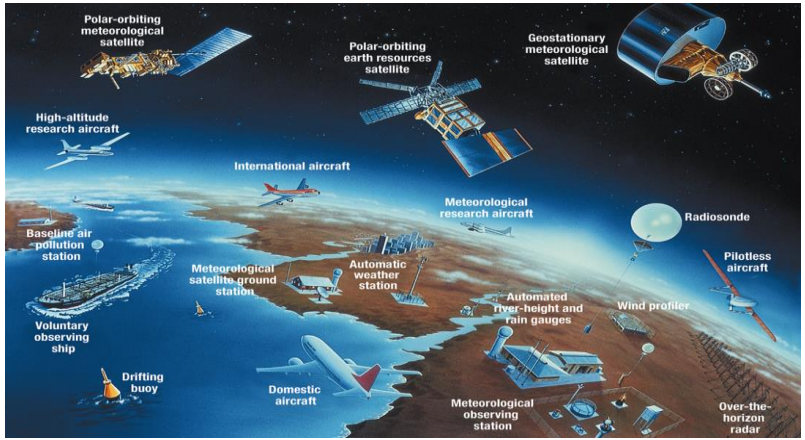
Climate, disasters and their impact

Prof. Petteri Taalas
Secretary-General

WEATHER CLIMATE WATER
TEMPS CLIMAT EAU

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

WMO OMM

International Meteorological Congress 1873 in Vienna => IMO/WMO

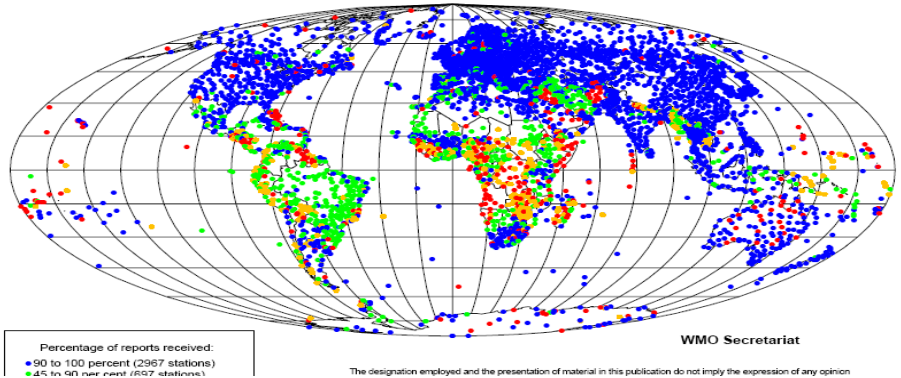
WMO OMM

WMO Mission/key activities

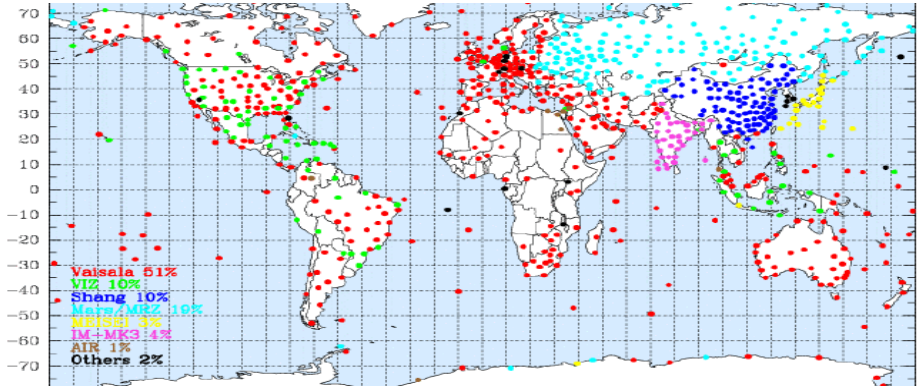
1. World climate
2. Weather, disasters & safety
3. Water resources
4. Data & technology
5. Strengthening of the national service capabilities
6. Earth system research
7. Efficient governance

WMO OMM

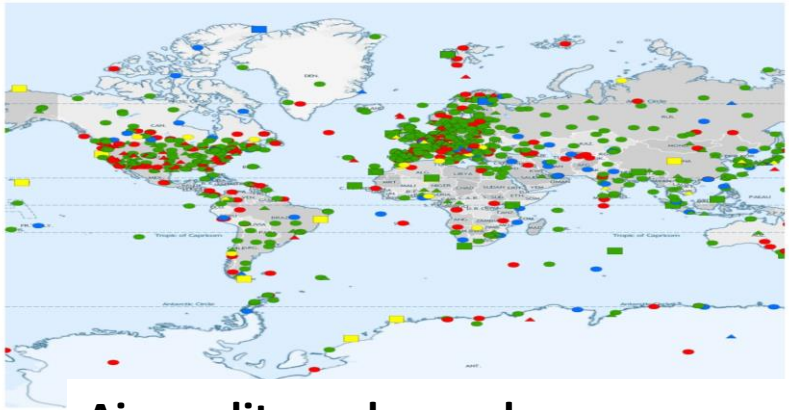
WMO Global Observing Networks >10000 stations



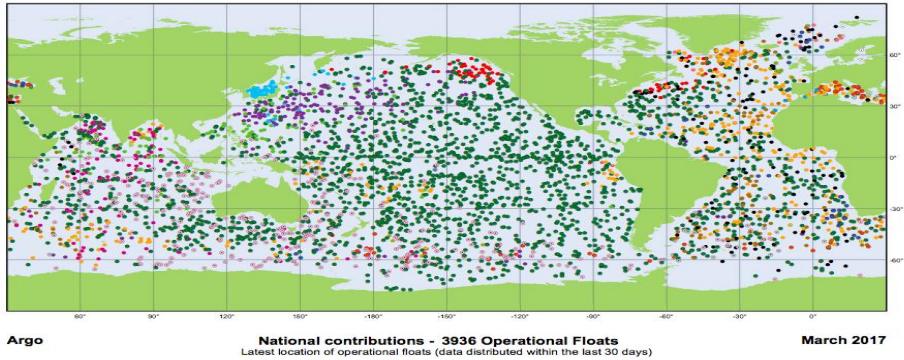
Surface observations



Balloon soundings

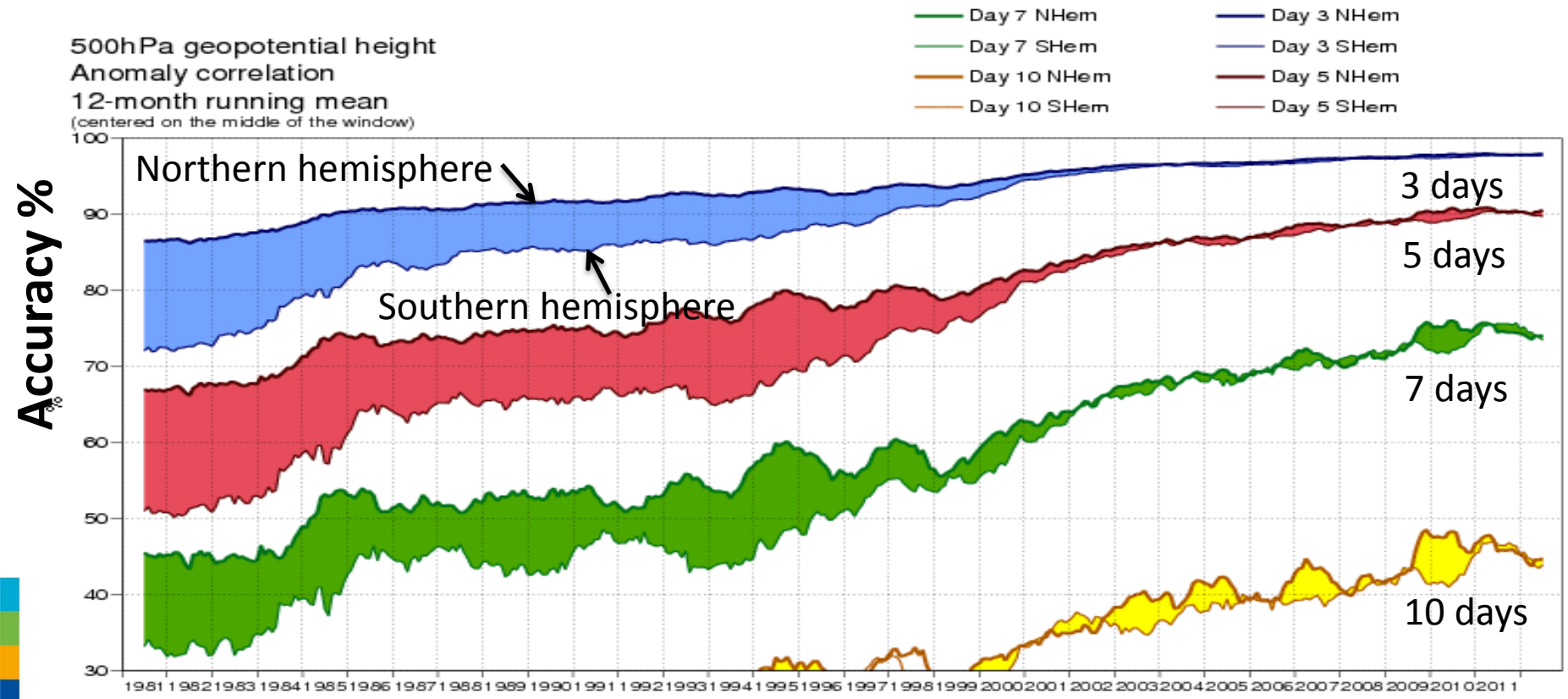


Air quality and greenhouse gases



Ocean weather (with IOC UNESCO)

