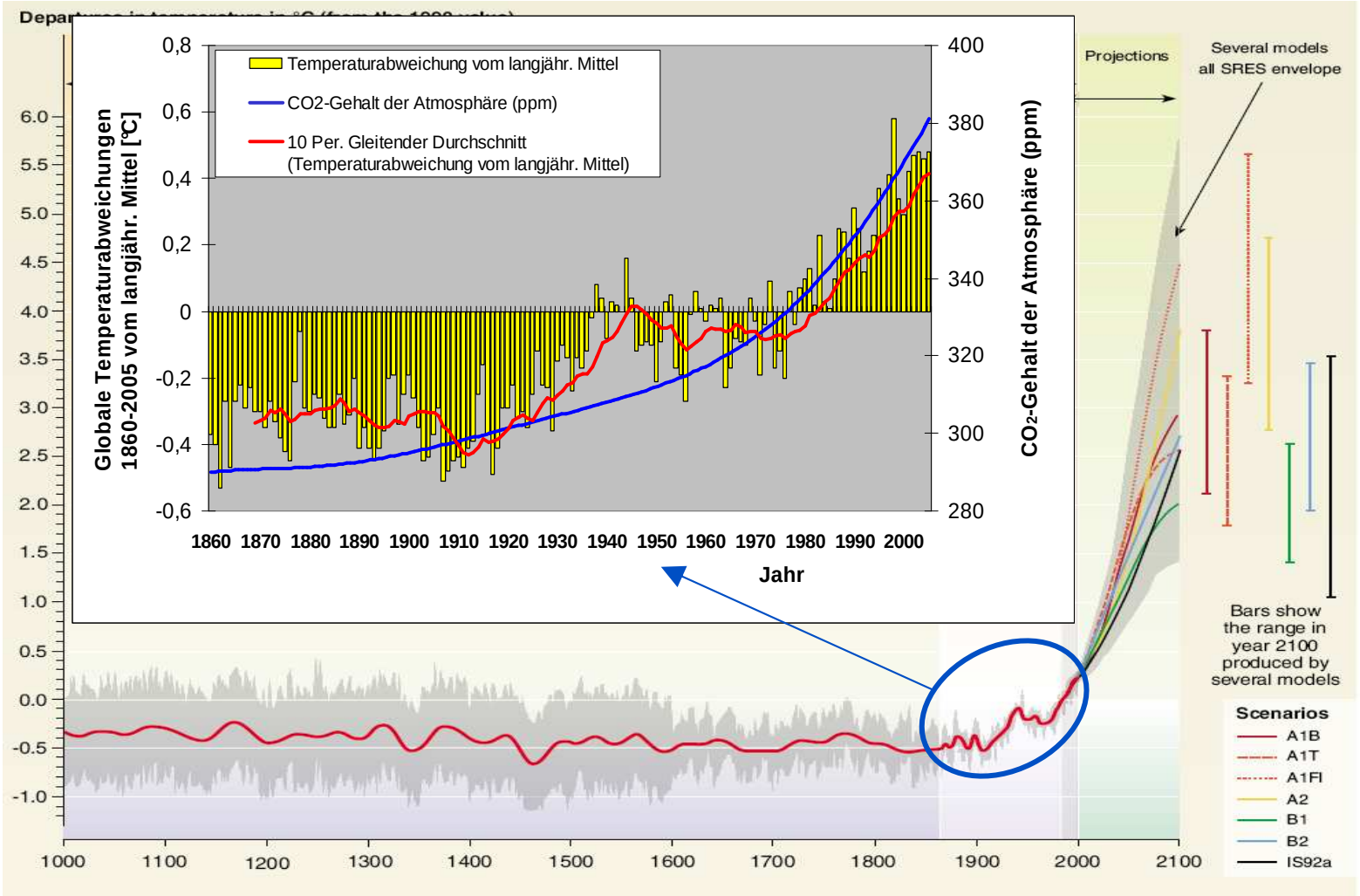






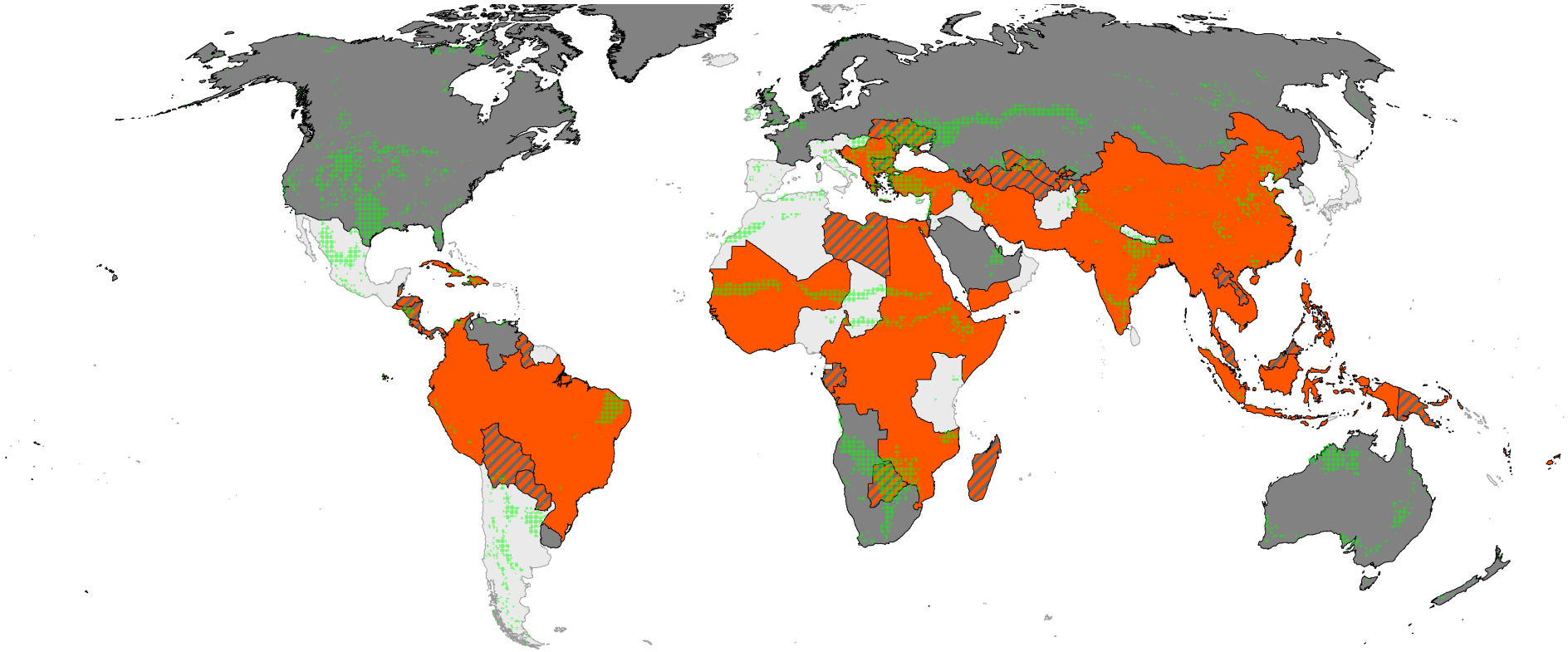
Quelle: Allianz Umweltstiftung

Global climate change – the "hockey racket graph"



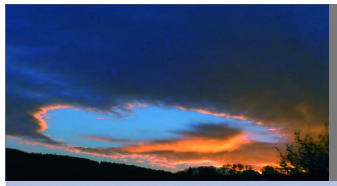
Increasing of the global temepratures since 1000 including the calculation until 2100 (IPCC 2001)

Global vulnerability und emissions



Highest vulnerability towards climate change vs. largest CO_2 emissions (from fossil fuel combustion and cement production, and including land use change, kg C per person and year from 1950 - 2003)

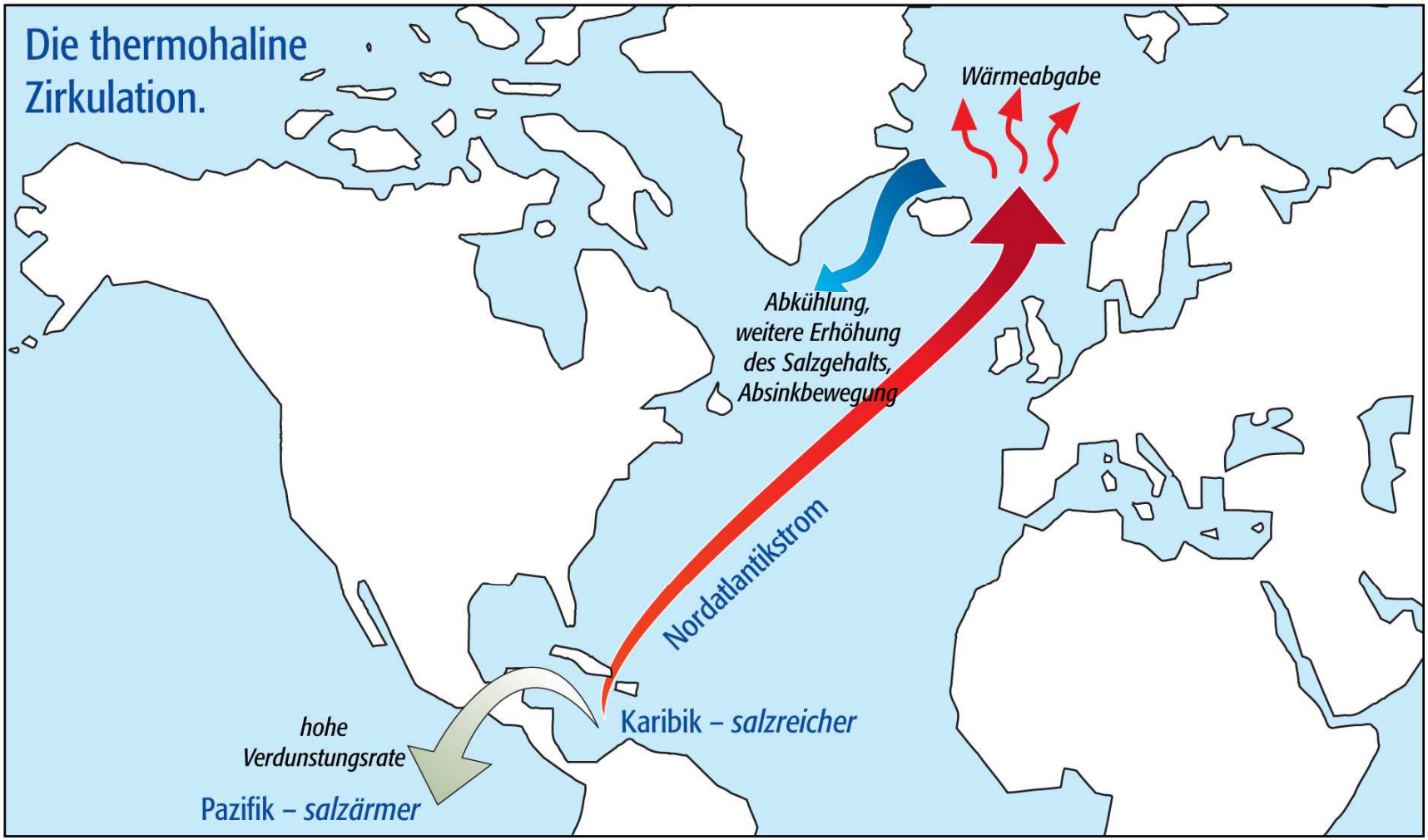
- Highest social and / or agro-economic vulnerability
- Areas with highest ecological vulnerability
- Largest per capita CO_2 emitters
- Largest per capita CO_2 emitters, and highest social and / or agro-economic vulnerability

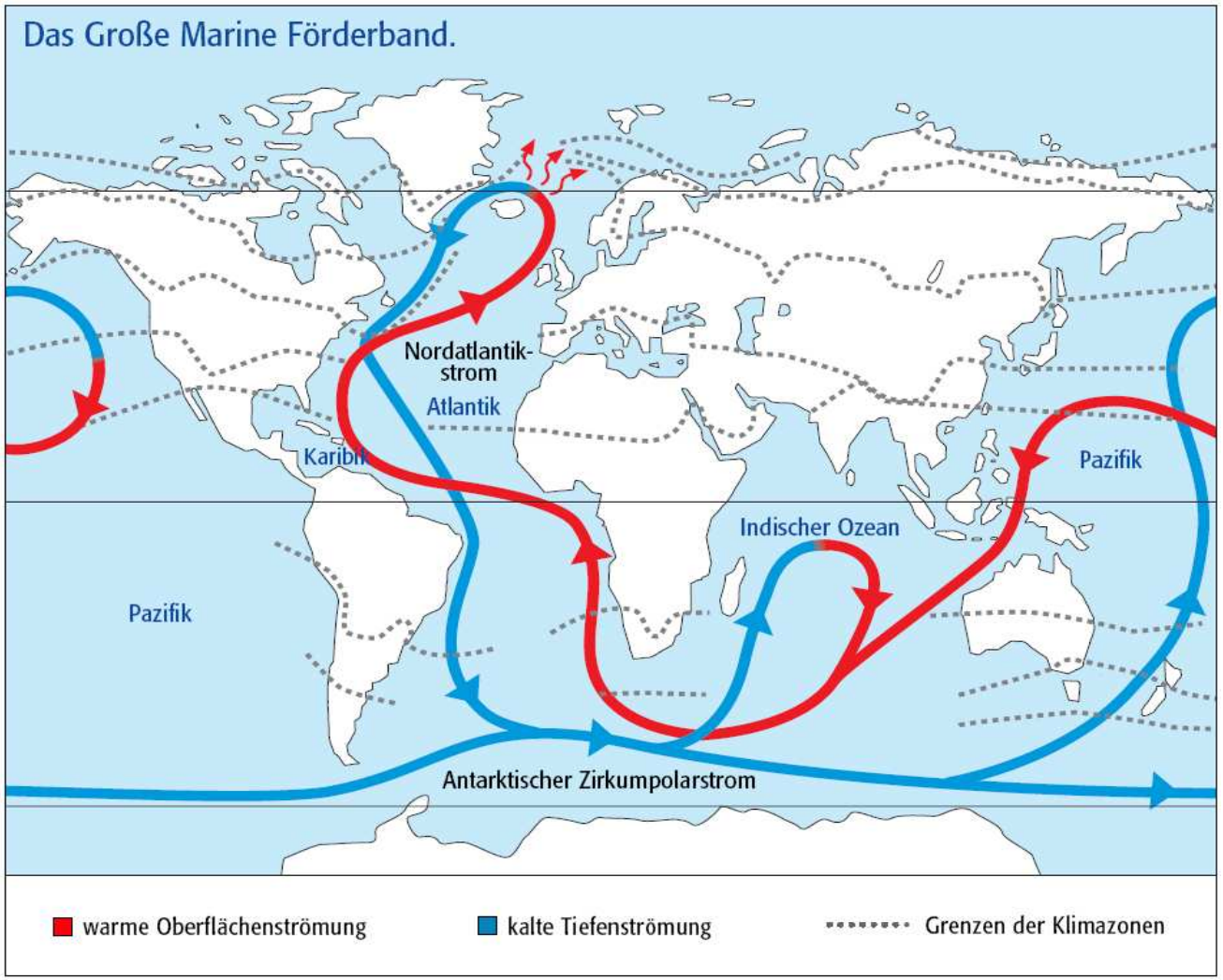


Some unconsidered factors:

