

Climate, disasters and their impact

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Secretary-General



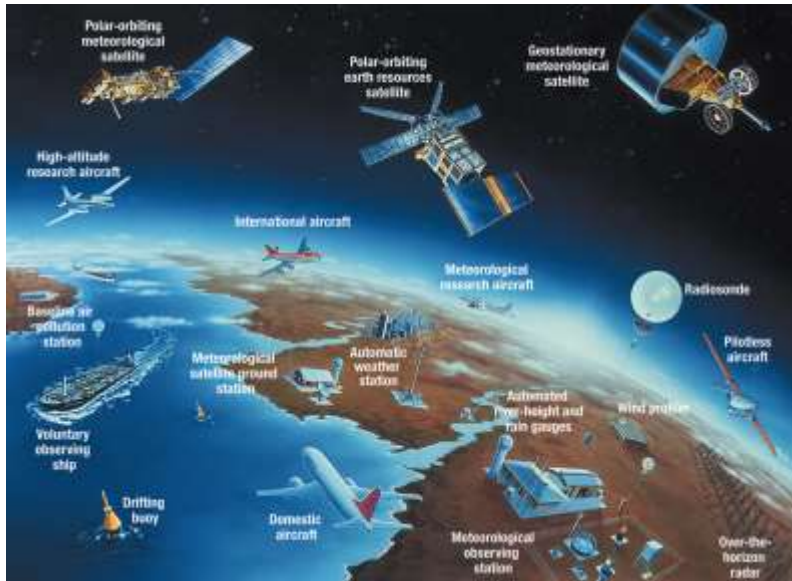
WMO OMM

World Meteorological Organization
Organisation météorologique mondiale

World Meteorological Organization



- UN Specialized Agency on weather, climate & water
- 191 Members, HQ in Geneva
- Coordinates work of > 200 000 national experts from meteorological & hydrological services, academia (& private sector)
- Co-Founder and host agency of IPCC (1st World Climate Conference)
- Co-sponsor of World Climate Research Programme & Global Climate Observing System



International Meteorological Congress 1873 in Vienna => IMO/WMO

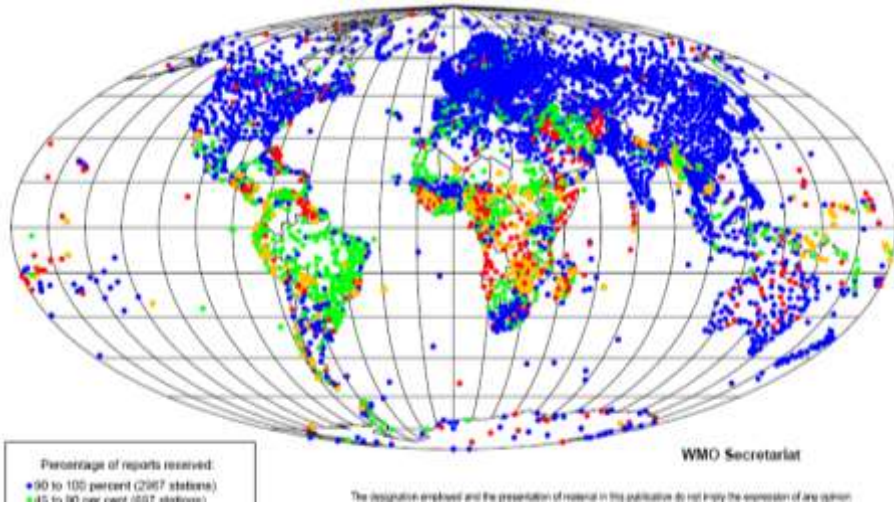


WMO Mission/key activities

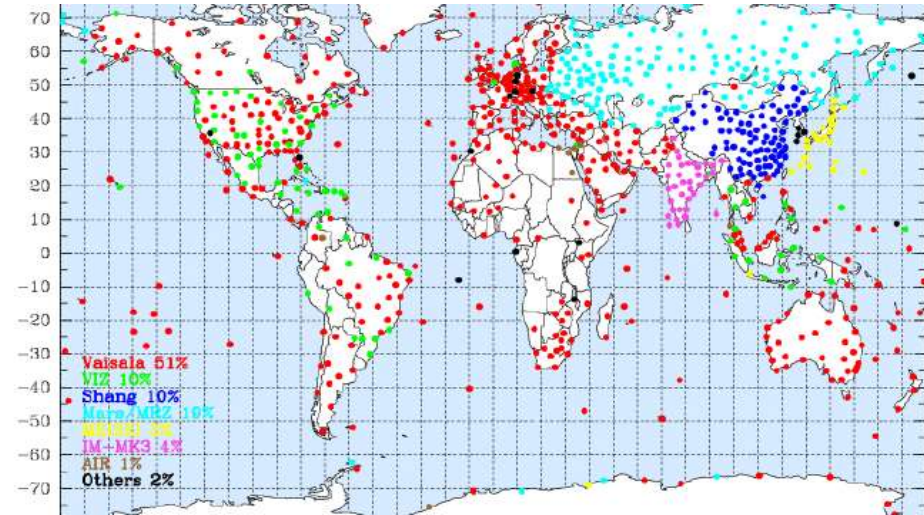
1. **World climate**
2. **Weather, disasters & safety**
3. **Water resources**
4. **Data & technology**
5. **Strengthening of the national service capabilities**
6. **Earth system research**
7. **Efficient governance**



WMO Global Observing Networks >10000 stations



Surface observations



Balloon soundings



Air quality and greenhouse gases

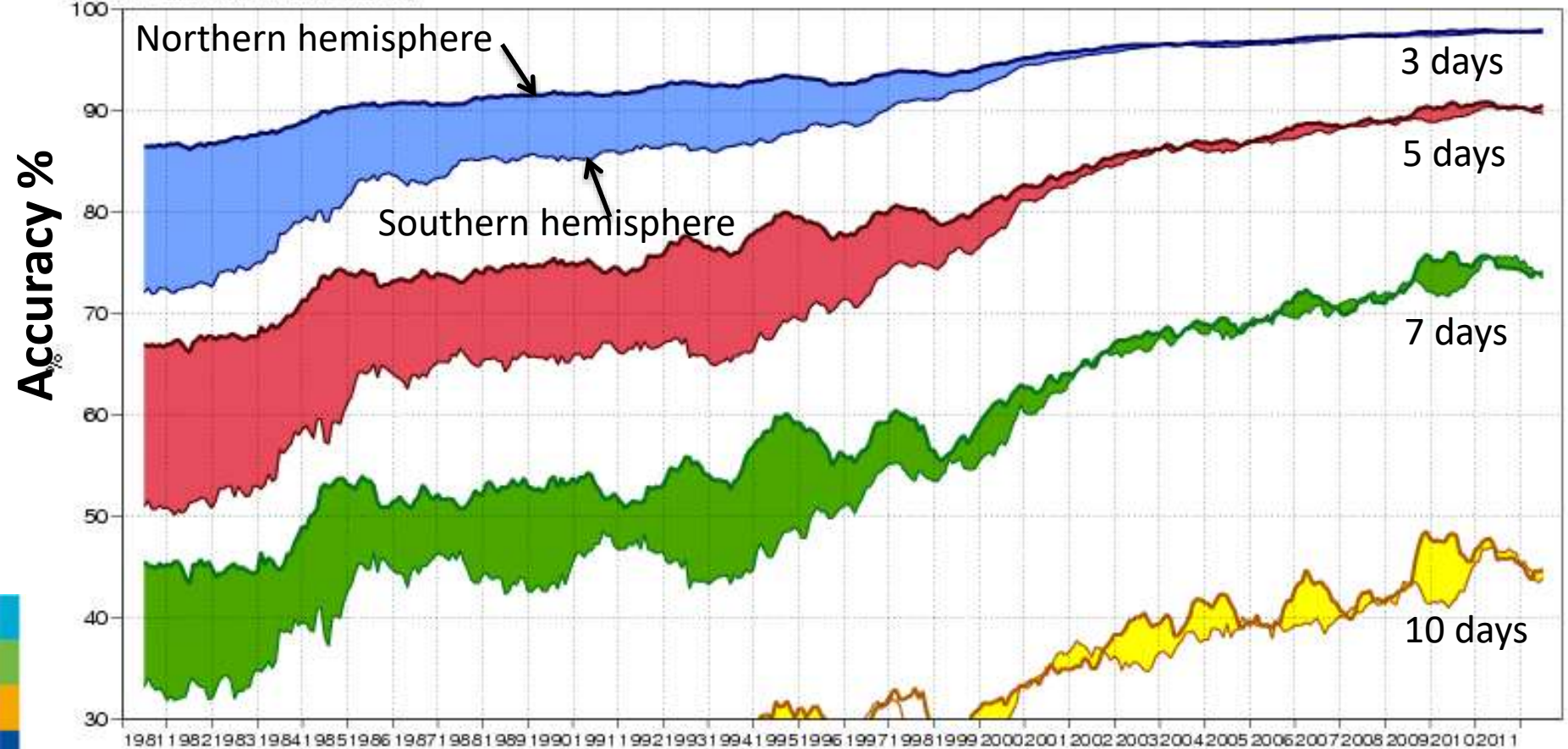


Ocean weather (with IOC UNESCO)

Improved weather forecasts

500hPa geopotential height
Anomaly correlation
12-month running mean
(centered on the middle of the window)

- Day 7 NHem
- Day 7 SHem
- Day 10 NHem
- Day 10 SHem
- Day 3 NHem
- Day 3 SHem
- Day 5 NHem
- Day 5 SHem





SUSTAINABLE DEVELOPMENT GOALS/WMO



1 NO POVERTY
Weather resilience



2 ZERO HUNGER
Climate change & -services



6 CLEAN WATER AND SANITATION
Water resource management



7 AFFORDABLE AND CLEAN ENERGY
Solar, wind & hydro use



8 DECENT WORK AND ECONOMIC GROWTH
Climate resilience



9 INDUSTRY, INNOVATION AND INFRASTRUCTURE
Big data, innovations



11 SUSTAINABLE CITIES AND COMMUNITIES
Air quality, heat waves, flooding



12 RESPONSIBLE CONSUMPTION AND PRODUCTION



13 CLIMATE ACTION
DRR, Adaptation, carbon & climate monitoring



14 LIFE BELOW WATER
Sea level rise, climate<->oceans



15 LIFE ON LAND
Climate change <->ecosystems



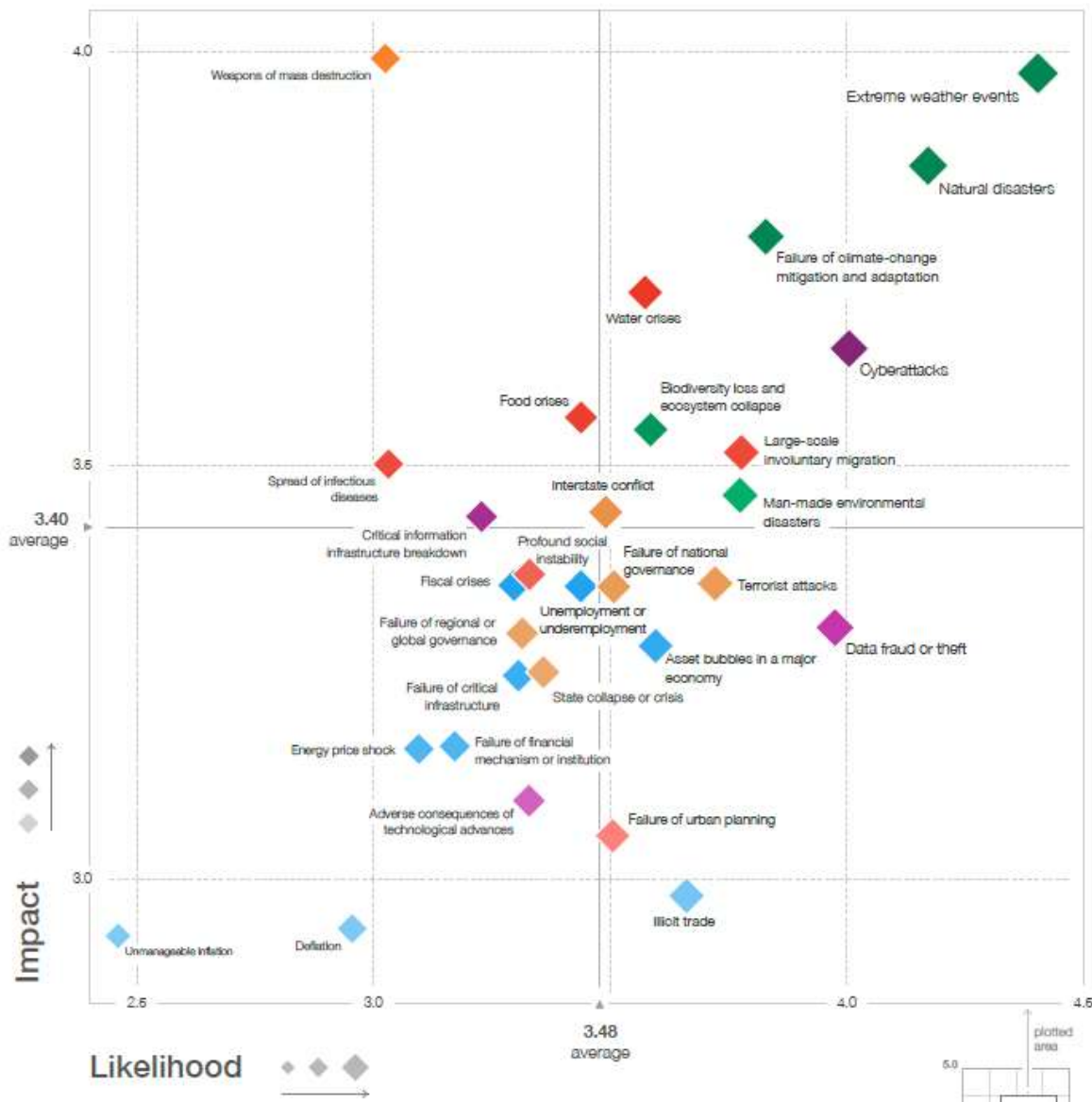
16 PEACE, JUSTICE AND STRONG INSTITUTIONS
Climate driven conflicts