Improved weather forecasts



WMO OMM

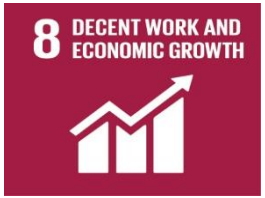
SUSTAINABLE DEVELOPMENT GOALS/WMO

Weather resilience

Climate change & -services

Water resource management

Solar, wind & hydro use



Climate resilience

Big data, innovations

Air quality, heat waves, flooding

DRR, Adaptation, carbon & climate monitoring

Sea level rise, climate<->oceans

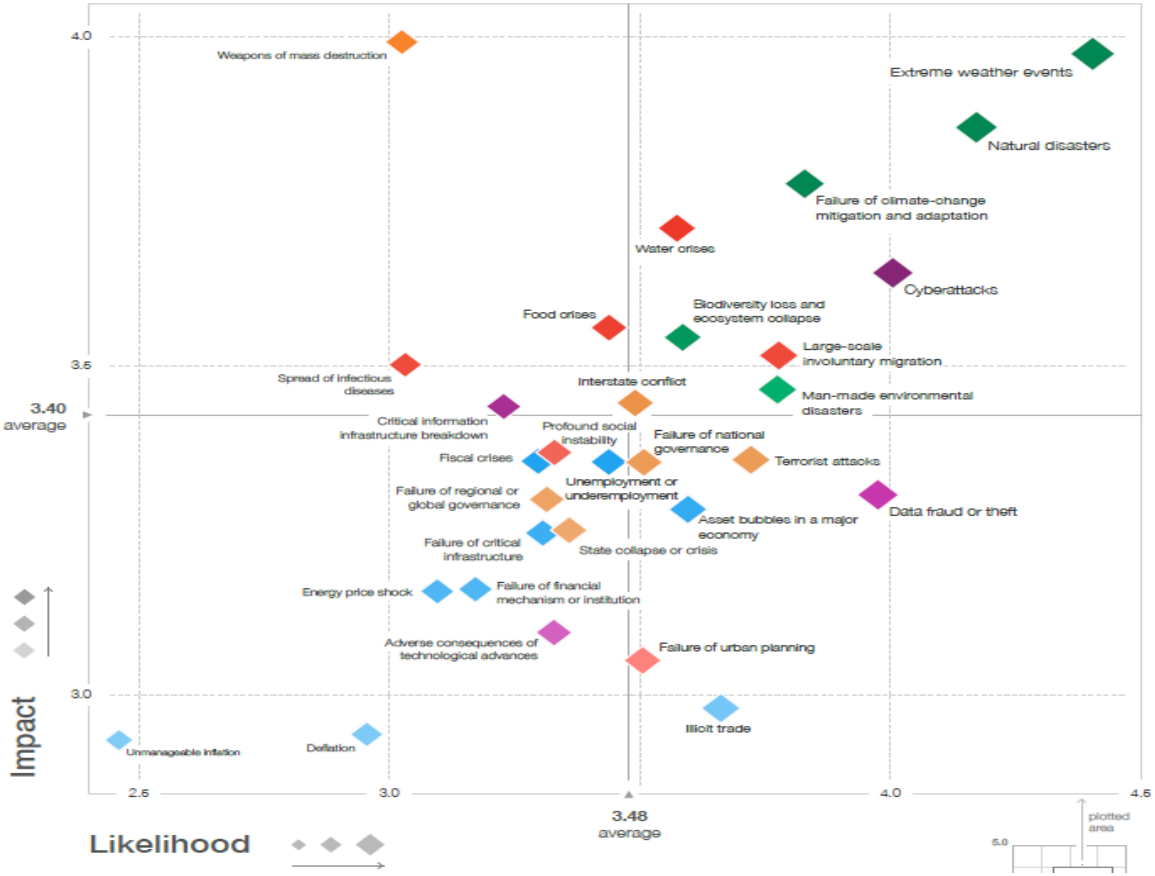
Climate change <->ecosystems

Climate driven conflicts

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

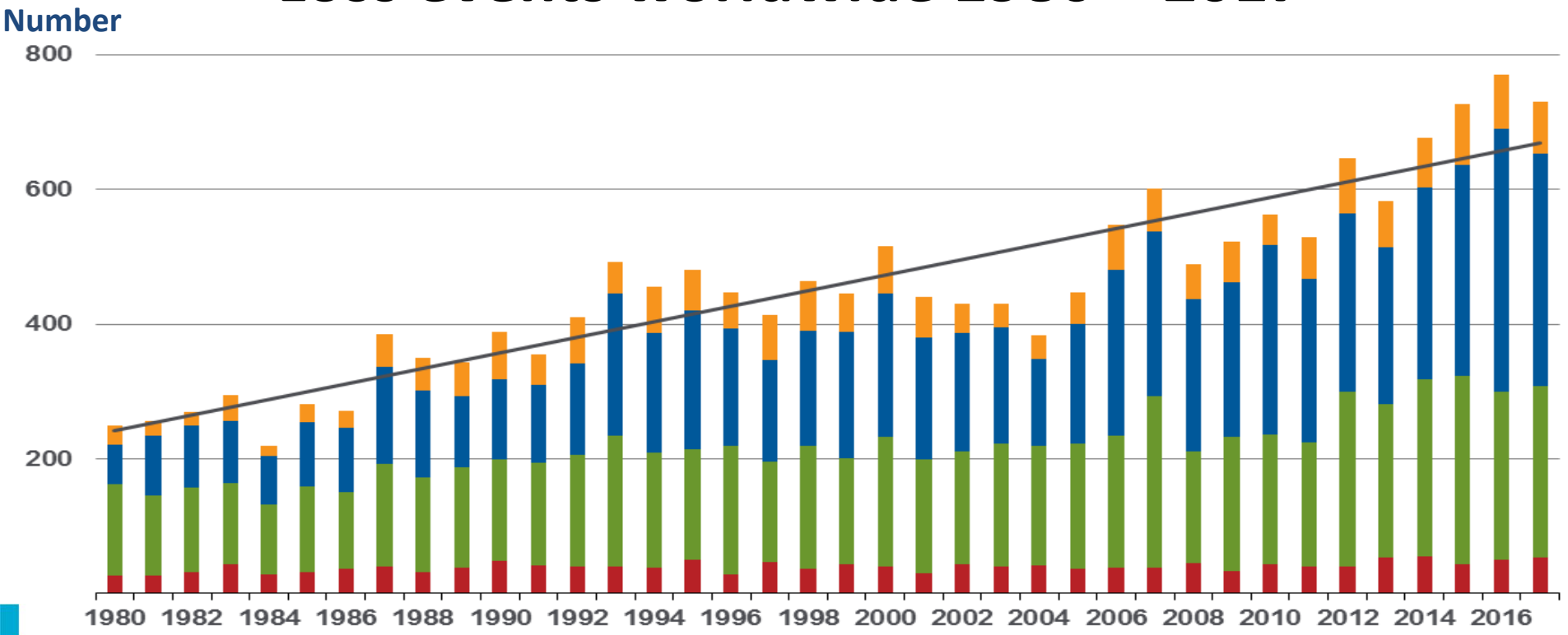
Environmental

Technological

Geopolitical

Source: World Economic Forum (2018)

Loss events worldwide 1980 – 2017



Geophysical events (Earthquake, tsunami, volcanic activity)