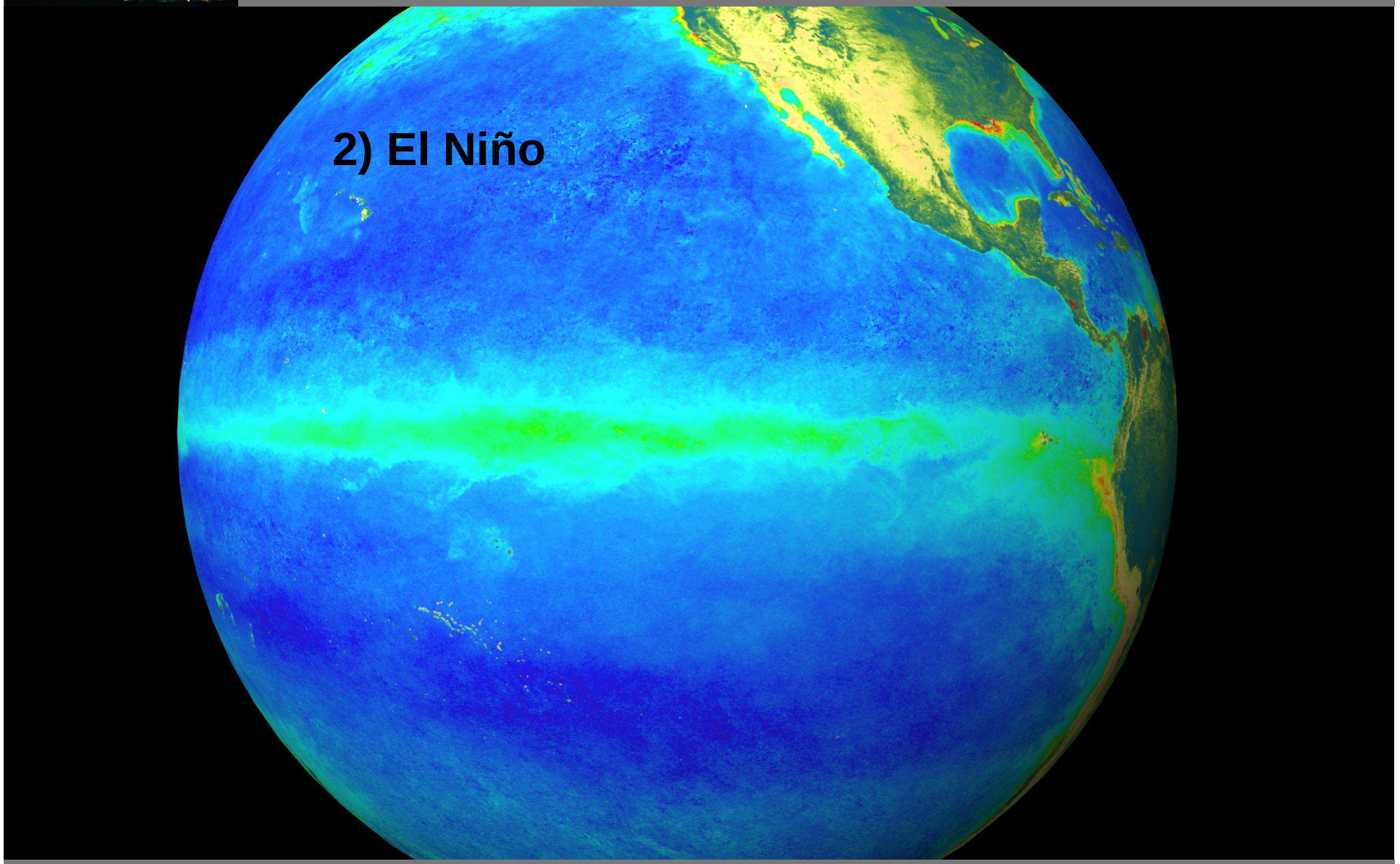
1) The part of the ocean: Increase of sea-level & change of circulation
2) El Nino
3) Melting of the permafrost ground
4) Destroying of rain forests

1) The part of the ocean – changing of global sea circulation



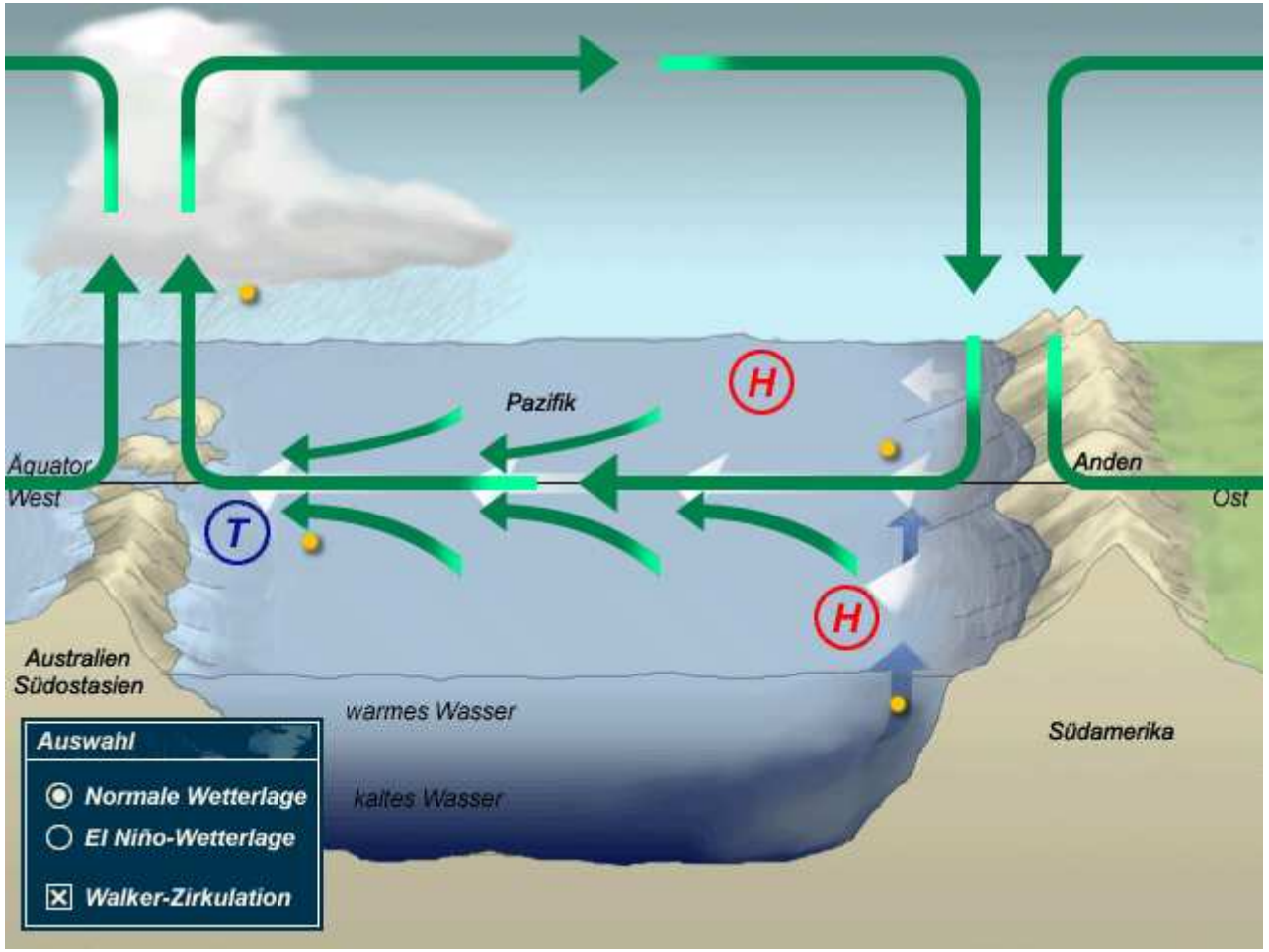


Quelle: Allianz Umweltstiftung



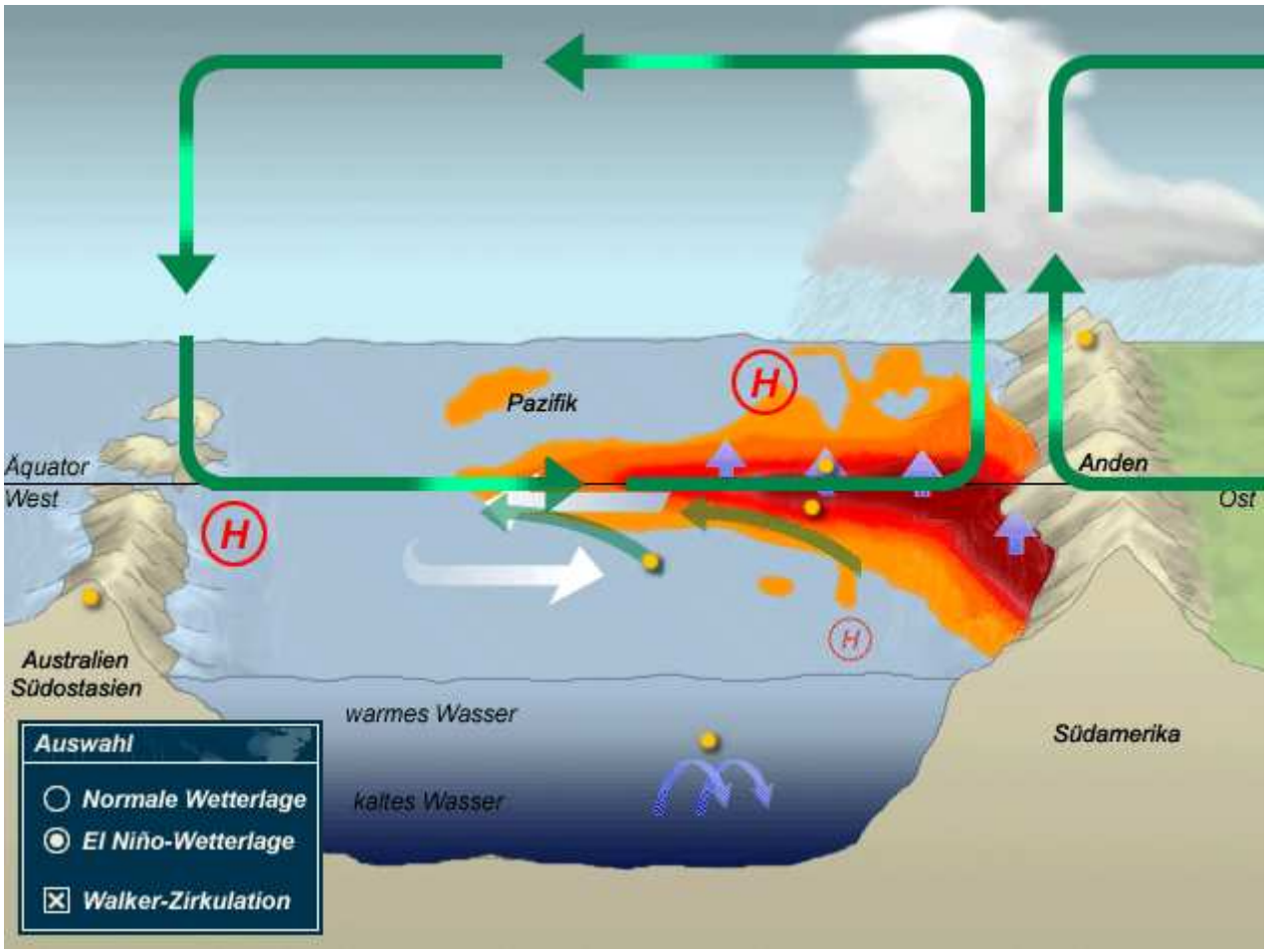
2) El Niño

The normal situation



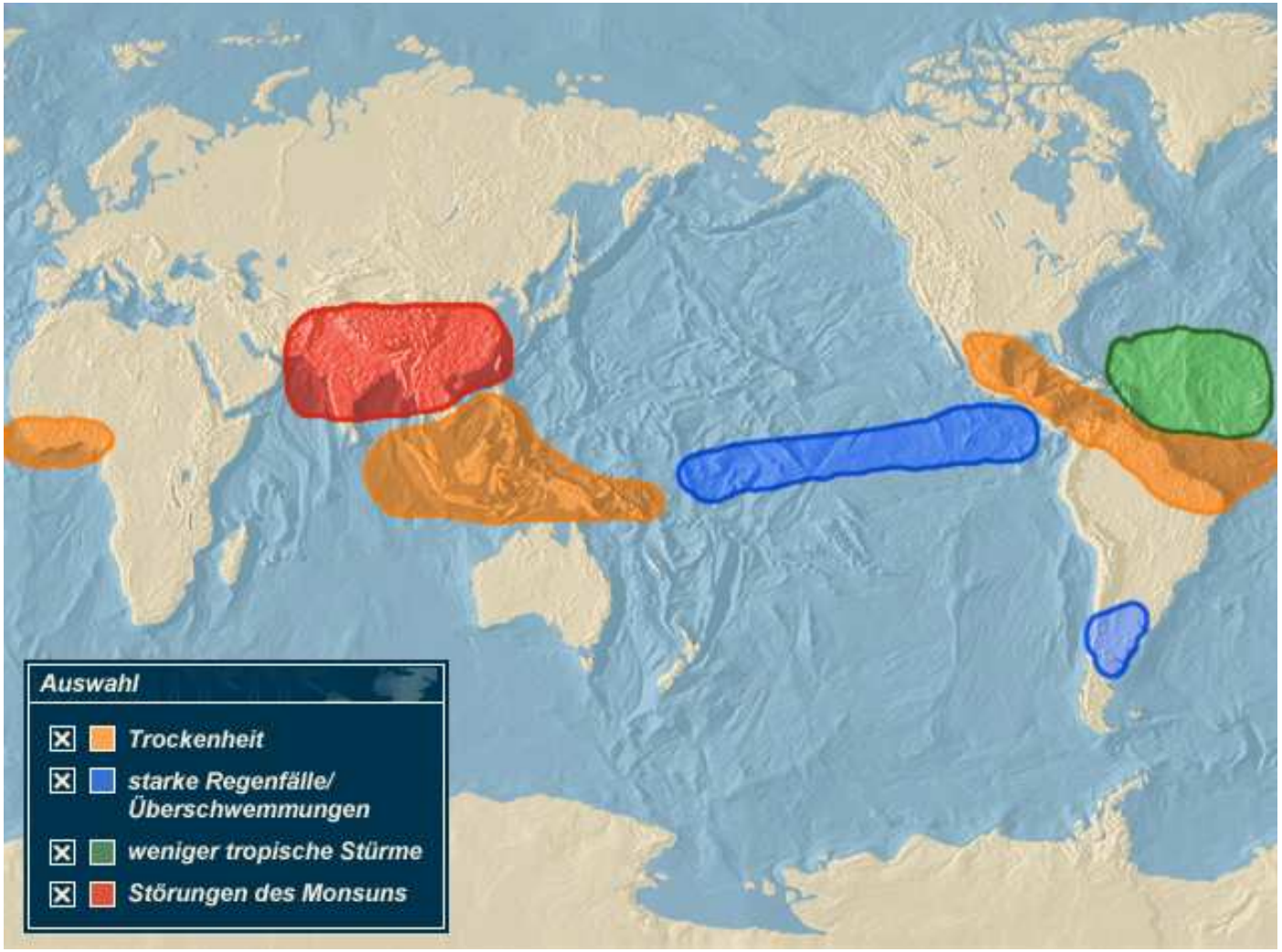
Quelle: Wetter und Klima, Springer Verlag