17 PARTNERSHIPS FOR THE GOALS
Resources for climate adaptation & DRR

Weather risks are the top economic risks

World Economic Forum, Davos - Global Risk Landscape 2018

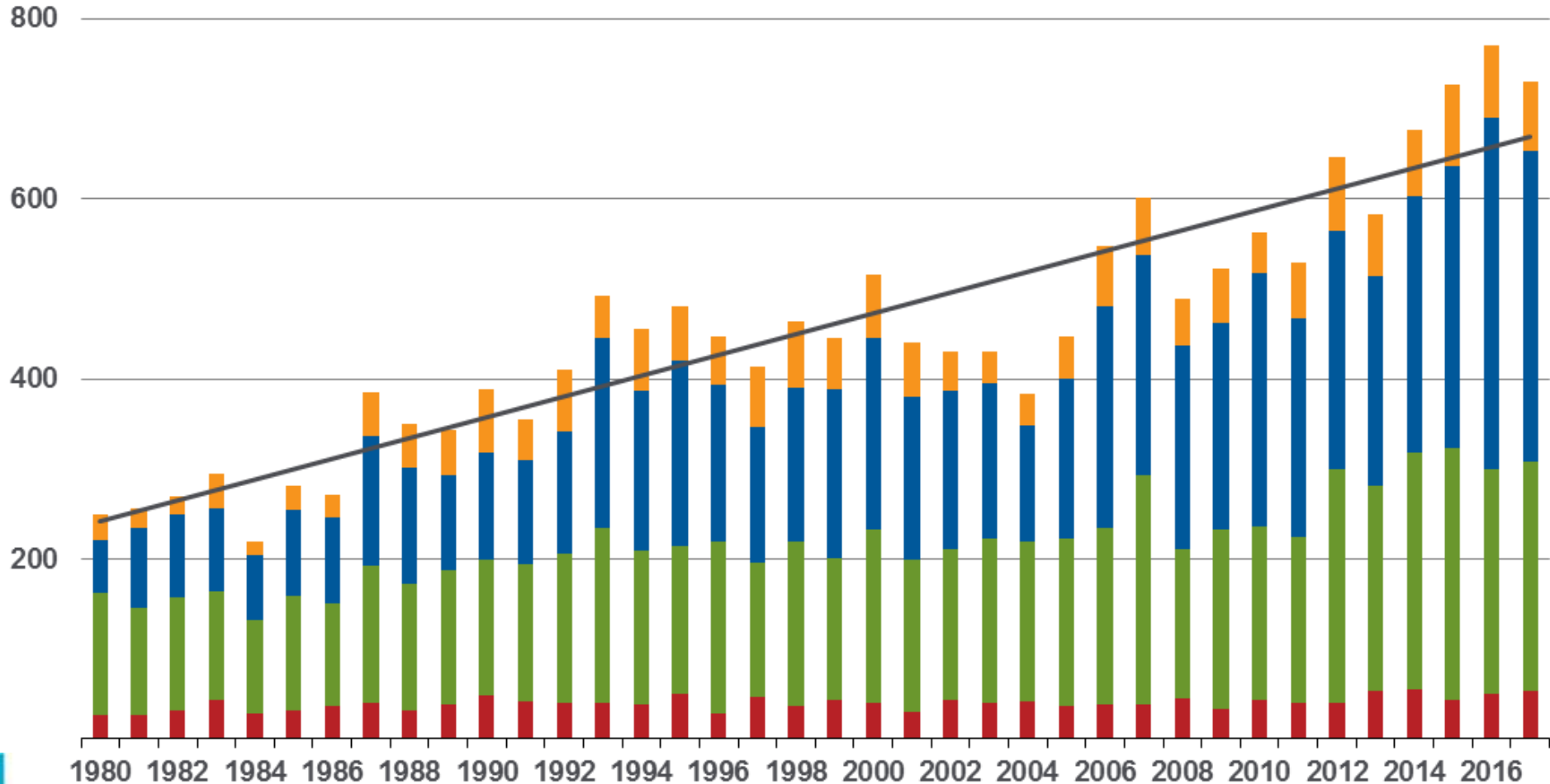


Extreme weather events
 Natural disasters
 Failure of climate-change mitigation and adaptation

- Economic
- Societal
- Environmental
- Technological
- Geopolitical

Loss events worldwide 1980 – 2017

Number



- **Geophysical events**
(Earthquake, tsunami, volcanic activity)
- **Meteorological events**
(Tropical storm, extratropical storm, convective storm, local storm)
- **Hydrological events**
(Flood, mass movement)
- **Climatological events**
(Extreme temperature, drought, forest fire)

2017 Record breaking economic losses

Losses from natural
catastrophes
2017

US\$ 330bn



Less than half of the
losses insured

US\$ 135bn
(41%)

Costliest hurricane
season on record

US\$ 215bn



Floods in South Asia:
a humanitarian disaster

**2,700 people
killed**

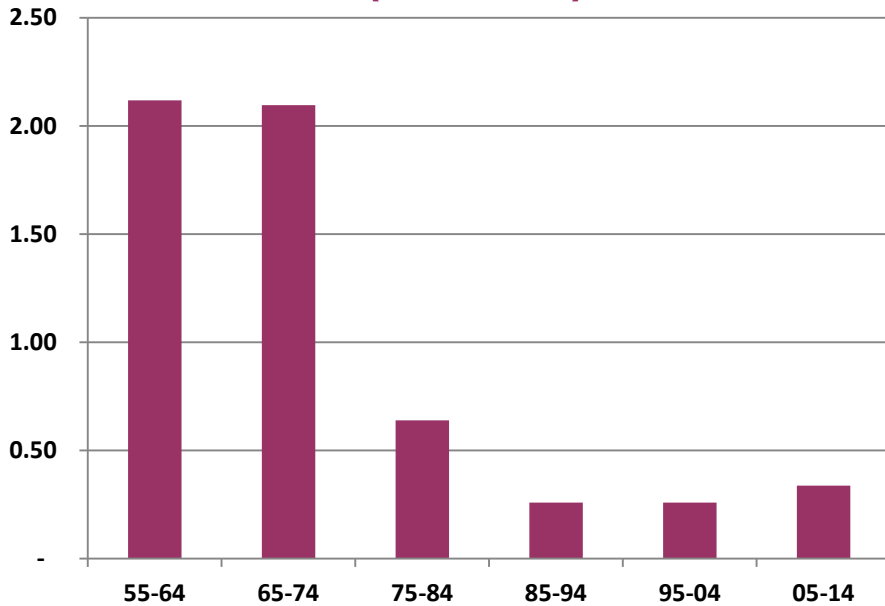


WMO OMM

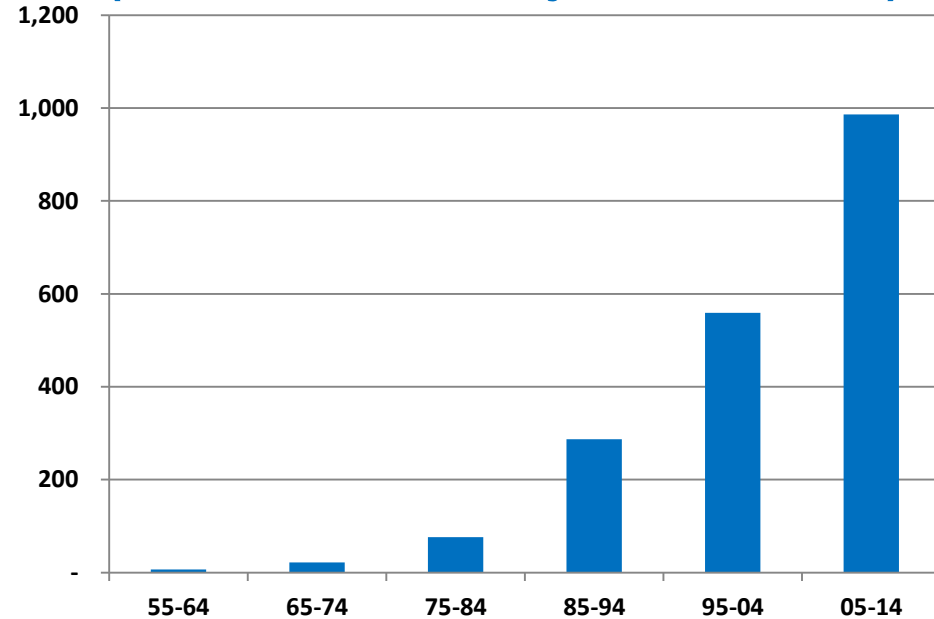
© Munich Re NatCatSERVICE

Impacts of hydrometeorological and climatological hazards (1955–2014)

Human losses by decade
(millions)



Economic losses by decade
(billions of US\$ adjusted to 2013)

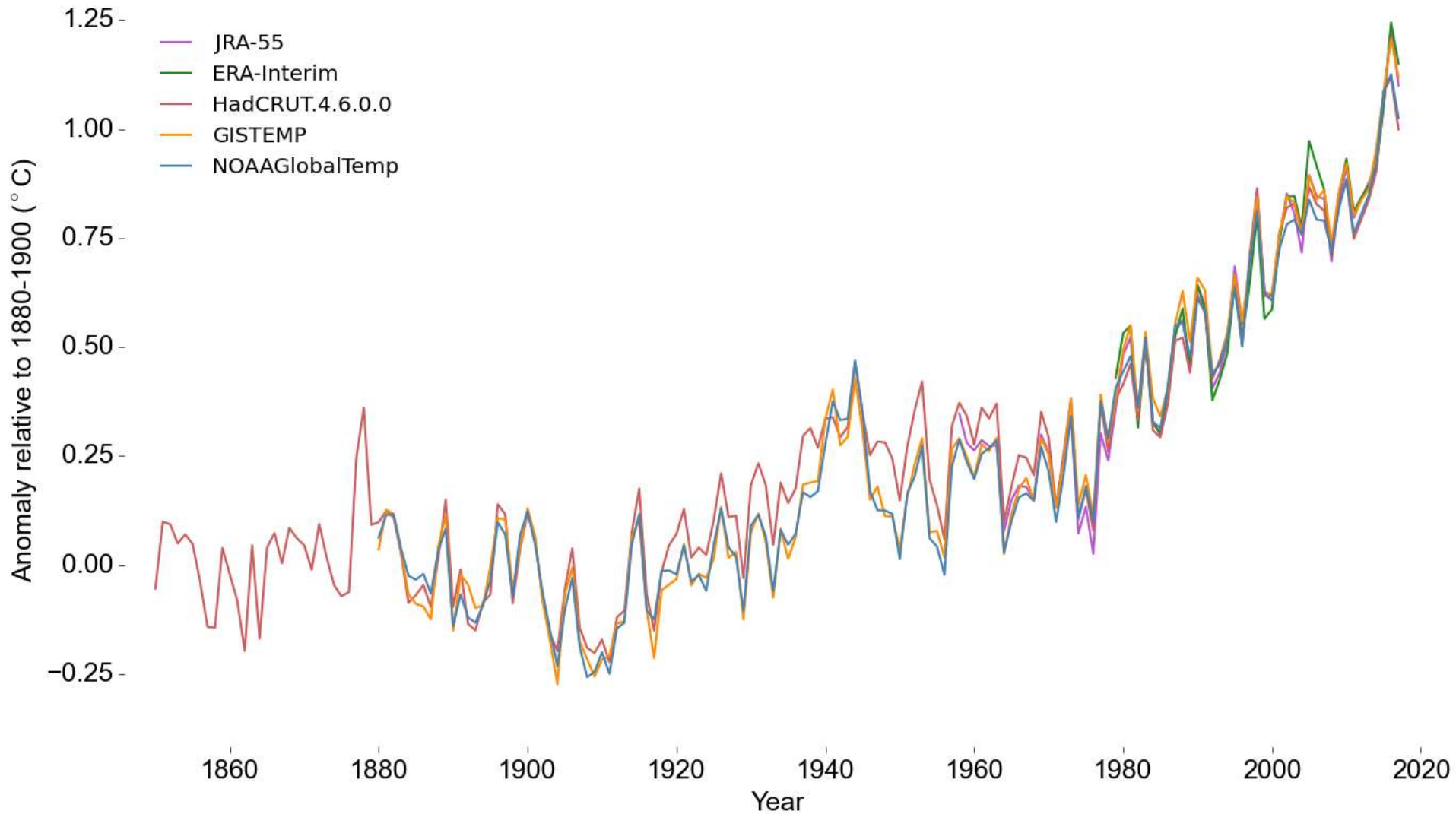


Reduction of the number of victims thanks to greater effectiveness of early warning systems and prevention measures