Meteorological events (Tropical storm, extratropical storm, convective storm, local storm)

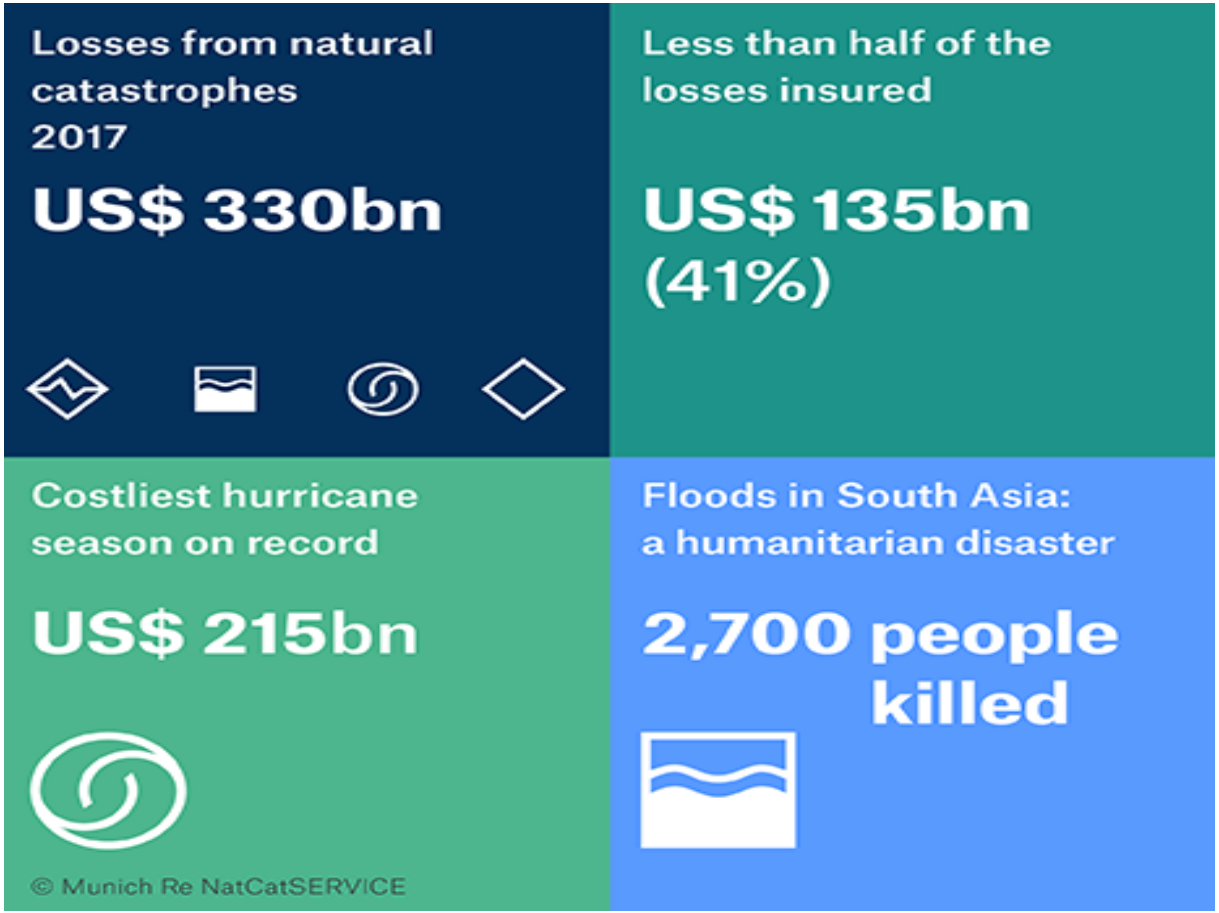
Hydrological events (Flood, mass movement)

Climatological events (Extreme temperature, drought, forest fire)

WMO OMM

Accounted events have caused at least one fatality and/or produced normalized losses ≥ US$ 100k, 300k, 1m, or 3m (depending on the assigned World Bank income group of the affected country).

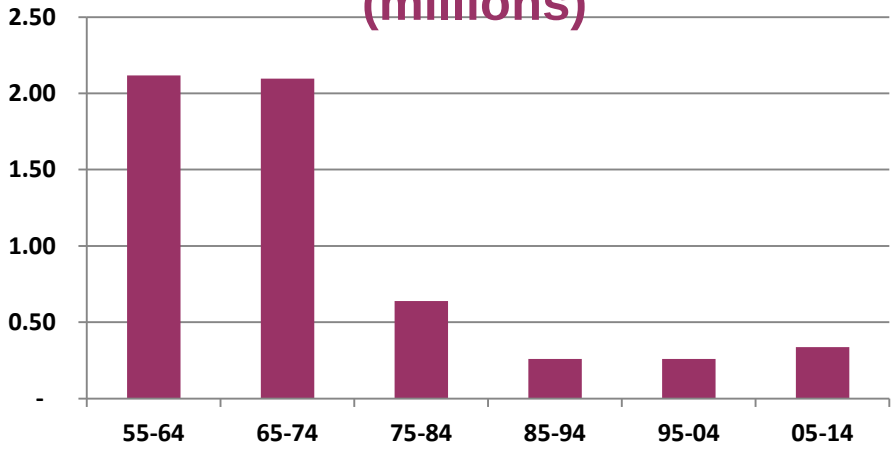
2017 Record breaking economic losses



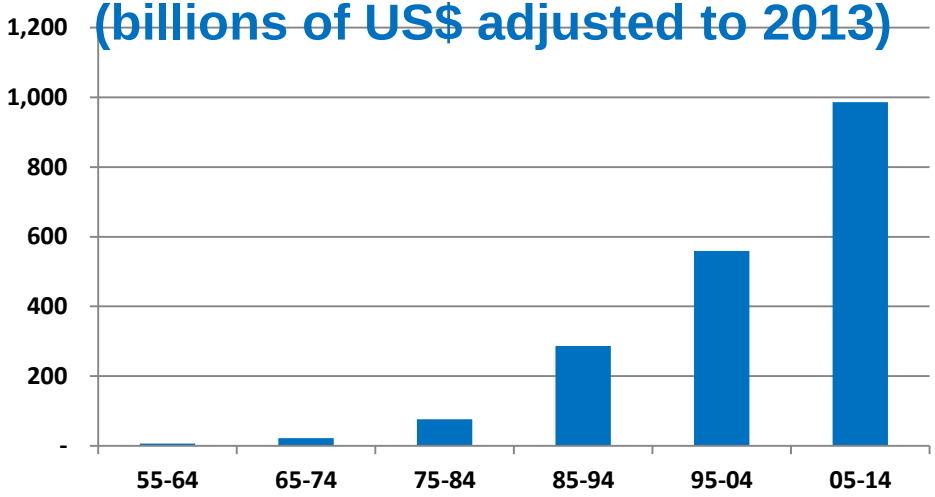
WMO OMM

Impacts of hydrometeorological and climatological hazards (1955–2014)

Human losses by decade (millions)



