

# Klima im System Erde – Perspektive feste Erde

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Deutsches GeoForschungsZentrum GFZ

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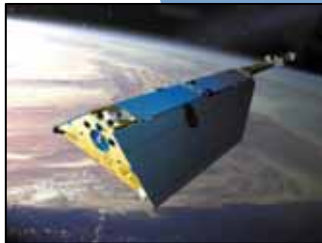
# Das System Erde

- Geosphäre
- Hydrosphäre
- Kryosphäre
- Atmosphäre
- Biosphäre



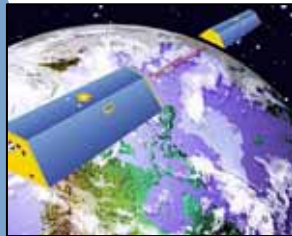
# Satellitenmissionen des GFZ

GFZ 1  
(1995)



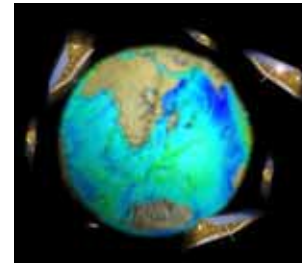
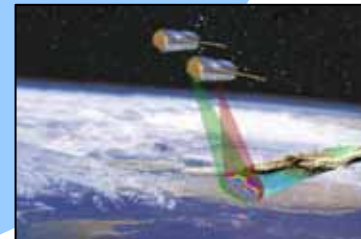
CHAMP  
(2000)

GRACE  
(2002)

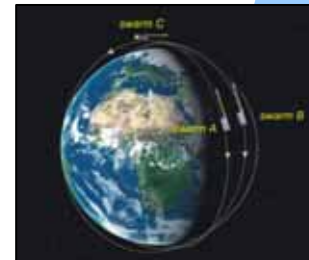


GOCE  
(2009)

TerraSAR-X  
(2007)  
TanDEM-X  
(2009)

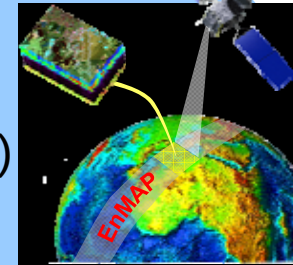


Mini-  
Satelliten



SWARM  
(2011)

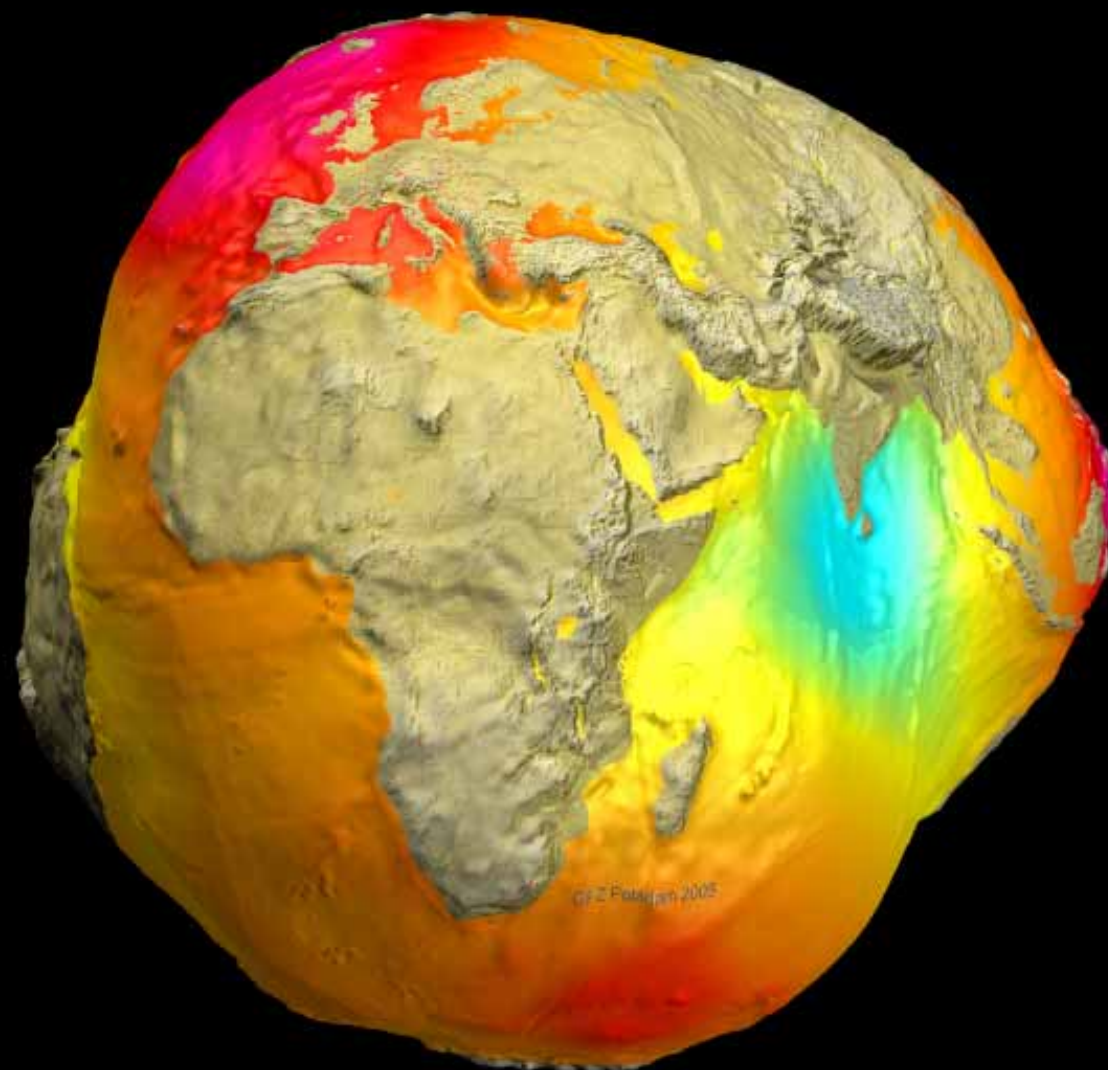
EnMAP  
(2012)



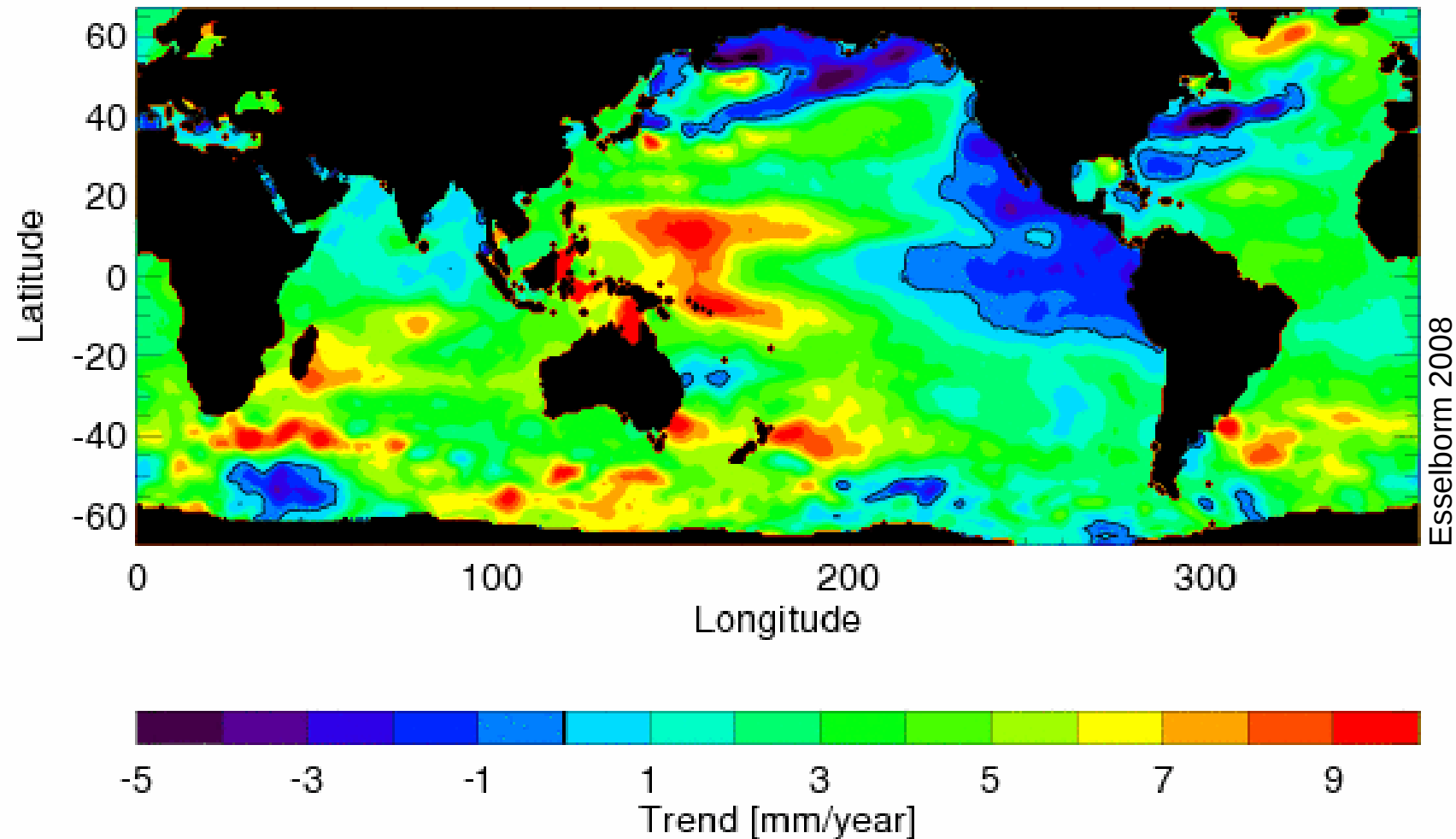
Mond  
(20??)



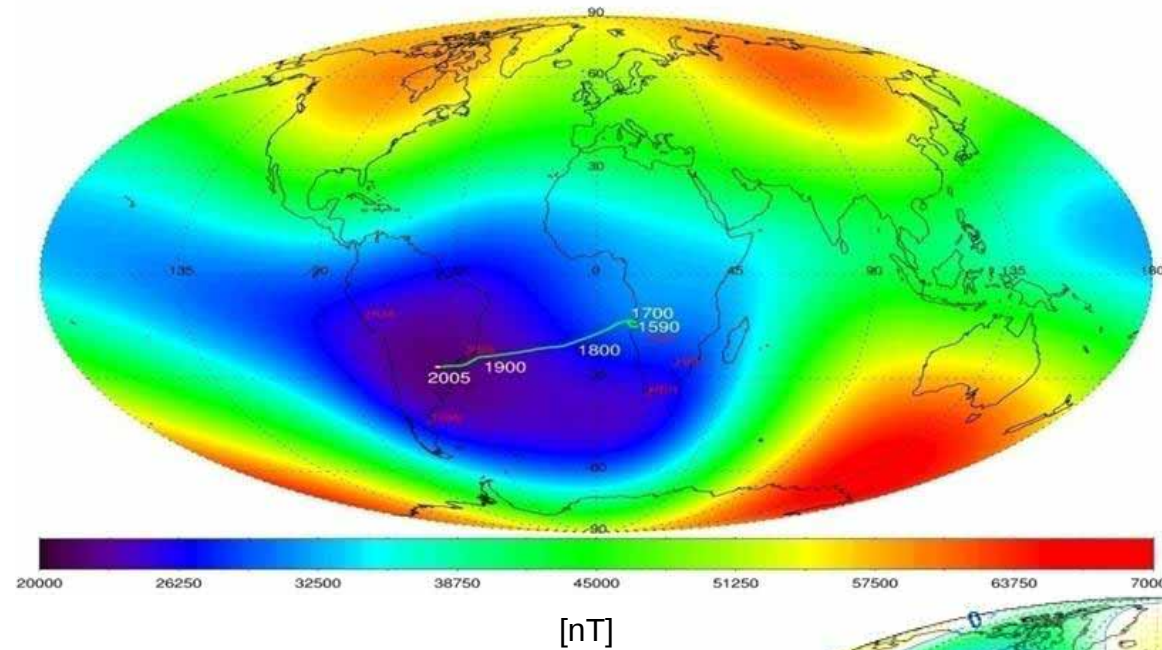
# Potsdamer Schwerekartoffel



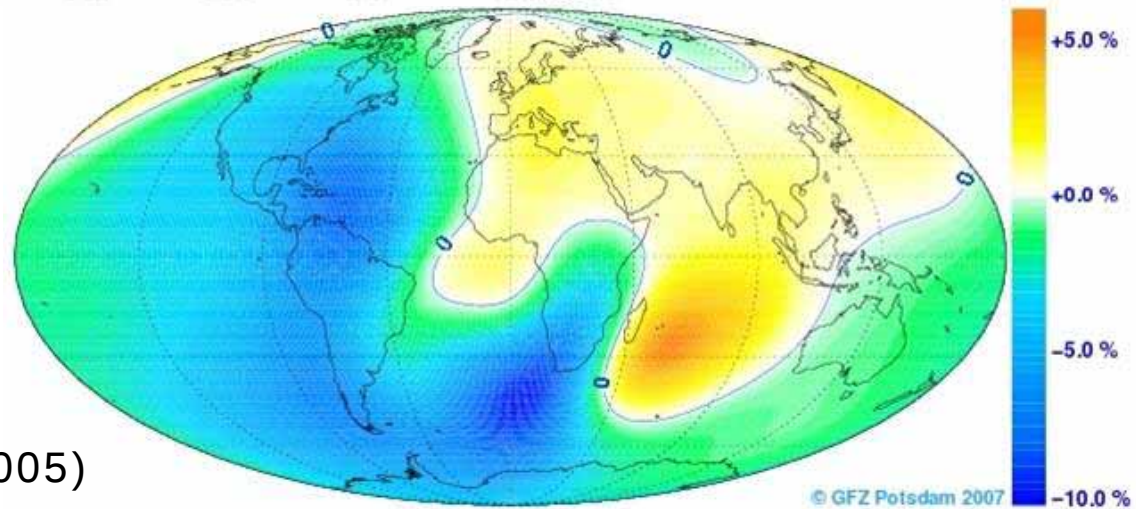
## Global sea level trends (01/1993 to 12/2007) from Topex and Jason-1 satellite altimetry