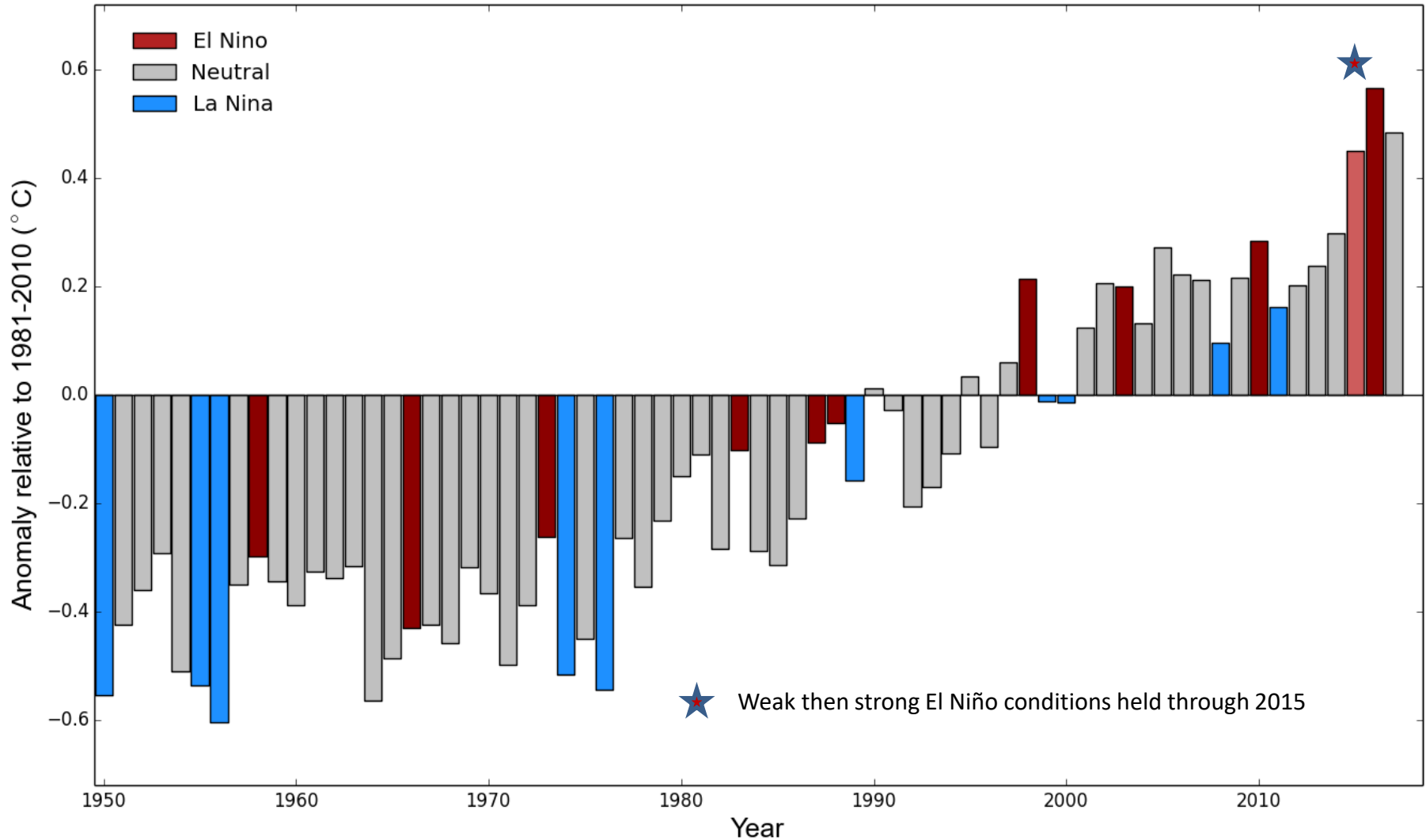
Global adaptation index



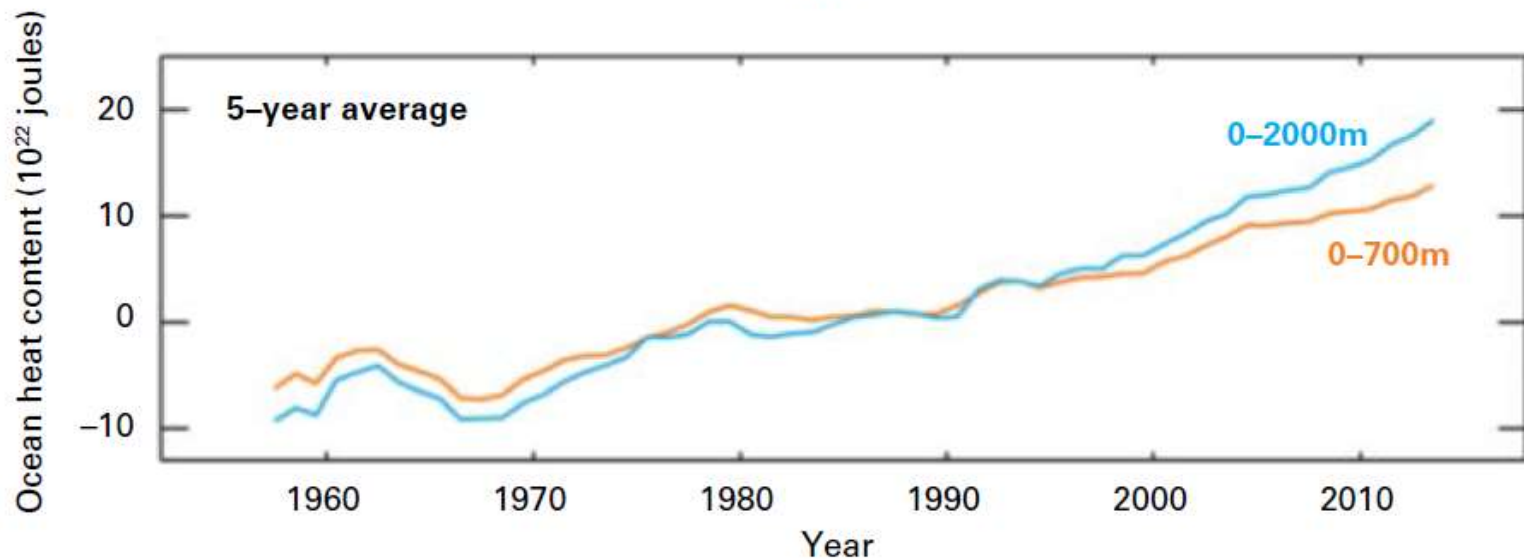
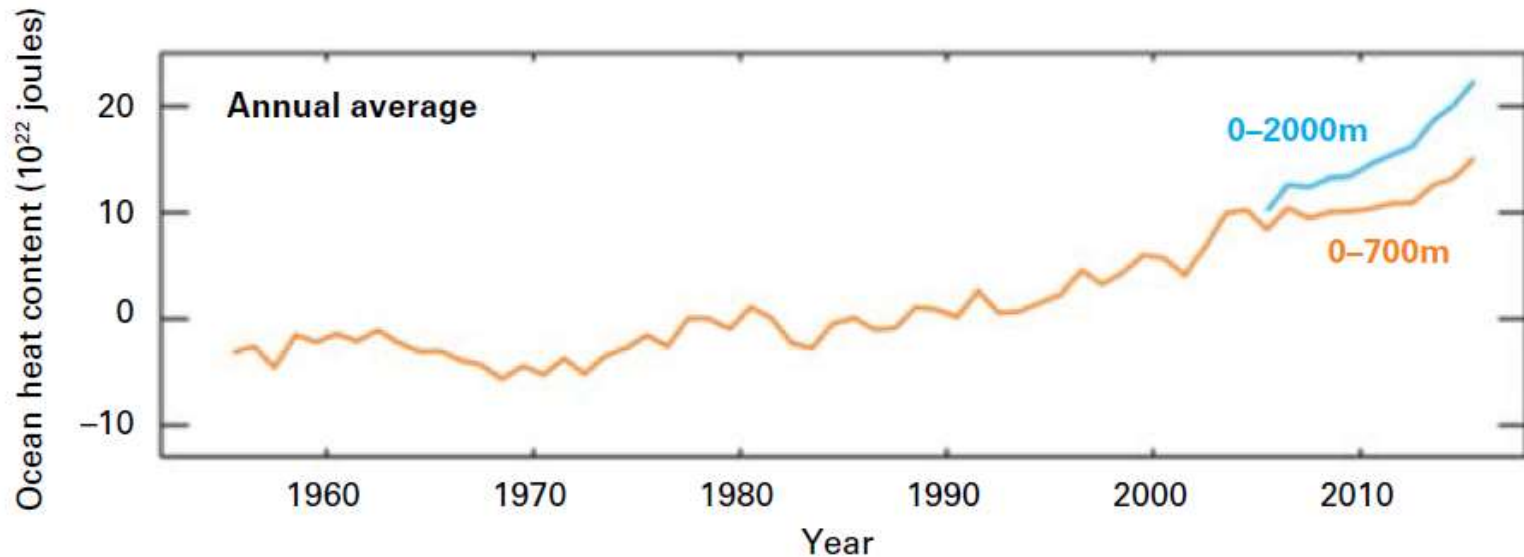
Global temperature deviations 1850-2017



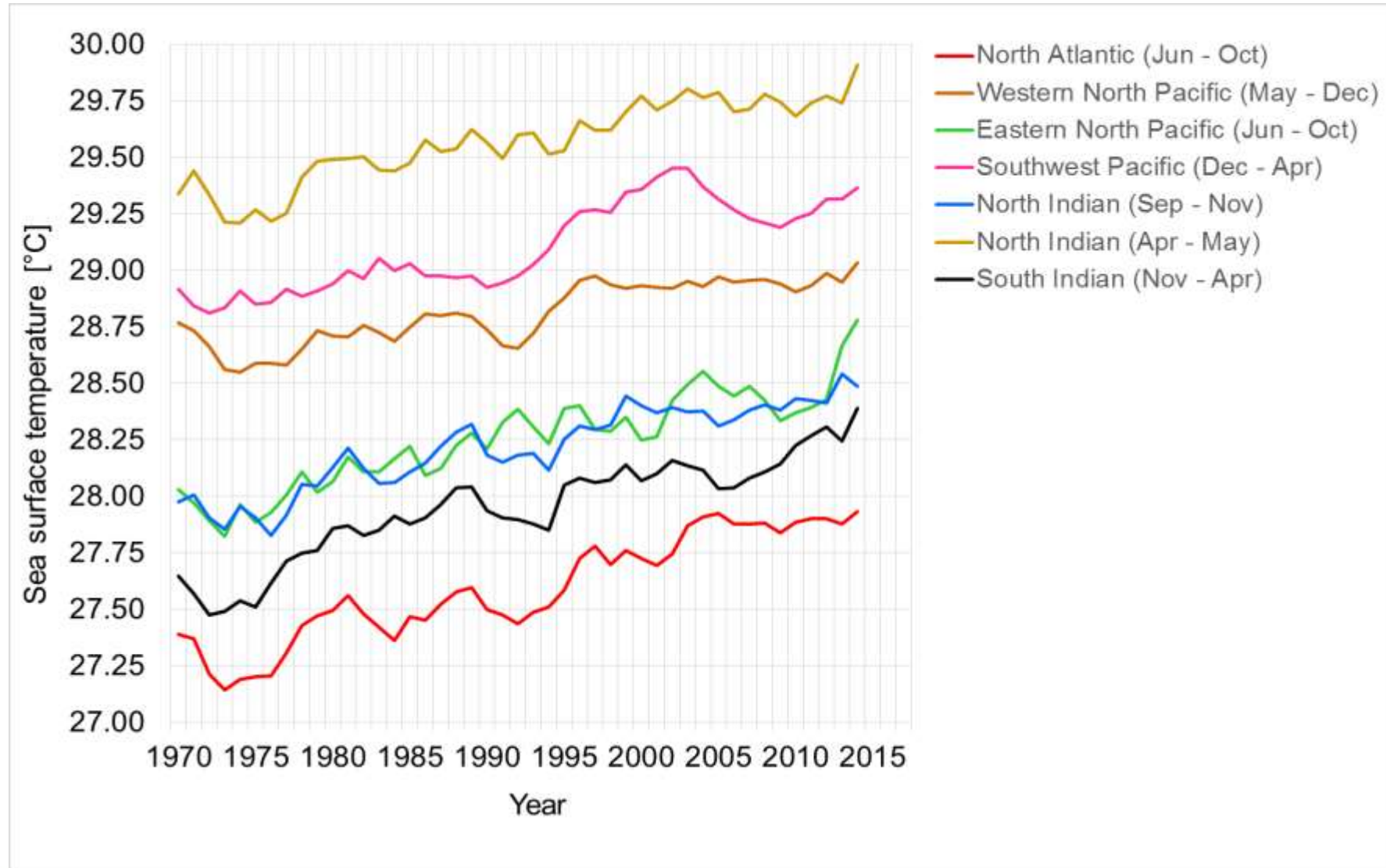
2017 – the warmest non-El Niño year on record



Ocean heat content

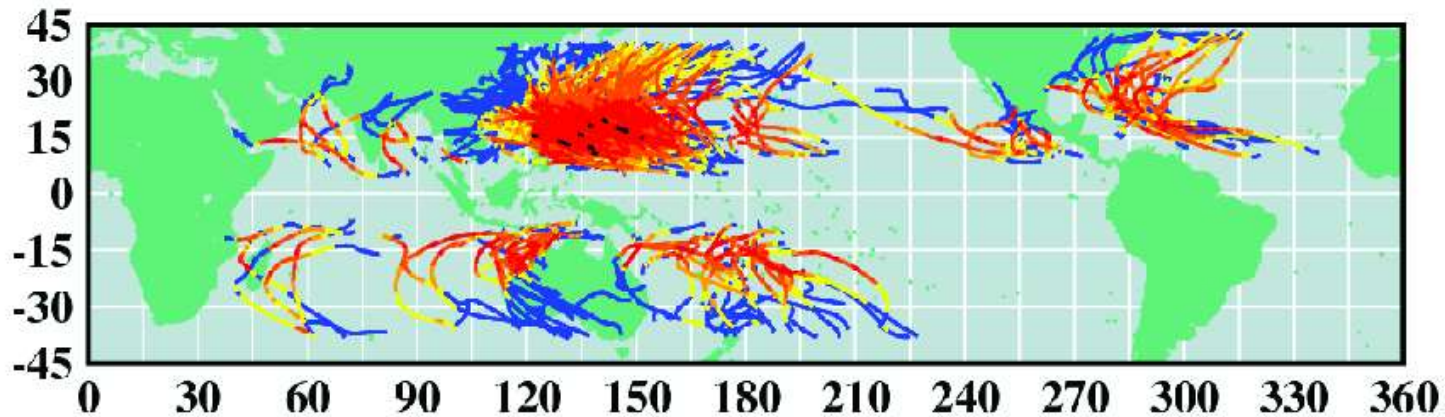


Sea-surface temperature of tropical oceans 1968-2016 (5-y running means)

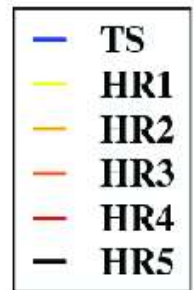


Tropical storms today and in 2 C warmed climate

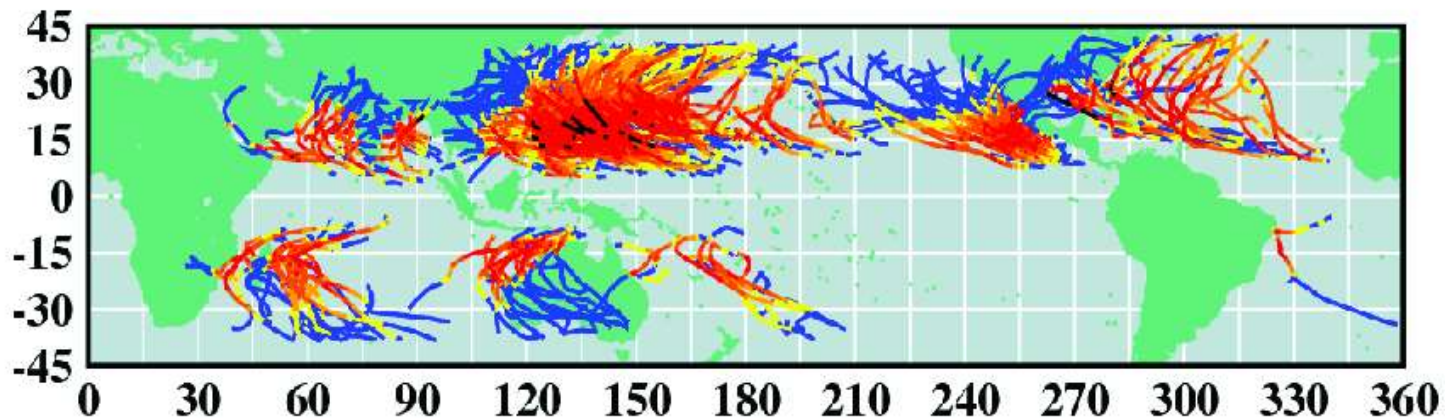
a) Present Day Simulation: 244 Cat 4-5 storms