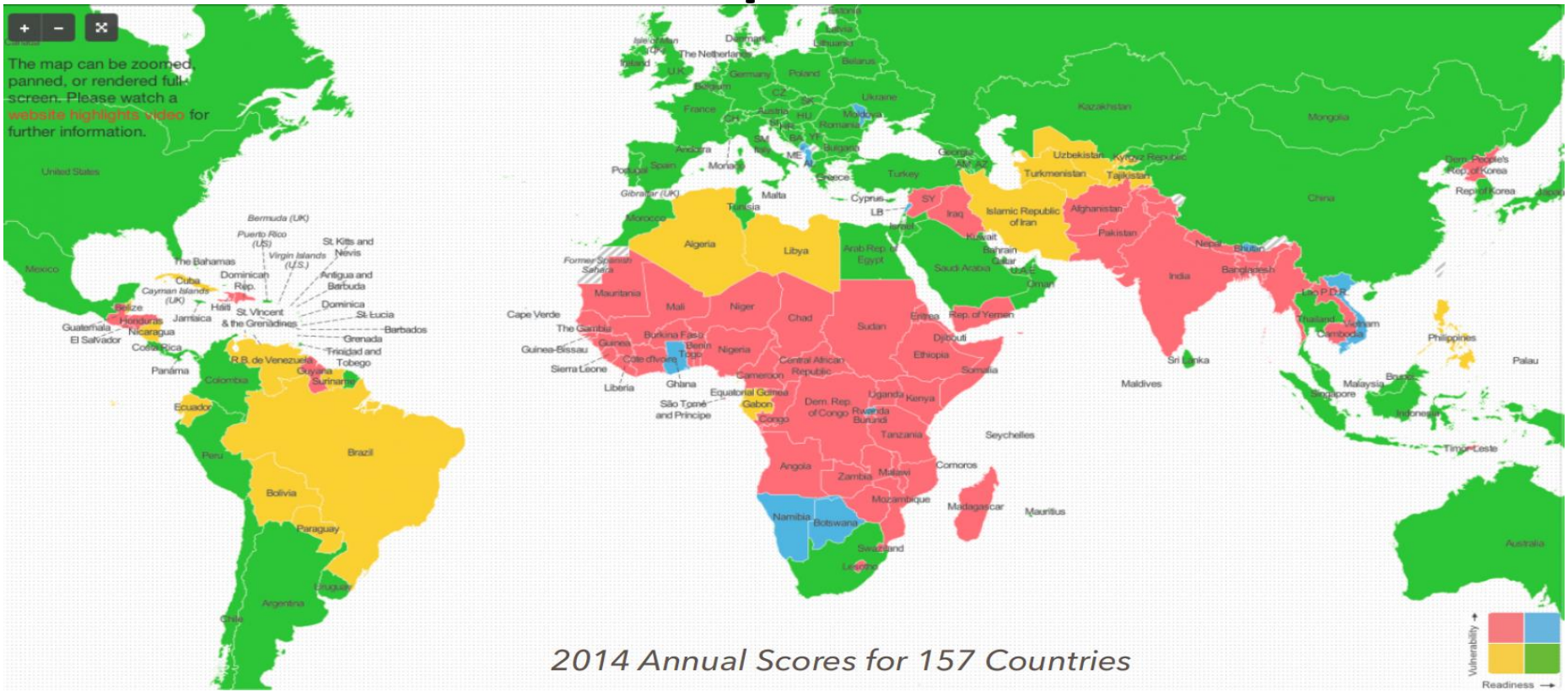
Economic losses by decade (billions of US$ adjusted to 2013)