The phenomen El Niño



Quelle: Wetter und Klima, Springer Verlag

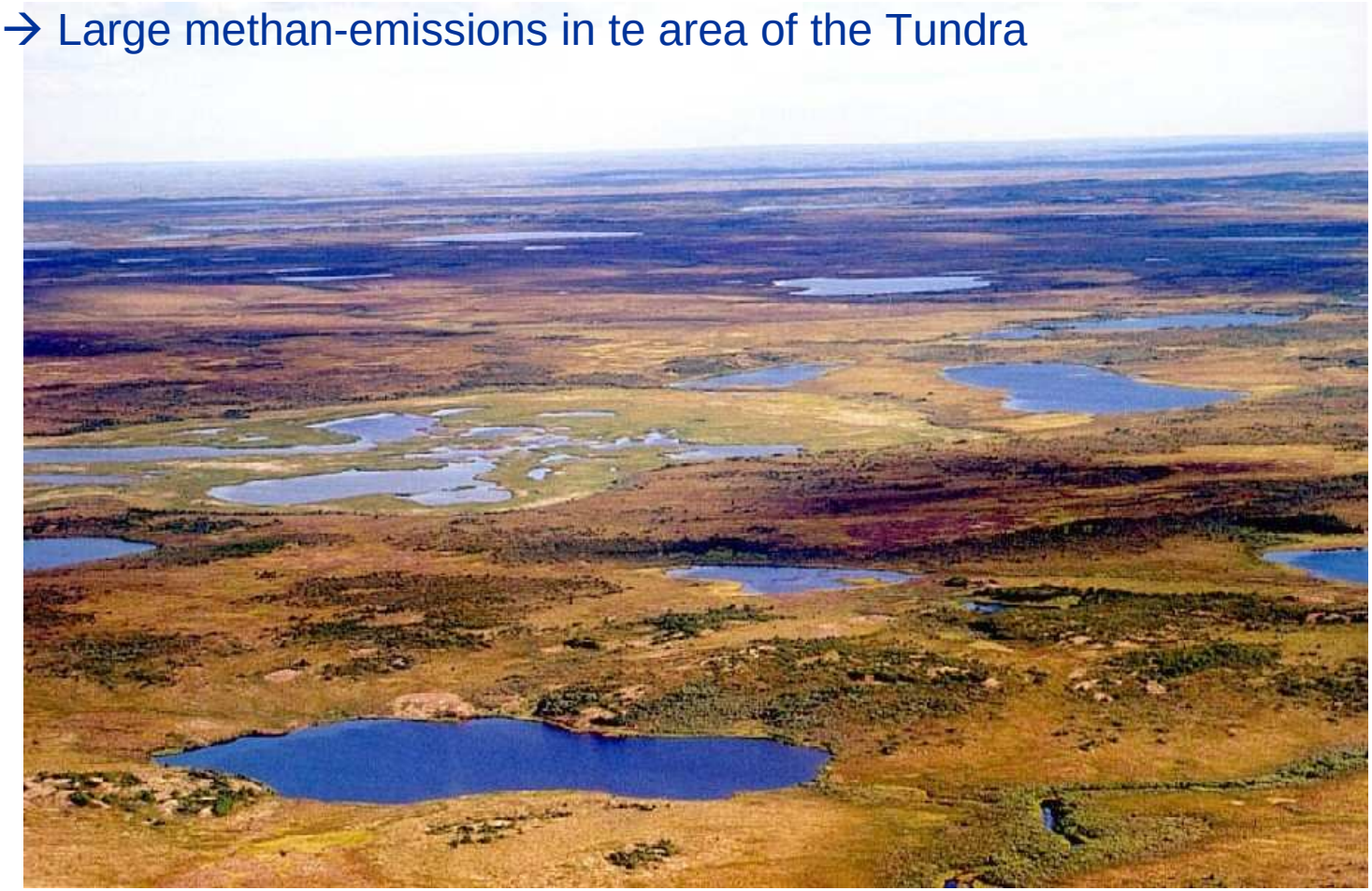
Effect of El Niño – Extreme weather events



Quelle: Wetter und Klima, Springer Verlag

3) Melting of the permafrost

→ Large methan-emissions in te area of the Tundra



Quelle: Wikipedia

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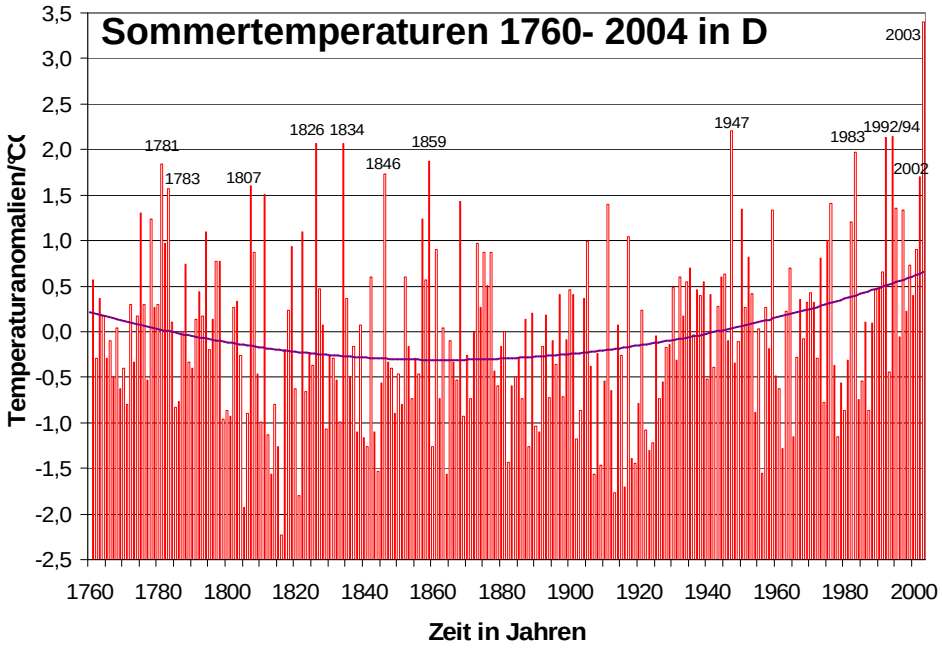
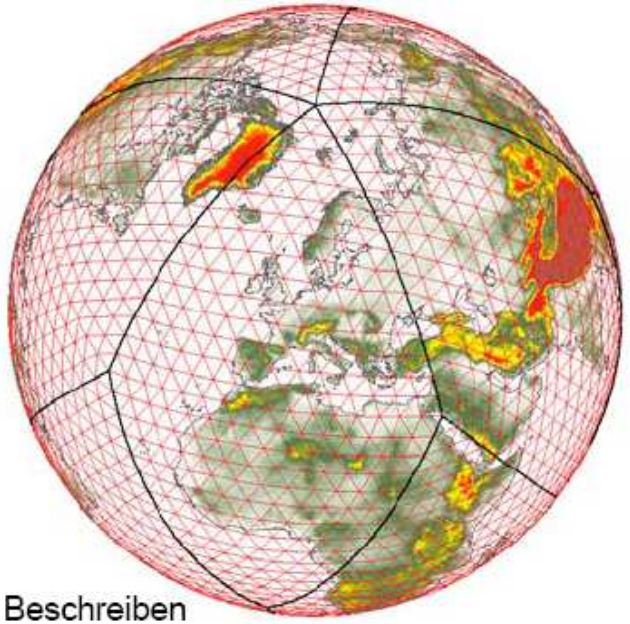
View backwards: Messures



Schönwiese, Trömel und Staeger, 2004

View towards: Modells



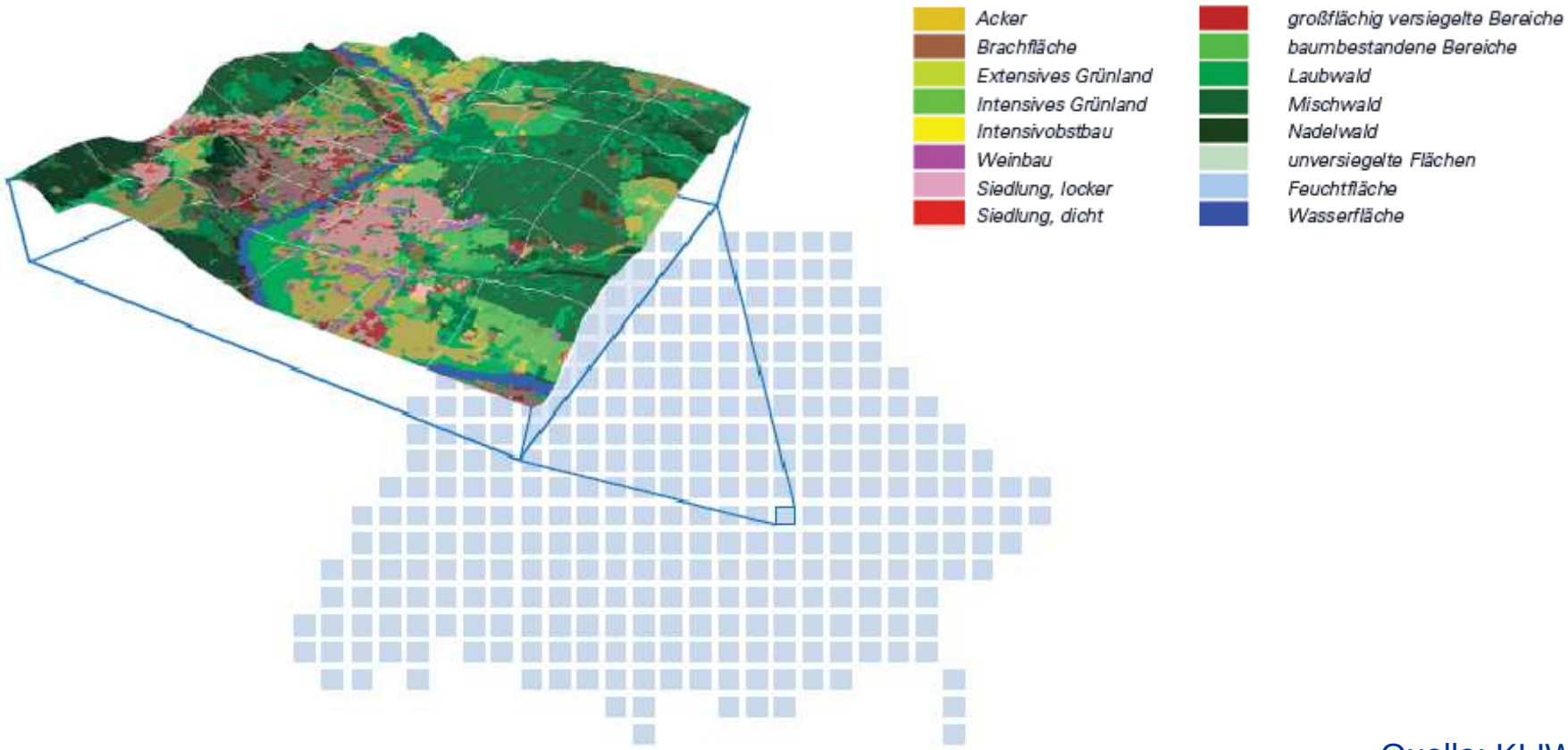
Beschreiben

- Atmosphäre,
- Ozeane, und
- Landoberflächen

auf einem globalen Rechengitter

Modelling of the water budget: Description of the hydrological processes

Water Budget
Precipitation = Evapotranspiration + Discharge + delta storage



Quelle: KLIWA

Action of modelling:

Preprocessing → **Processing** → **Postprocessing**

digitalisation of input-data

formatting of input-data

calculation of necessary input-data

creation of control-file

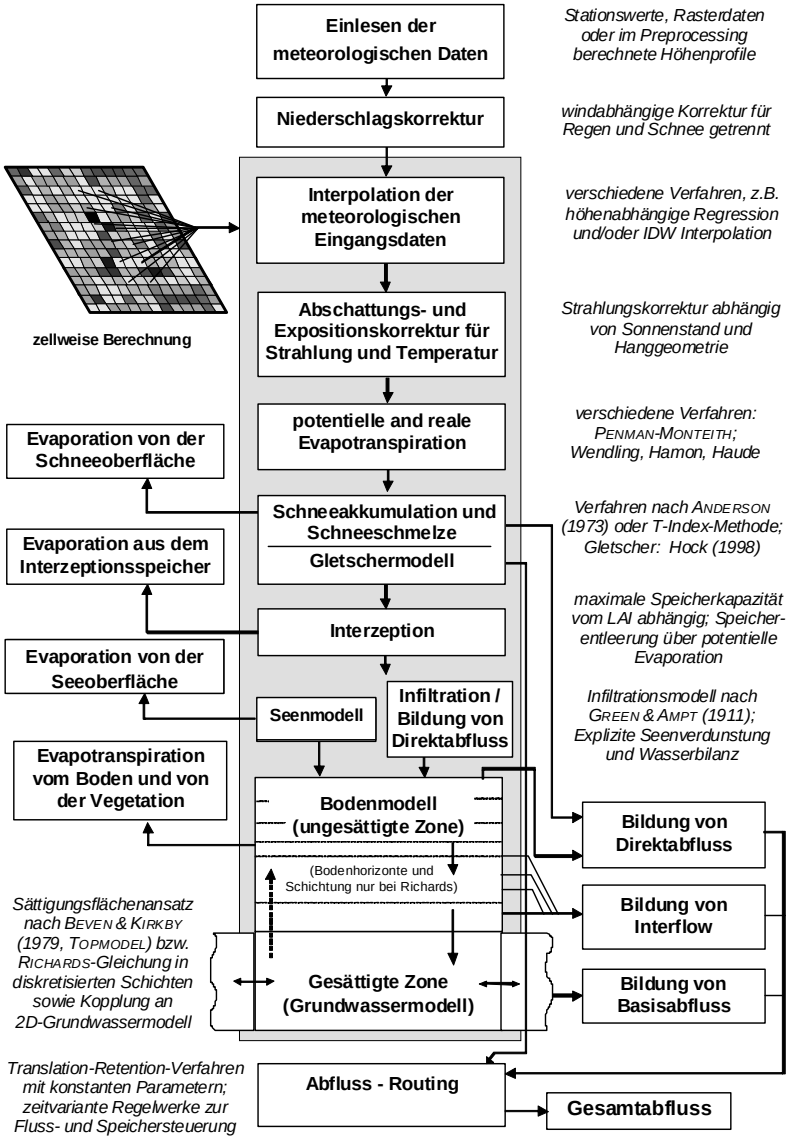
feeding with input-data

calibration

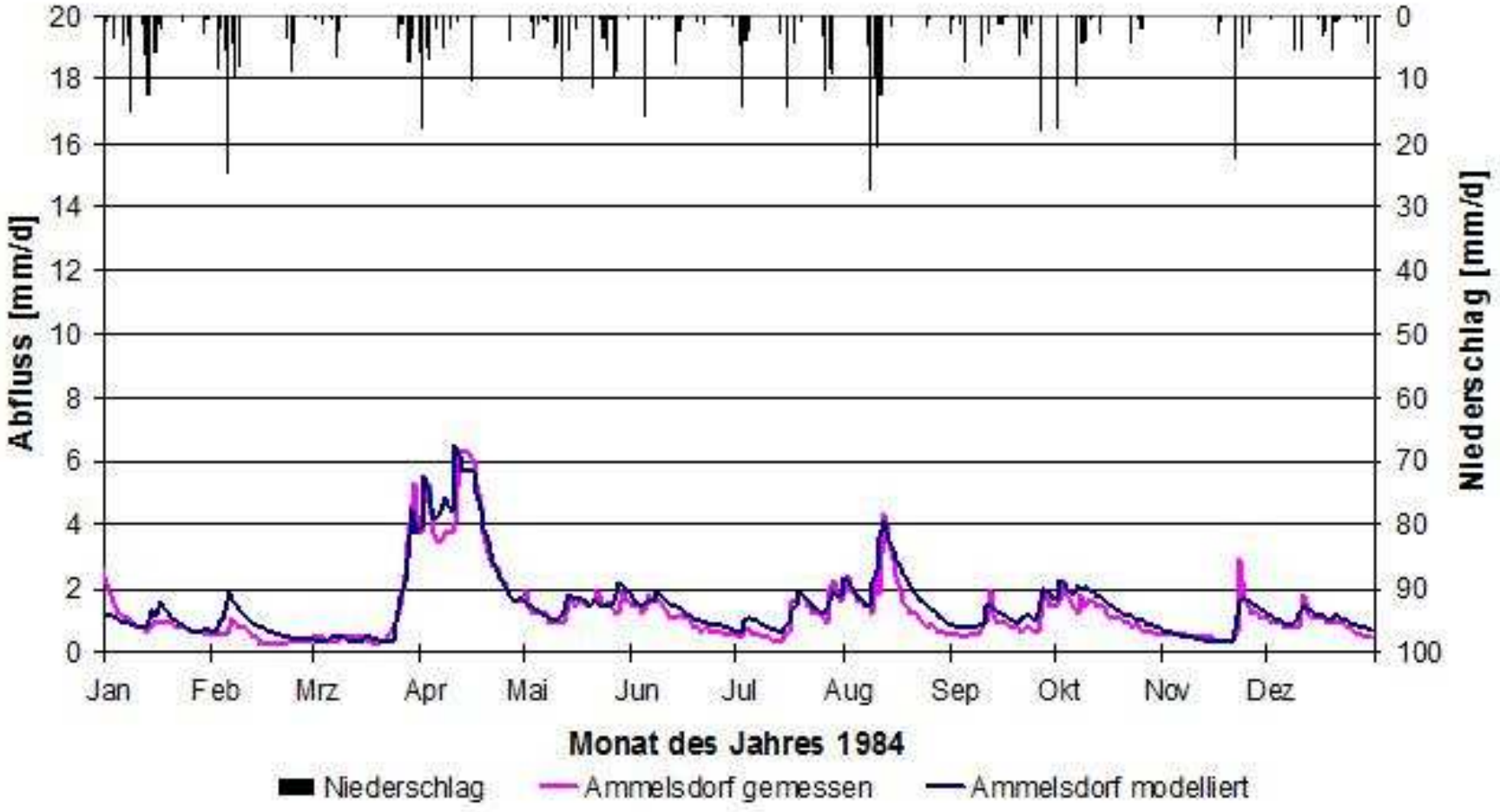
validation

preparation and analysis of results

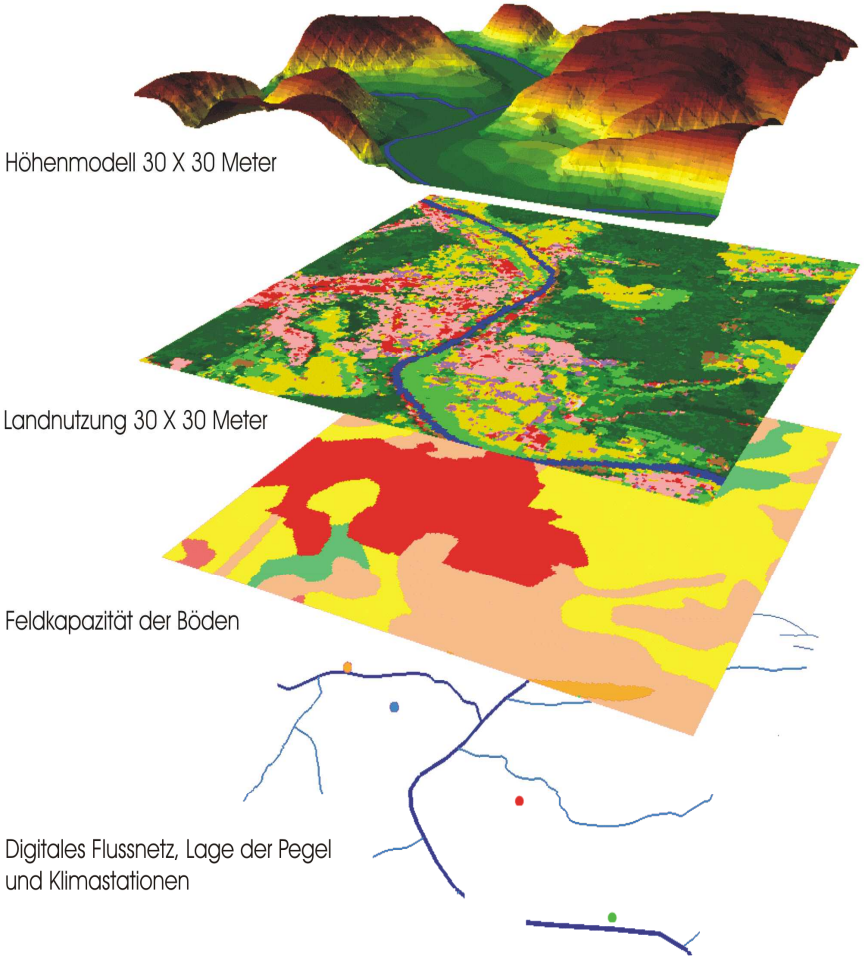
Processes (ASGI-Wasim ETH)



Exemplified results of water-budget-modelling



How can we incorporate climate change?



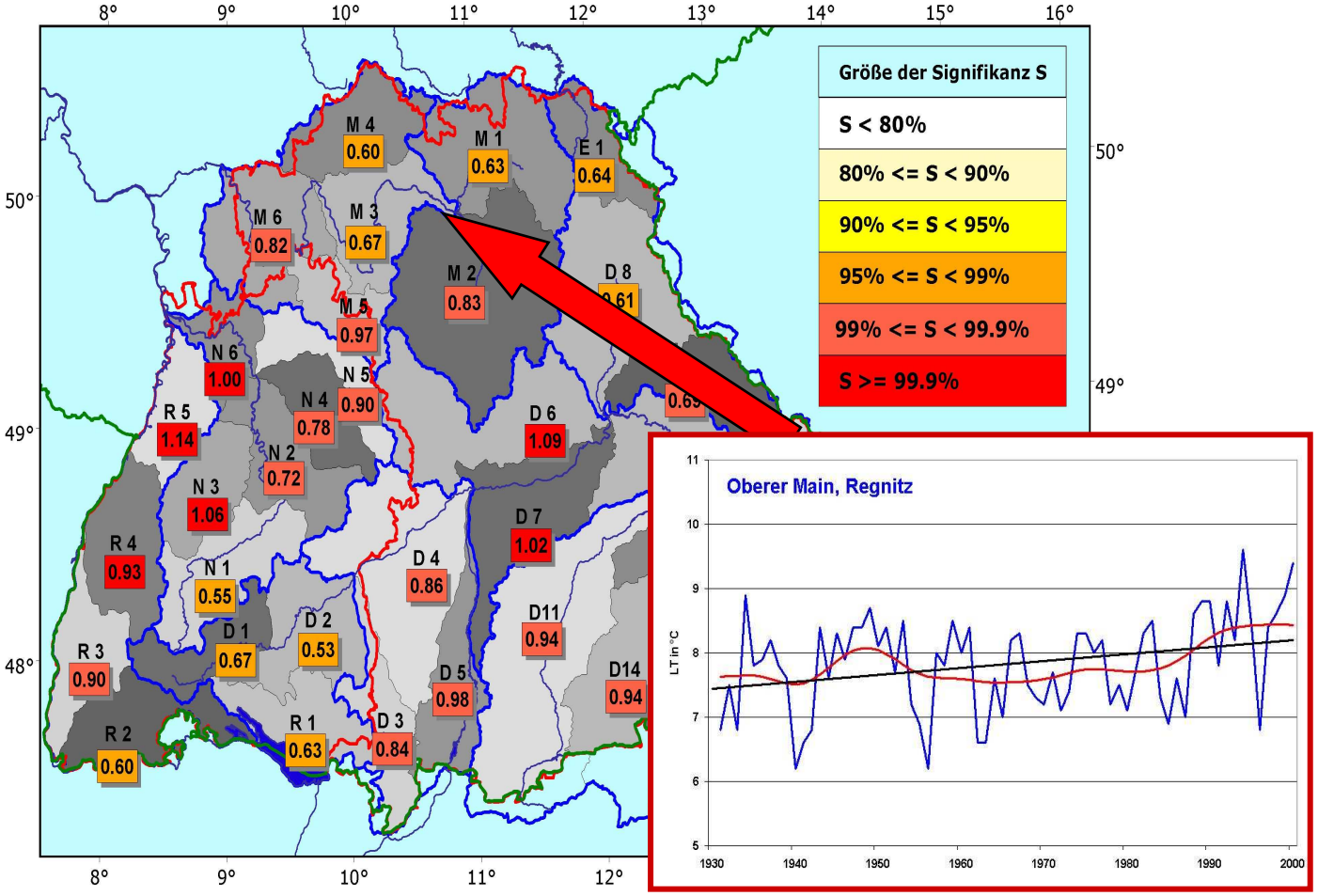
Essential input parameters:

- metereological data (precipitation, temperature, wind, sunshine etc.)
- vegetation / soil ⇔ infiltration
- vegetation ⇔ evapotranspiration
- topography ⇔ discharge formation

Modelling:

- Spatial distribution: 1x1 km
- Temporal distribution: 1 day

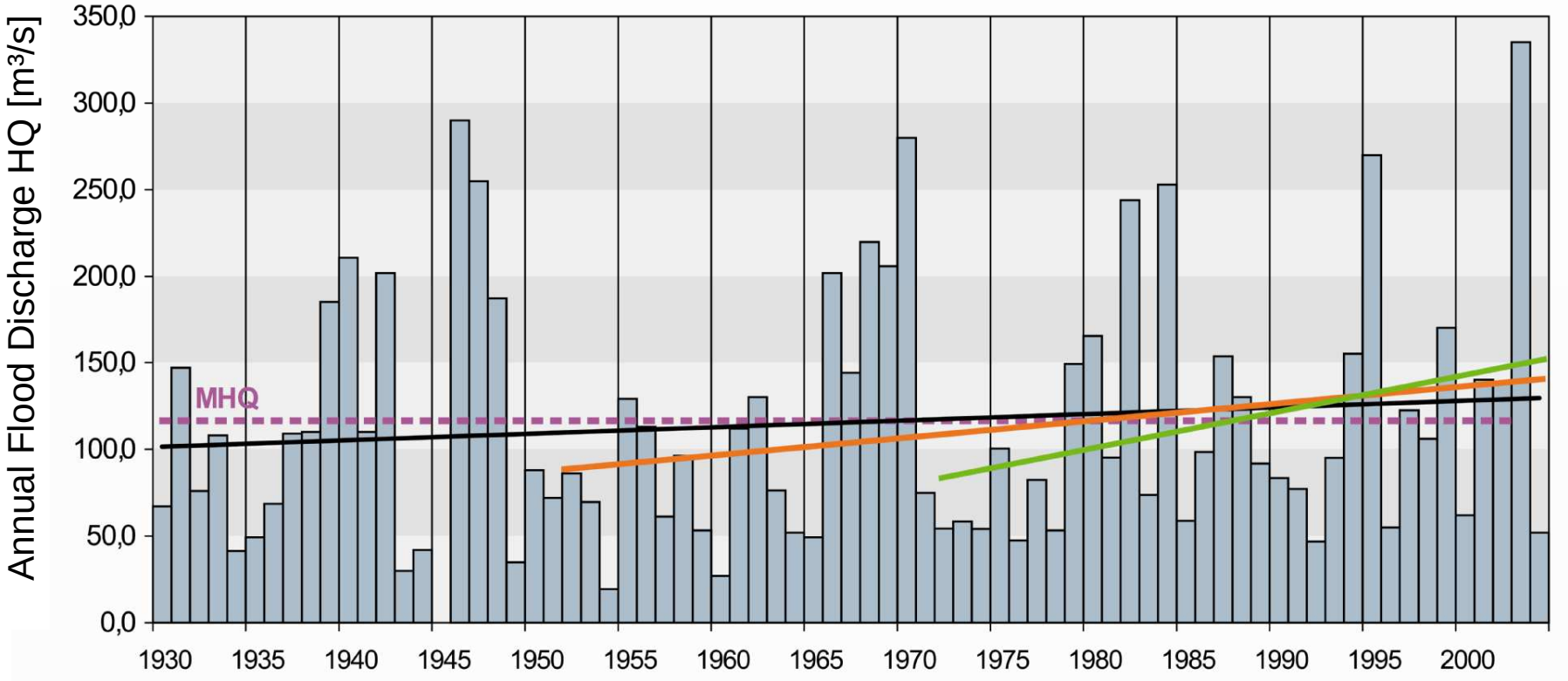
Knowing what happend – analysis of trends