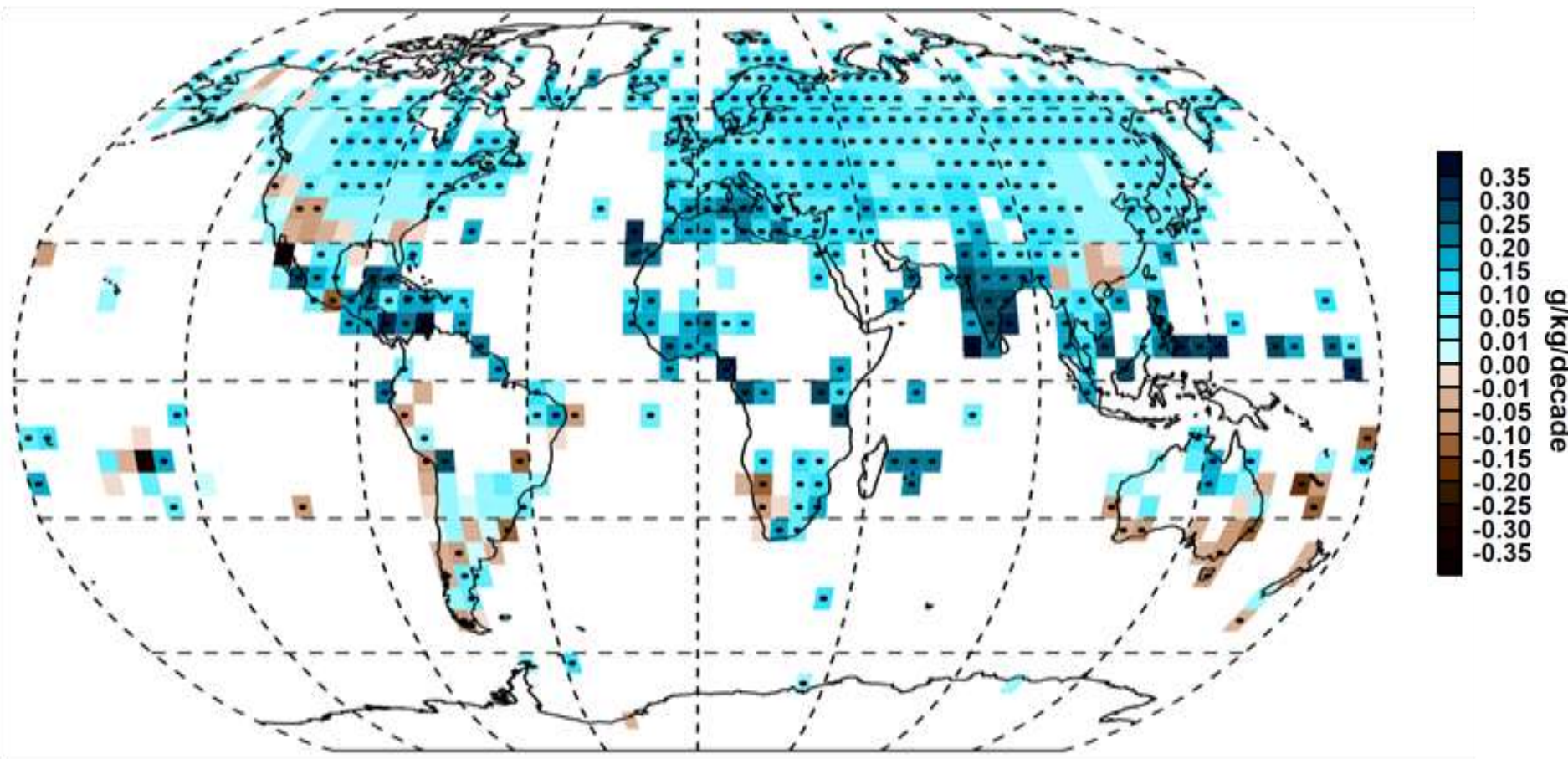
Storm
Category



b) RCP4.5 Late 21st Century: 313 Cat 4-5 storms

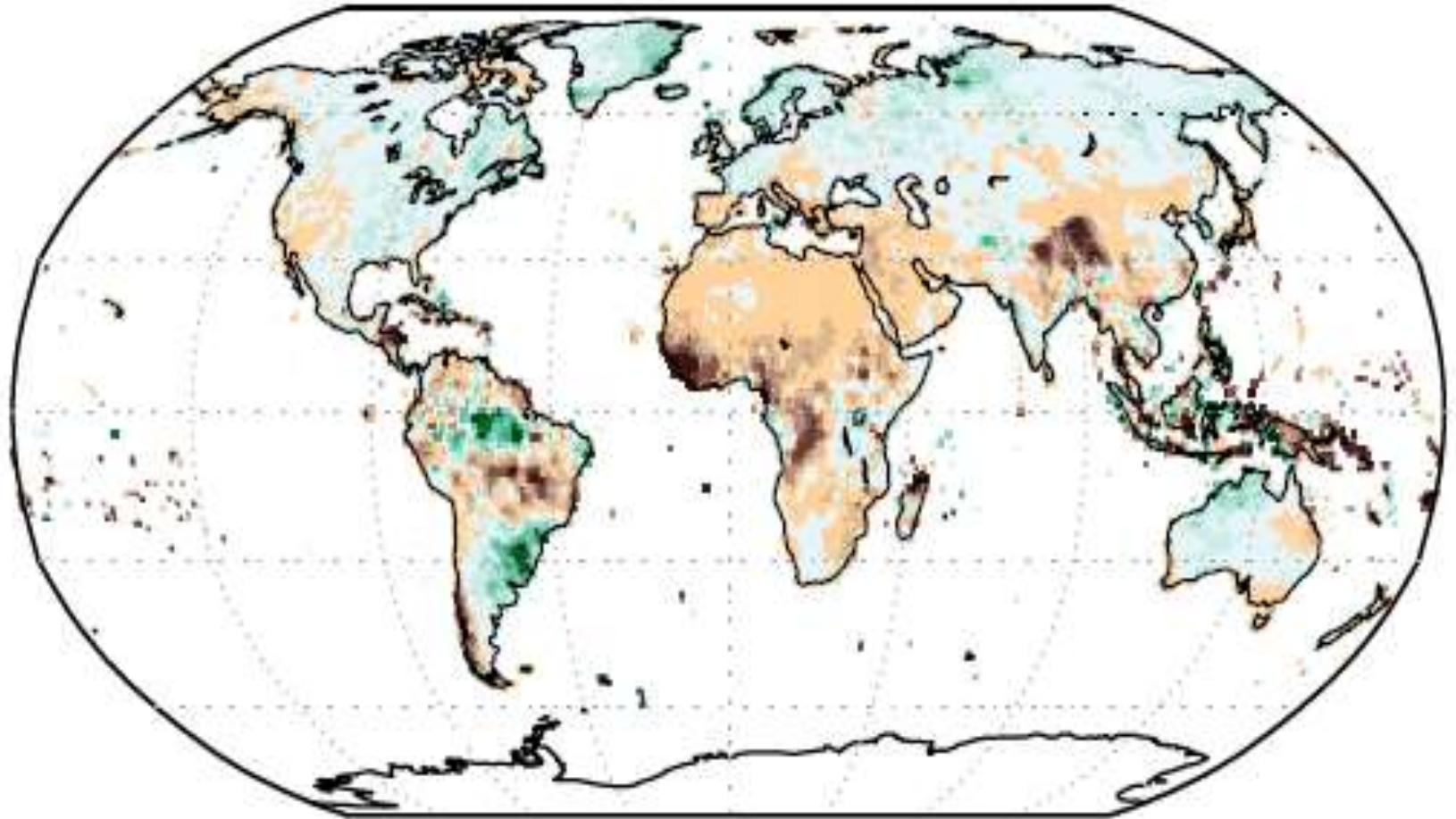


Specific humidity has risen in large parts of the Northern Hemisphere

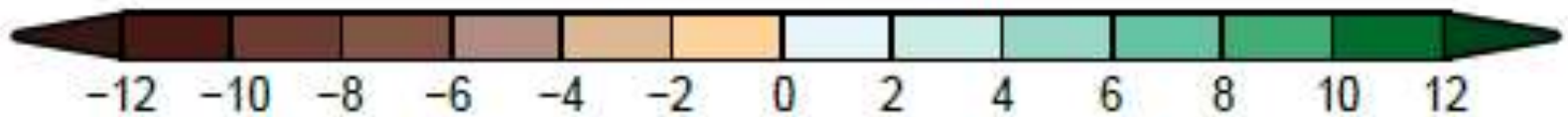


Change in near-surface specific humidity over time in the northern hemisphere 1973–2012 (Source: Willett et. al. (2013), *Clim. Past*, 9, 657–677. Black dots: trends significant at the 95% level)

Global precipitation 1986–2015 vs. 1901–1960

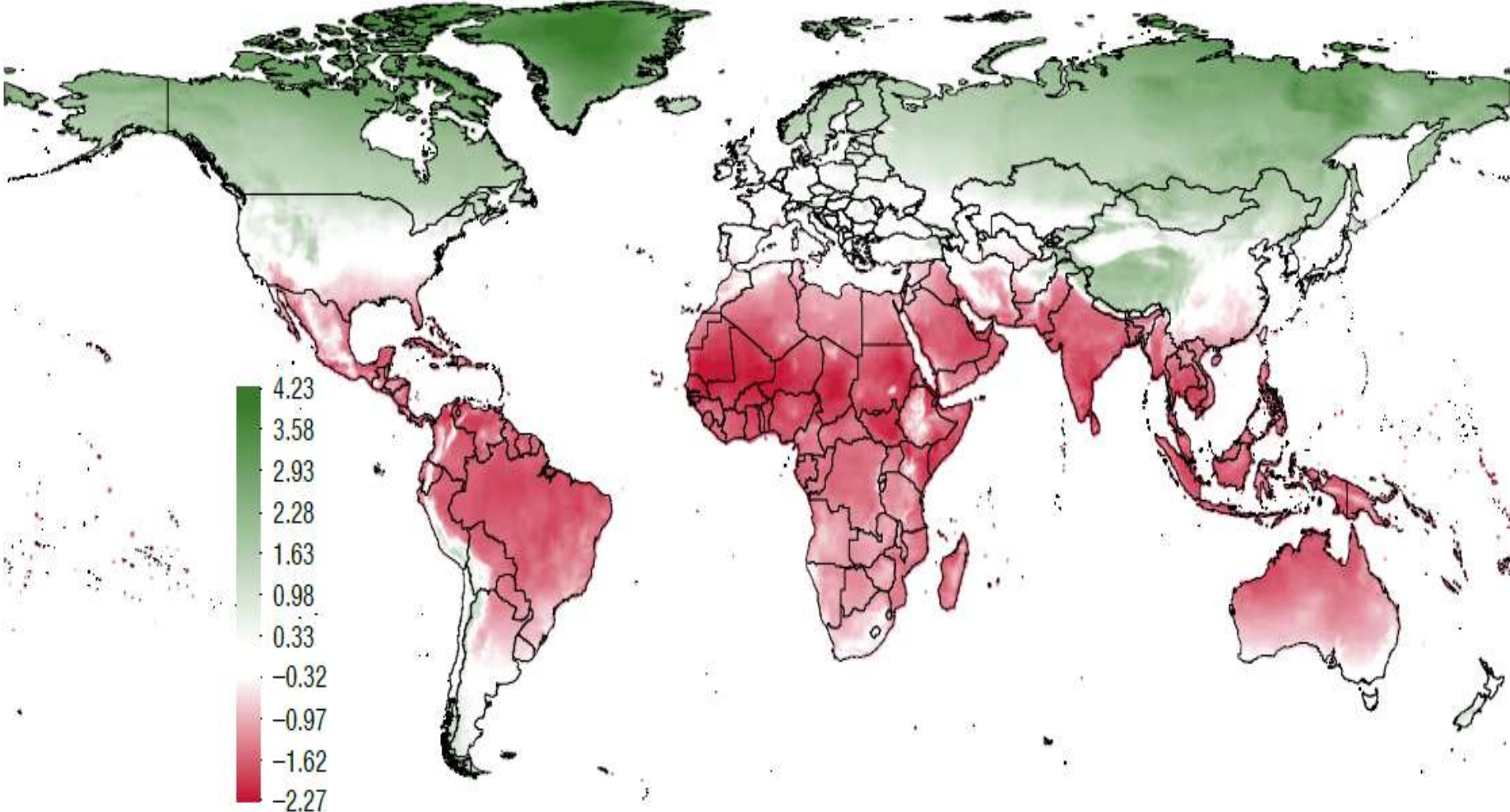


Change in Precipitation (inches)