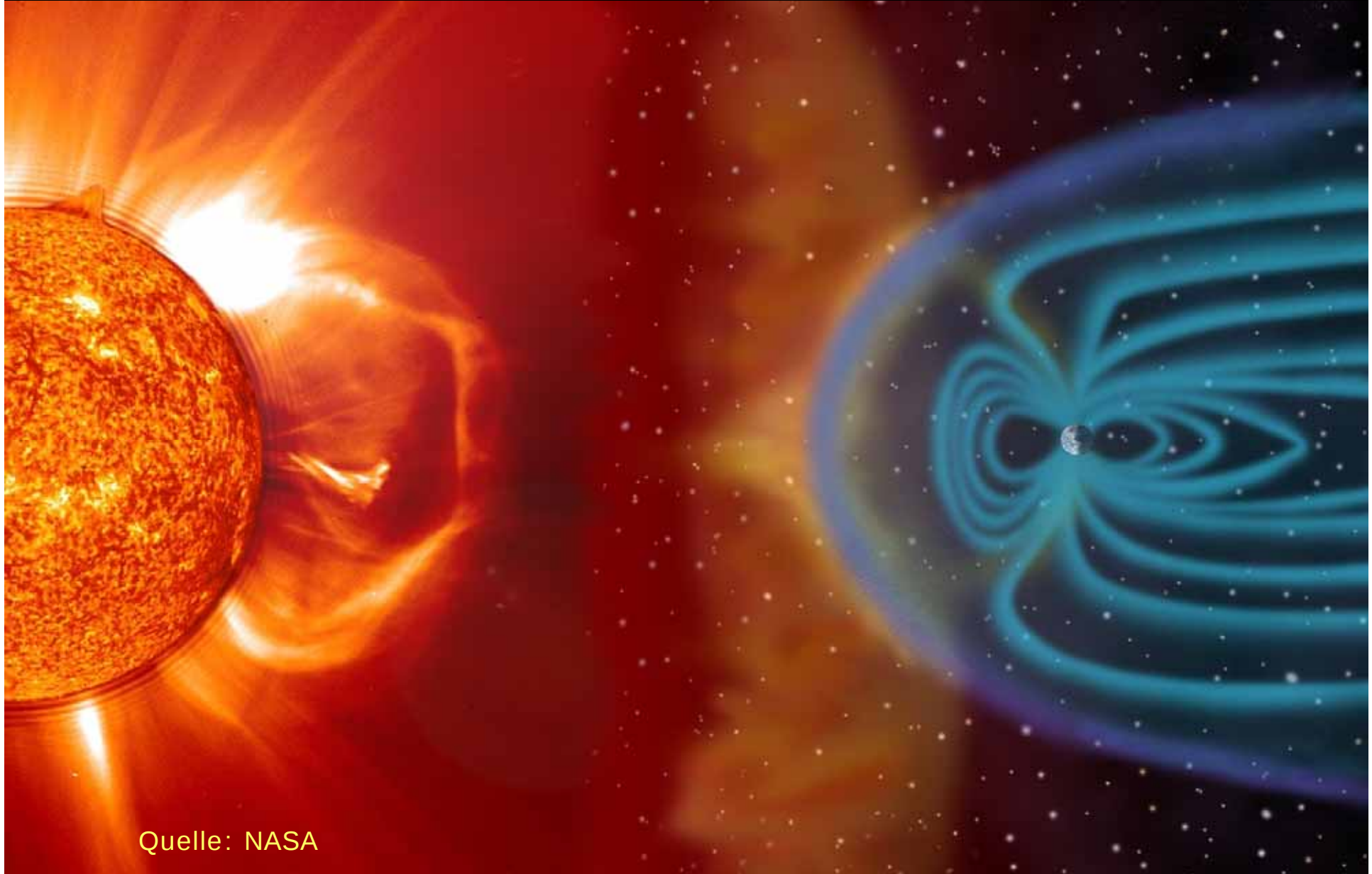
# Erdmagnetfeld – Beispiel Südatlantik-Anomalie



Magnetfeldänderung  
über 25 Jahre (1980–2005)

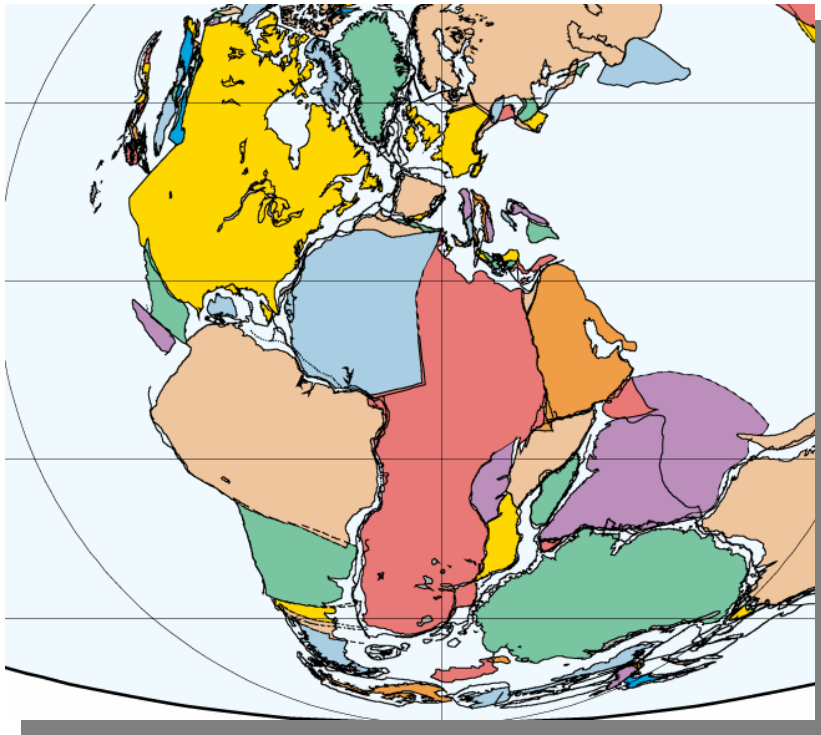


# Erdmagnetfeld: Schutzschild vor kosmischen Strahlen

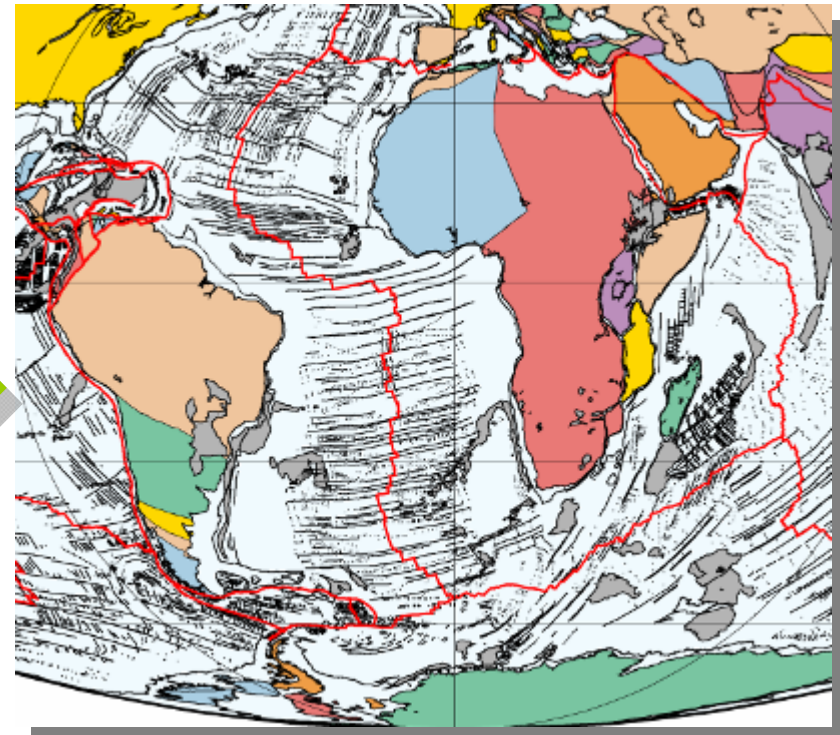


Quelle: NASA

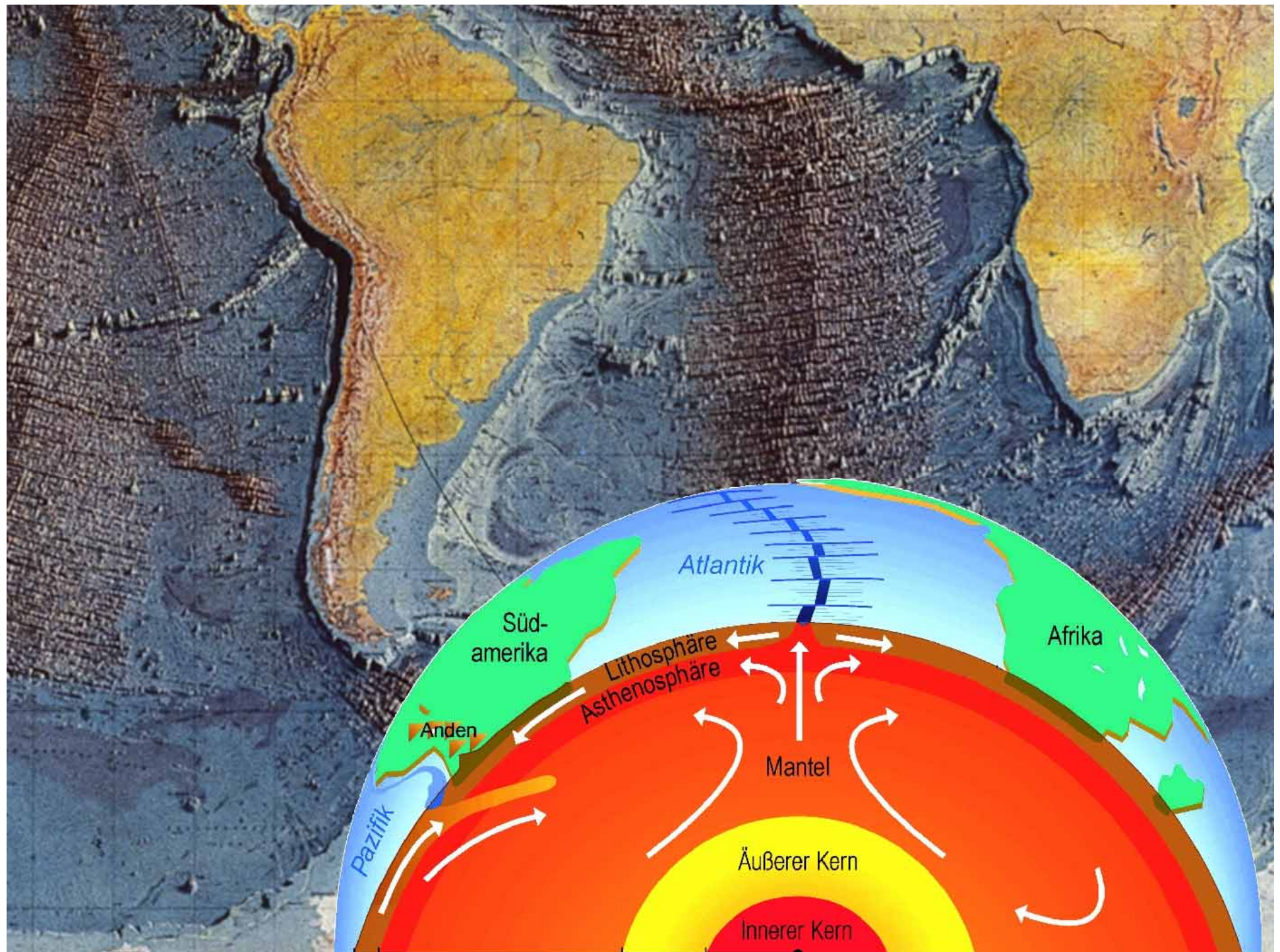
# Kontinentaldrift – Entstehung des Atlantiks



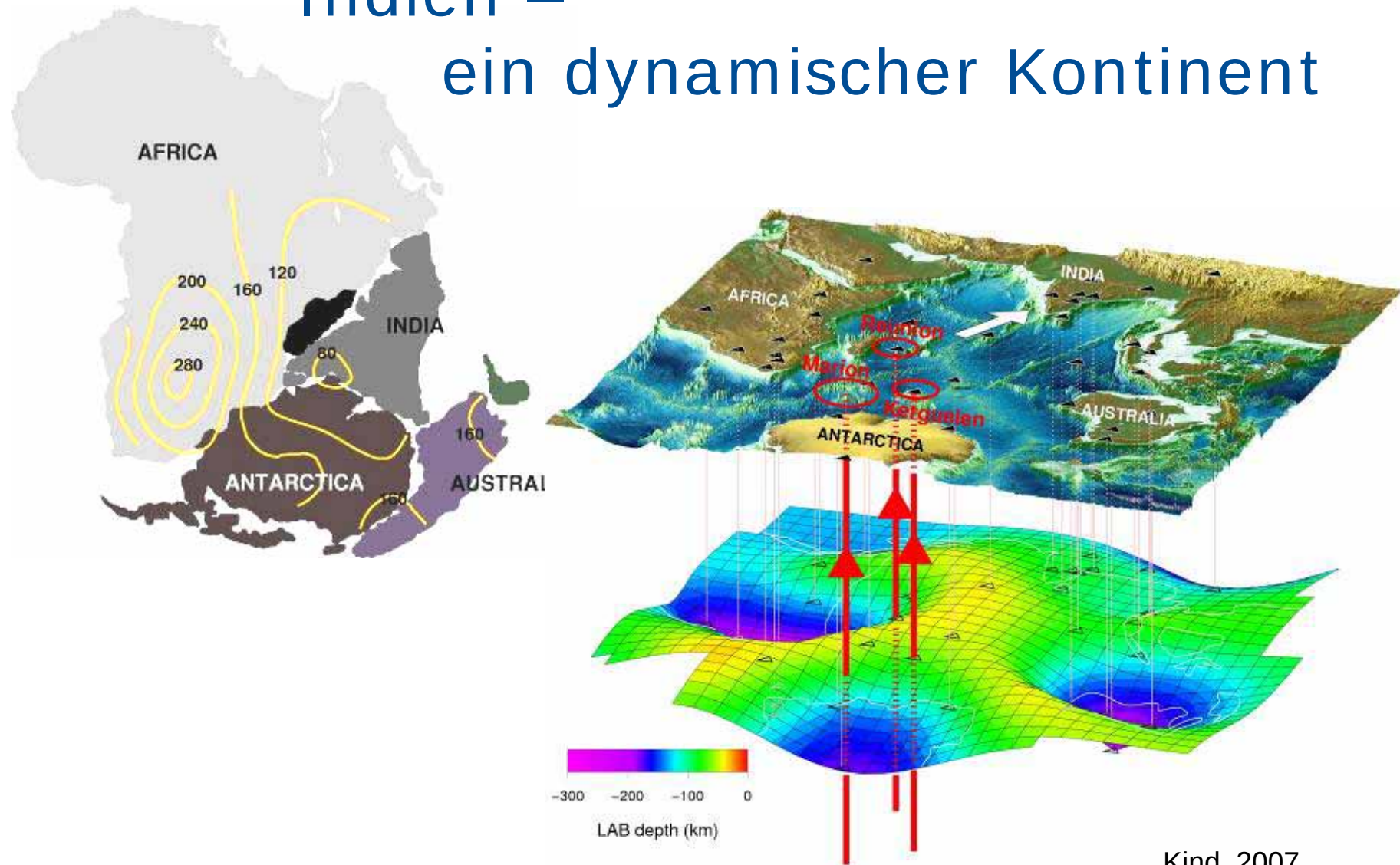
Gondwana-Superkontinent  
vor ca. 200 Mio. Jahren