: Absolut trend [℃] of air temperature, 1931 bis 200 0

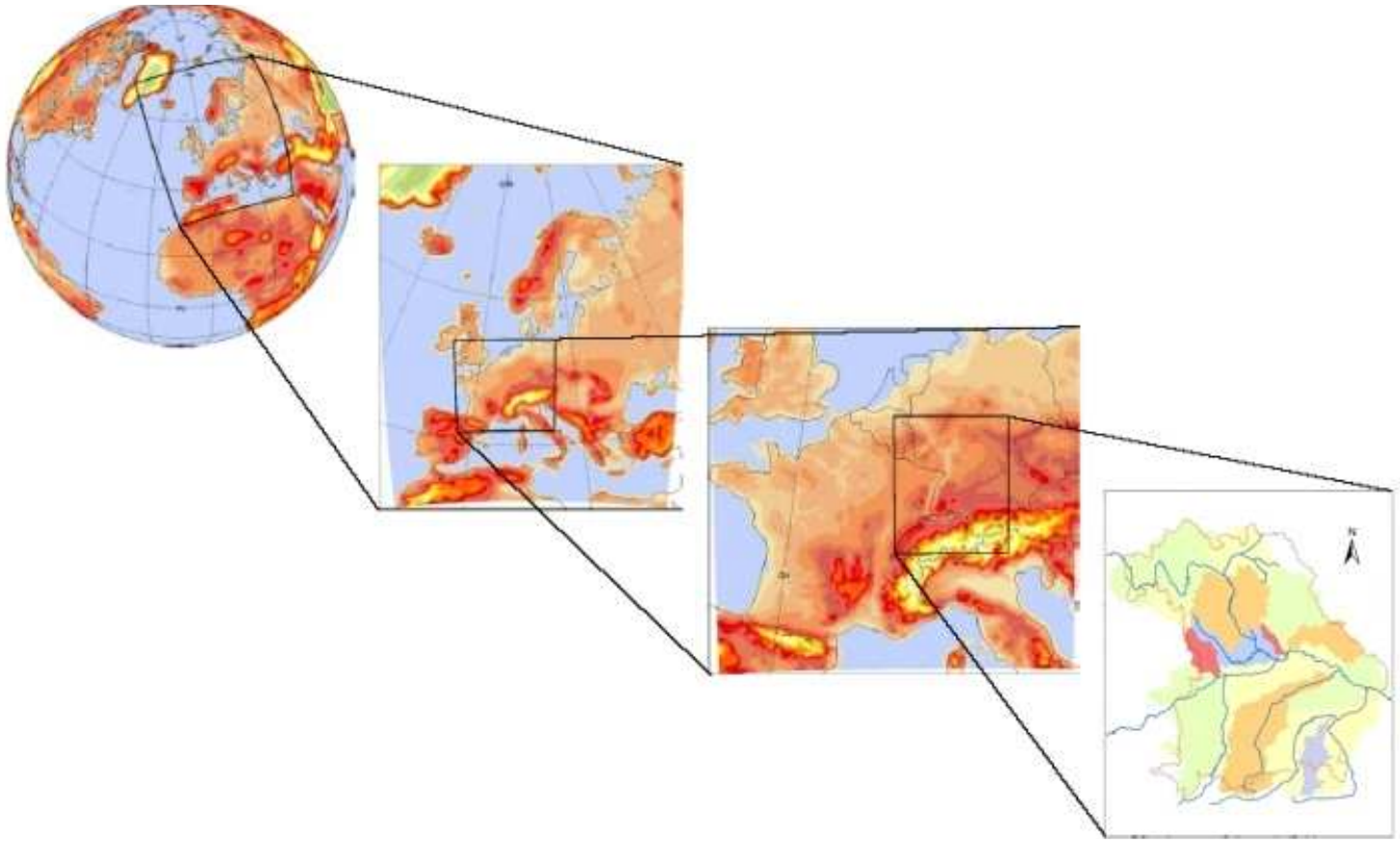
Knowing what happend – analysis of trends

Trend analysis of flood discharges in the past at gauge Bad Kissingen: change of the average annual flood discharge (MHQ m³/s), 1931-2005



Quelle: Universität Karlsruhe, Institut für Wasser und Gewässerentwicklung

Looking forward: forecasting by models – the model chain



nach Kleinn et al.
ETH Zürich

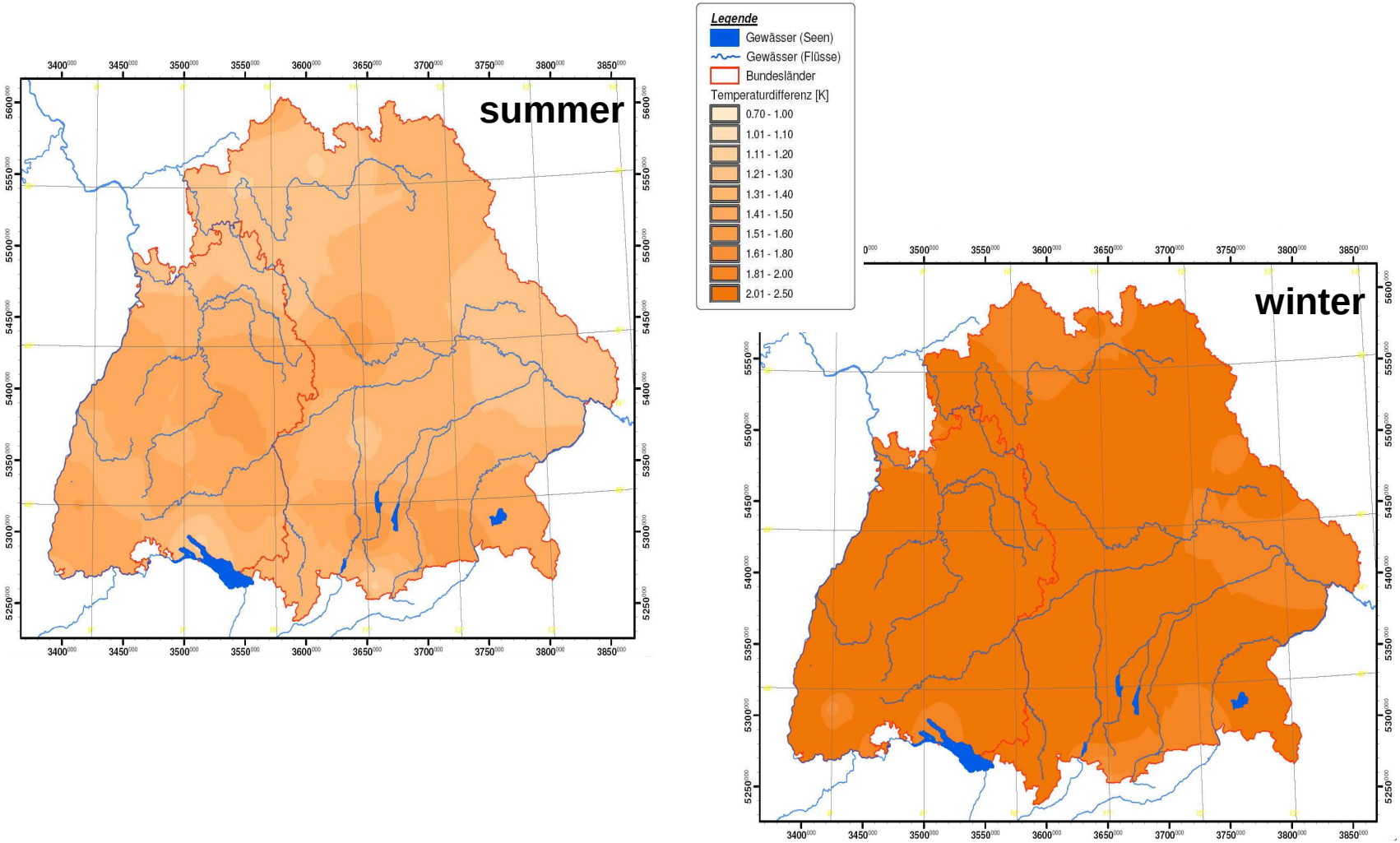
Global Climate model
120 km raster

Regional Climate Model
56 km raster

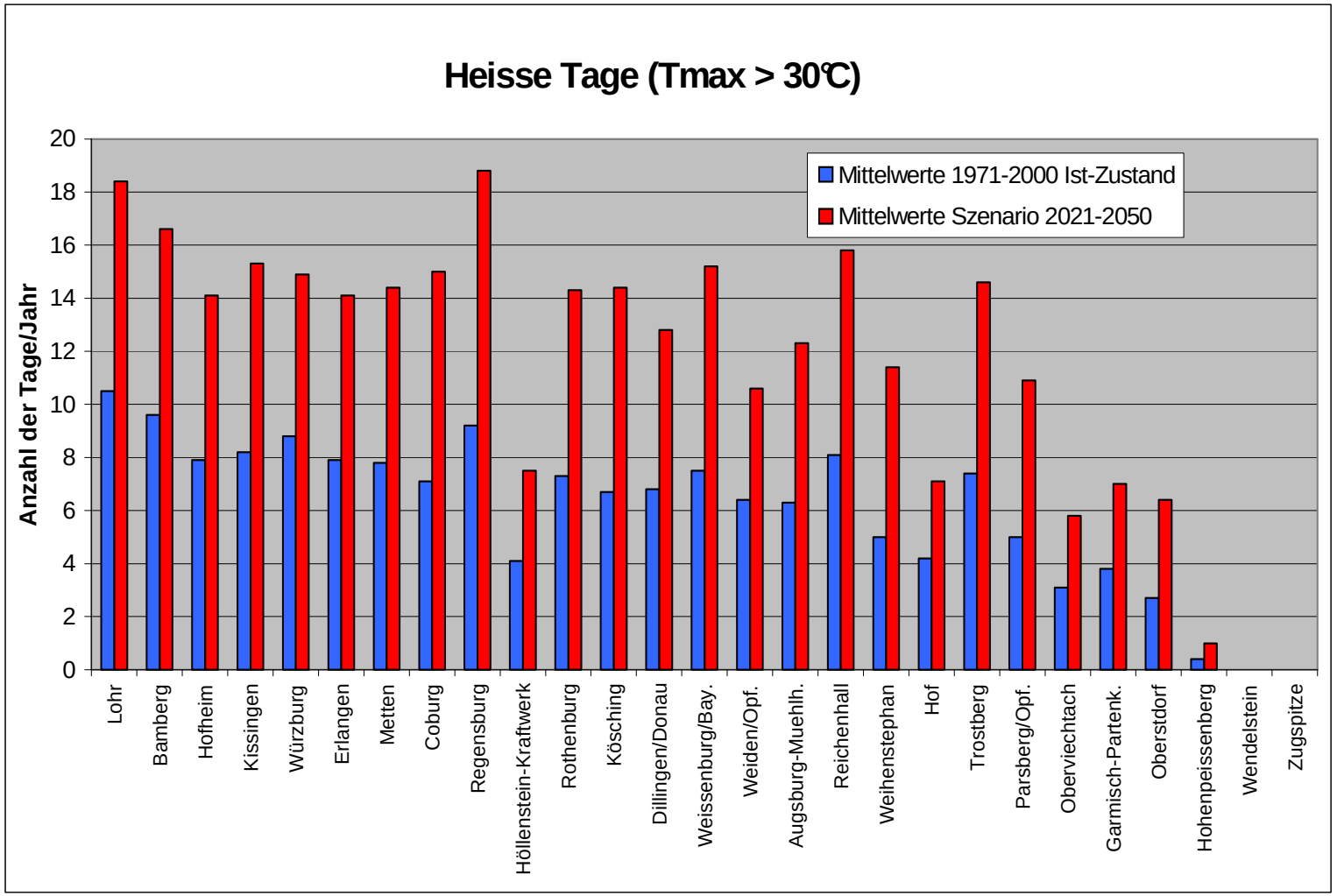
Regional Climate Model
14 km raster

Water balance model
(WaSiM-ETH, 1 km raster)

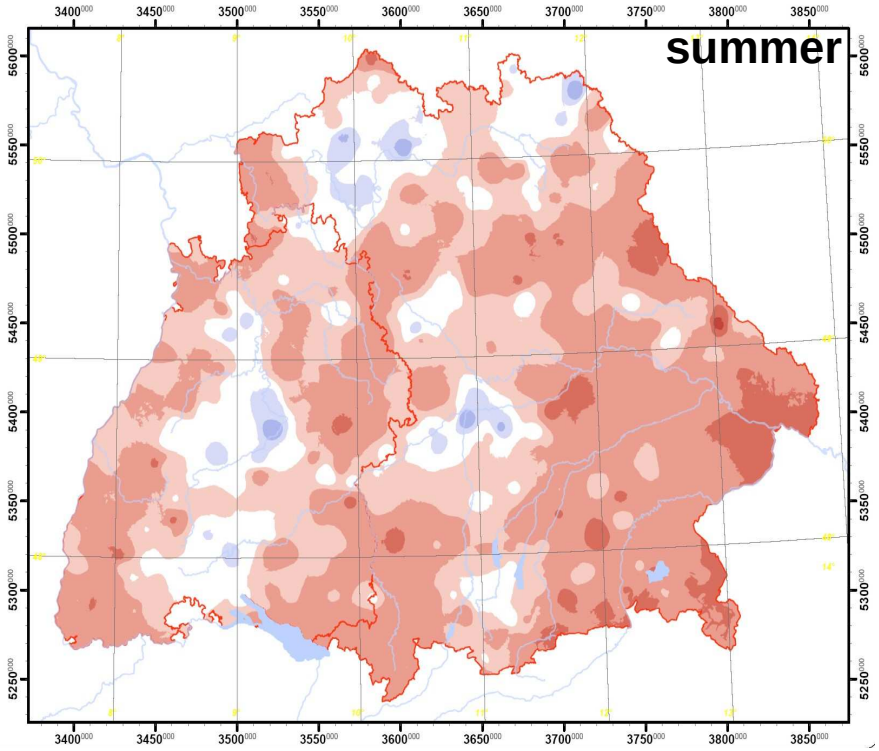
Forecasting what will happen: Change of temperature (2021-2050)