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

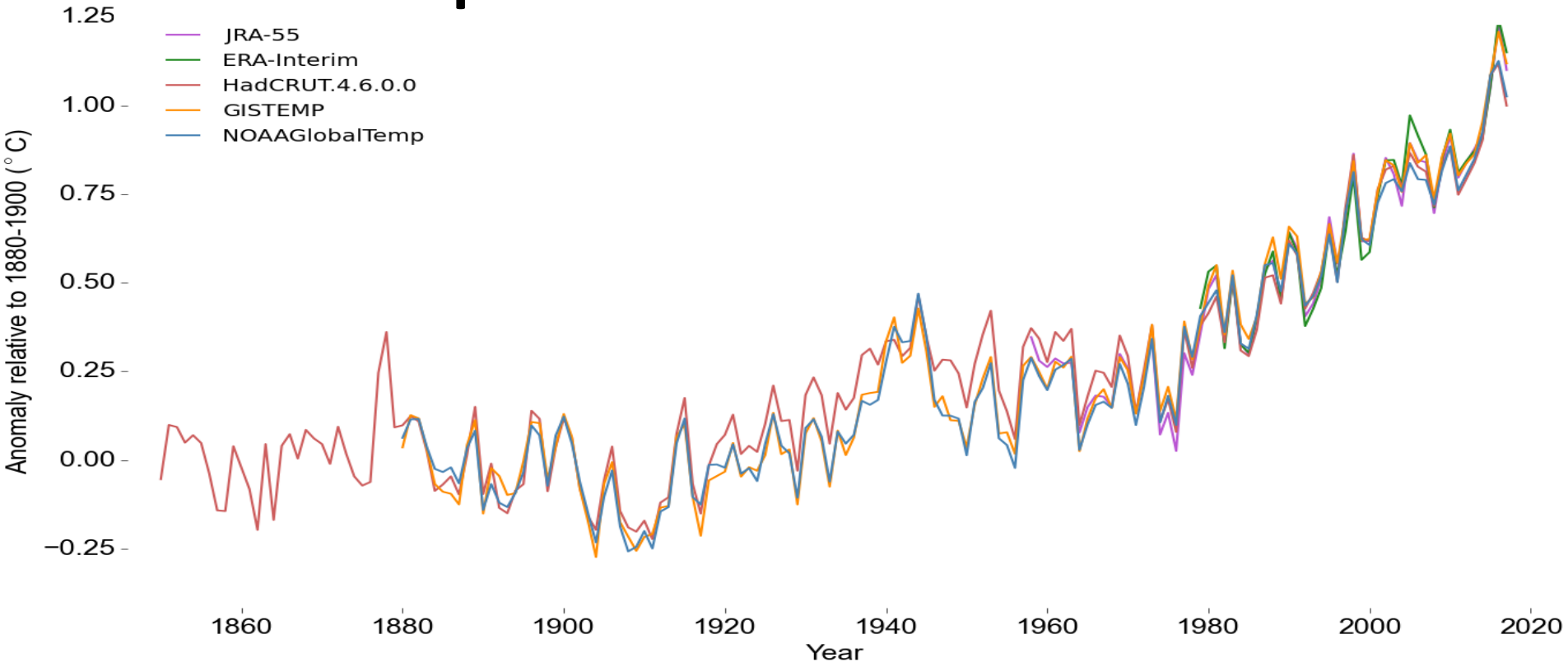
WMO OMM

Global adaptation index



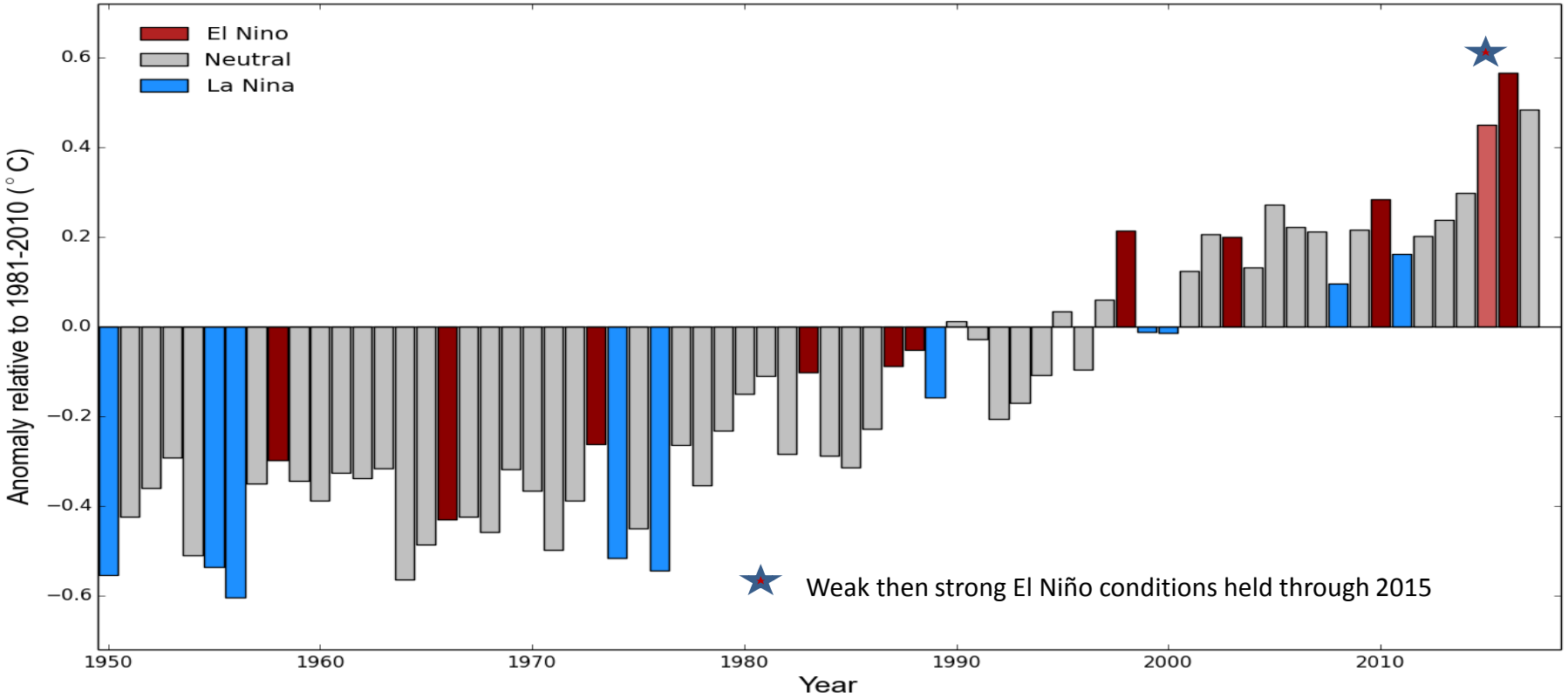
Univ. Notre Dame

Global temperature deviations 1850-2017



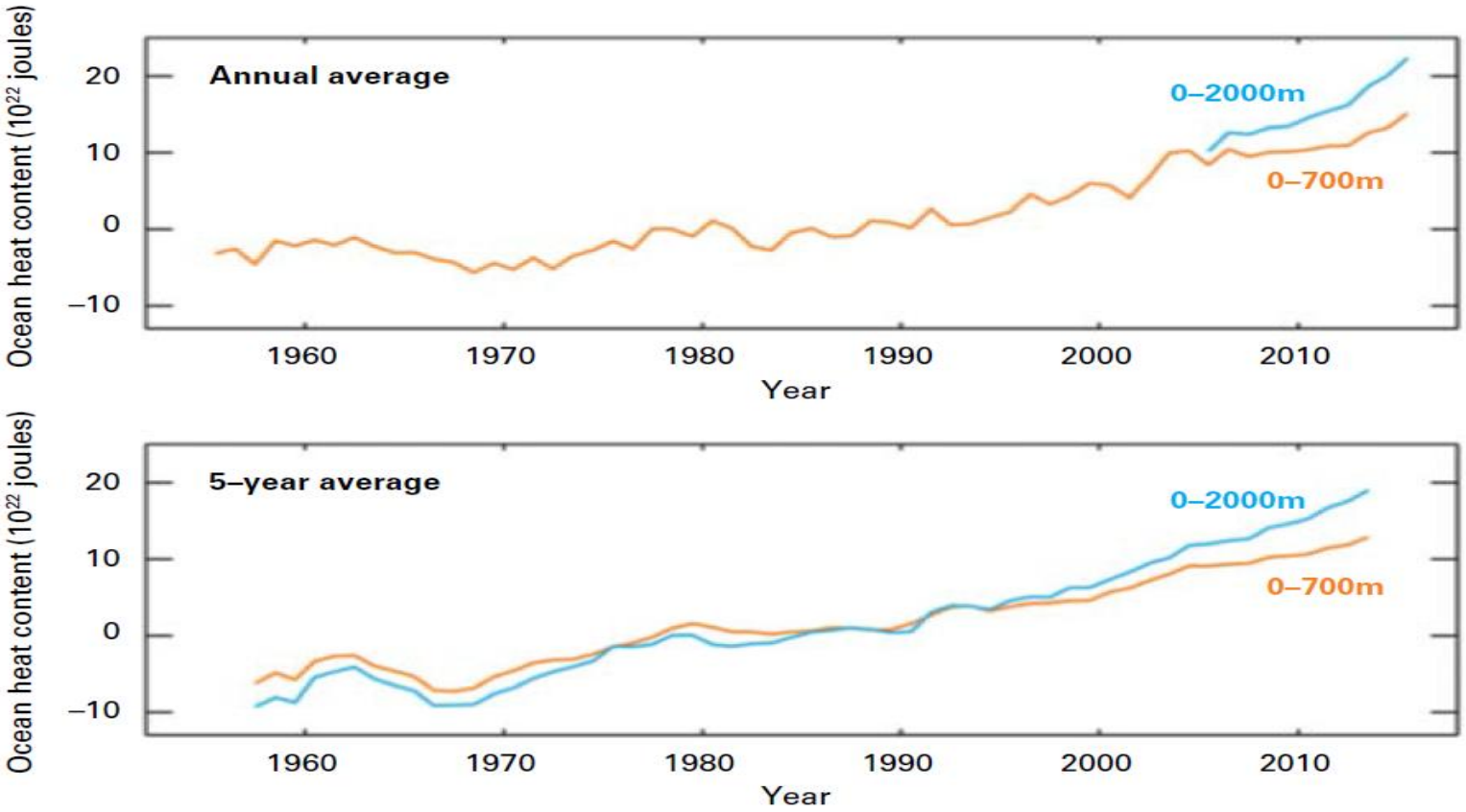
WMO OMM

2017 – the warmest non-El Niño year on record



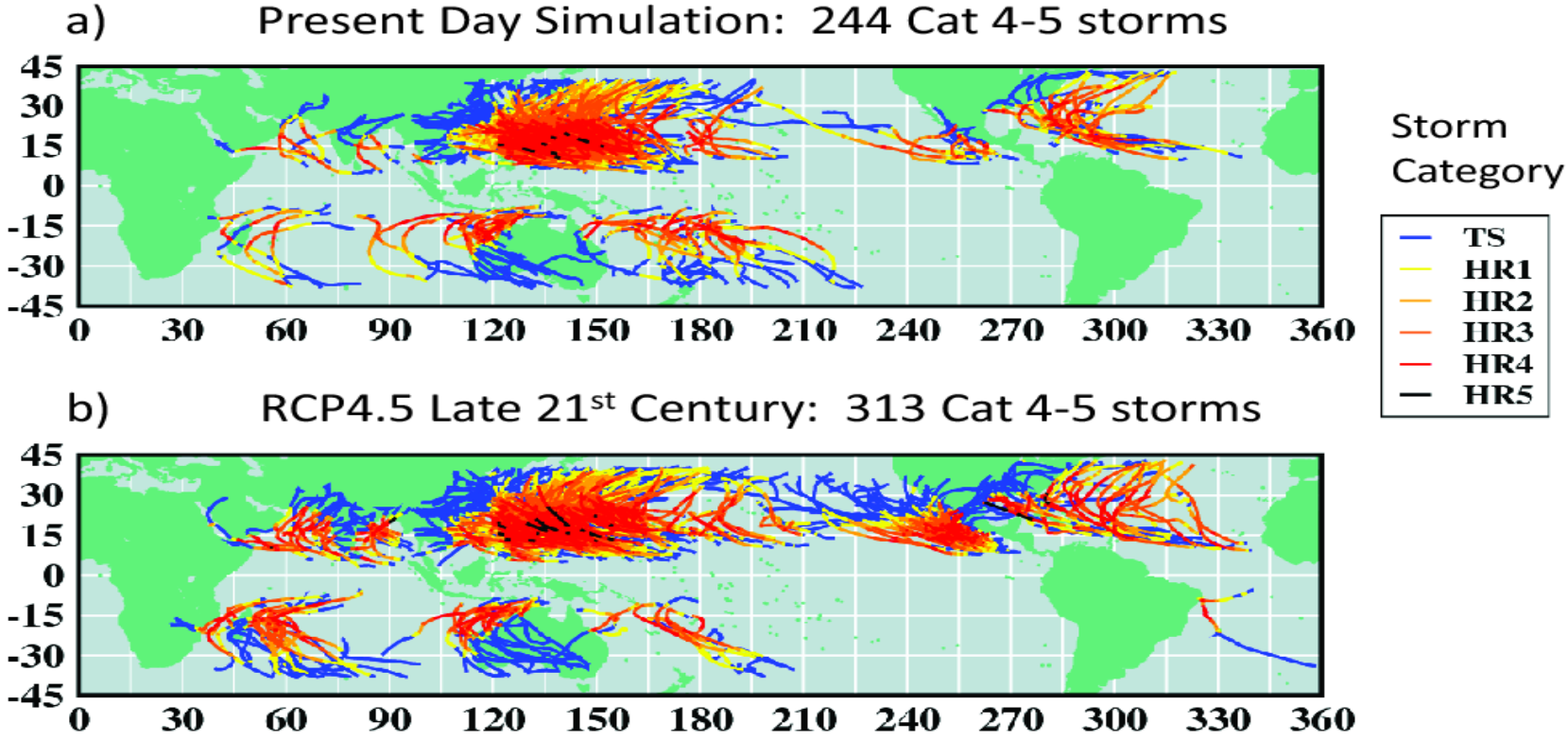
WMO OMM

Ocean heat content



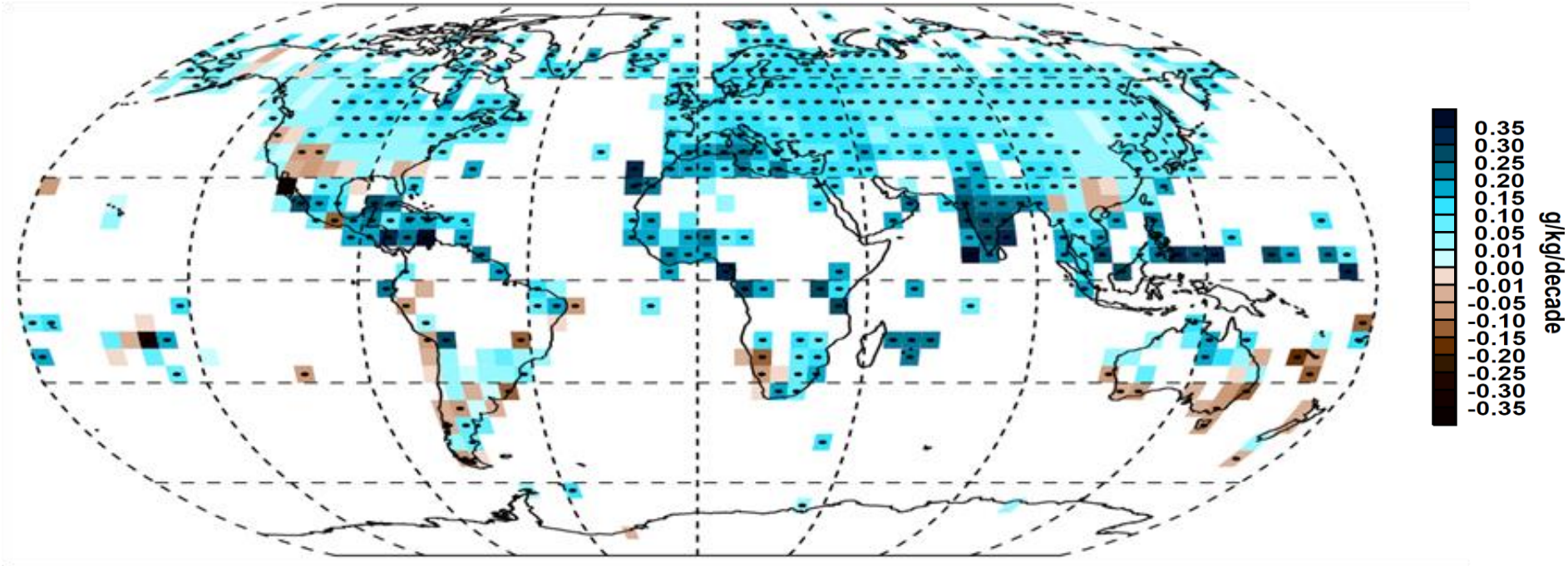