Plattenkonfiguration heute

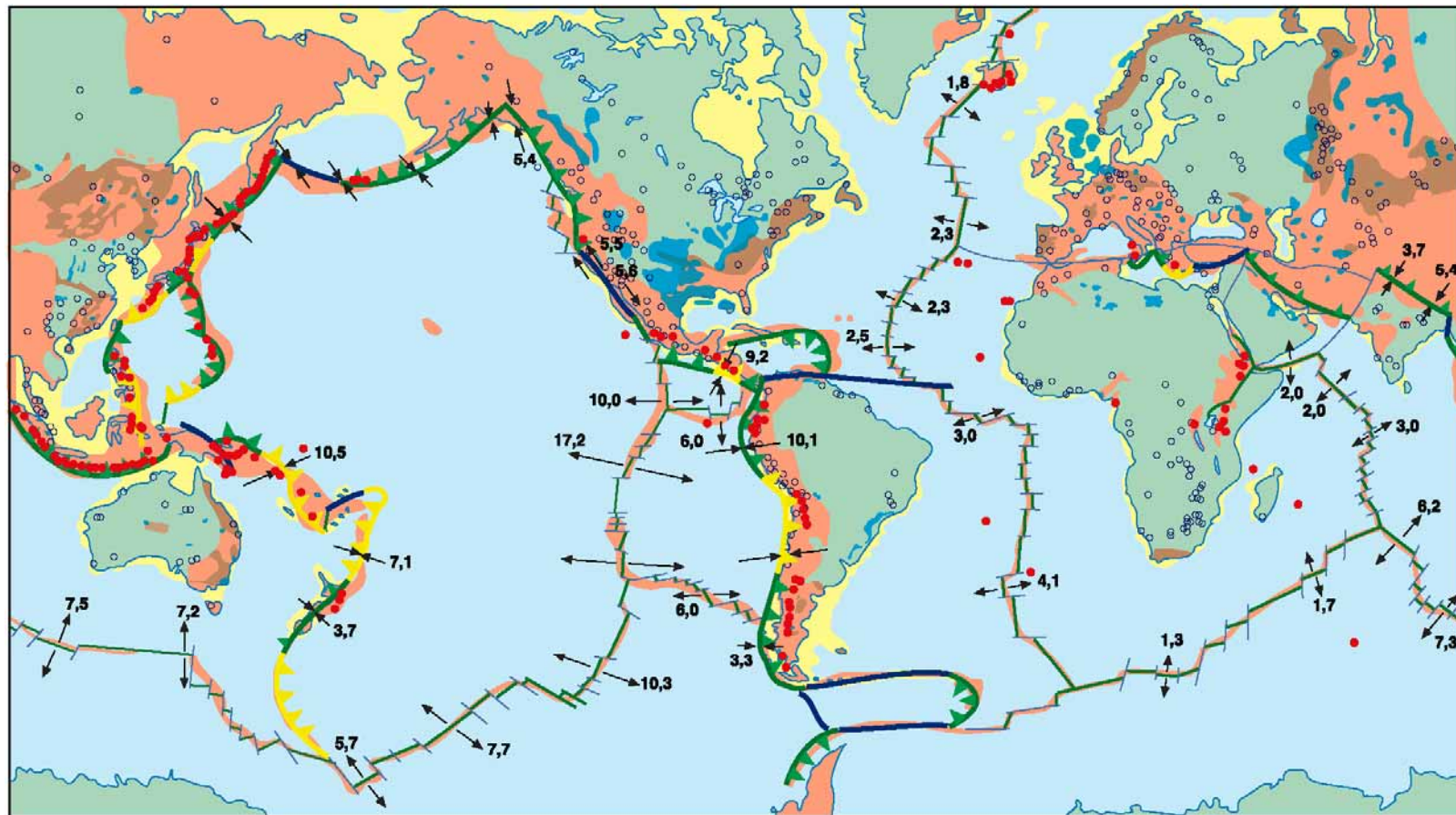


# Indien – ein dynamischer Kontinent



Kind, 2007

# Geodynamik



## Konvergente Plattenränder

erosiv akkretionär Transform

## "divergente Plattenränder"

— 7,7 Öffnungsrate in cm/a

mineralische Rohstoffe

Kohlenwasserstoffe

"kontinentale Schelfe"

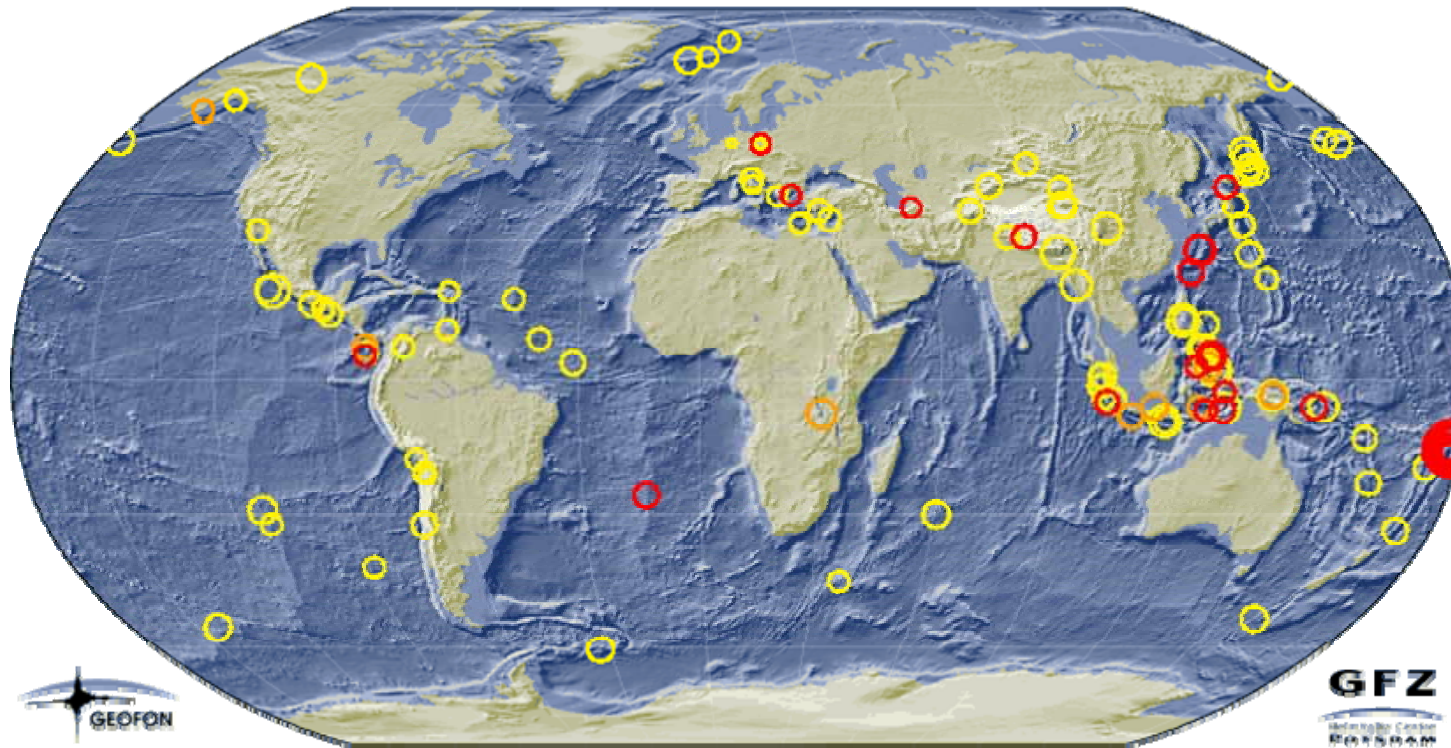
Erdbebenzonen

• aktive Vulkane

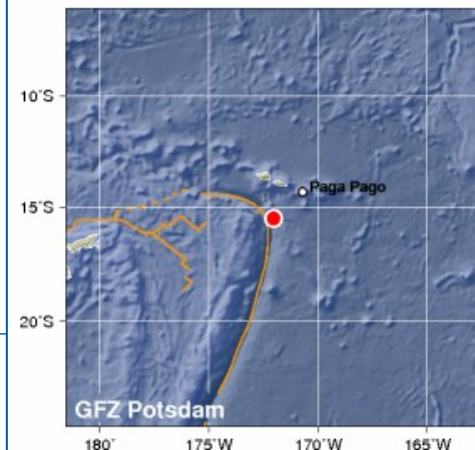
"kontinentale Schilde"

Phanerozoische Orogene + Becken

# Automatic GEOFON Global Seismic Monitor



The displayed events are within the last **24 hours** / **1-4 days** / **4-14 days**.



Most recent large event:

**Samoa Islands Region**

Magnitude: **8.2**

Origin time: **2009-09-29 17:48:10.3 UTC**

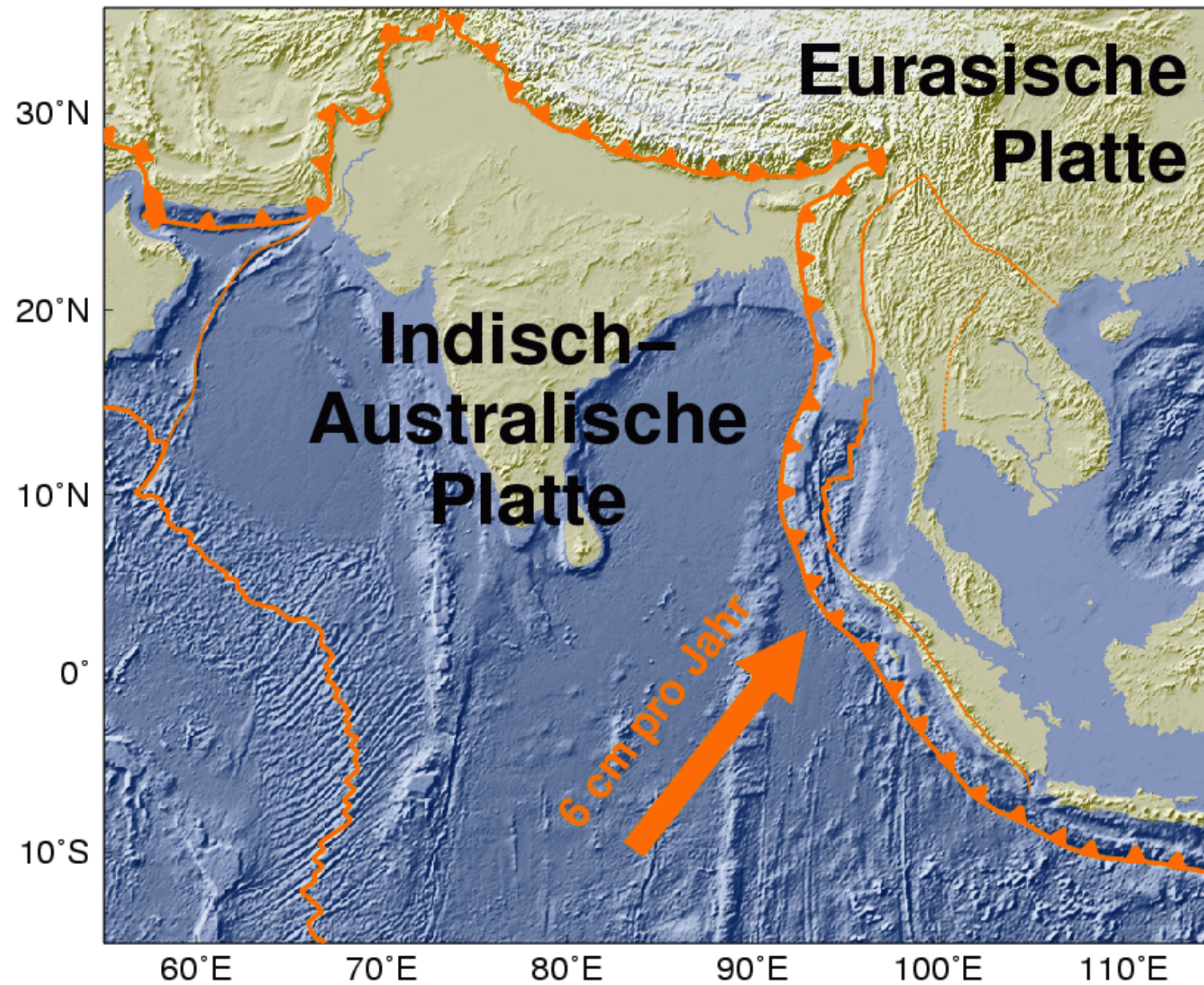
Epicenter: **172.04°W 15.49°S**

Depth: **10 km**

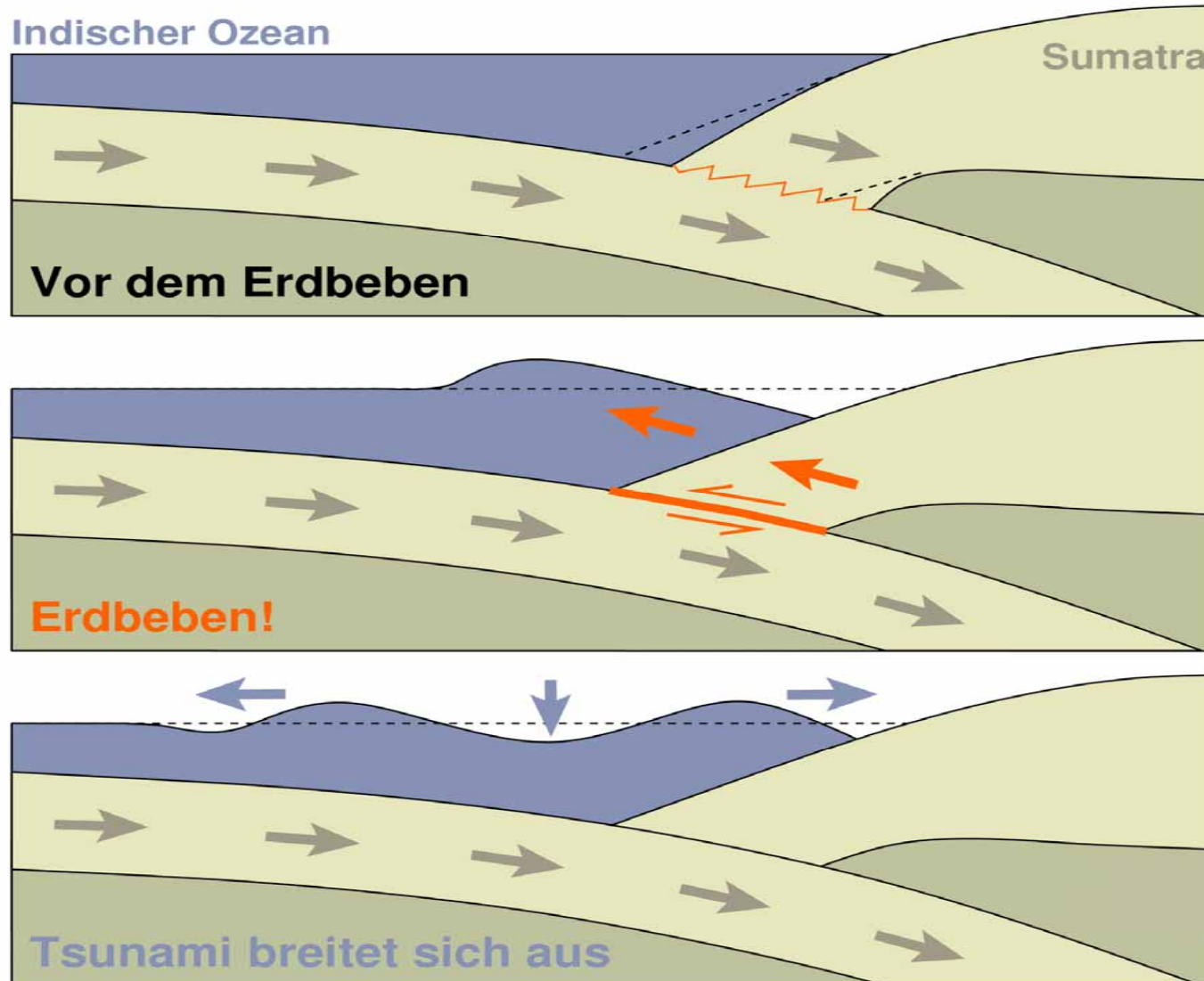
Location: **manually revised**

See also:

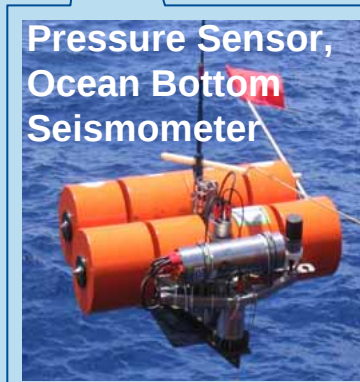
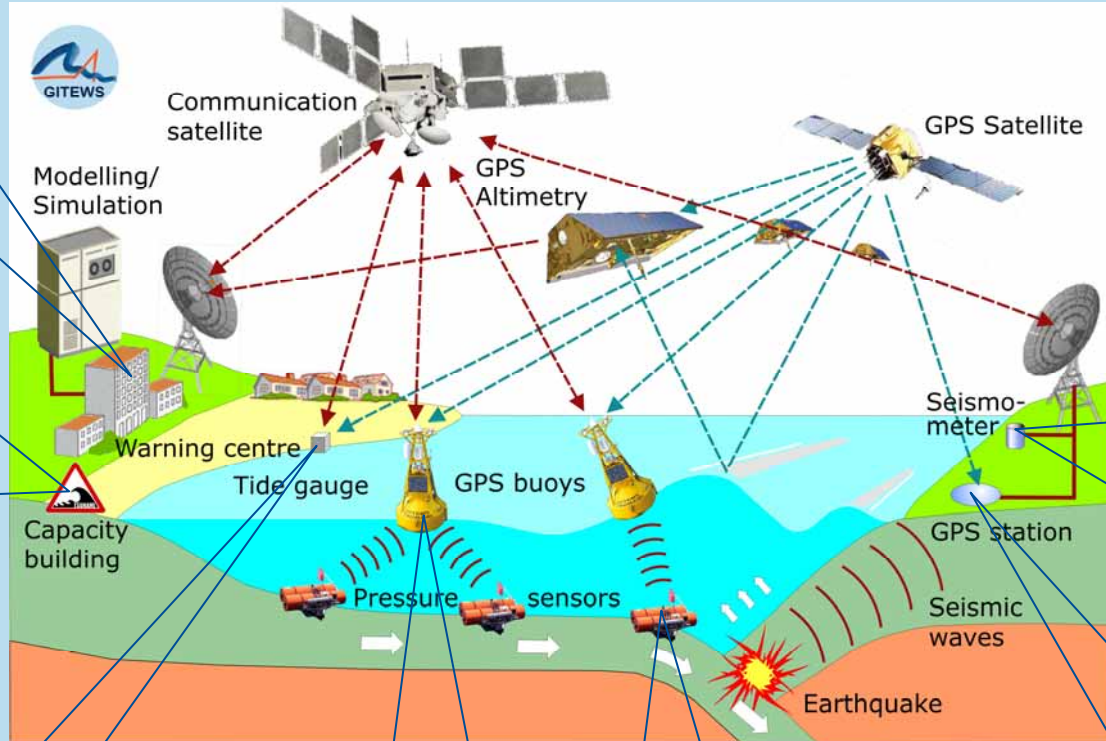
- The [specific page](#) for this event
- The [complete list](#) of automatic GEOFON alerts



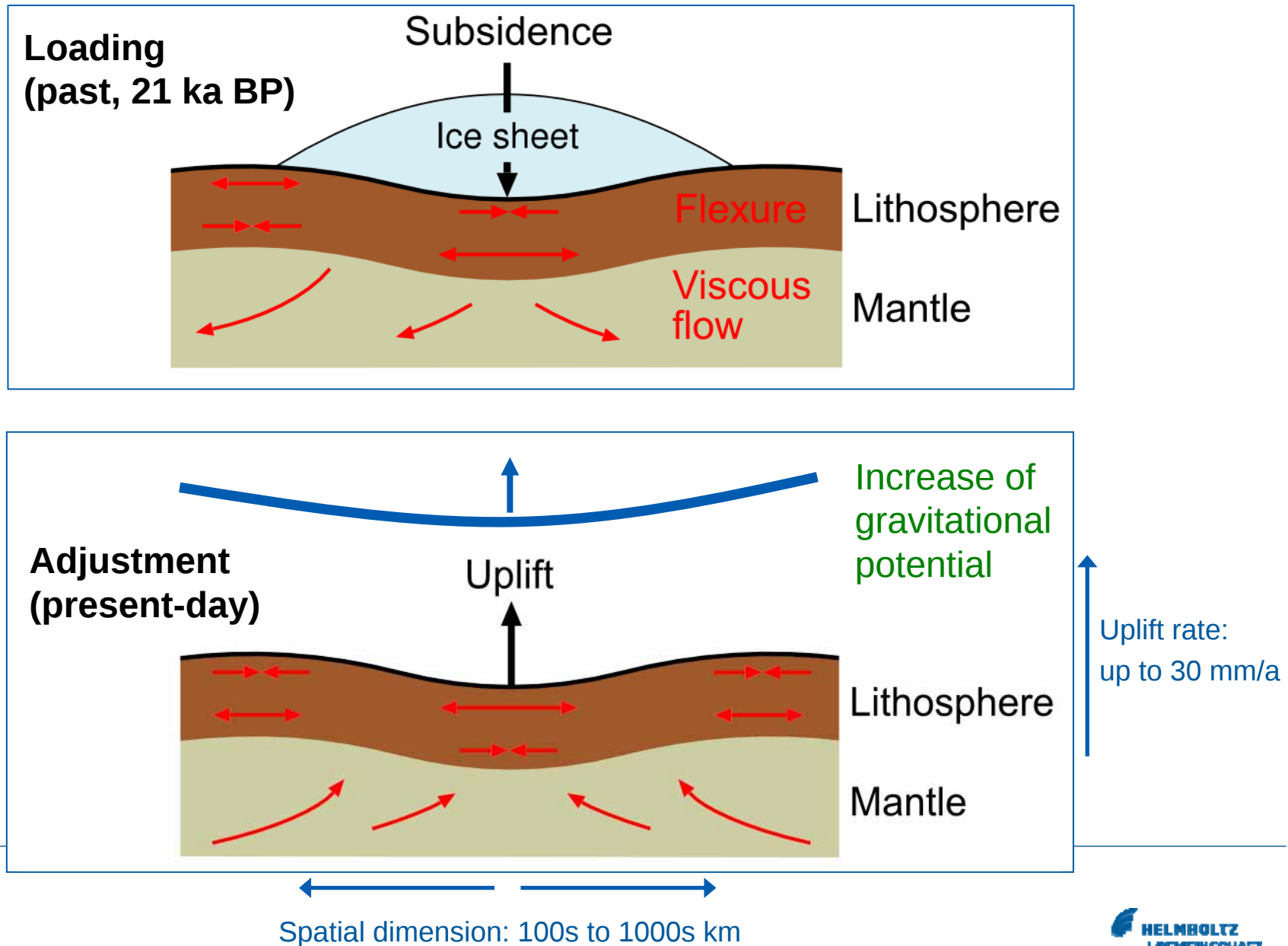
# Tsunami-Entstehung





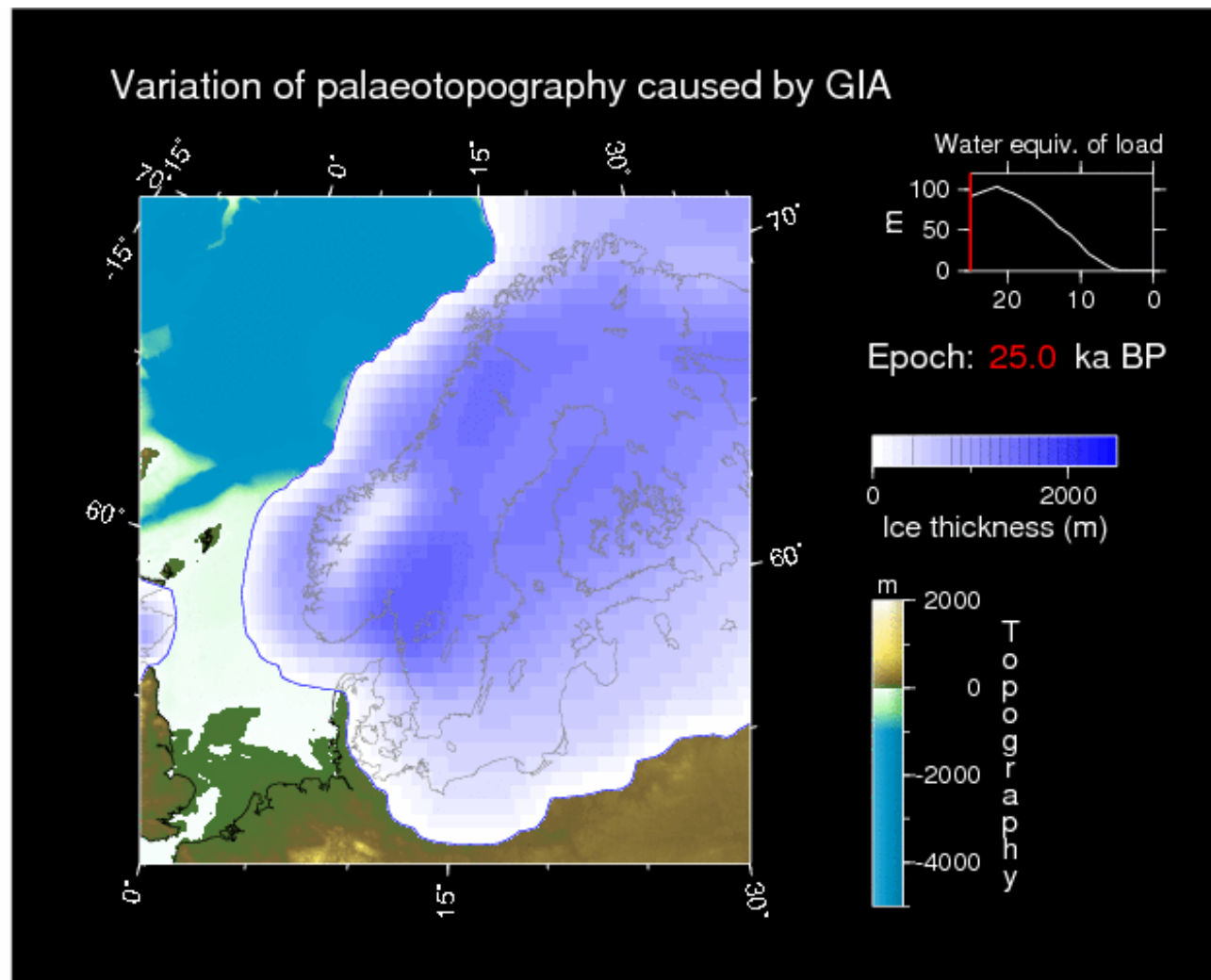


# Glacial-isostatic adjustment (GIA)



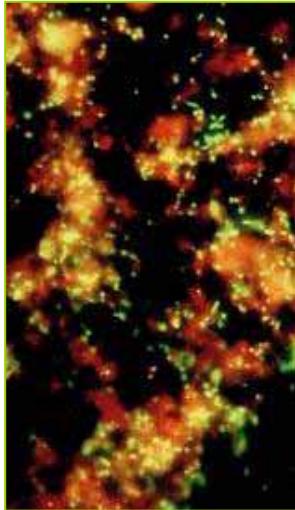
# Example: GIA in Fennoscandia

Output of viscoelastic earth model (VILMA)



- Mass conservation, self-gravitation, Earth rotation included
- Migration of coastlines

# Tiefe Biosphäre – Leben im Untergrund



Eingefärbte Bakterien der Tiefen Biosphäre

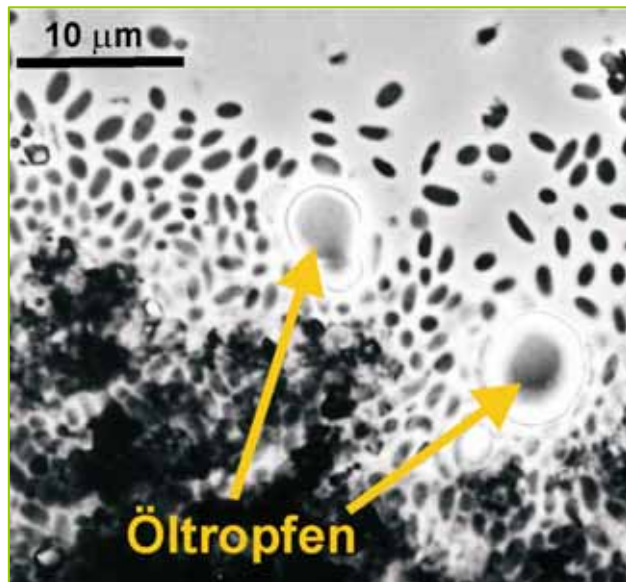


Kohlefragmente – eine potentielle Nahrungsquelle für mikrobielles Leben in der Tiefe (Huntley-Bohrung, Neuseeland)

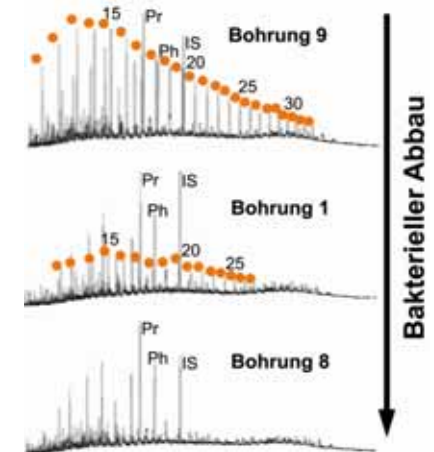
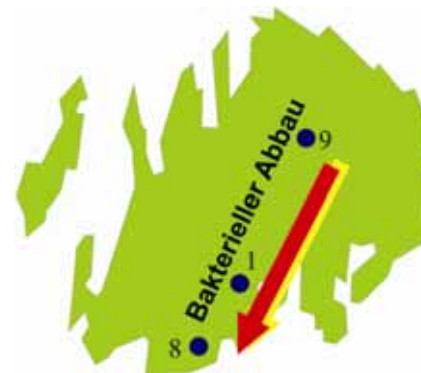
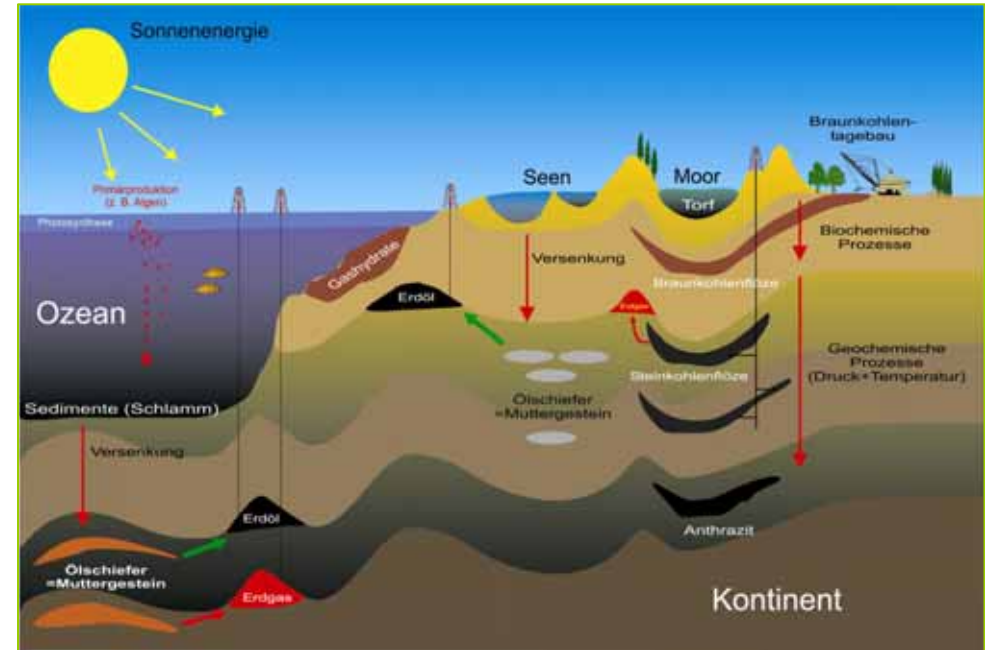