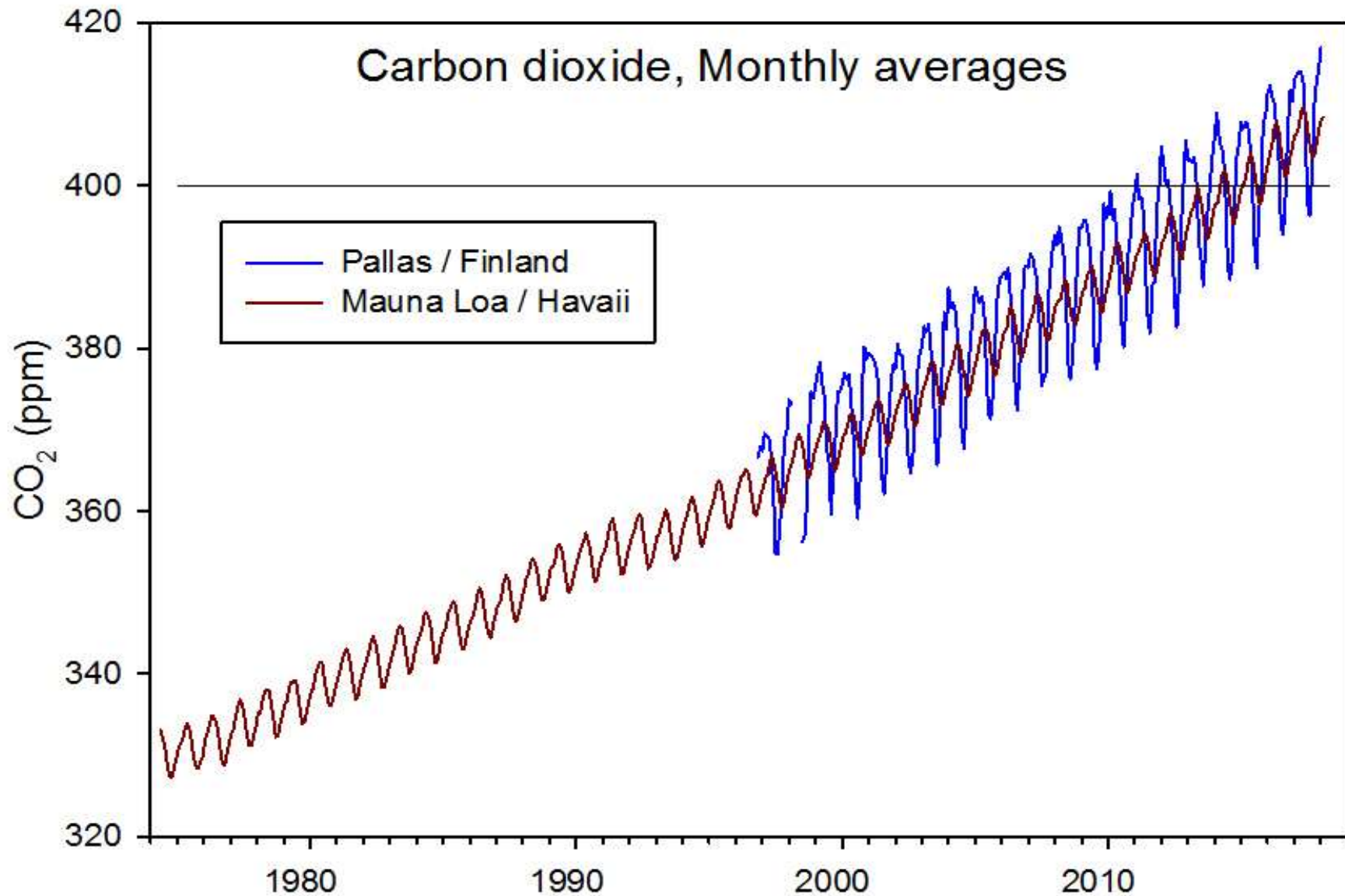


WMO OMM

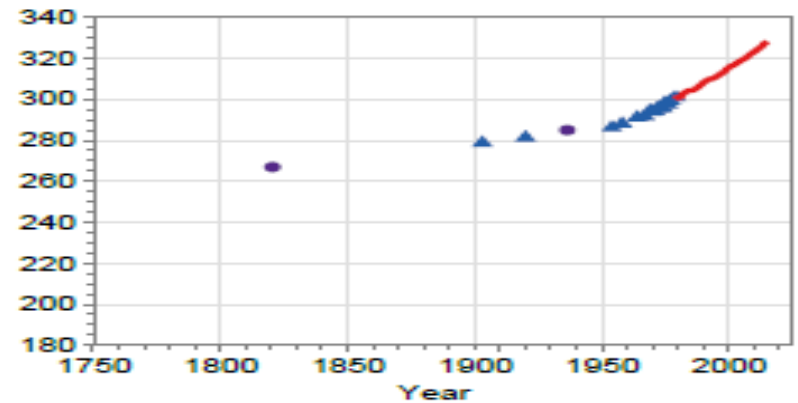
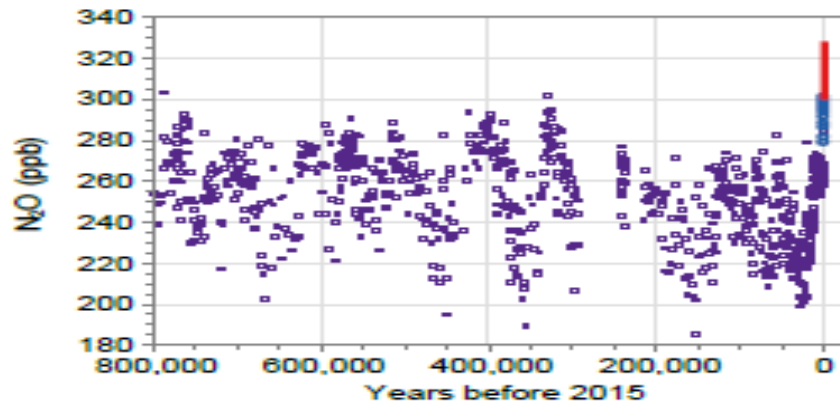
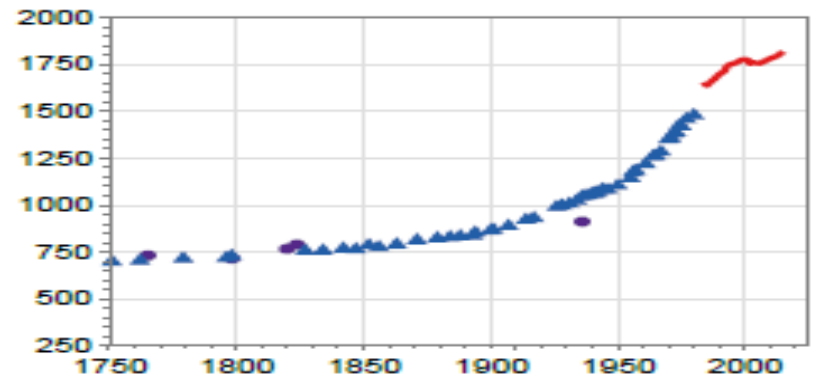
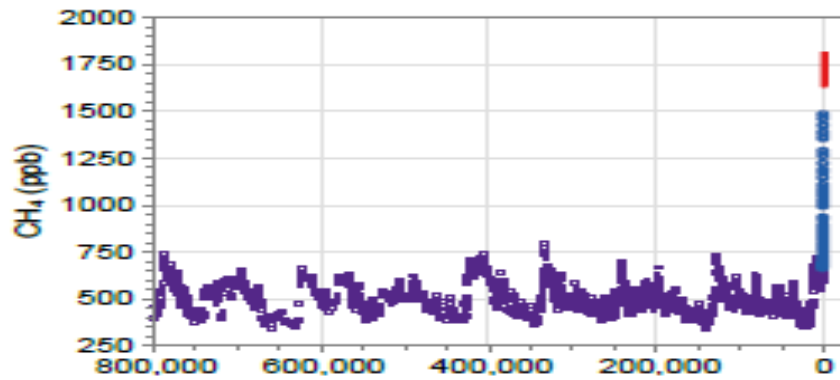
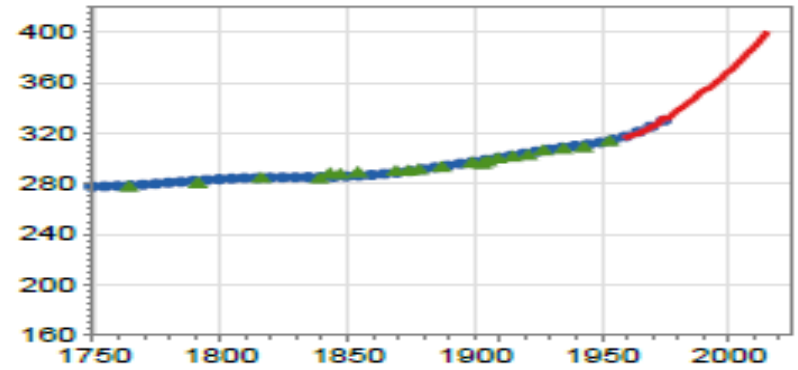
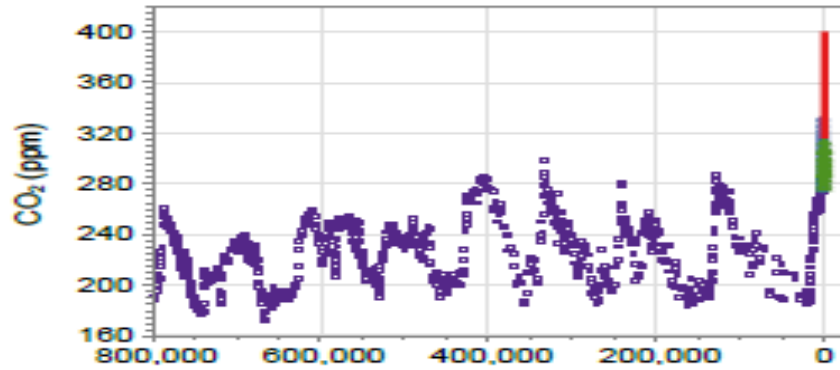
Effect of 1°C temperature increase on per capita output



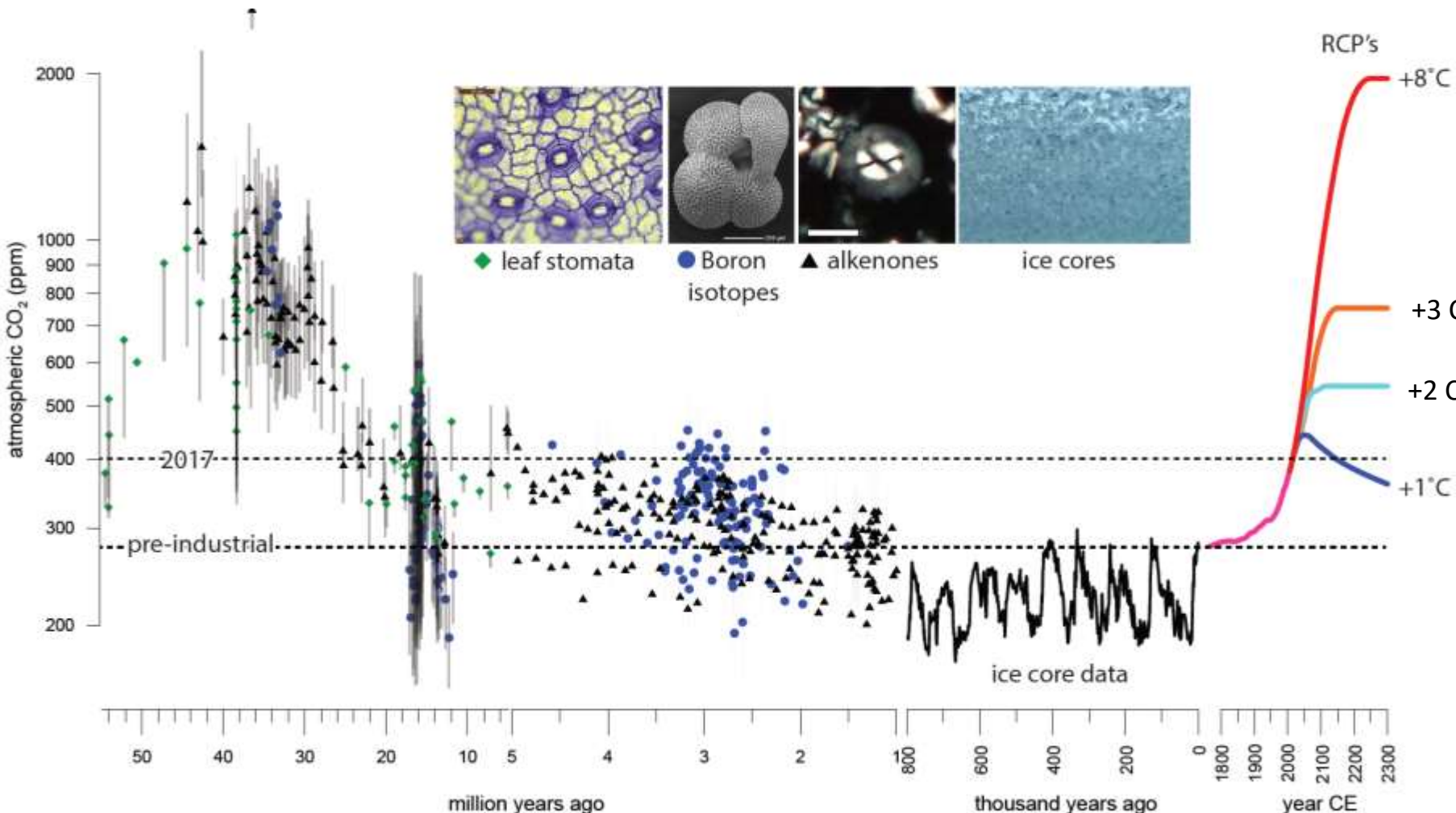
Carbon dioxide tropics/Arctic



CO₂, CH₄ & N₂O 800 000 BC-2016 AD

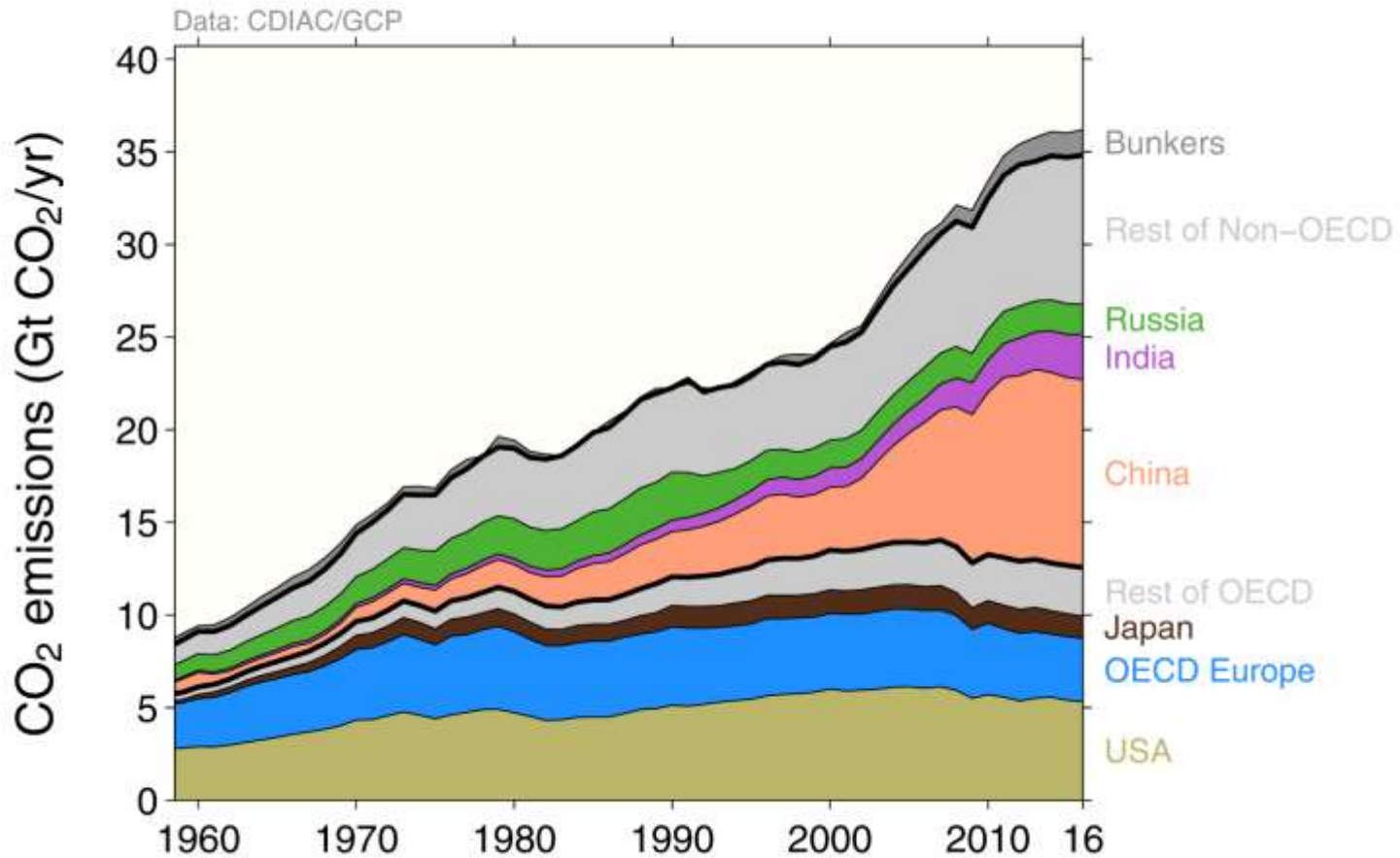


Variation of carbon dioxide concentration 50 M years



Global CO₂ emissions by country

Emissions from OECD countries are about the same as in 1990
 Emissions from non-OECD countries have increased rapidly in the last decade