Source: Data from NOAA/NESDIS/NODC Ocean Climate Laboratory, United States, updated from Levitus et al. (2012)

Tropical storms today and in 2 C warmed climate



WMO OMM

Specific humidity has risen in large parts of the Northern Hemisphere

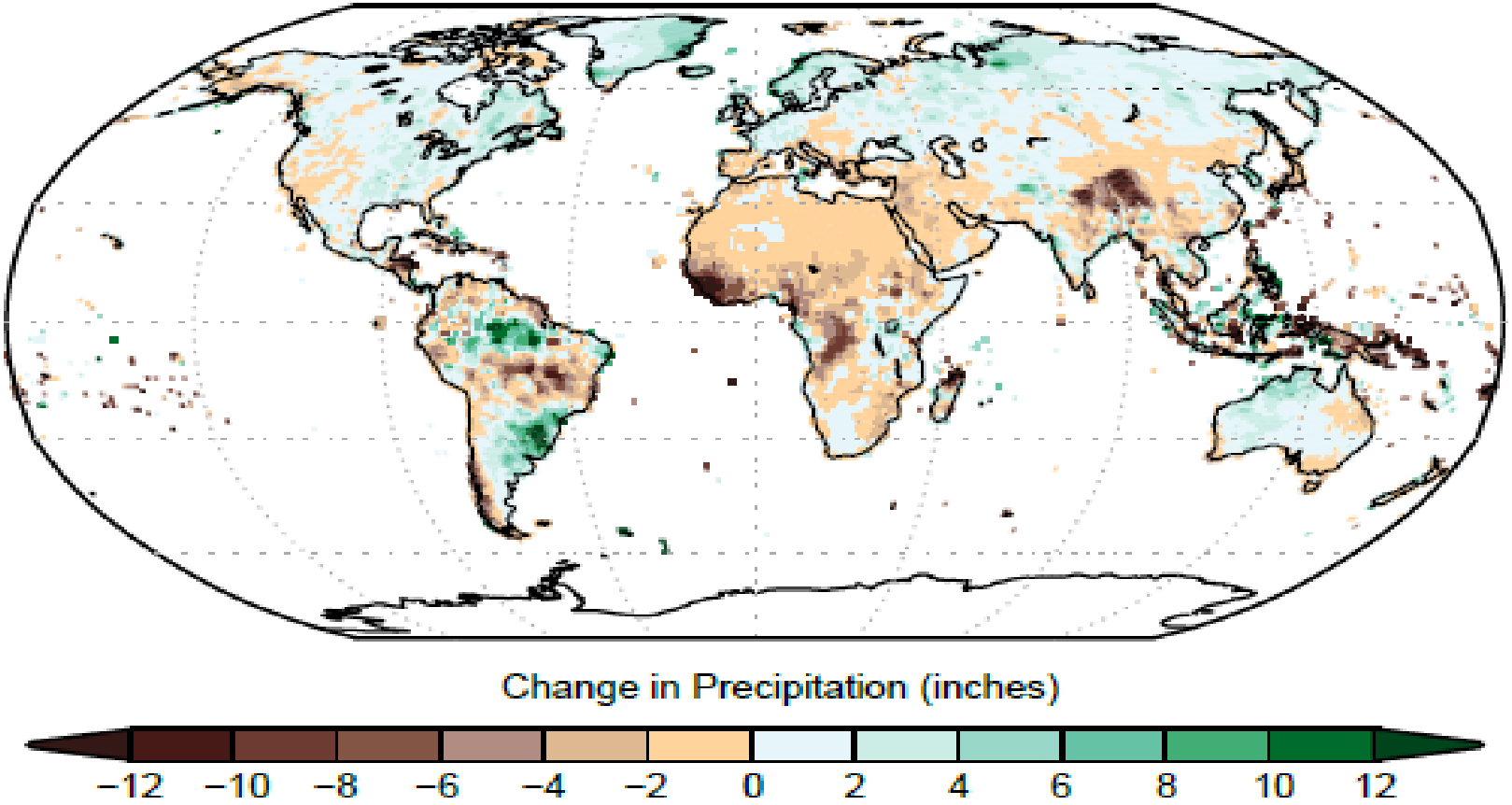


Change in near-surface specific humidity over time in the northern hemisphere 1973–2012 (Source: Willett et. al. (2013), Clim. Past, 9, 657–677.Black dots: trends significant at the 95% level