# Organische Geochemie

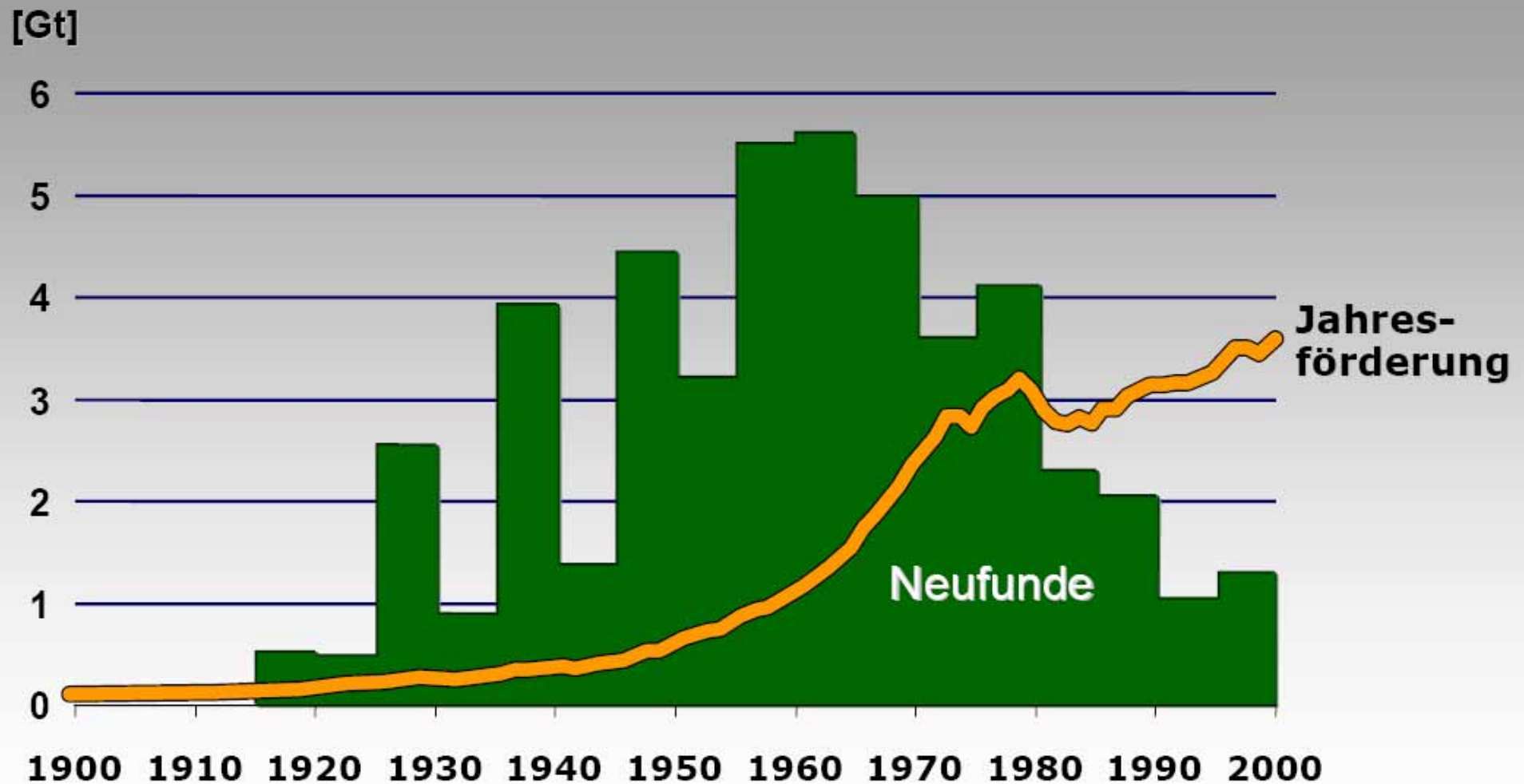
## Abbau von Erdöl



Anaerobe Bakterien fressen Erdöl

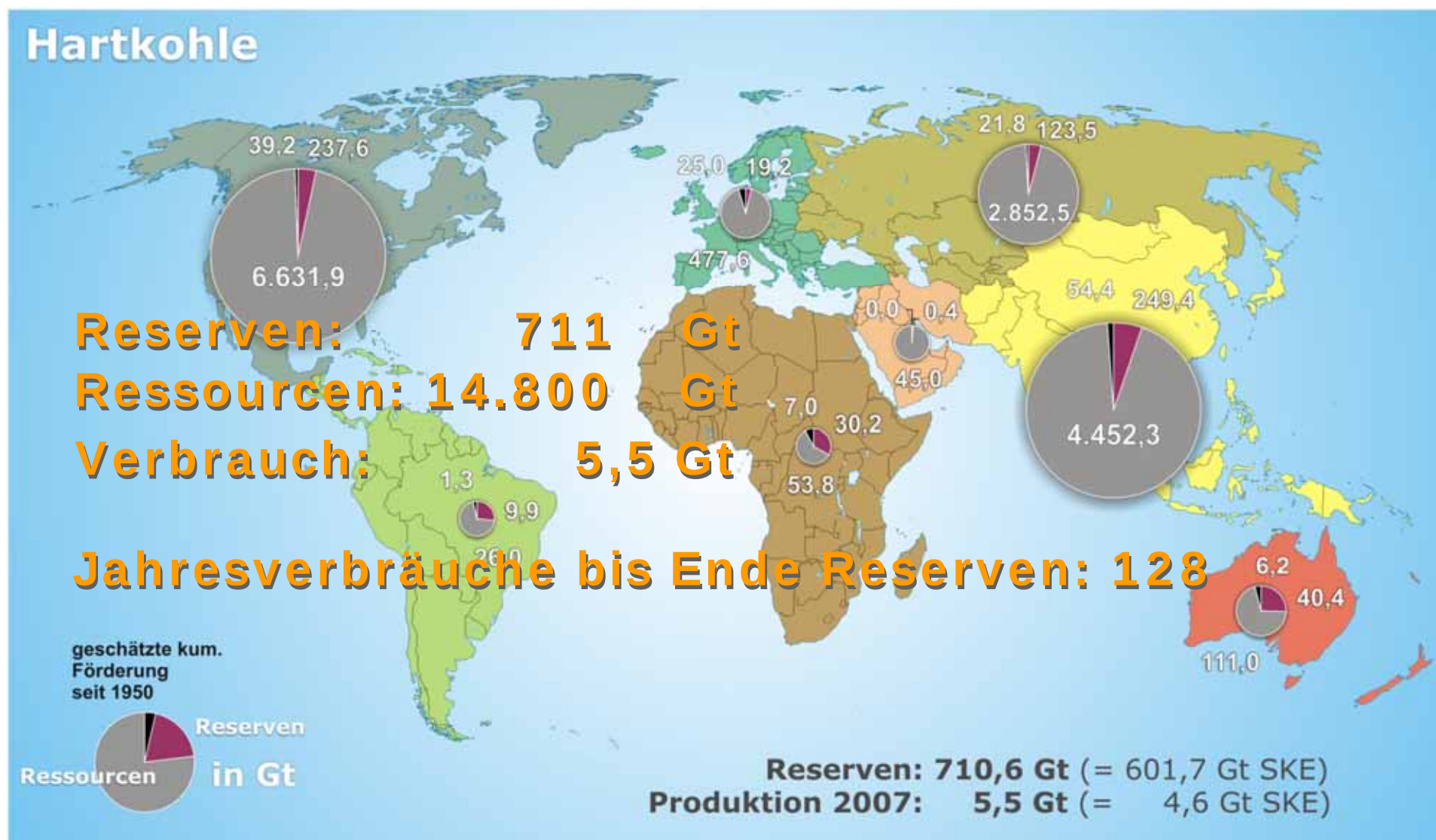


# Erdölneufunde (im 5-Jahresmittel) und Jahresförderung



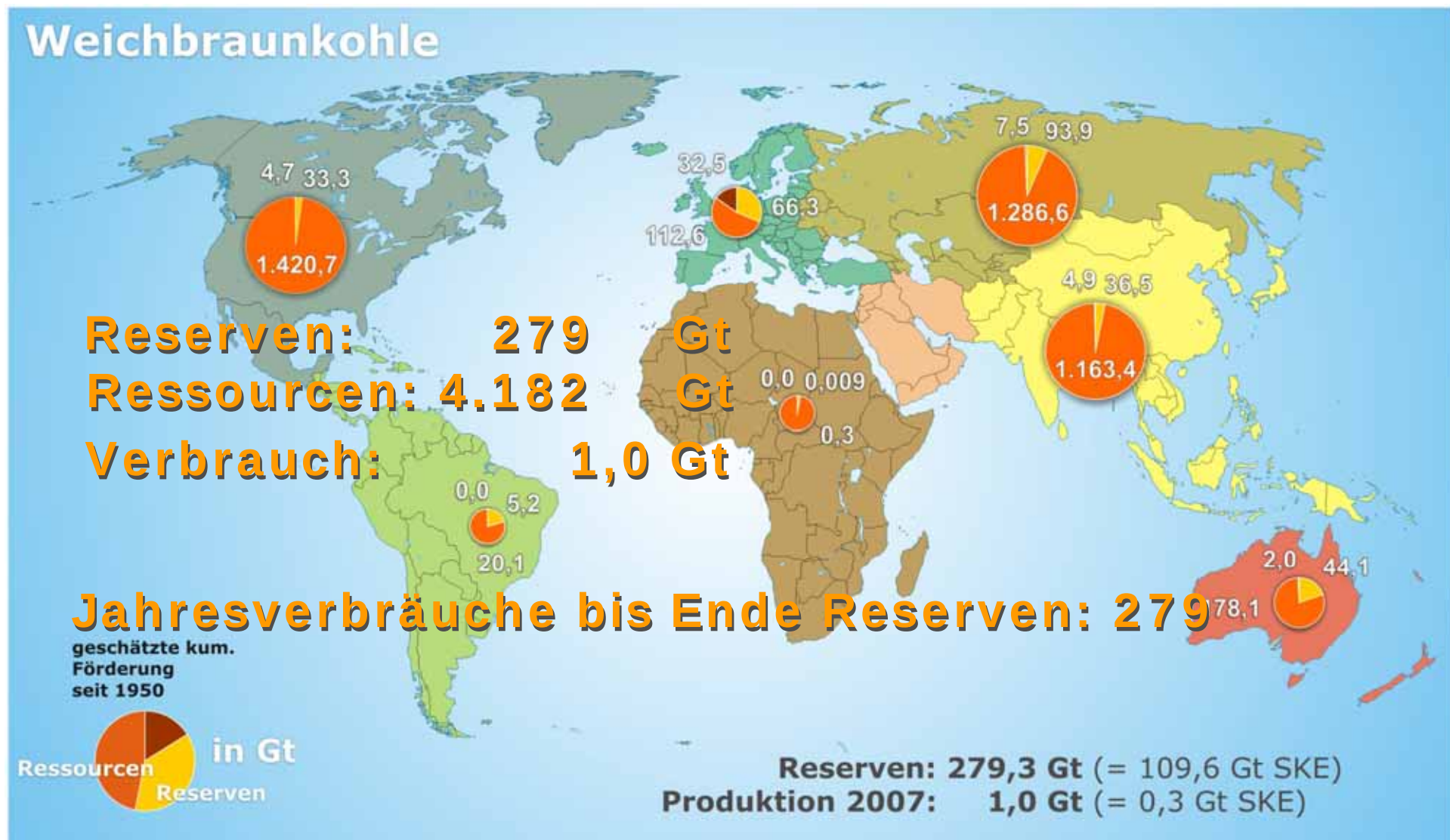
BGR (2007)

# Hartkohle – Kenndaten 2007



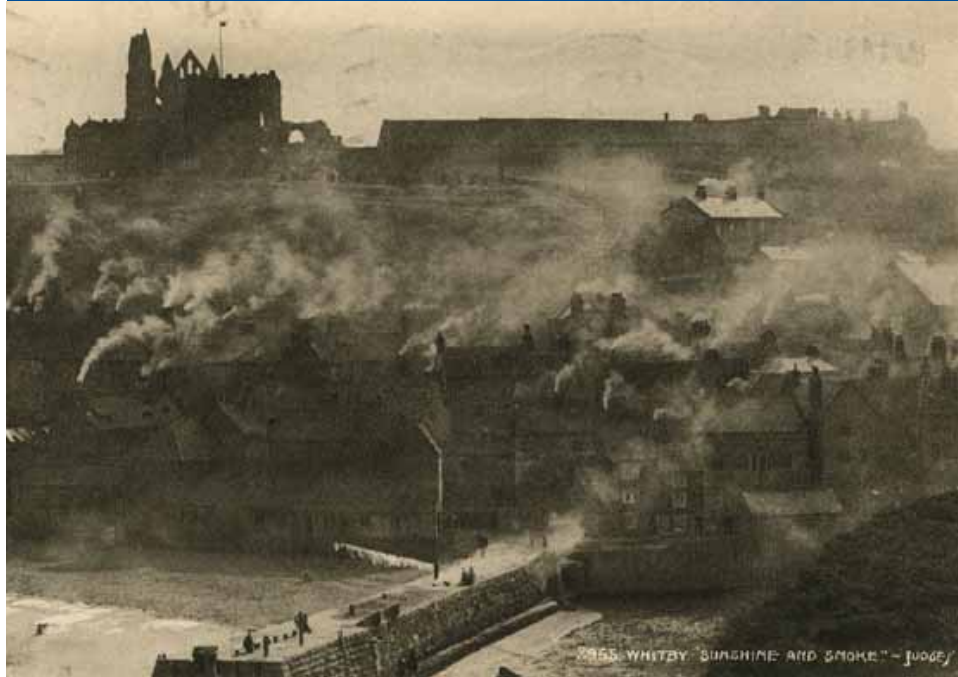
BGR (2009)