Fate of anthropogenic CO₂ emissions (2007–2016)

Sources = Sinks



34.4 GtCO₂/yr
88%



12%
4.8 GtCO₂/yr



17.2 GtCO₂/yr
46%

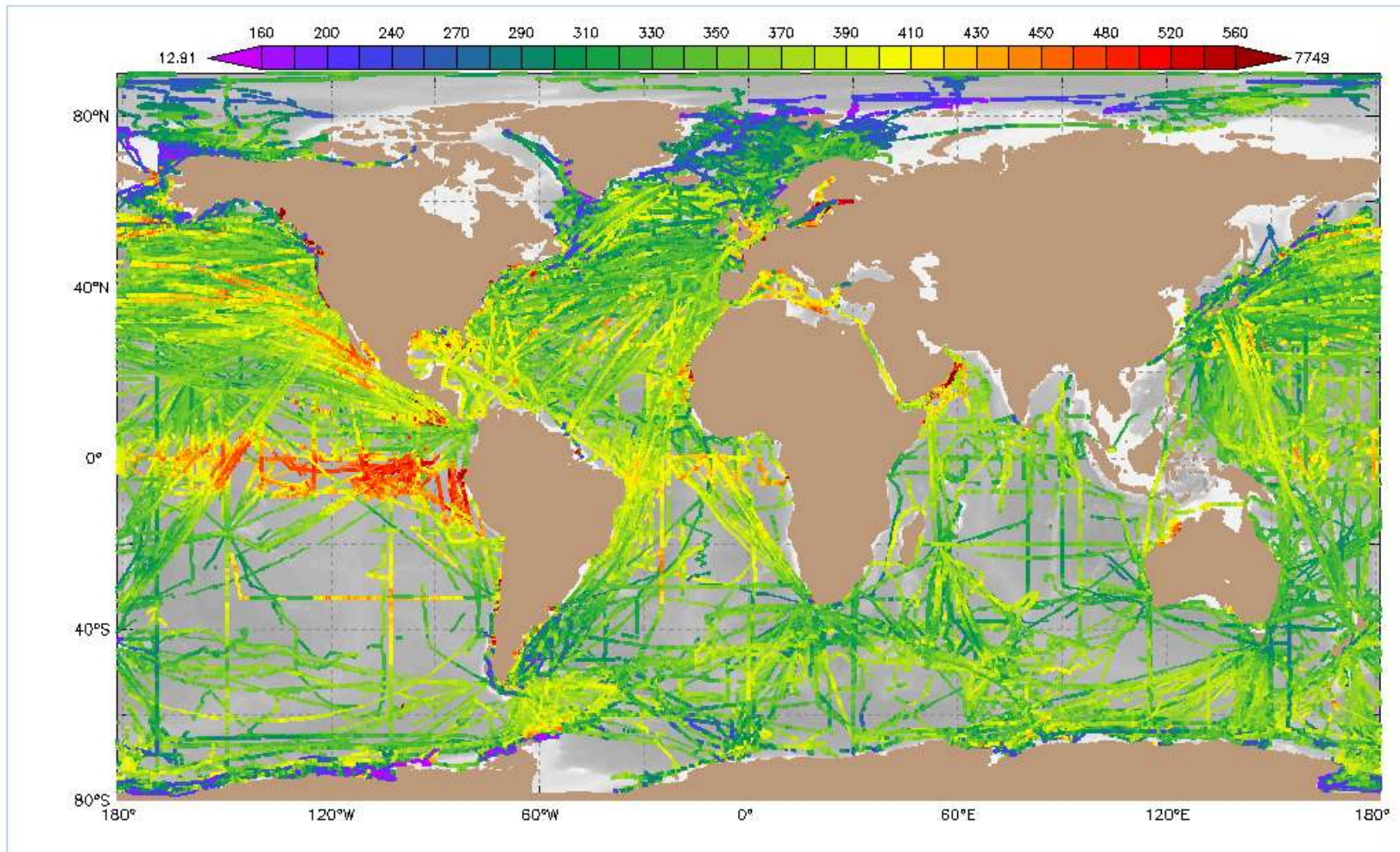


30%
11.0 GtCO₂/yr



24%
8.8 GtCO₂/yr

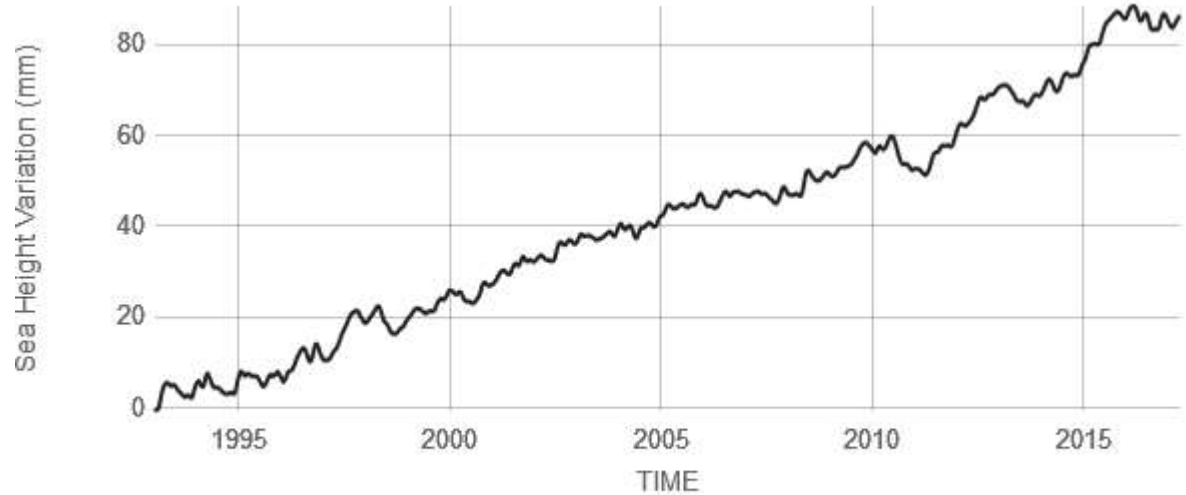
Ocean Acidification



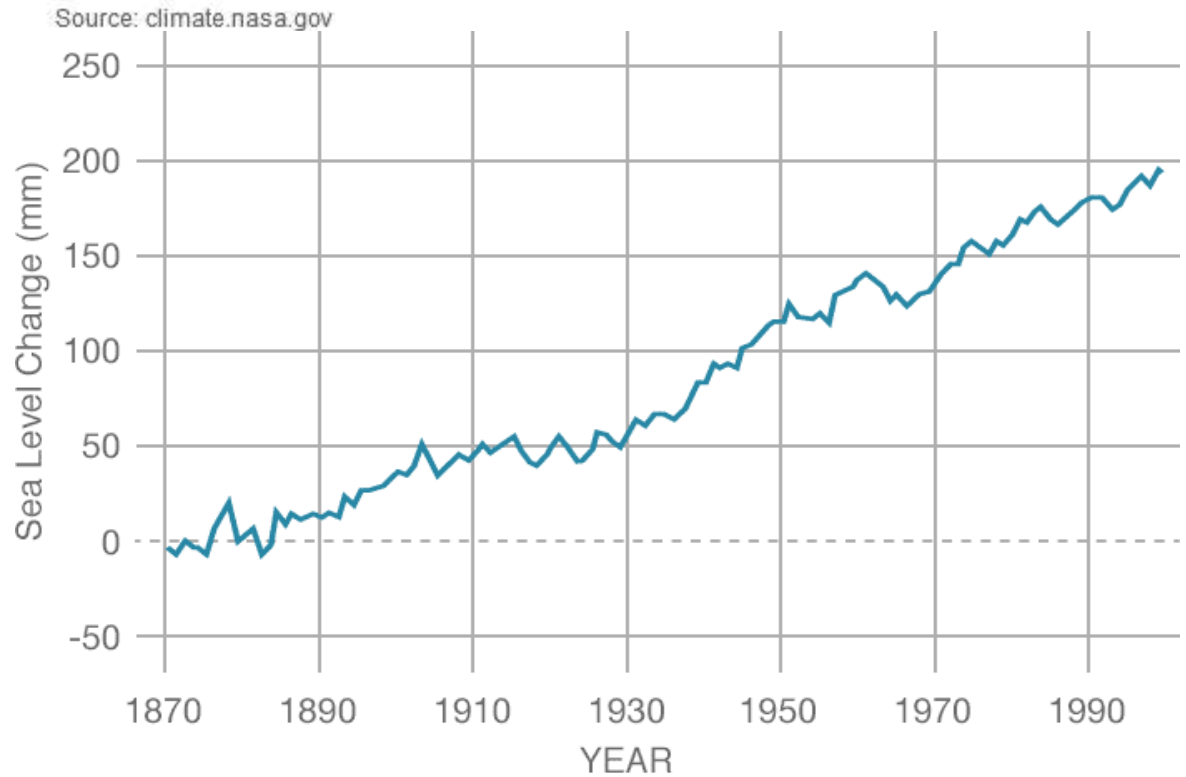
Ocean acidification is a global problem that threatens marine organisms, ecosystems, services and resources and that has potentially considerable ecological and socio-economic consequences (food security, livelihood of fishing communities)

Global sea level rise: + 26 cm 1870-2017

NASA-EUMETSAT
Satellites
(1993-present)

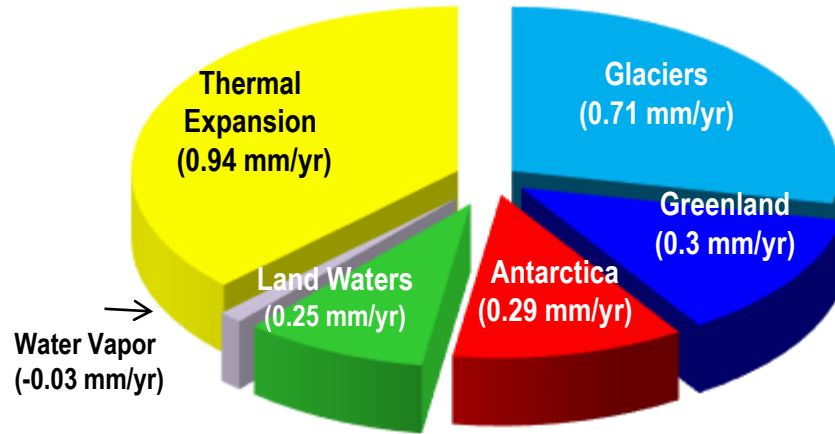


Tide gauges
(1870-2000)