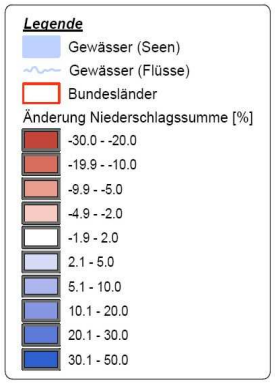


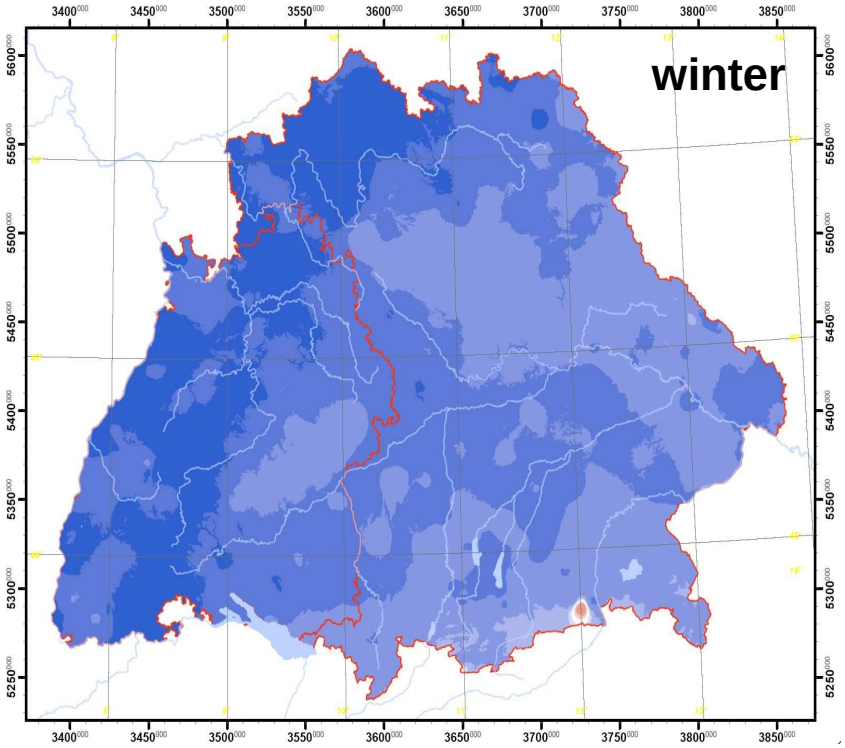
Number of days with temperatures higher than 30℃ (2021-2 050)



Change of precipitation (2021-2050)

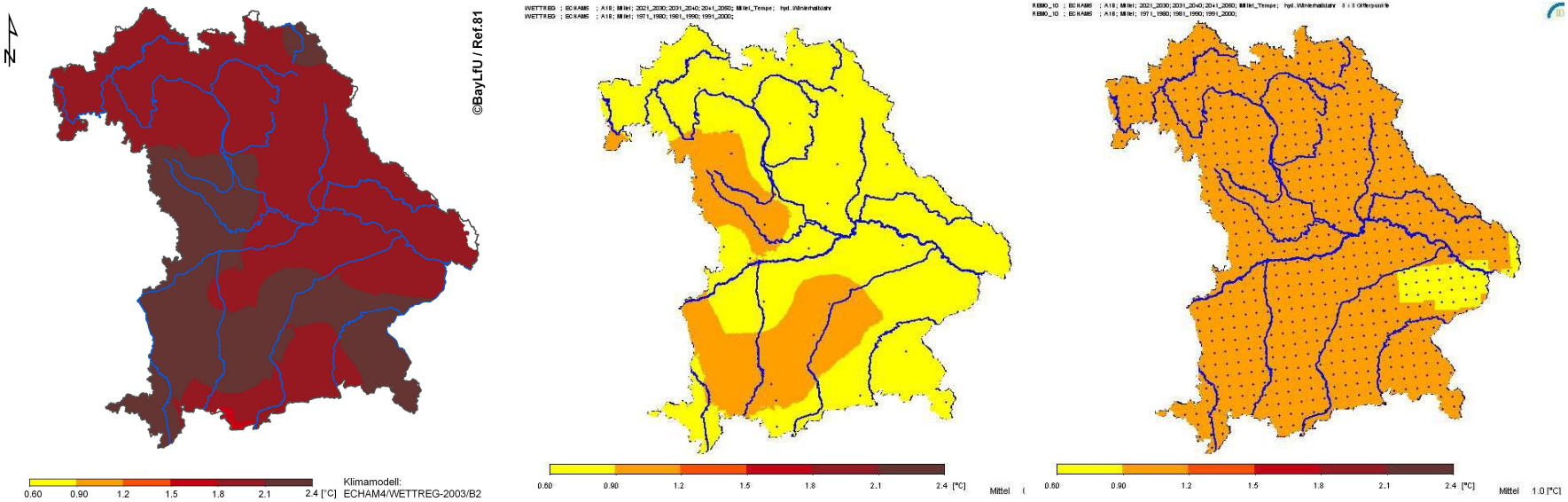






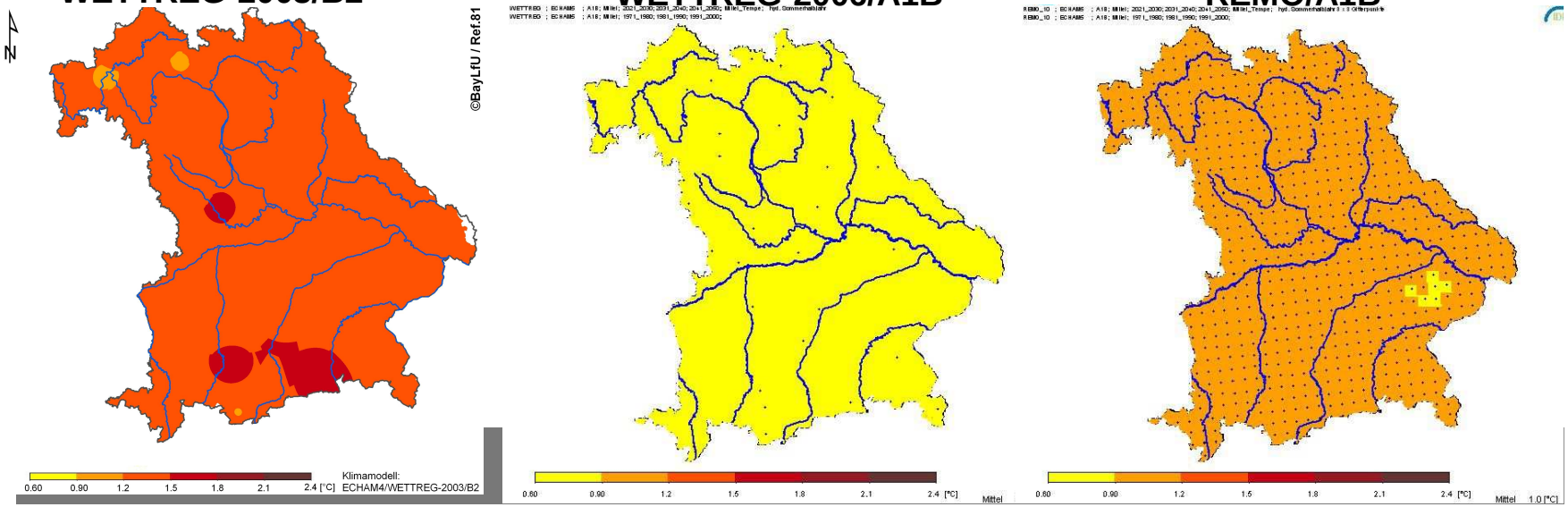
Change of temperature, 2021-2050 vs. 1971-2000, different regional climate projections

hydrological winter half year



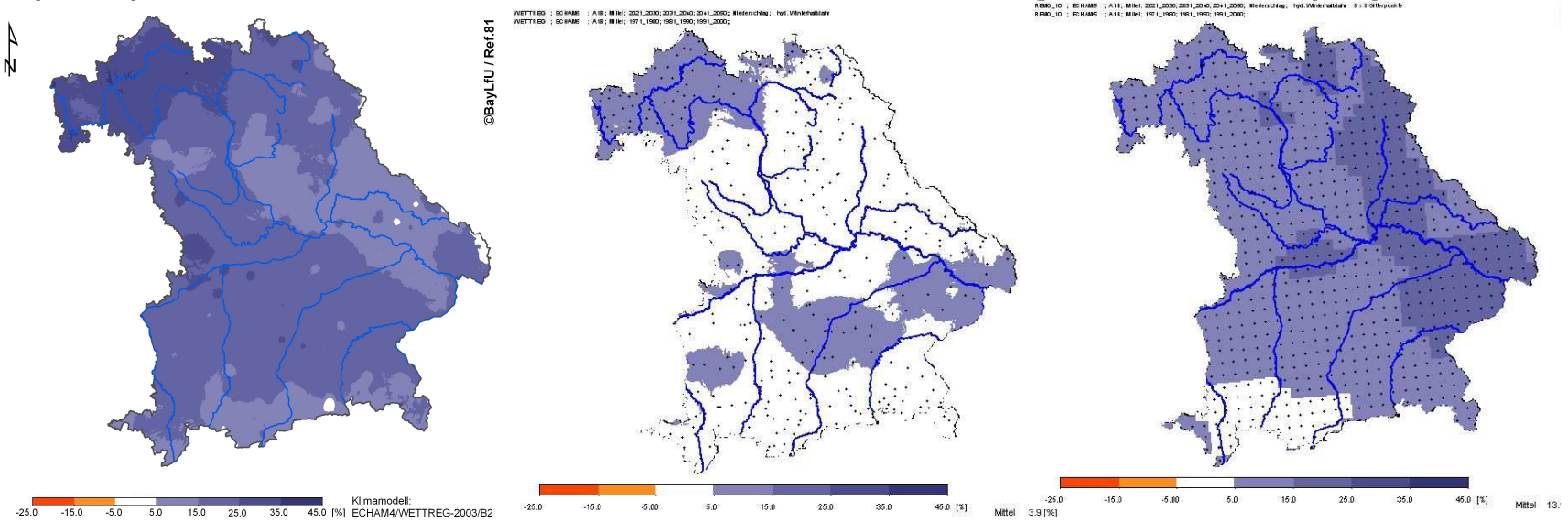
hydrological summer half year

WETTREG-2003/B2 **WETTREG-2006/A1B** **REMO/A1B**



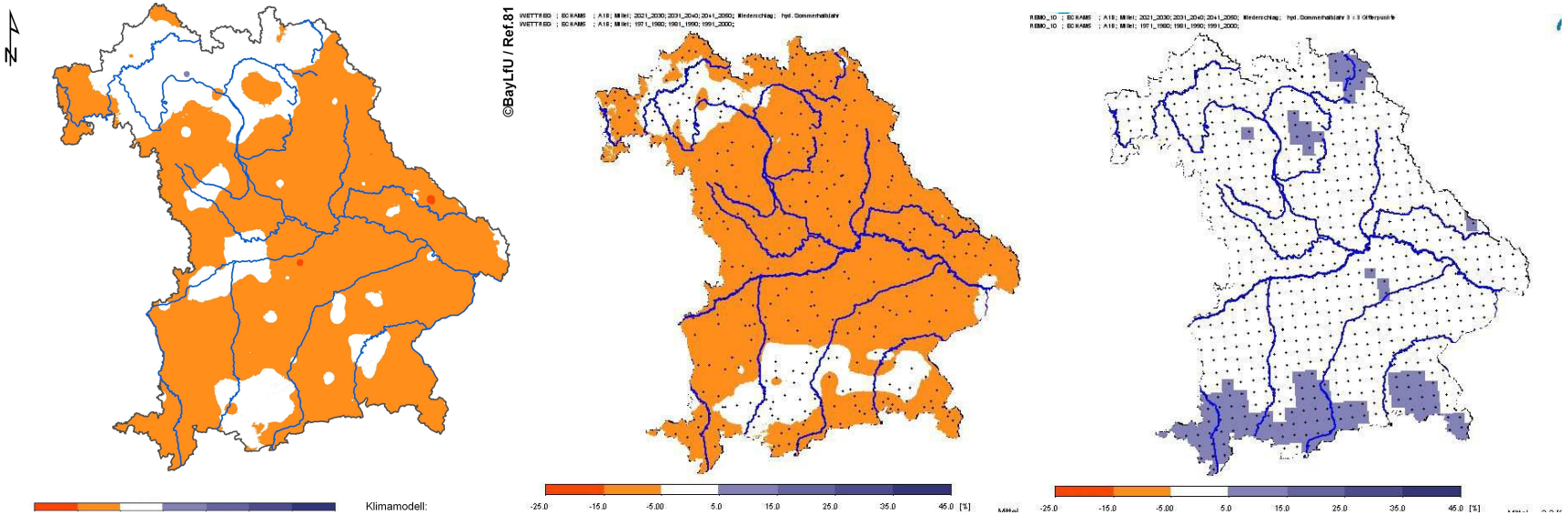
Change of precipitation, 2021-2050 vs. 1971-2000, different regional climate projections