# Weichbraunkohle – Kenndaten 2007

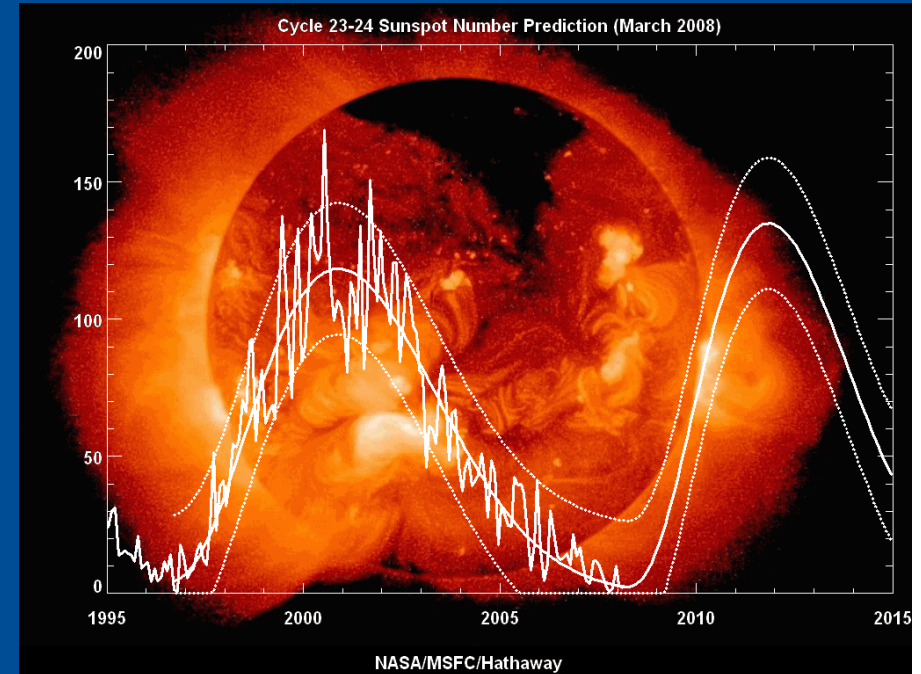


# Klimadynamik

## Anthropogene Faktoren



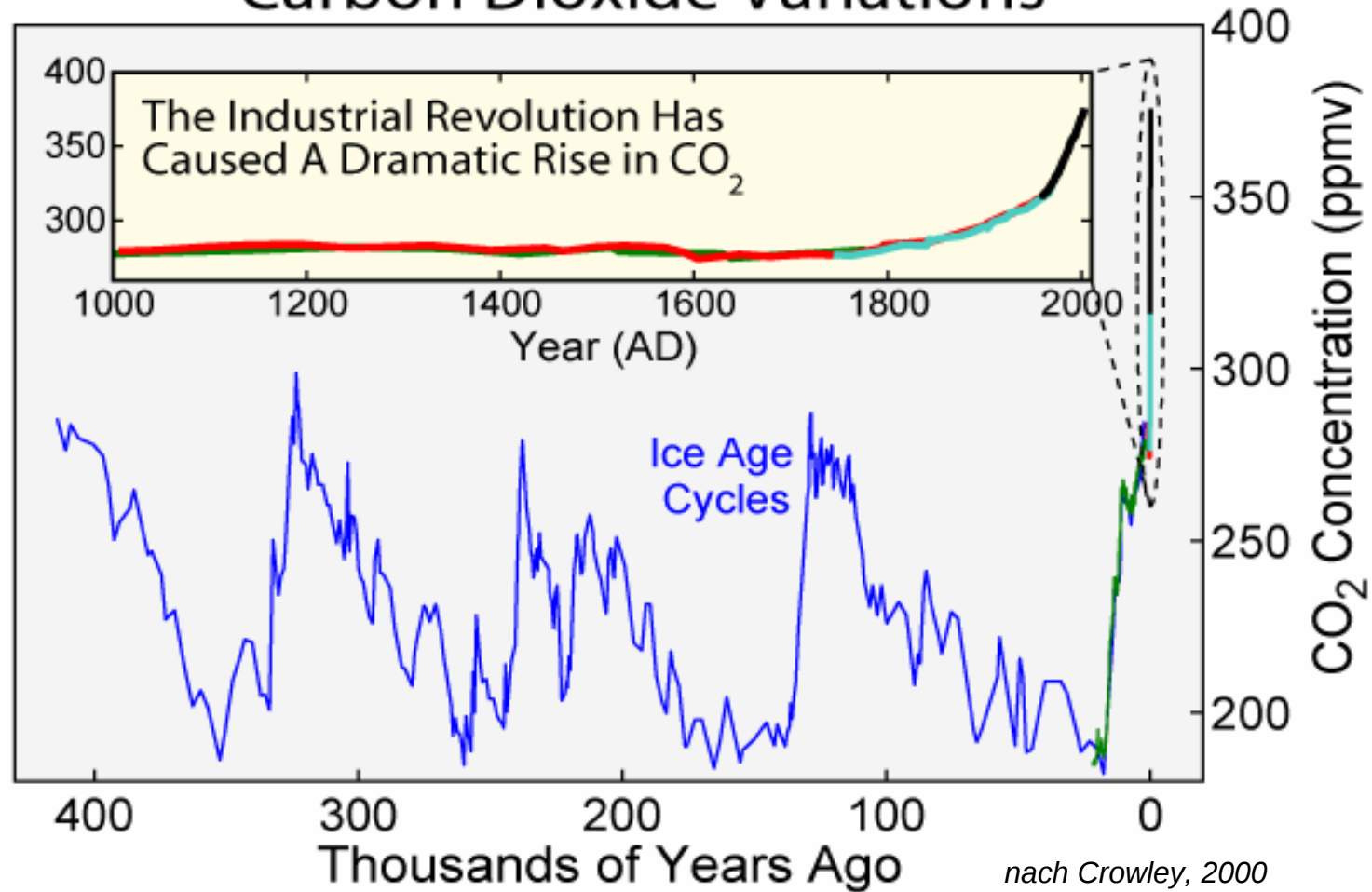
## Natürliche Faktoren



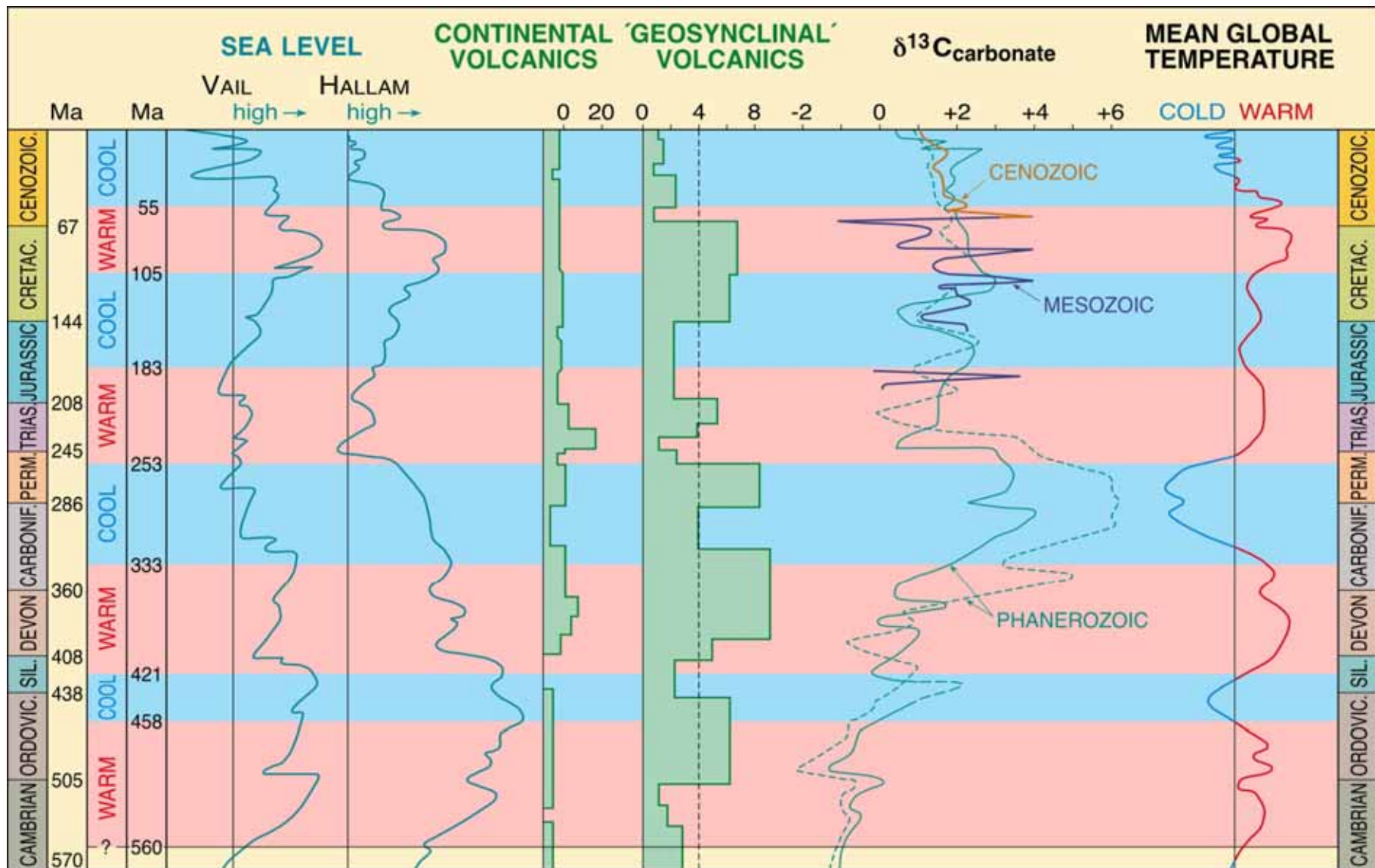
Klimawandel heute und in Zukunft

# Klimafaktor Mensch

## Carbon Dioxide Variations

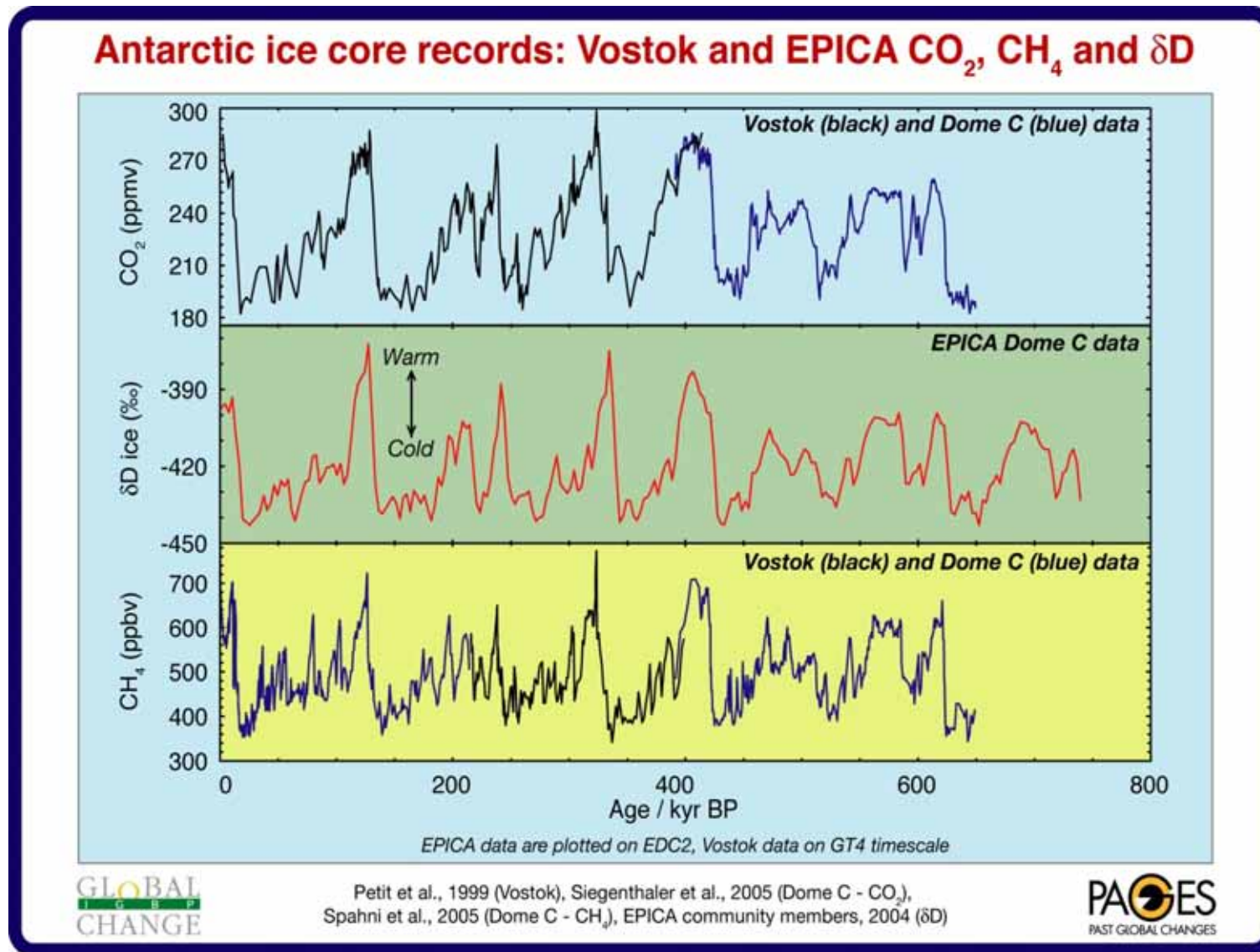


# Zeitfenster 1: „Eishaus“ – Treibhaus

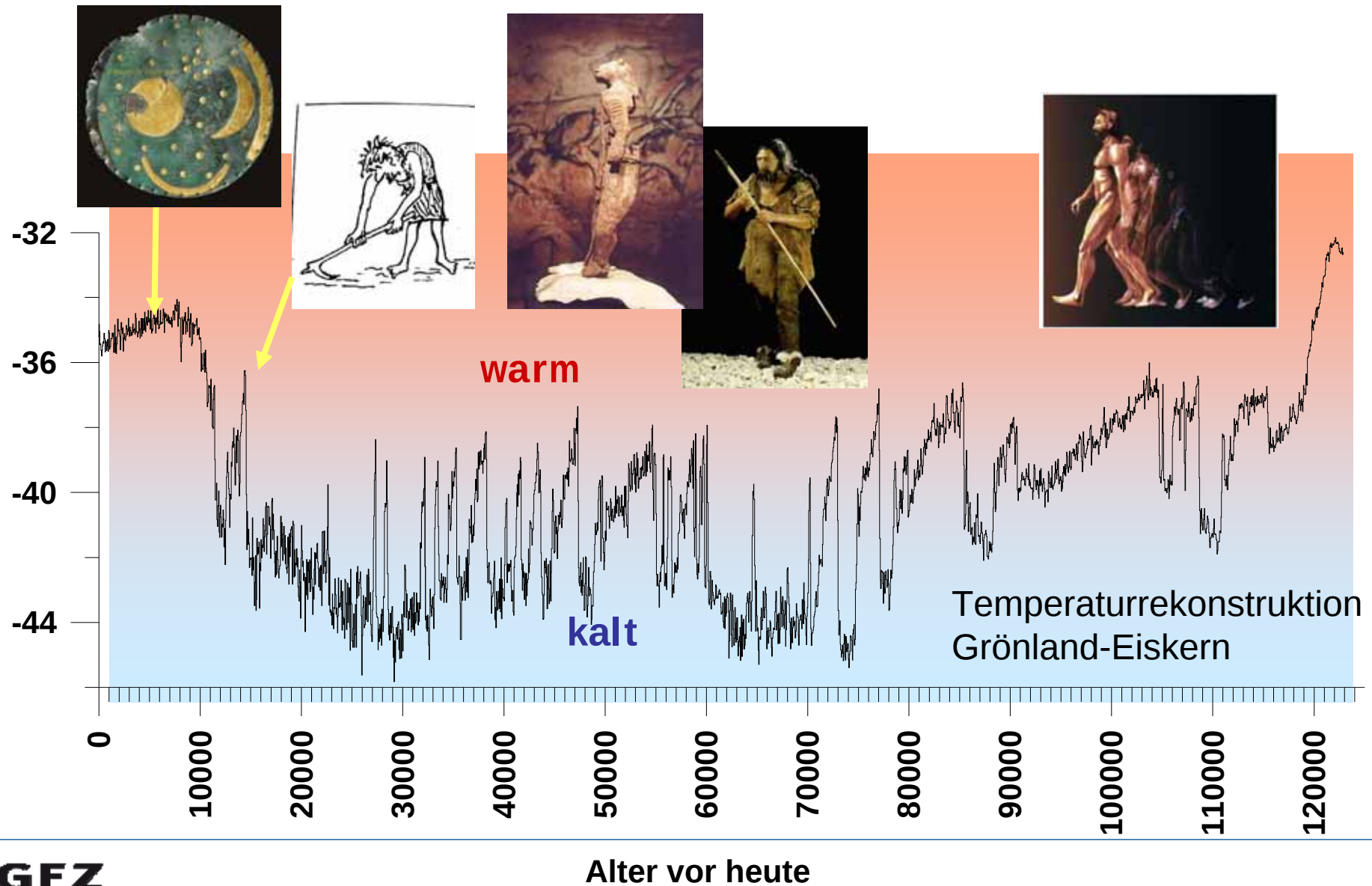


nach Frakes et al., 1994