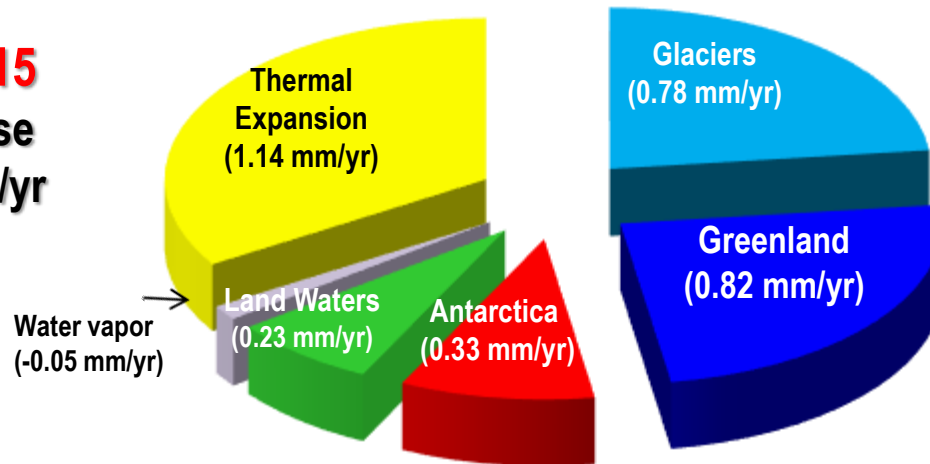
Contributions to global sea level rise

1993-2004
GMSL rise
= 2.7 mm/yr



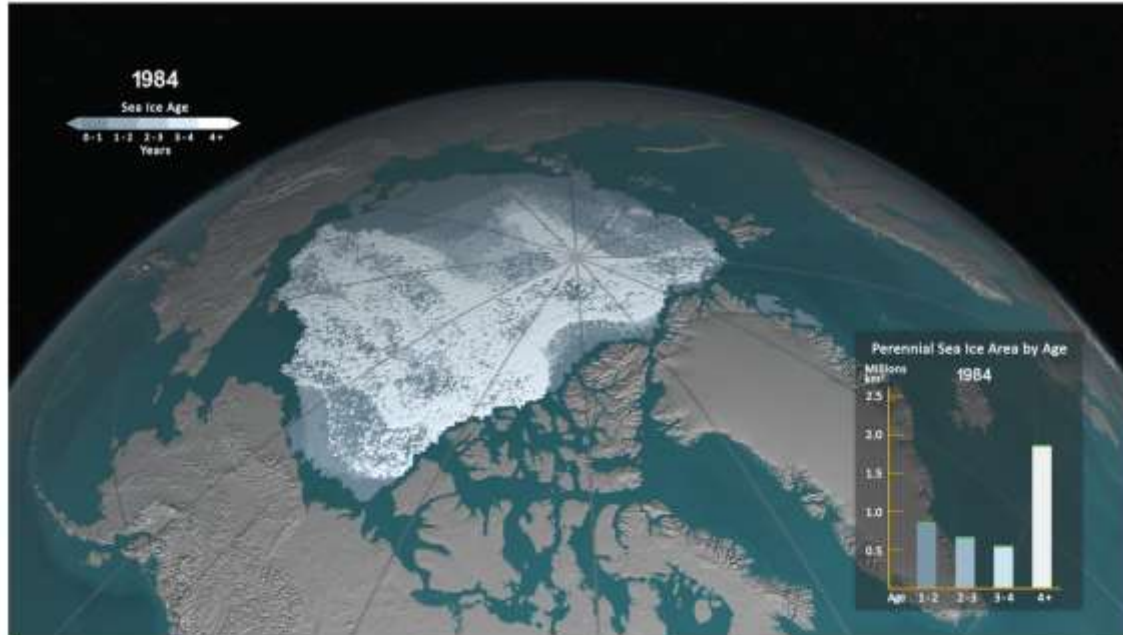
→ Total land ice: 47%

2004-2015
GMSL rise
= 3.5 mm/yr

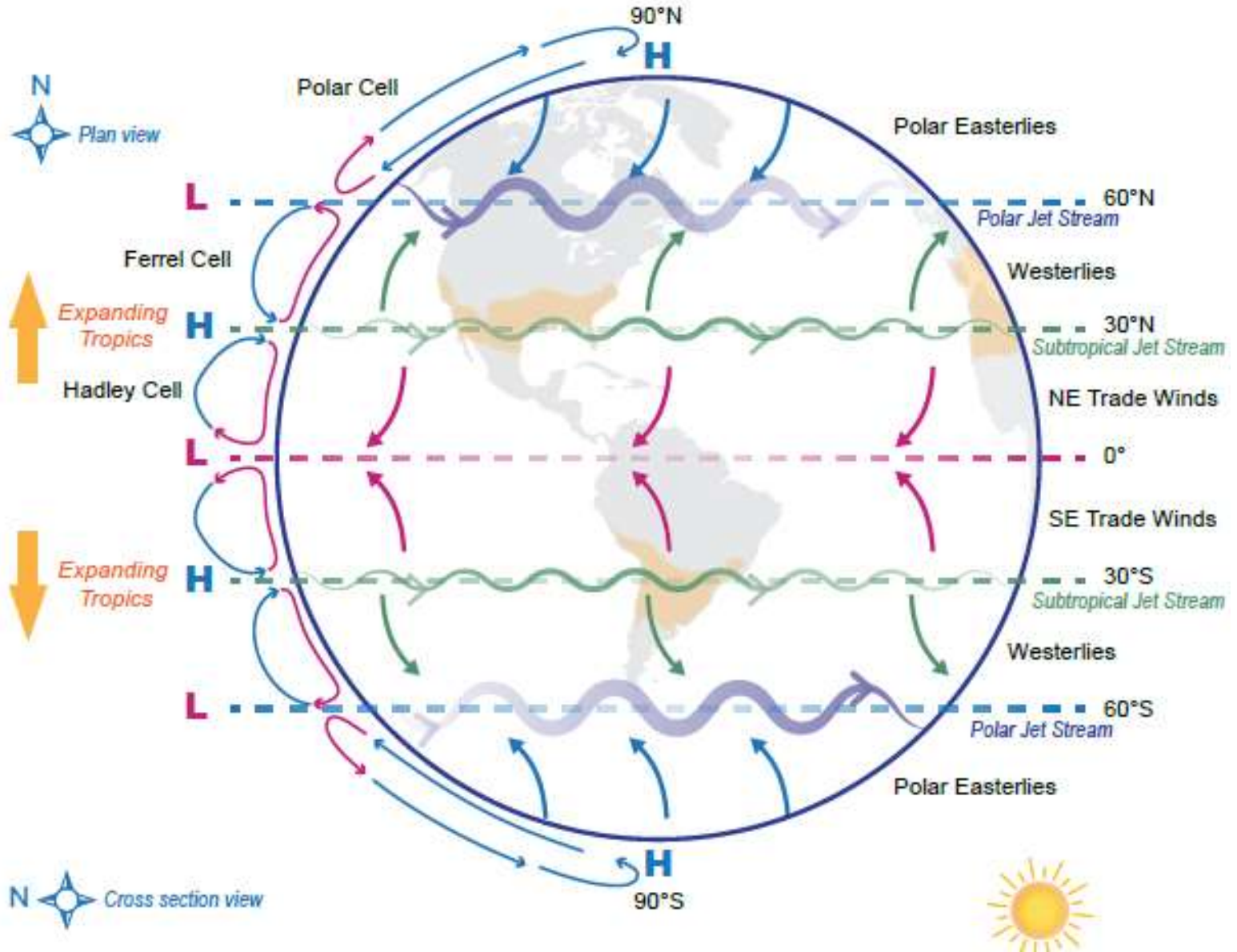


→ Total land ice: 55%

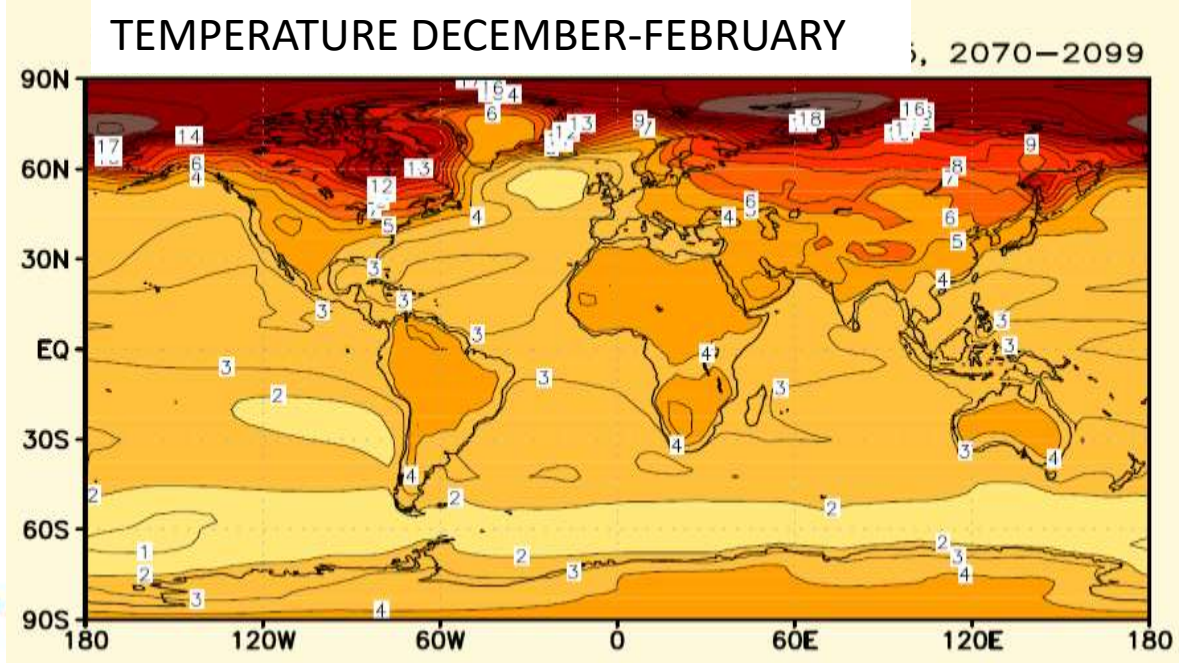
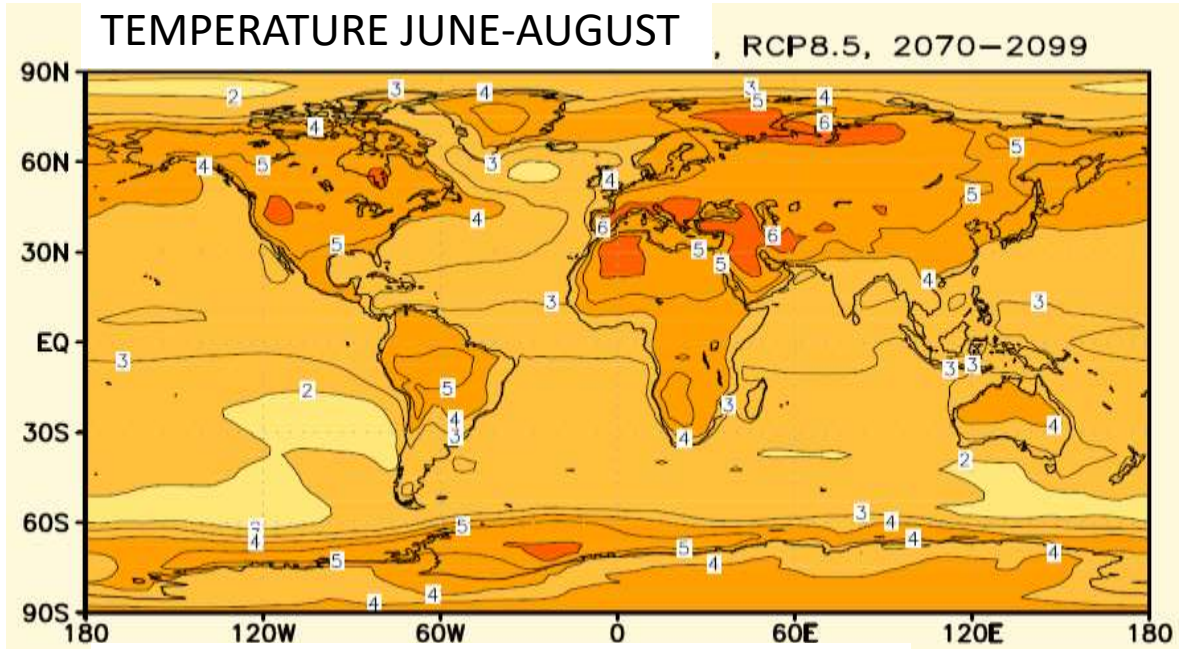
Multi-year ice 1984 and 2016



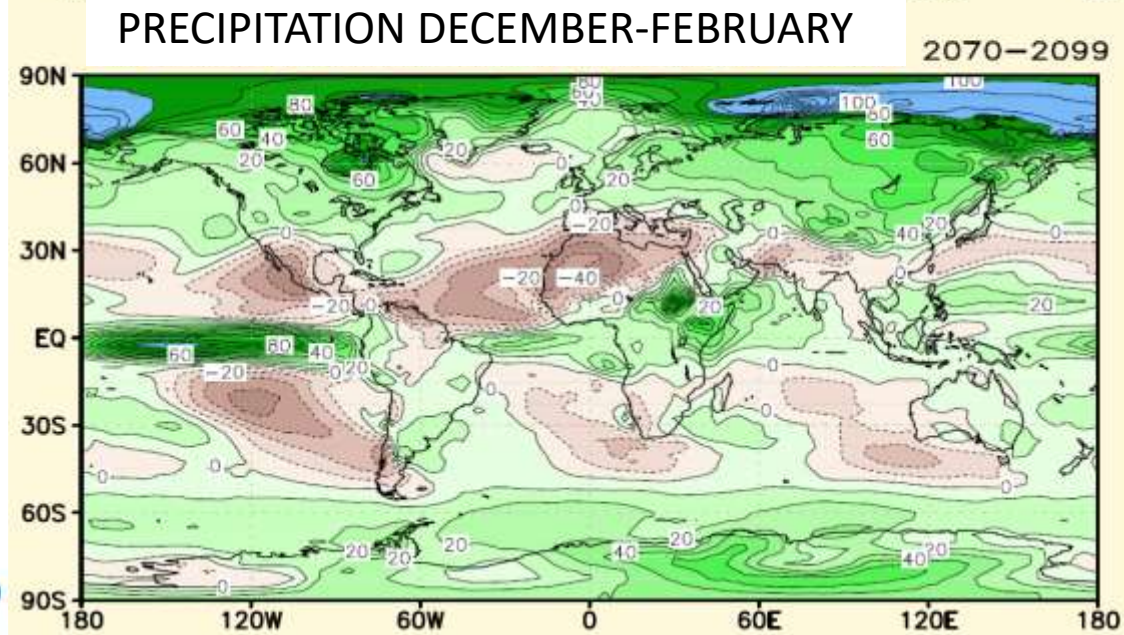
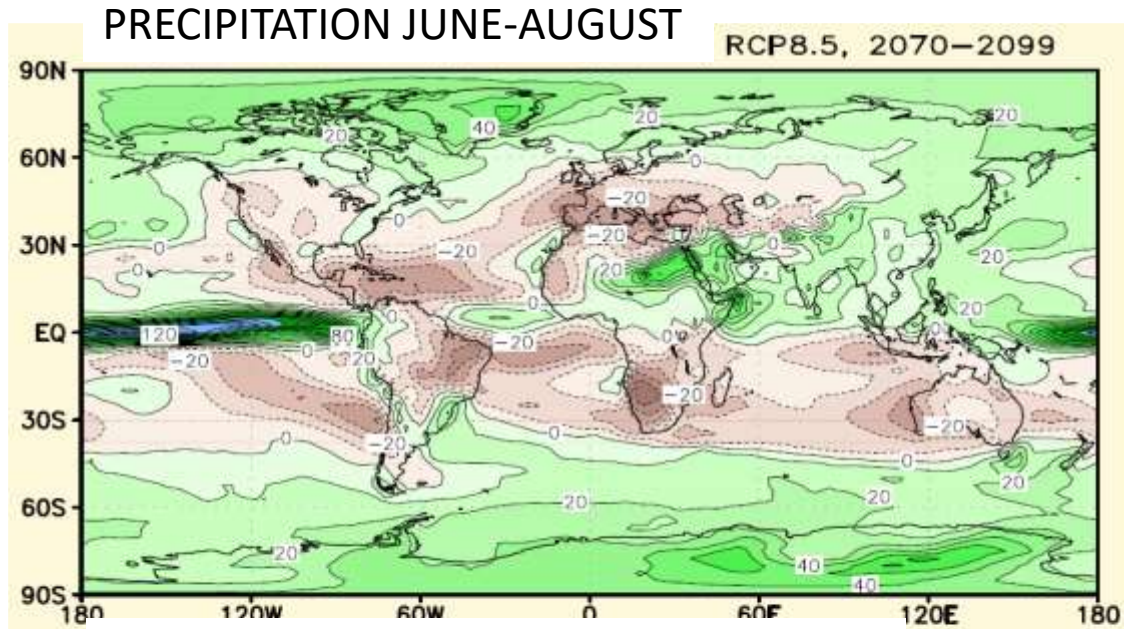
Changes in the Arctic affect weather globally



Temperature change =>2070-99, RCP 8.5



Precipitation change =>2070-99, RCP 8.5



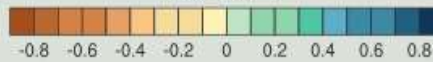
Annual mean hydrological cycle change (RCP8.5: 2081-2100)

Precipitation

39

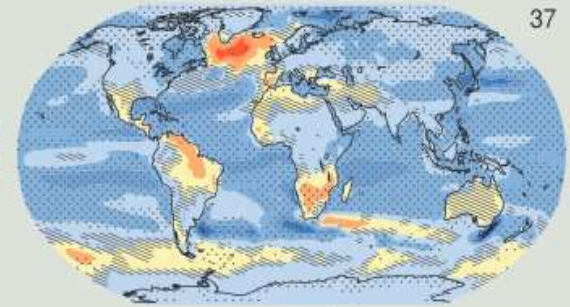


(mm day⁻¹)