hydrological winter half year

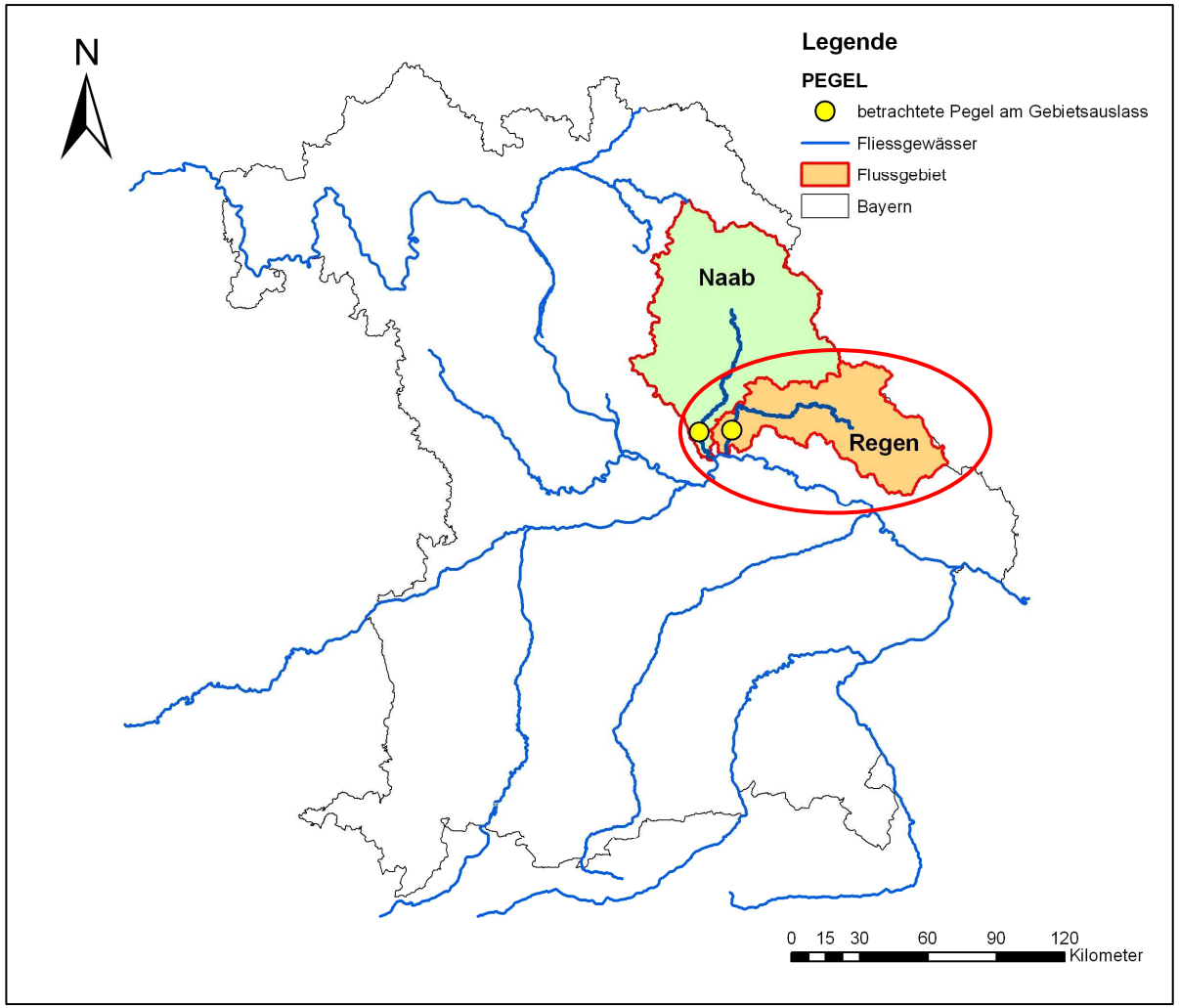


WETTREG-2003/B2 **WETTREG-2006/A1B** **REMO/A1B**

hydrological summer half year



Exemplary results for water balance modeling

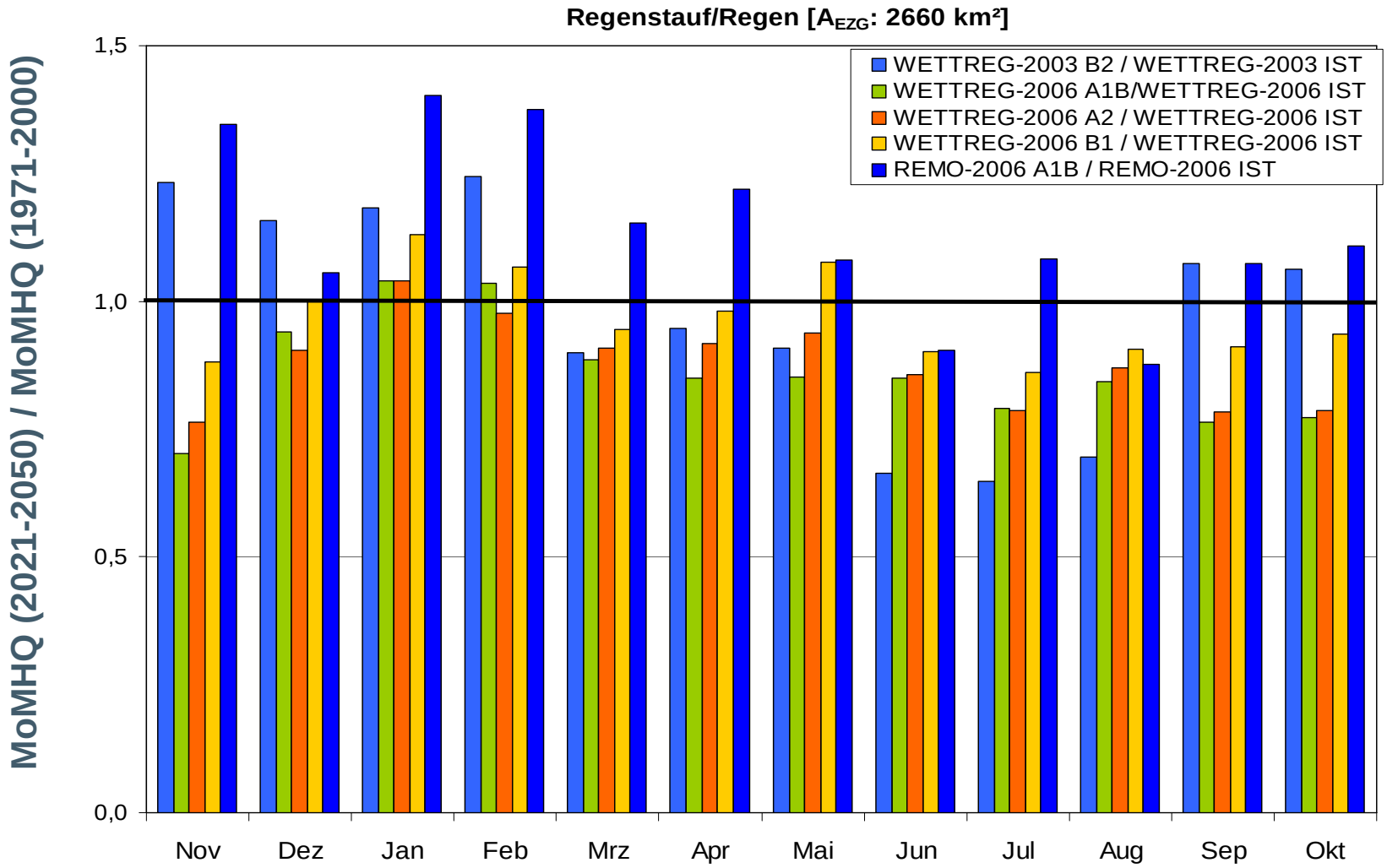


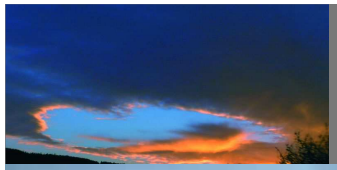
catchment area:
Naab ca. 5400 km²
Regen ca. 2600 km²

climate regionale projections
WETTREG-2003/B2
(GCM ECHAM4)

WETTREG-2006/A1B, A2, B1
REMO-2006/A1B
(GCM ECHAM5)

Change of annual mean monthly maximum discharges (2021-2050 vs. 1971-2000)





Climate Change and impacts

Impacts on important parameters:

- Temperature (average and extreme values)
- Precipitation (distribution, intensity)
- atmospheric conditions (radiation, storms, droughts)

Impacts on:

- discharge and water budget
- ecosystems
- grounds, landuse and forestry
- natural hazards
- social and economic aspects

Impacts on the water budget and extreme events

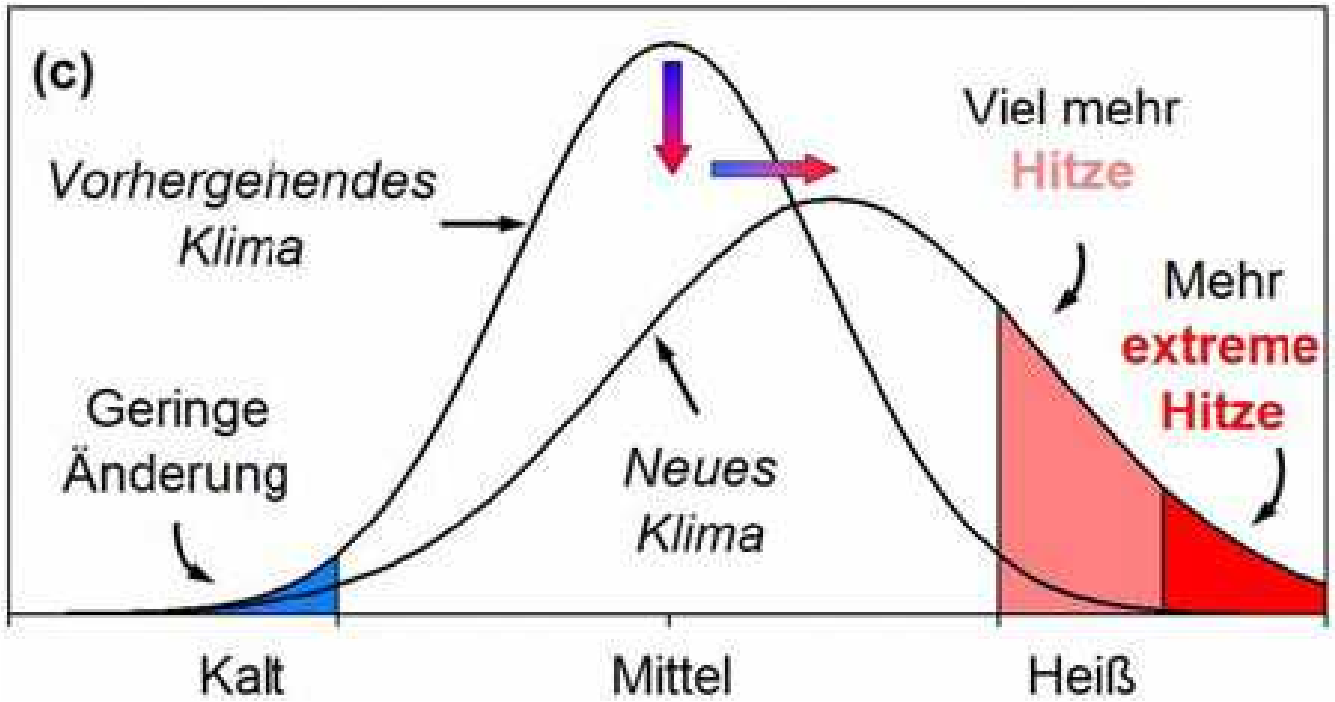
Aralsee nahe Muniak (Karalpakstan)

Above:
Flood in 08/2002

Below:
River Danube in 08/2003

→ More frequent drought & flood events

And why?
: Disproportionality high increase of extreme events due to a increase of the average



… and other areas (1): Natural Hazards

→ Accumulation of natural hazards in vulnerable areas - samples

… and other areas (2): Tourism

Nescessarity to have adapted and new concepts:

- Changes in the duration of bath season
  → Impacts on the water quality
- Changes in peregrine tourism
- Changes of flows of traffic

+ global warming!

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  - Forecasting what will happen – climate szenario calculation
  - Consequences on water-related issues
- **Local View: Case Study Fränkische Saale (project ESPACE)**

The local few: Case Study "Fränkische Saale" - Aims

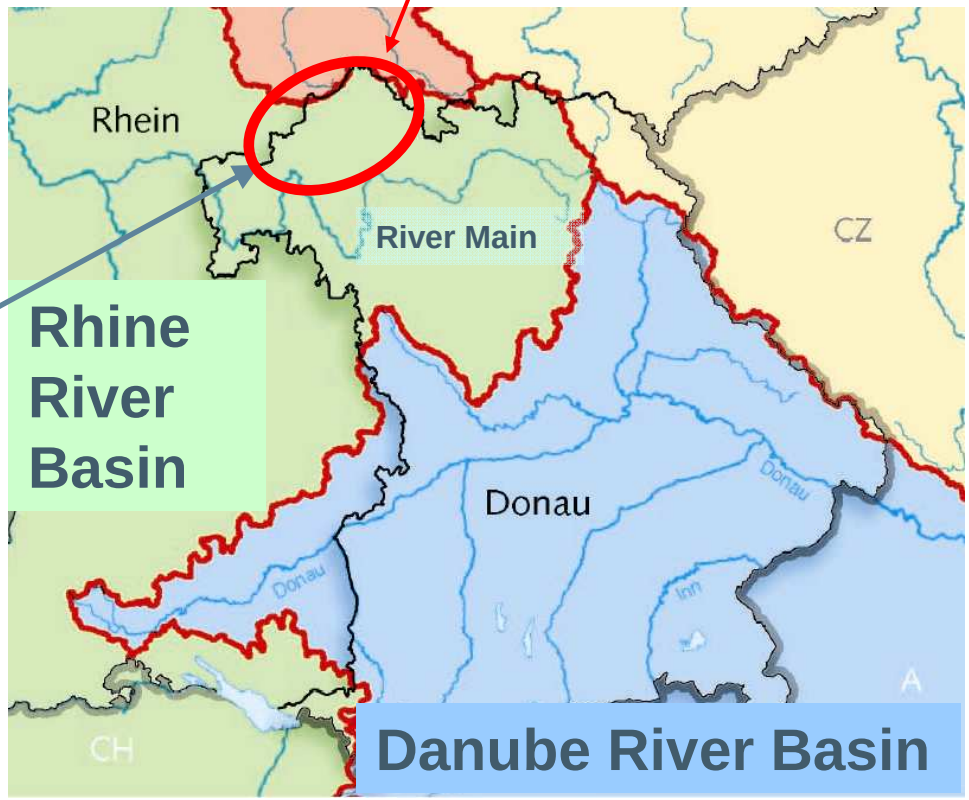
- How can the effects of climate change on flood events be assessed and quantified?
  → physical impact: Climate change induced impacts on flood areas and depths
  → economic impact: Climate change induced impacts on damage potentials
  → social impact: Public awareness concerning climate change and floods

- And how to adapt to these changes in future?

- How to switch from cure to prevention in the field of flood protection and spatial planning?

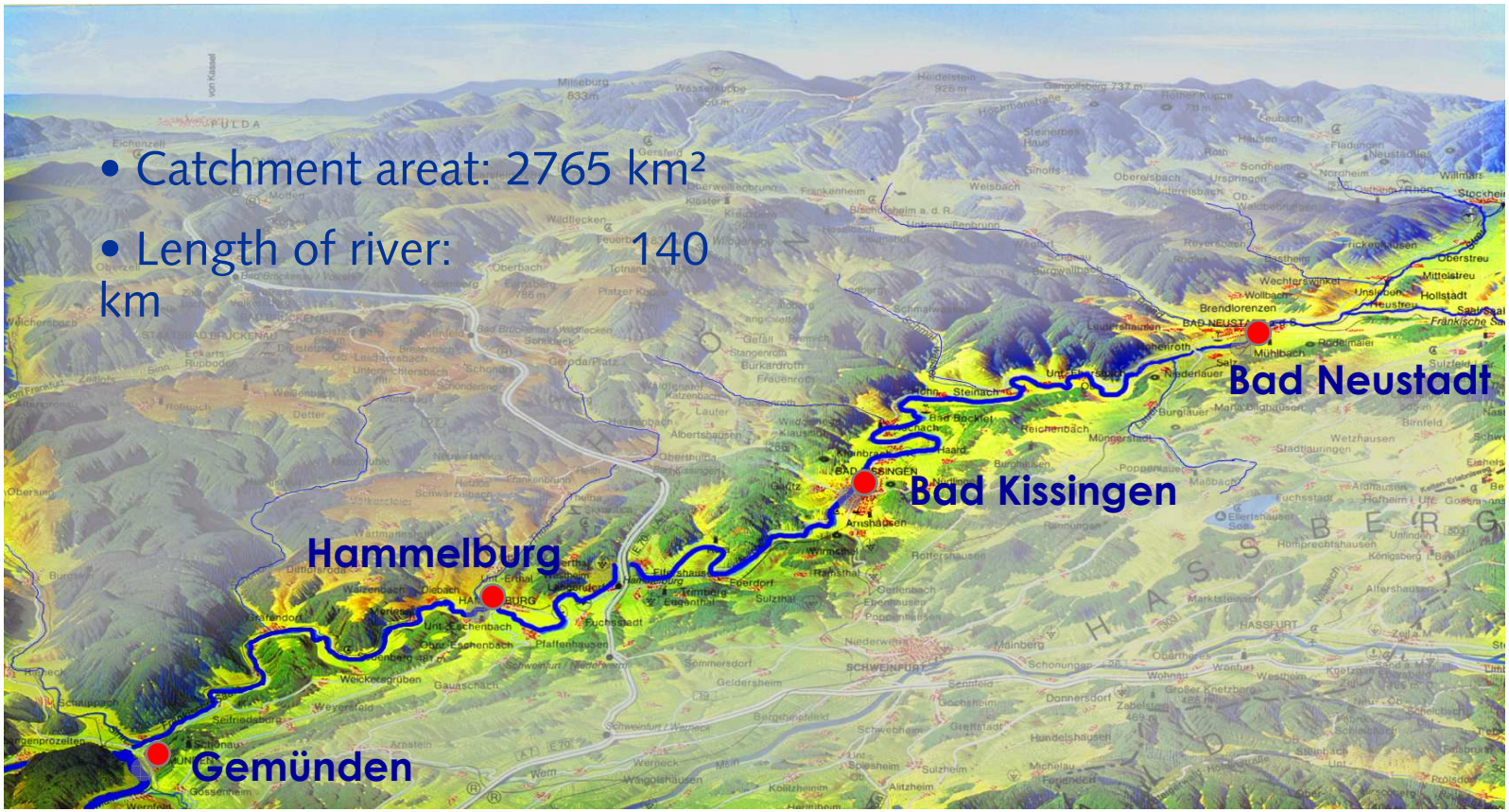
Where is the case-study area Fränkische Saale?