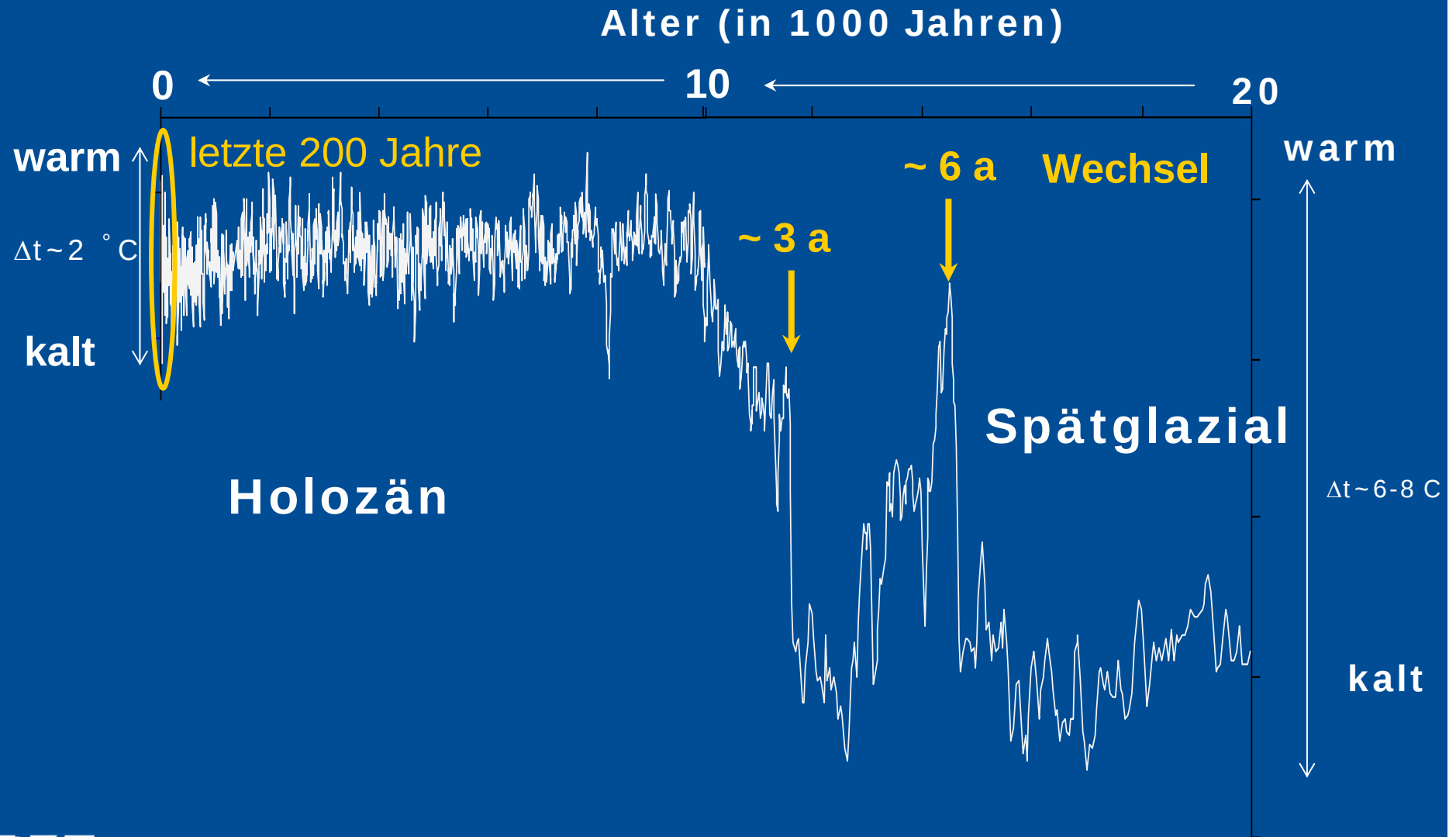
# Zeitfenster 2: Glazial – Interglazial



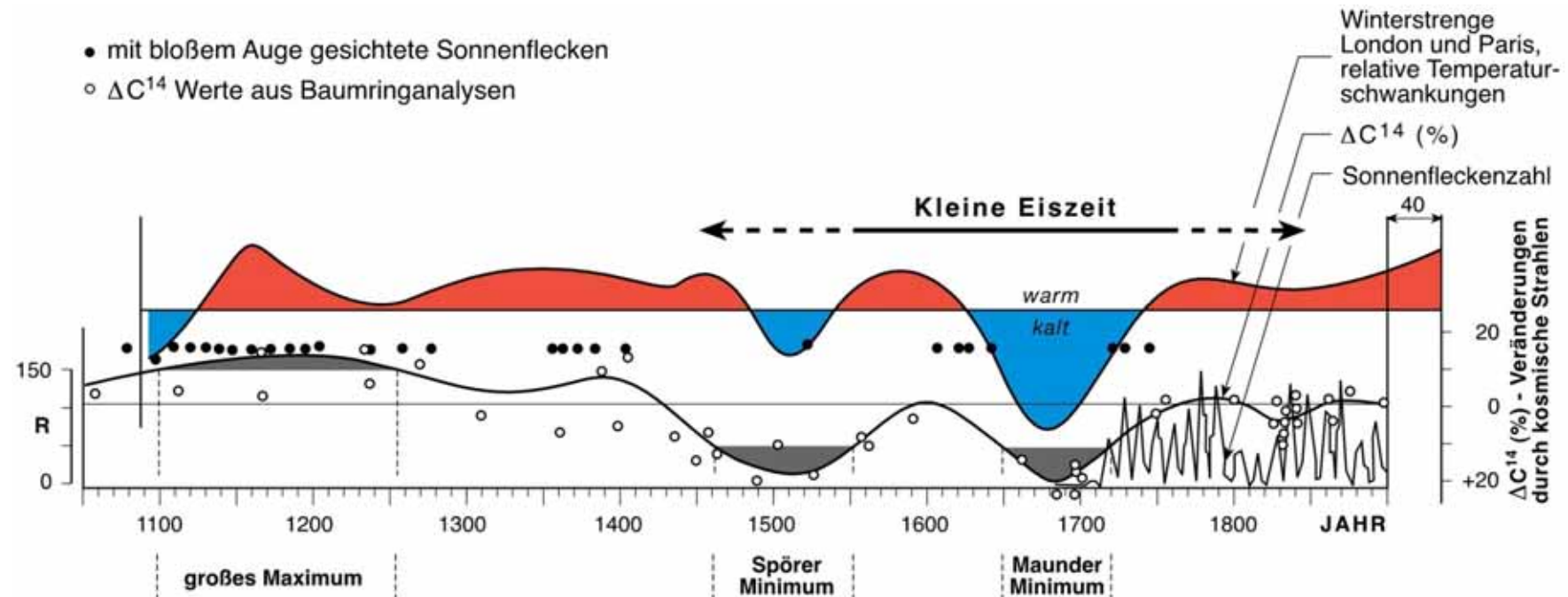
# Zeitfenster 3: glaziale Klimavariabilität



# Natürliche Klimadynamik

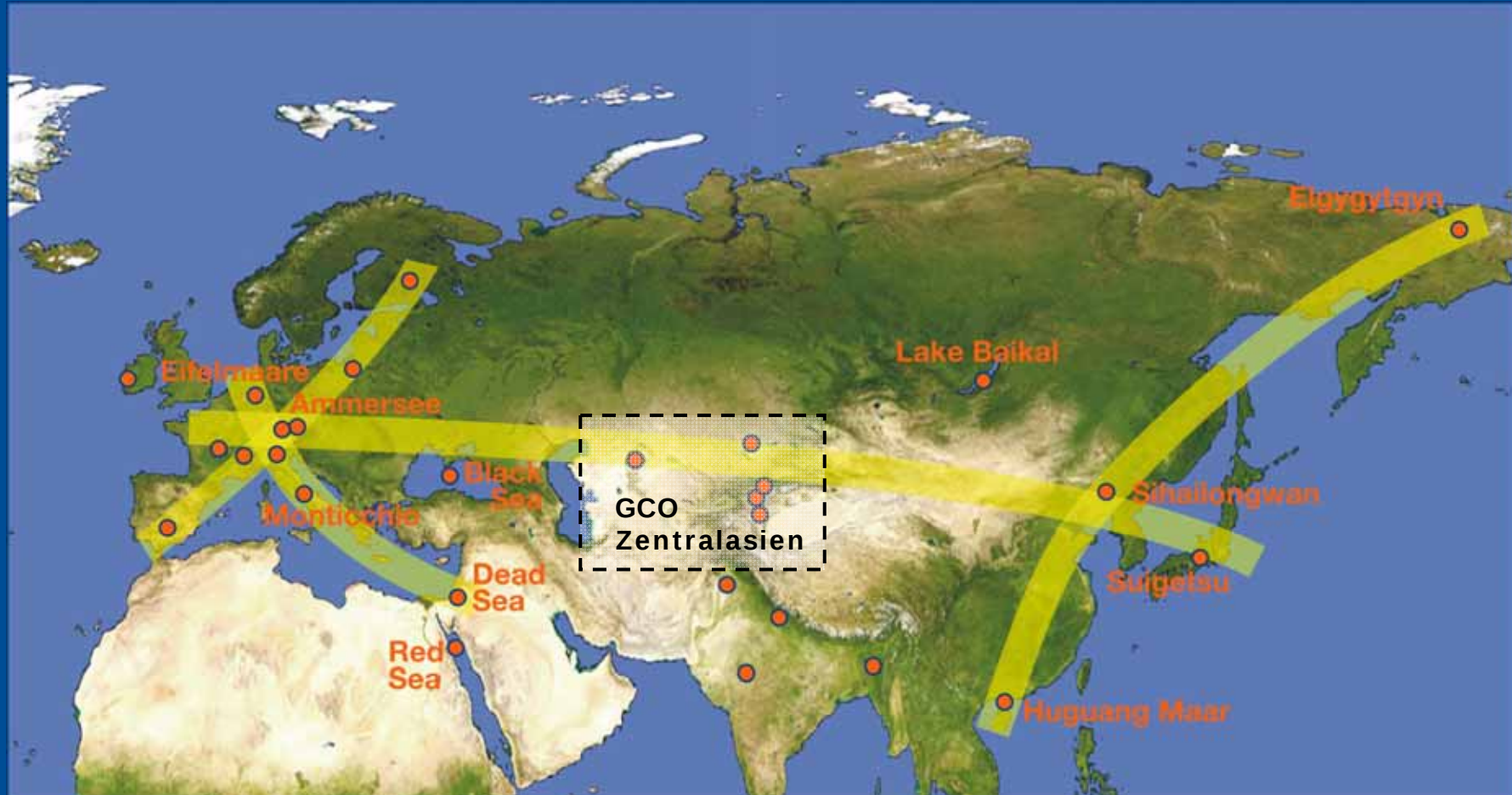


# Zeitfenster 4: interglaziale Klimavariabilität



# Datierung und Synchronisierung hochauflösender Geoarchive

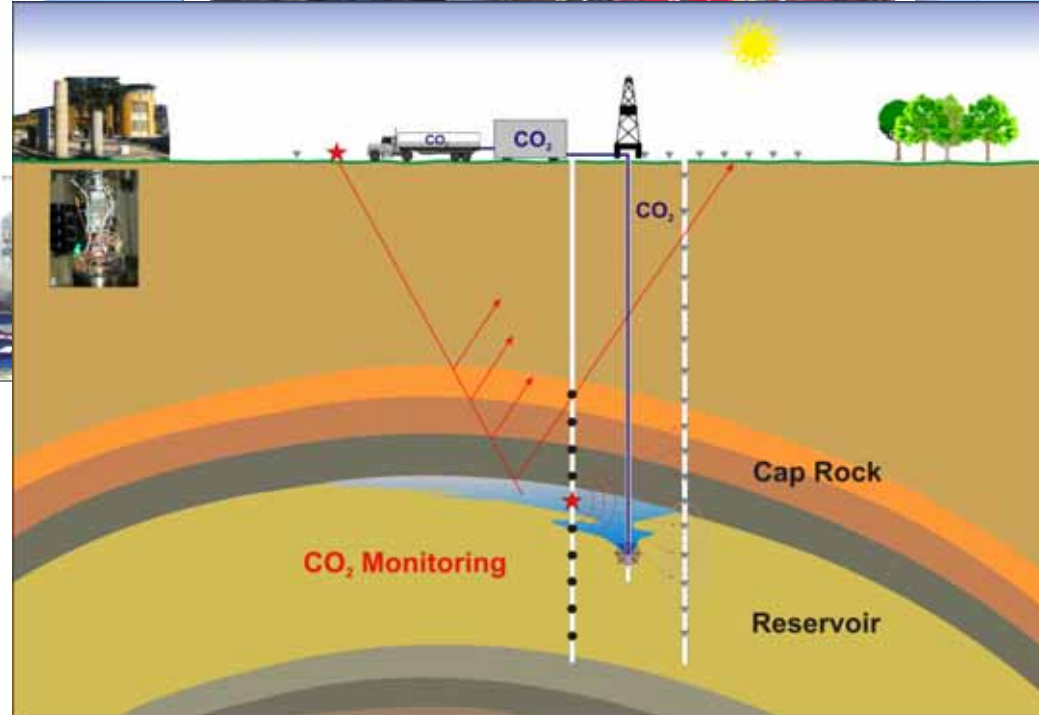
Herausforderung: Identifizierung regionaler Muster