WMO OMM

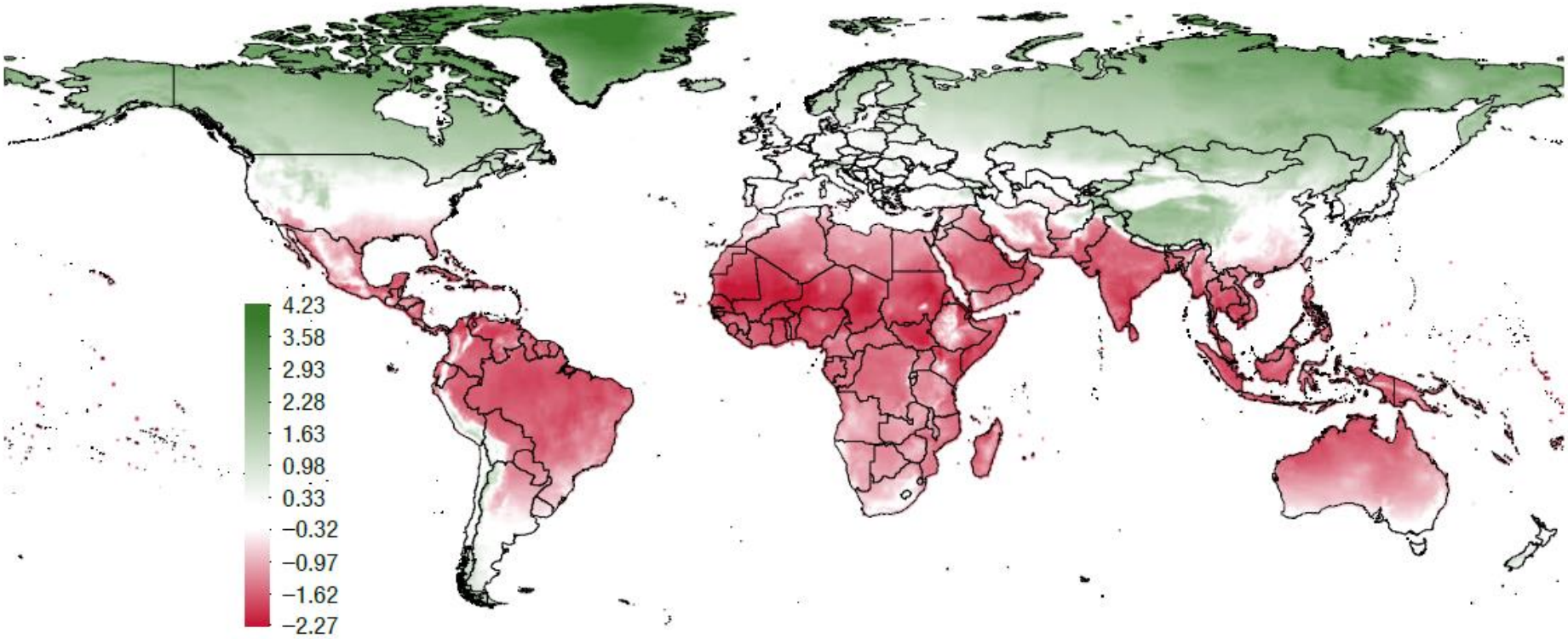
Climate model studies: Increase due to anthropogenic climate change (Willet et al., 2010, Environ. Res. Letter, 5; Santer et al., 2007, PNAS, 104)

Global precipitation 1986–2015 vs. 1901–1960



WMO OMM

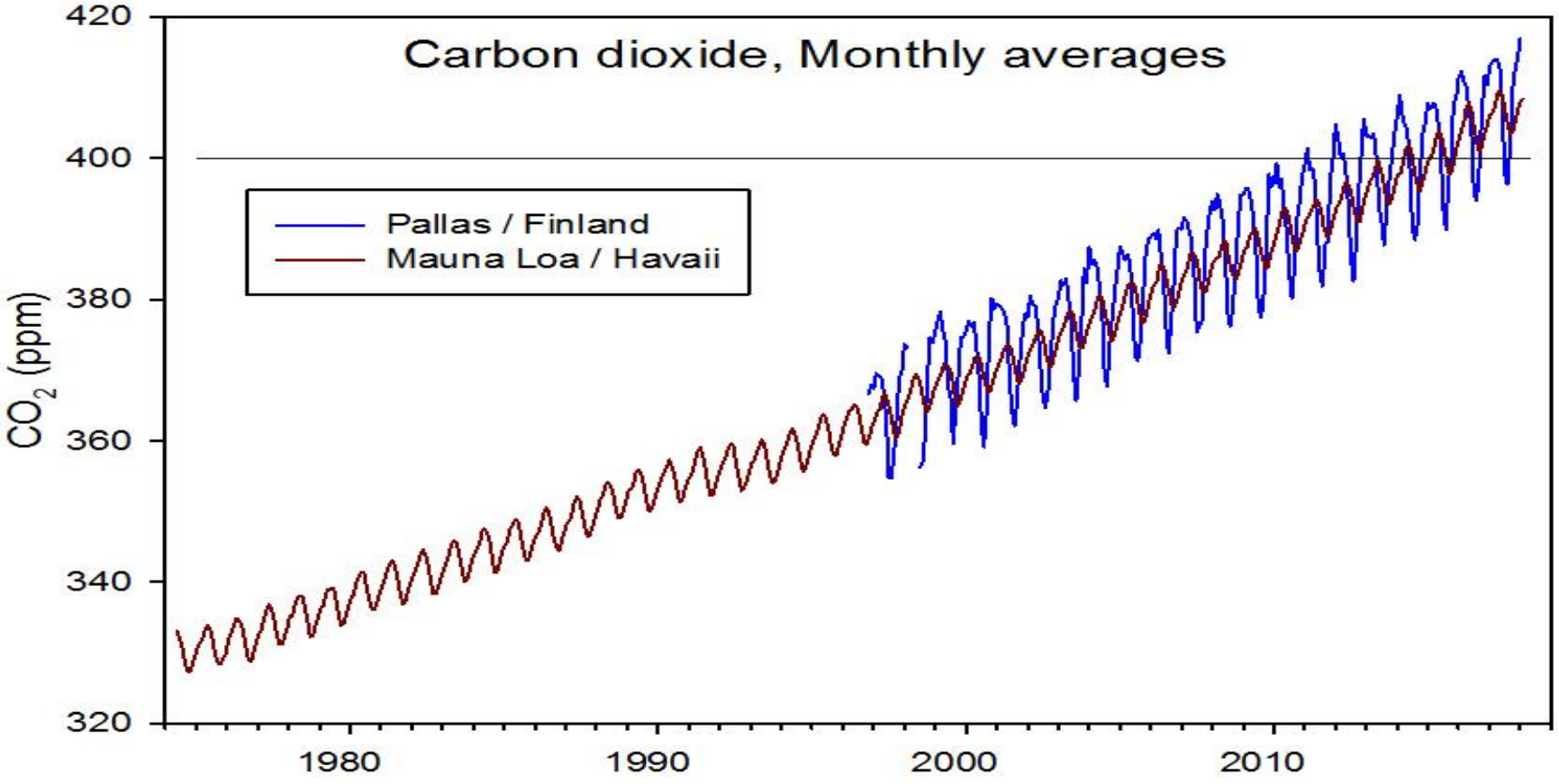
Effect of 1°C temperature increase on per capita output