Case Study Area Fränkische Saale



Why the area of the Fränkische Saale?

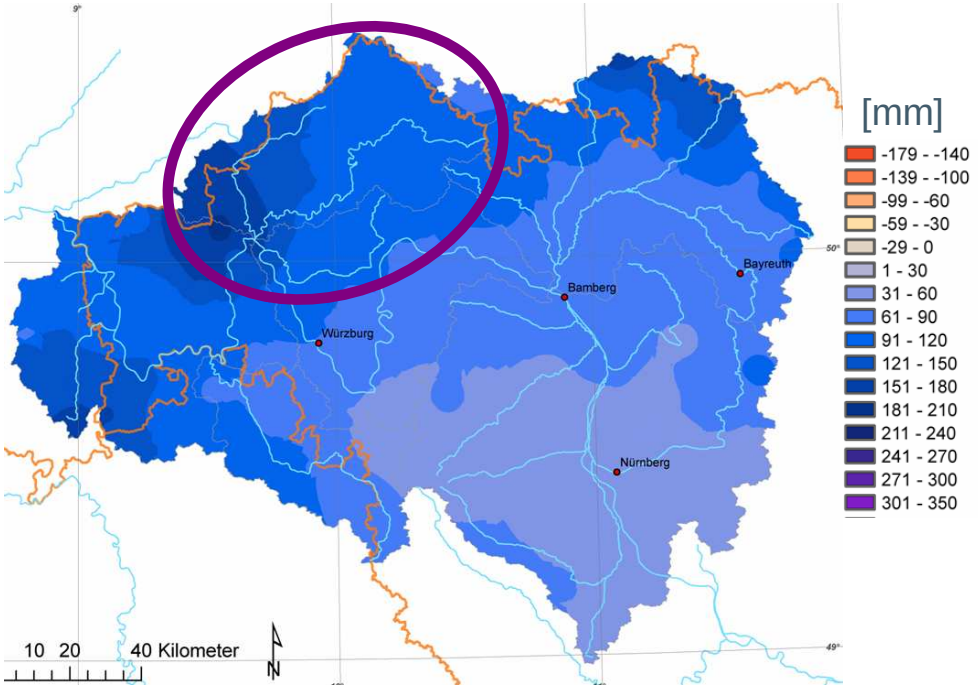
Area that experienced severe flooding in 2003 and 2006
→ Intensified effort to protect against the effects of extreme floods.



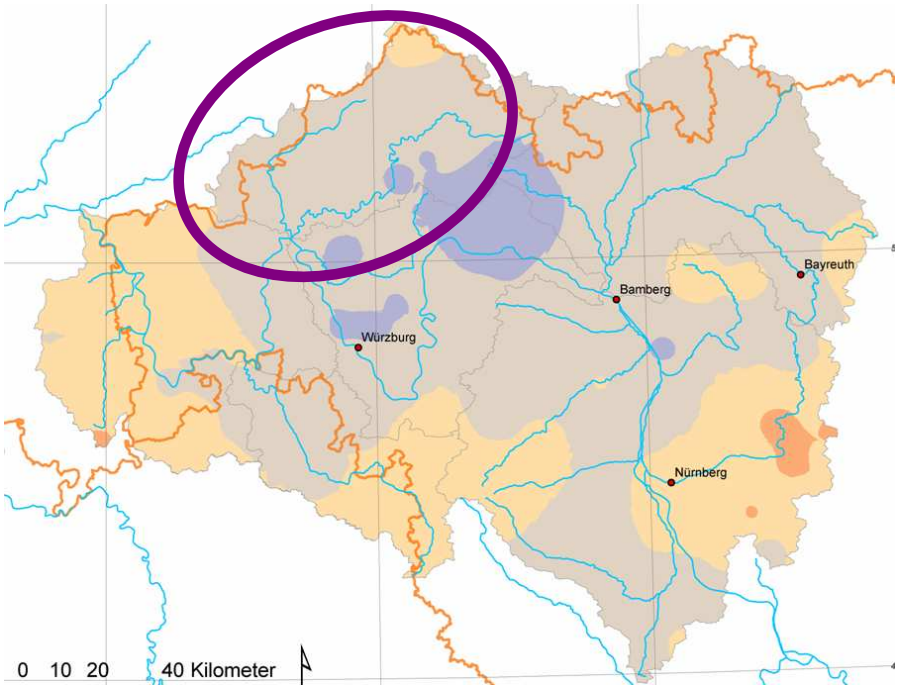
Differences in the amount of precipitation : Future scenario (2021-2050) vs. the "status quo" (1971 – 1990)

(Catchment Area of the River Main)

Winter half-year

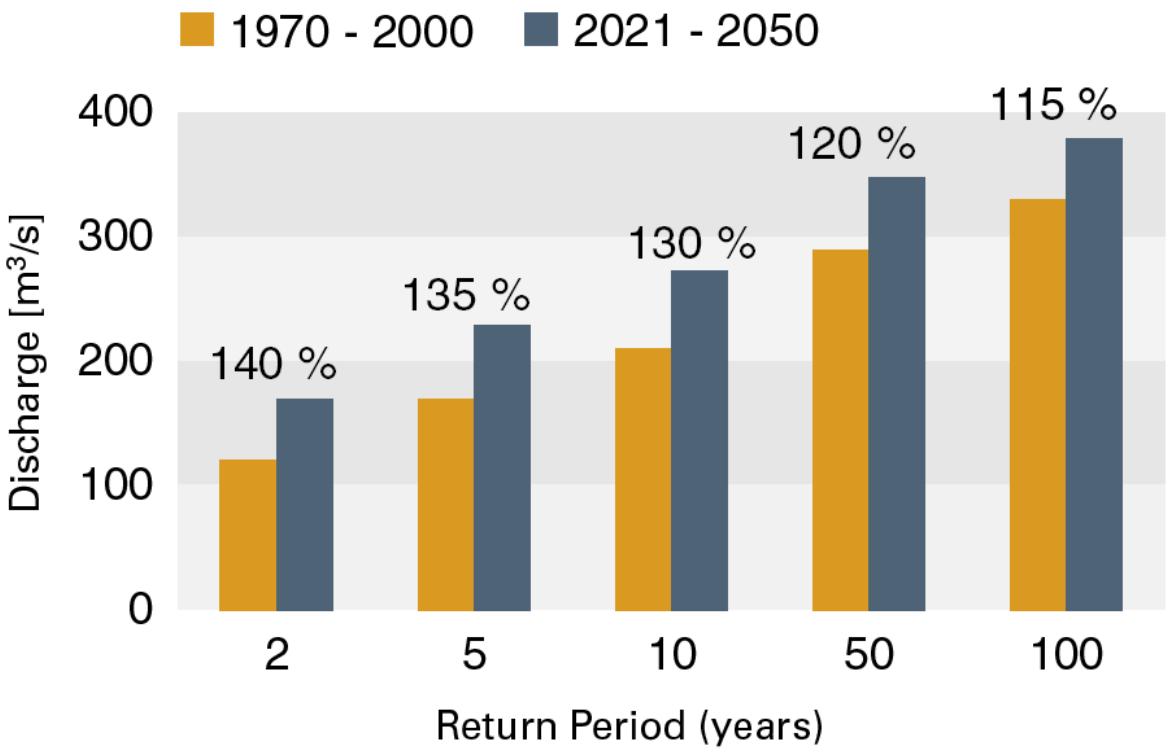


Summer half-year



Modelling what will happen

Physical impacts: Changes in the discharge for flood events with different return periods due to climate change (town of Bad Kissingen)

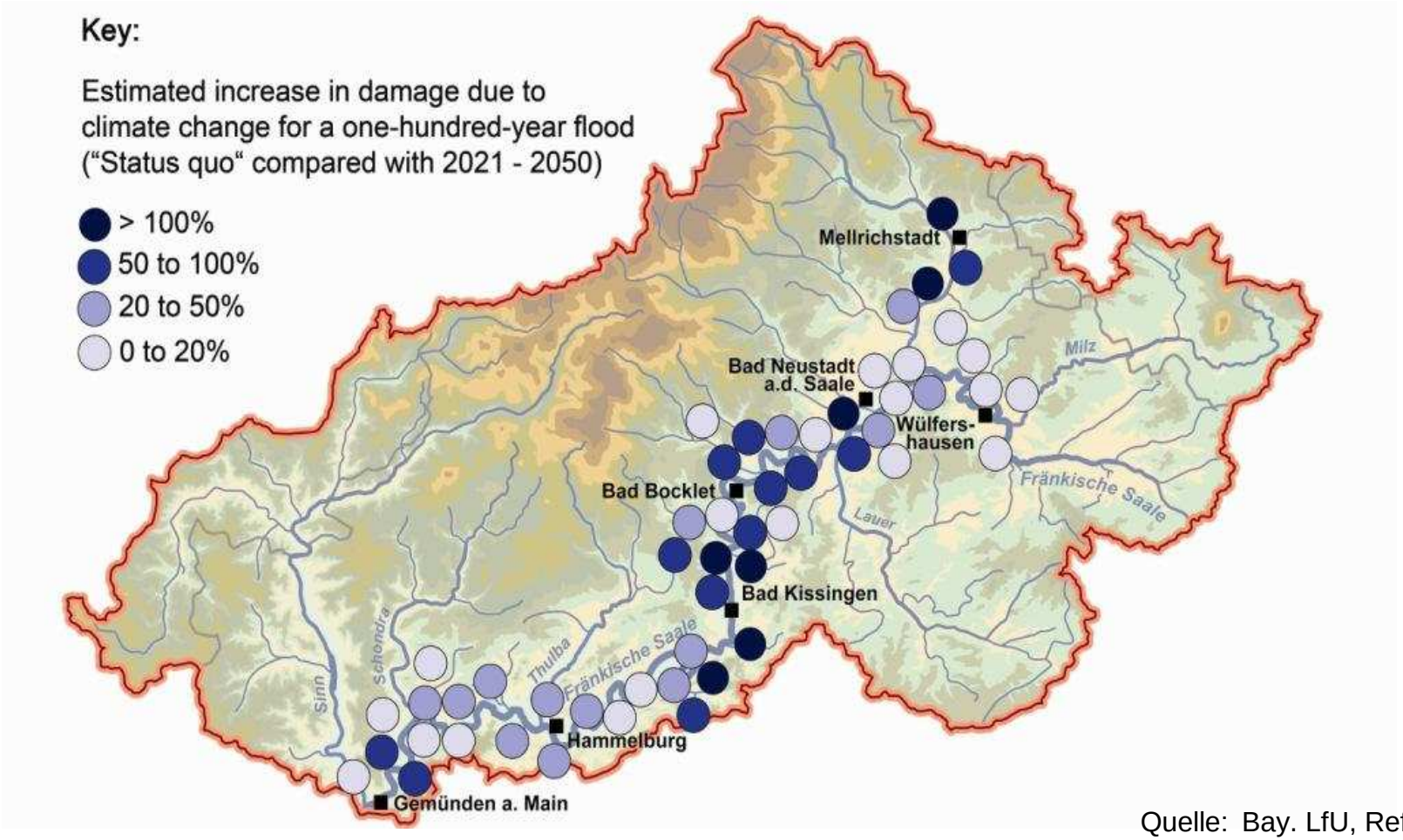


Result:

The climate change induced increase of floods is especially severe for those floods, that have a high return period.

Quelle: Bay. LfU, Referat 81

Economic impacts: Spatial distribution of the estimated increase in damage due to climate change for a one-hundred-year flood



Quelle: Bay. LfU, Referat 81

Thank you for your attention!

Straßenschilder in Pirna während des Elbehochwassers im Frühjahr 2006 (N. Kaiser)

And what is your part?

Facing the impacts of climate change on floods in Bayreuth:

Try to develop in teamwork the pieces of the jigsaw for a sustainable and balanced flood protection concept taking into account economic, ecologic and social demands. Develop an companying PR.

→ part A: adaptation strategies – technical approach

→ part B: adaptation strategies – "soft", natural approach and private precaution

→ part C: project management (time management, budgeting), communication, raising awareness and presentation of the finale results

More information you will get at the kick-off together with some specific data at the 15th of May

Bereich A: Anpassungskonzept - technische Ansätze

A1: Innerstädtischer Verbau - der Königsweg? Kritische Analyse und Verbesserungspotentiale, mögliche technische Alternativen zum Bestand auch unter dem Blickwinkel Hochwasserwahrnehmung in der Öffentlichkeit und höhere Lebensqualität in der Stadt

A2: Rückhalt in der Fläche - das Hochwasser bleibt draußen: Ansätze, Chancen und Auswirkungen

A3: Einfluss der WRRL auf die Ausgestaltung der flussbaulichen Maßnahmen

A4: Mögliche Verbesserungen und Konzepte für den HWS als Beitrag zur Landesgartenschau 2016

Bereich B: Anpassungskonzept - weiche, naturnahe Ansätze und private Vorsorge

B1: Renaturierung in der Stadt - die Stadt am Fluss: Hochwasserschutz meets Stadtqualität.

B2: Private Vorsorge und angepasste Nutzung: Mit dem Hochwasser alleine gelassen oder Chance?

B3: Bessere Vorhersage in Verbindung mit mobilen Schutzanlagen (mit Besuch der HVZ Main des LfU in Hof)

Bereich C: Projektmanagement, Kommunikation, Bewusstseinswandel, Wahrnehmung

C1: Bewusstseinswandel: Wie wird die Thematik Klimawandel und Hochwasser wahrgenommen? Erarbeitung eines Umfragebogens und Durchführung einer Umfrage unter Bayreuther Bürgern in der Stadt

C2: Erarbeitung eines begleitenden Kommunikationskonzeptes unter Berücksichtigung von D1


Thank you and all the best for your project!