# CO<sub>2</sub>SINK-Projekt bei Ketzin

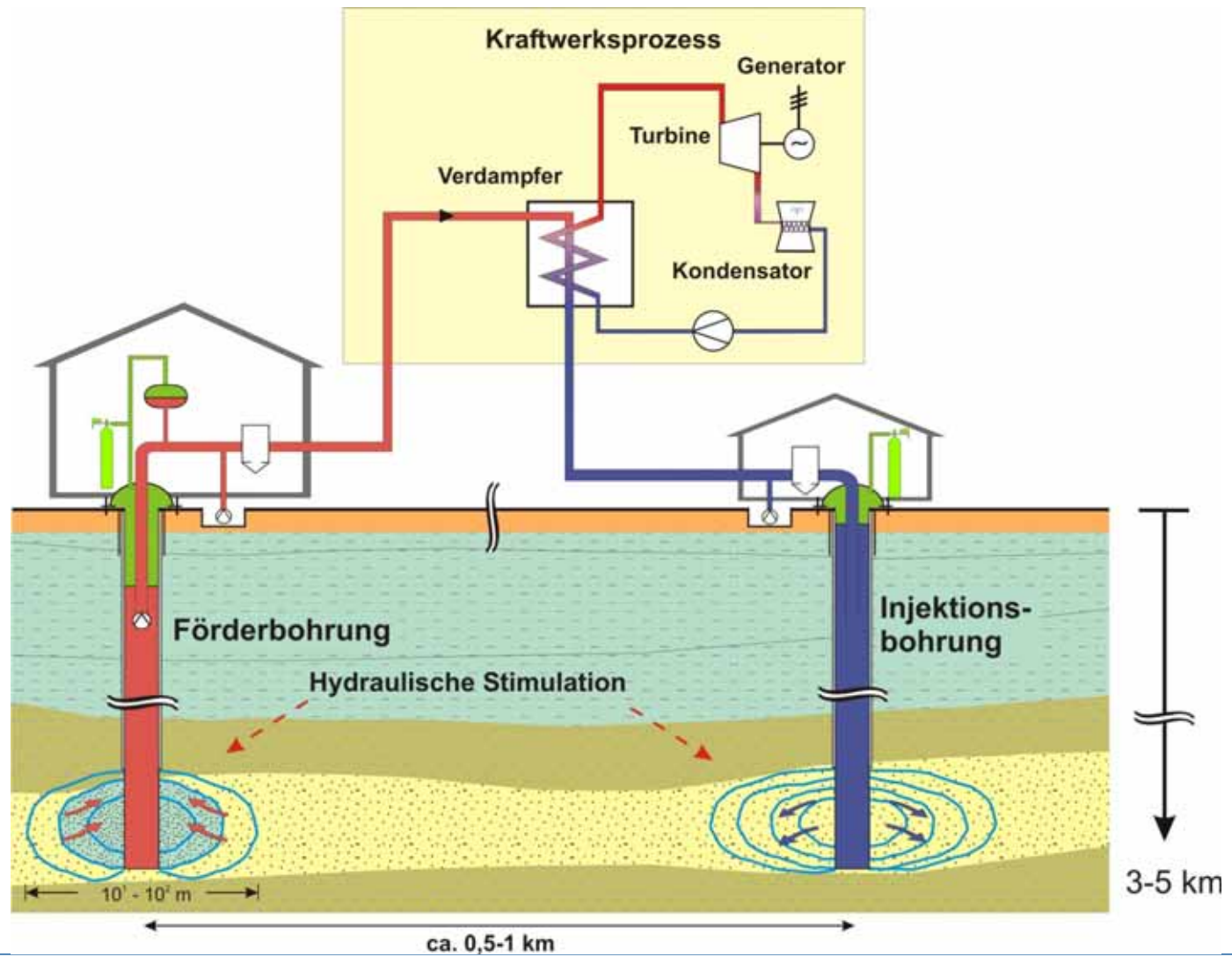
## CO<sub>2</sub>-Speicherung und Monitoring



18 Partner  
9 Länder



# GFZ-Geothermielabor Groß Schönebeck

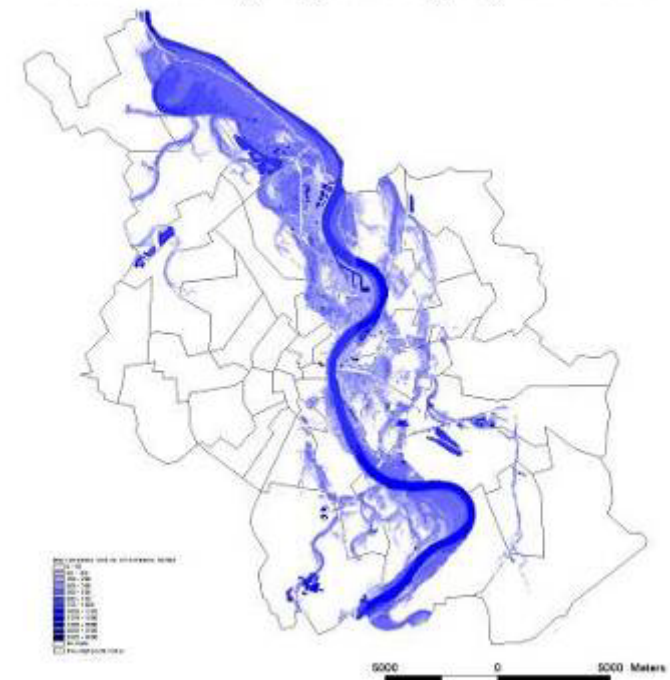


# Georisiken

## Überschwemmungen

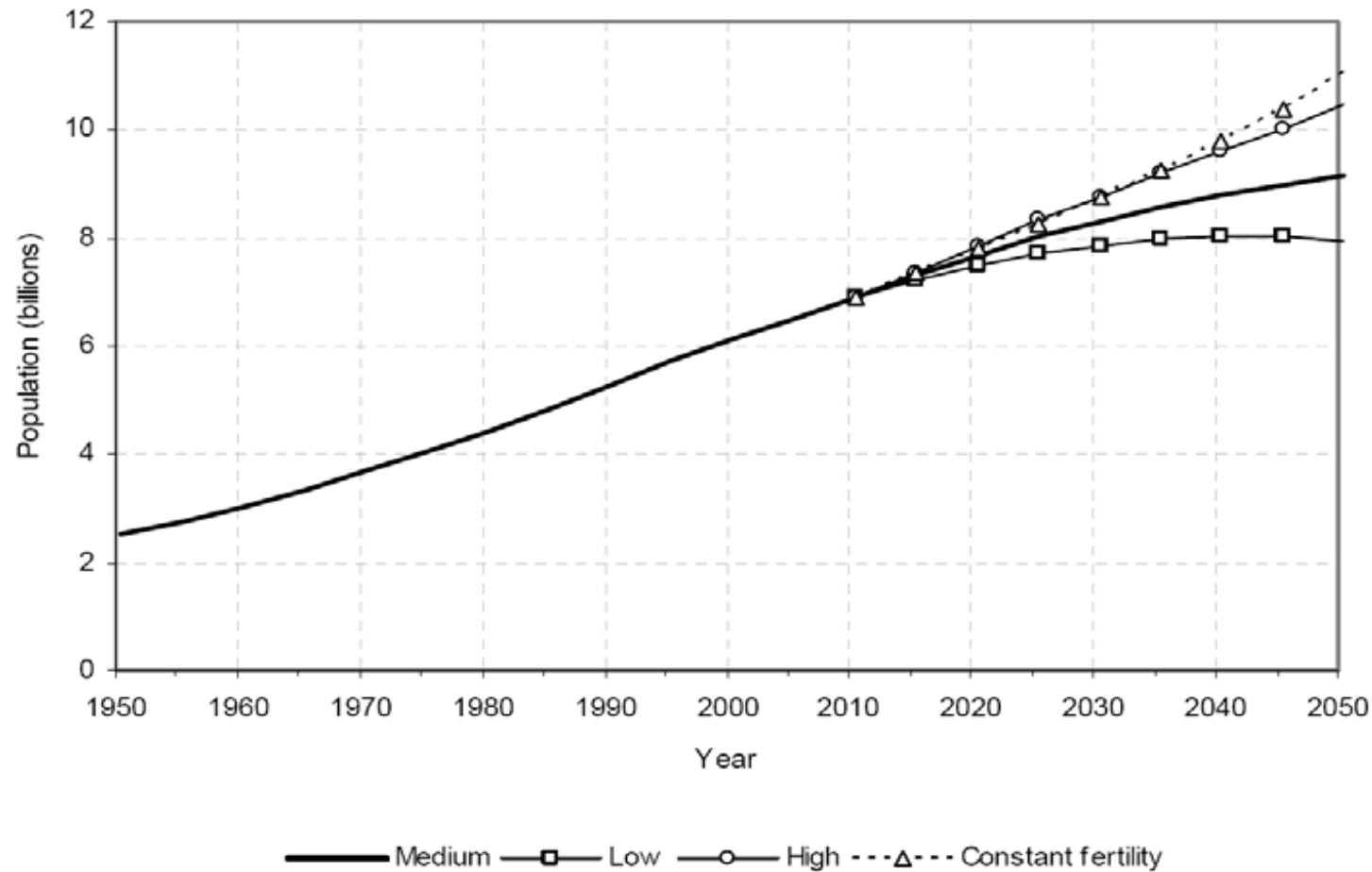


Water level (gauge Cologne): 12.50 m



# Gesellschaftspolitische Herausforderung: Wachstum der Weltbevölkerung

Population of the world, 1950-2050, according to different projections and variants

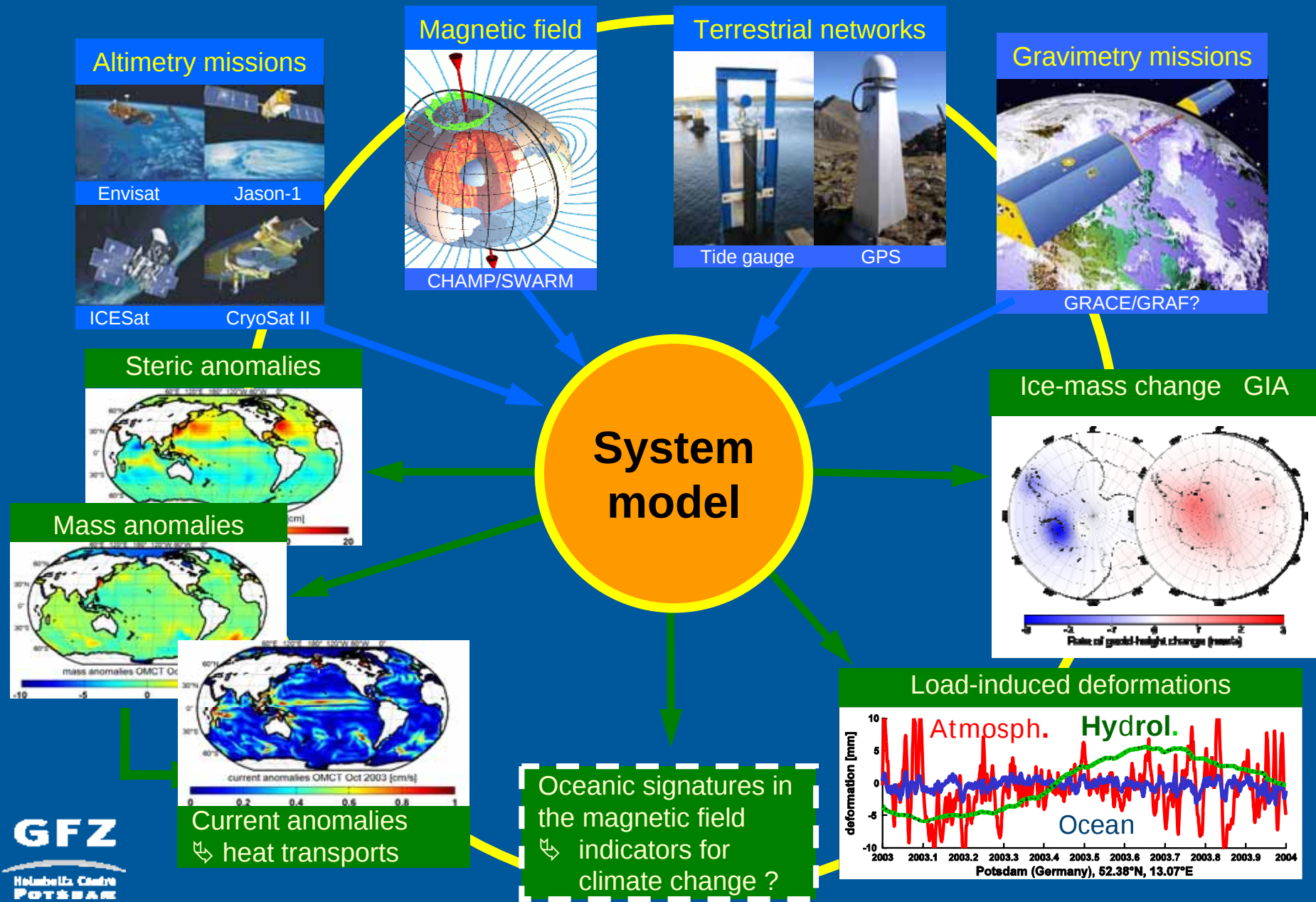


Quelle: UN World Population Prospects 2008

# Ressourcen und Rohstoffe



# Modelling, interpretation and assimilation of monitoring data



## Erde im Wandel

### Monitoring: Planet Erde

Globale Prozesse und Änderungen

*beobachten, analysieren, quantifizieren, vorhersagen*

### Geodynamik

Gekoppelte Prozesse und regionaler Impact

*Auswirkungen verstehen*

### Naturkatastrophen

Bewertung und Risikovermeidung

*Risiko minimieren*

### Georessourcen

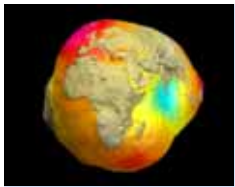
Nachhaltigkeit, Umwelt-Engineering

*Lebensraum nutzen*

## Zukunft der Menschheit

**Geowissenschaften als Leitwissenschaften  
der kommenden Jahrzehnte:  
> 9 Mrd. Menschen 2050**

# Vom System Erde zum System Erde-Mensch



## System Erde

- Geosphäre
- Hydrosphäre
- Kryosphäre
- Biosphäre
- Atmosphäre

## Georisiken

- Erdbeben
- Vulkanismus
- Überschwemmungen

## Georessourcen

- Mineralische Rohstoffe
- Energierohstoffe
- Wasser
- Boden

## System Erde-Mensch

- Geosphäre
- Hydrosphäre
- Kryosphäre
- Biosphäre
- Atmosphäre

+ **Anthroposphäre**  
(Lebensraum des  
Menschen,  
*Human Habitat*)

Umweltbelastungen