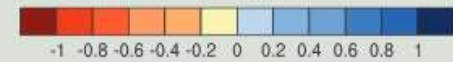


Evaporation

37

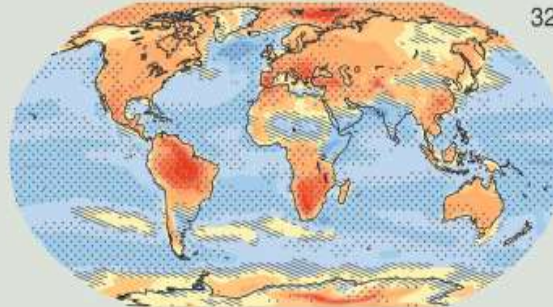


(mm day⁻¹)

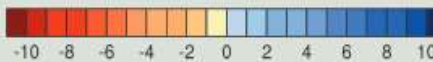


Relative humidity

32

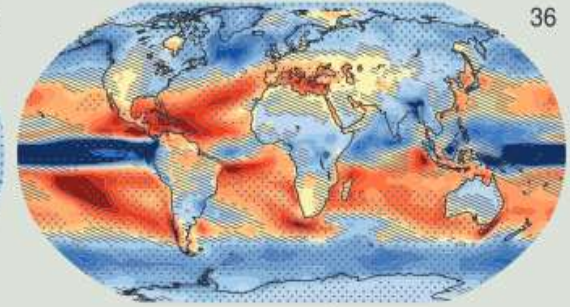


(%)

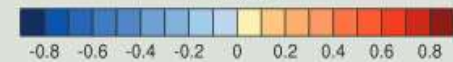


E-P

36

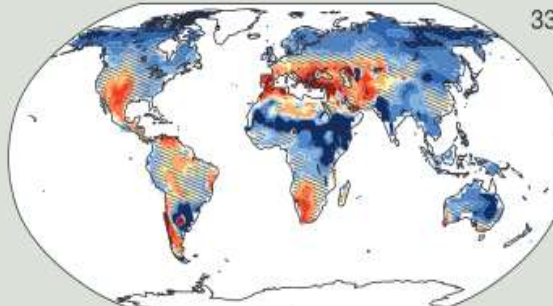


(mm day⁻¹)

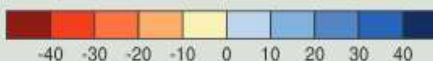


Runoff

33

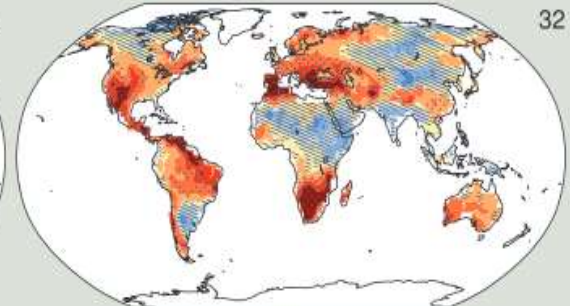


(%)

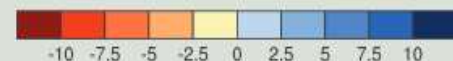


Soil moisture

32



(%)

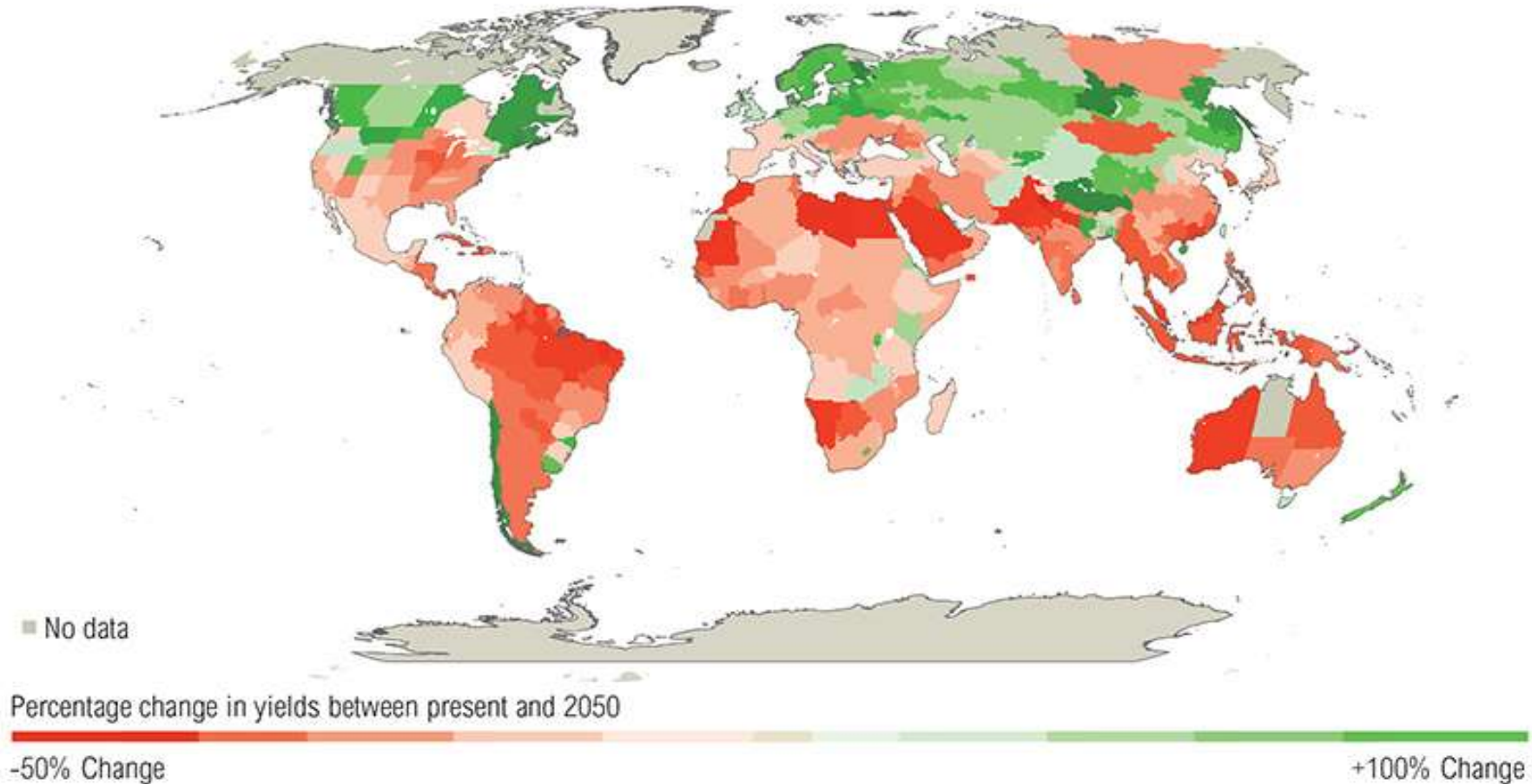


NO EMISSION CUTS

NOW => 2081-2100

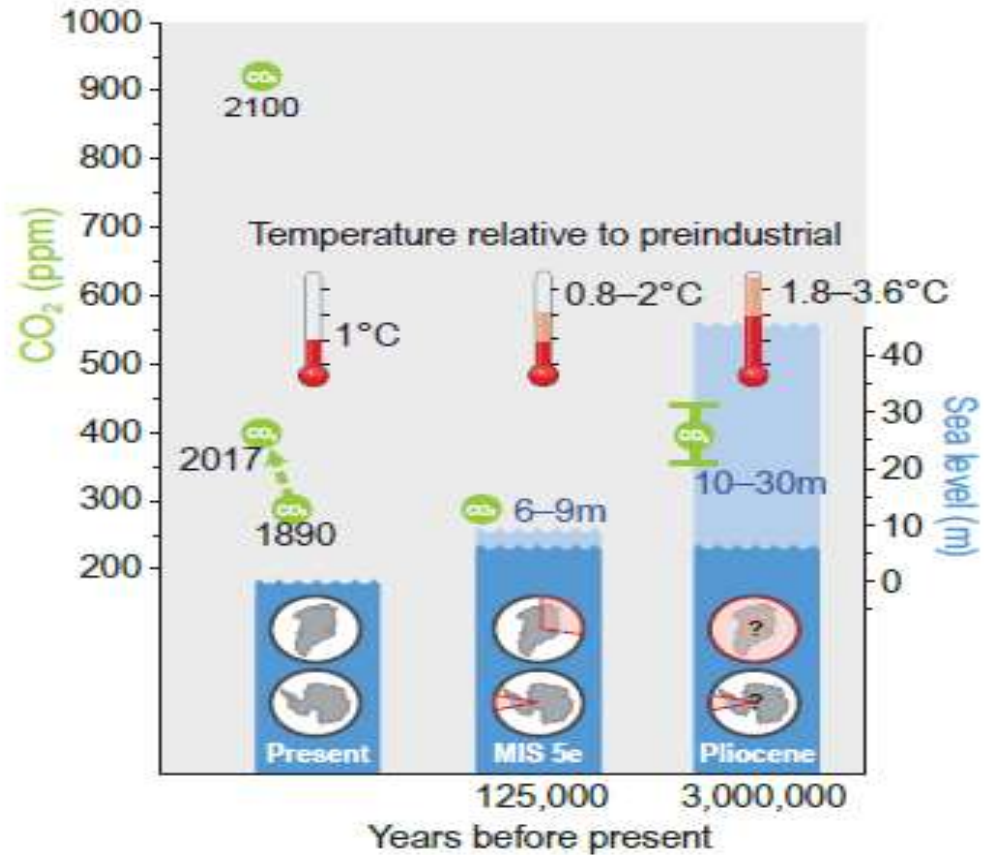
Impact of 3 C warming on crop yields

Most studies now project adverse impacts on crop yields due to climate change (3°C warmer world)

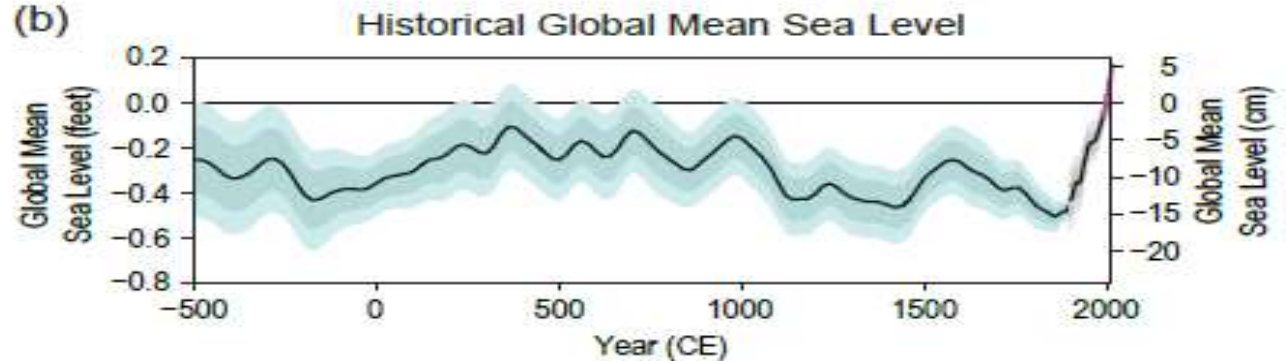


Historical CO₂-temperature-sea level

(a)

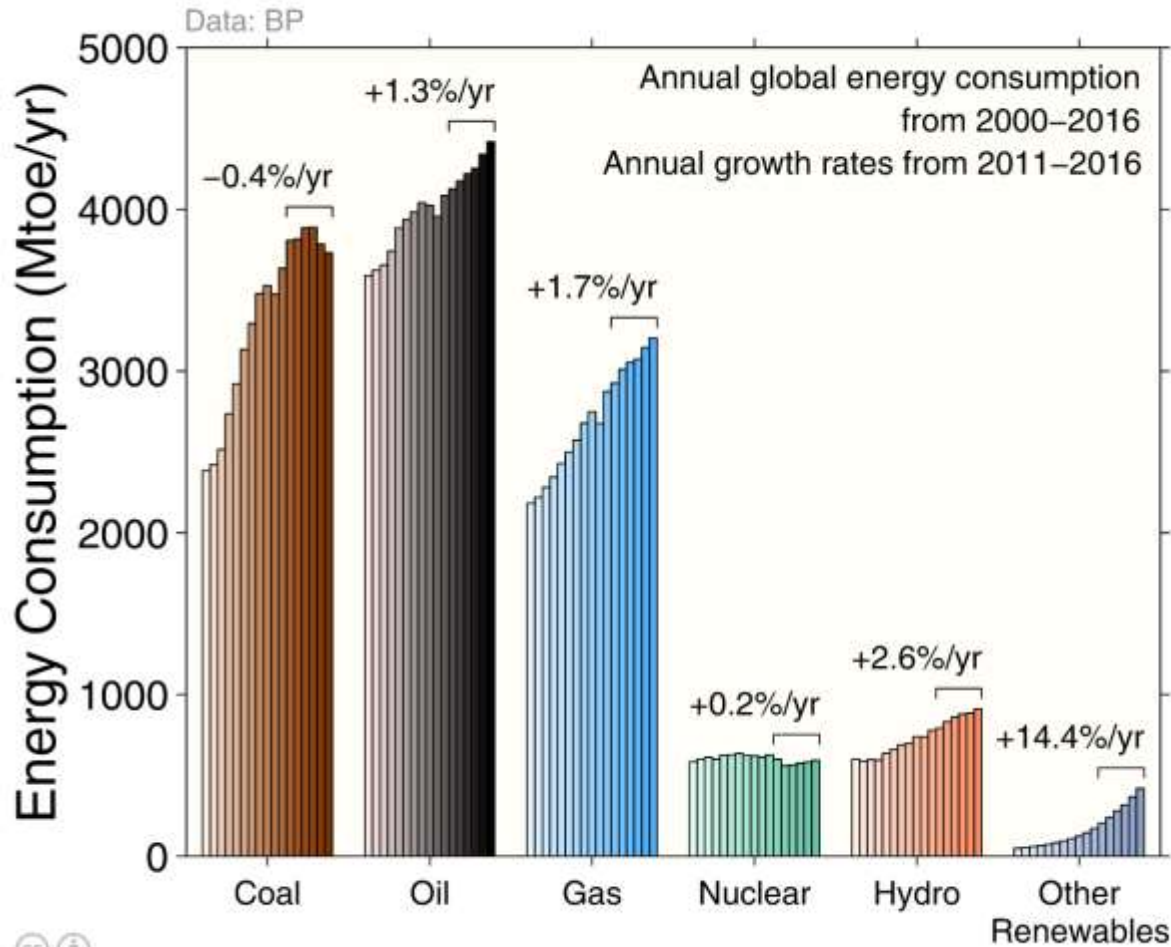


(b)



Energy consumption by energy type

Energy consumption by fuel source from 2000 to 2016, with growth rates indicated for the more recent period of 2011 to 2016





WORLD
METEOROLOGICAL
ORGANIZATION



Thank you