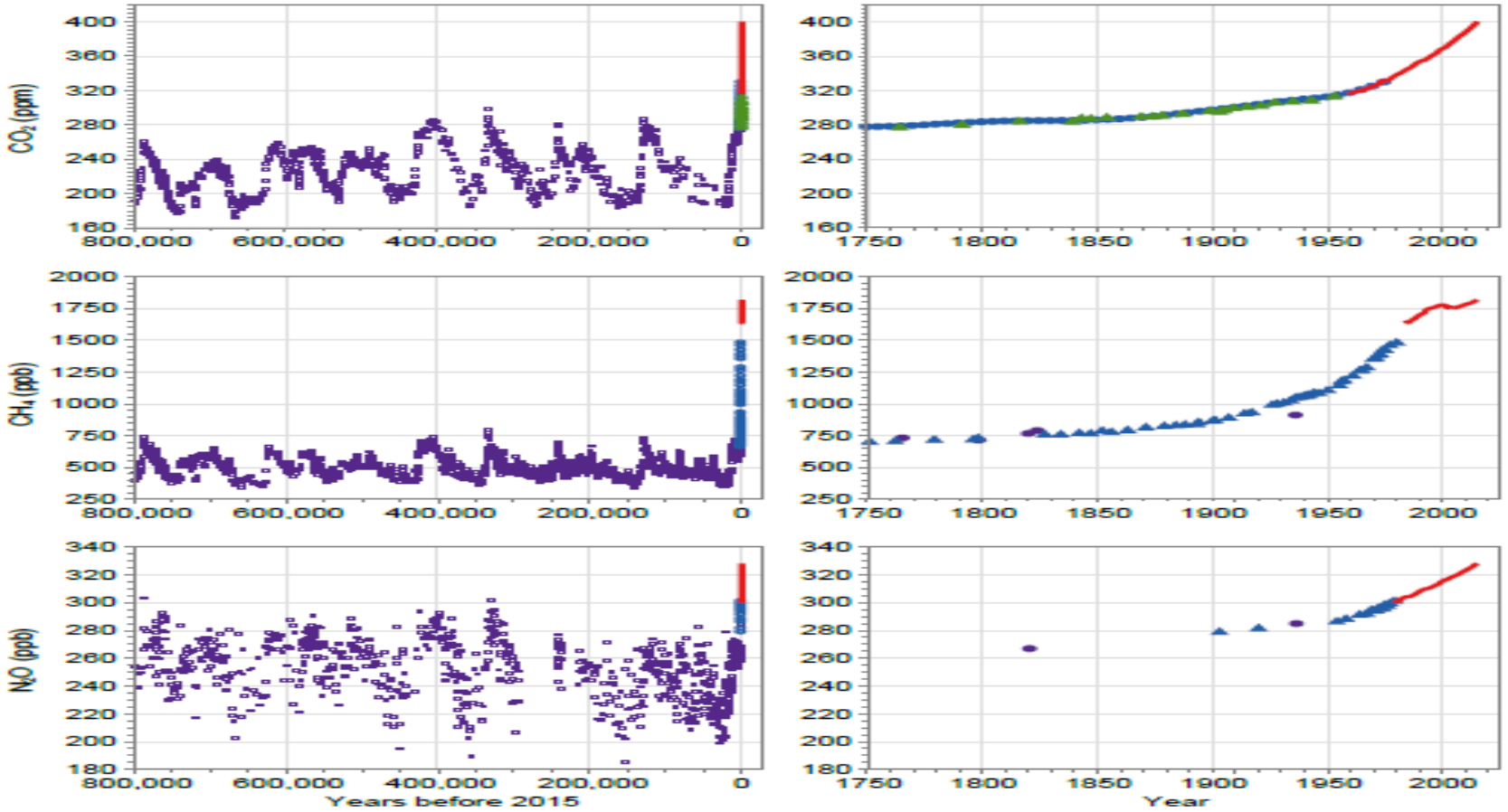
WMO OMM

Source: International Monetary Fund (IMF) World Economic Outlook

Carbon dioxide tropics/Arctic

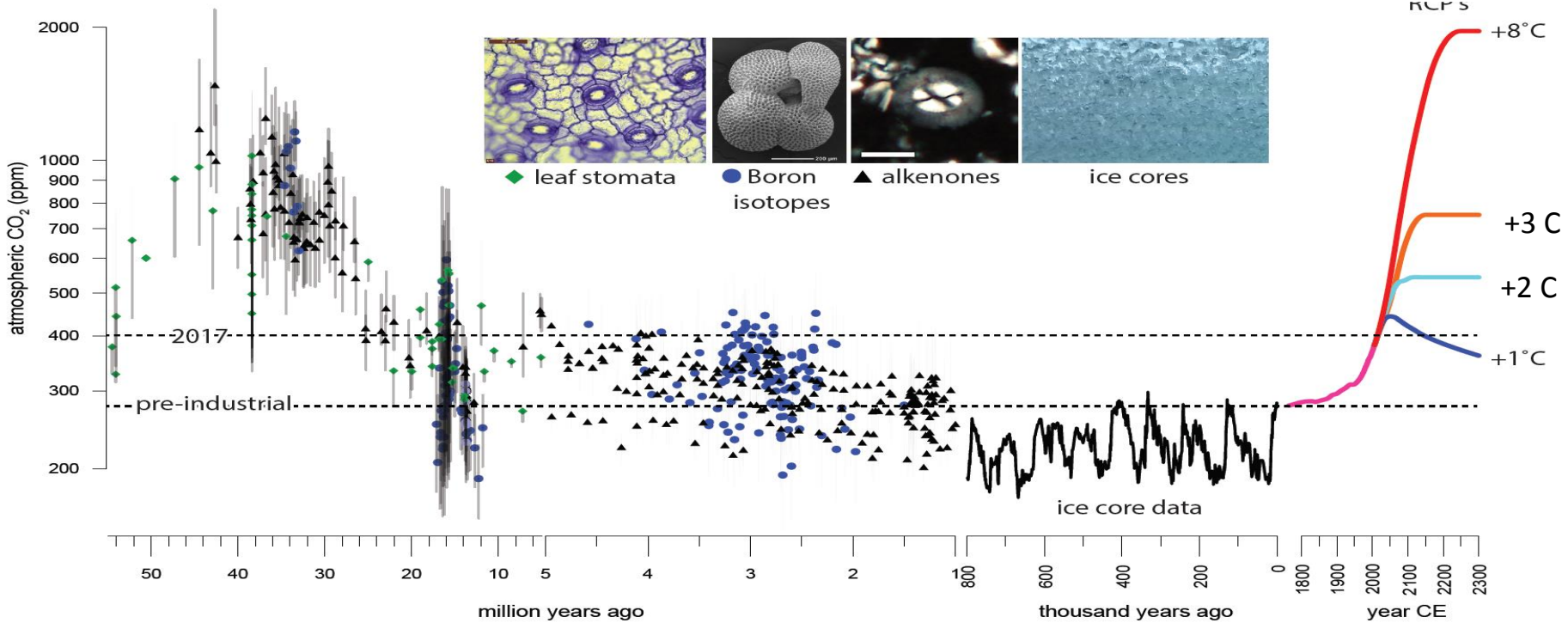


CO_2, CH_4 & N_2O 800 000 BC-2016 AD



WMO OMM

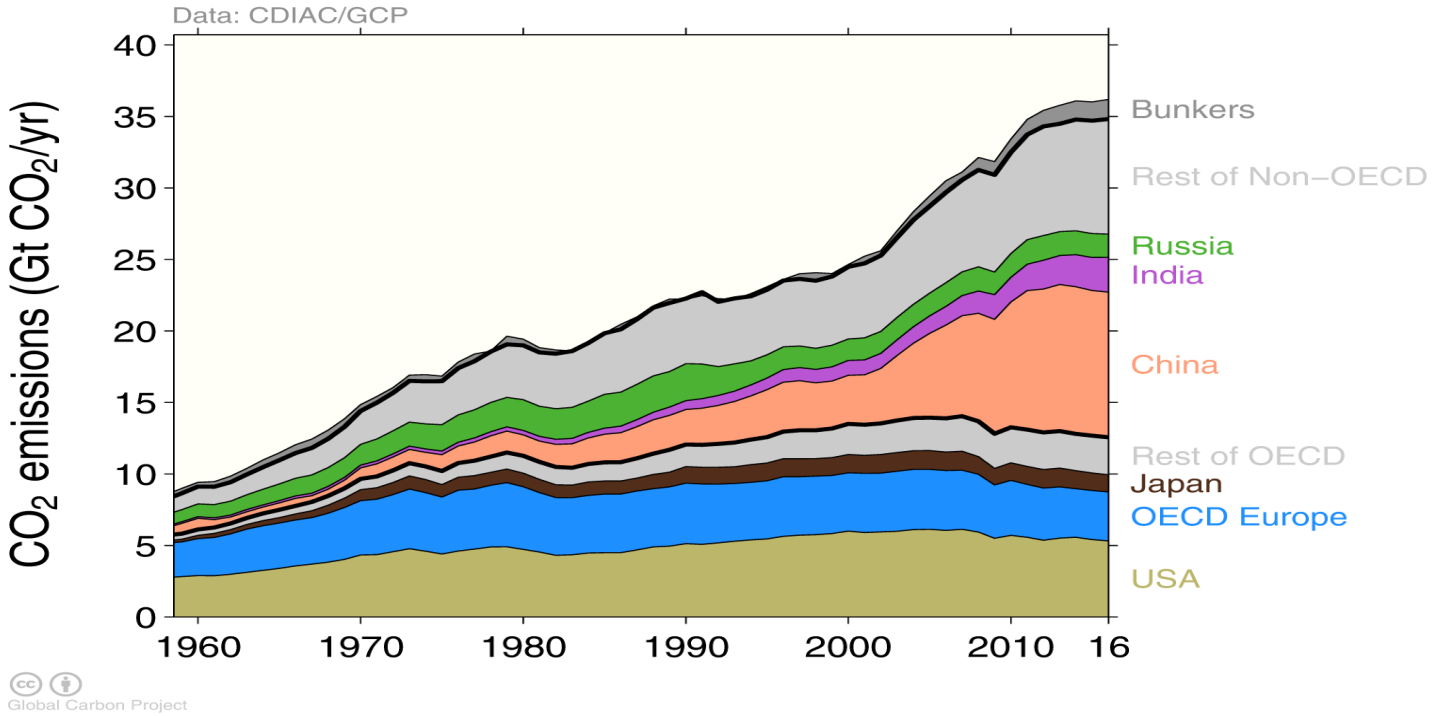
Variation of carbon dioxide concentration 50 M years



WMO OMM

Global CO_2 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



Source: CDIAC; Le Quéré et al 2017; Global Carbon Budget 2017

GLOBAL CARBON PROJECT

Fate of anthropogenic CO_2 emissions (2007–2016)

Sources

34.4 $GtCO_2/yr$

88%

12%

4.8 $GtCO_2/yr$

= Sinks

17.2 $GtCO_2/yr$

46%

30%

11.0 $GtCO_2/yr$

24%

8.8 $GtCO_2/yr$

WMO OMM

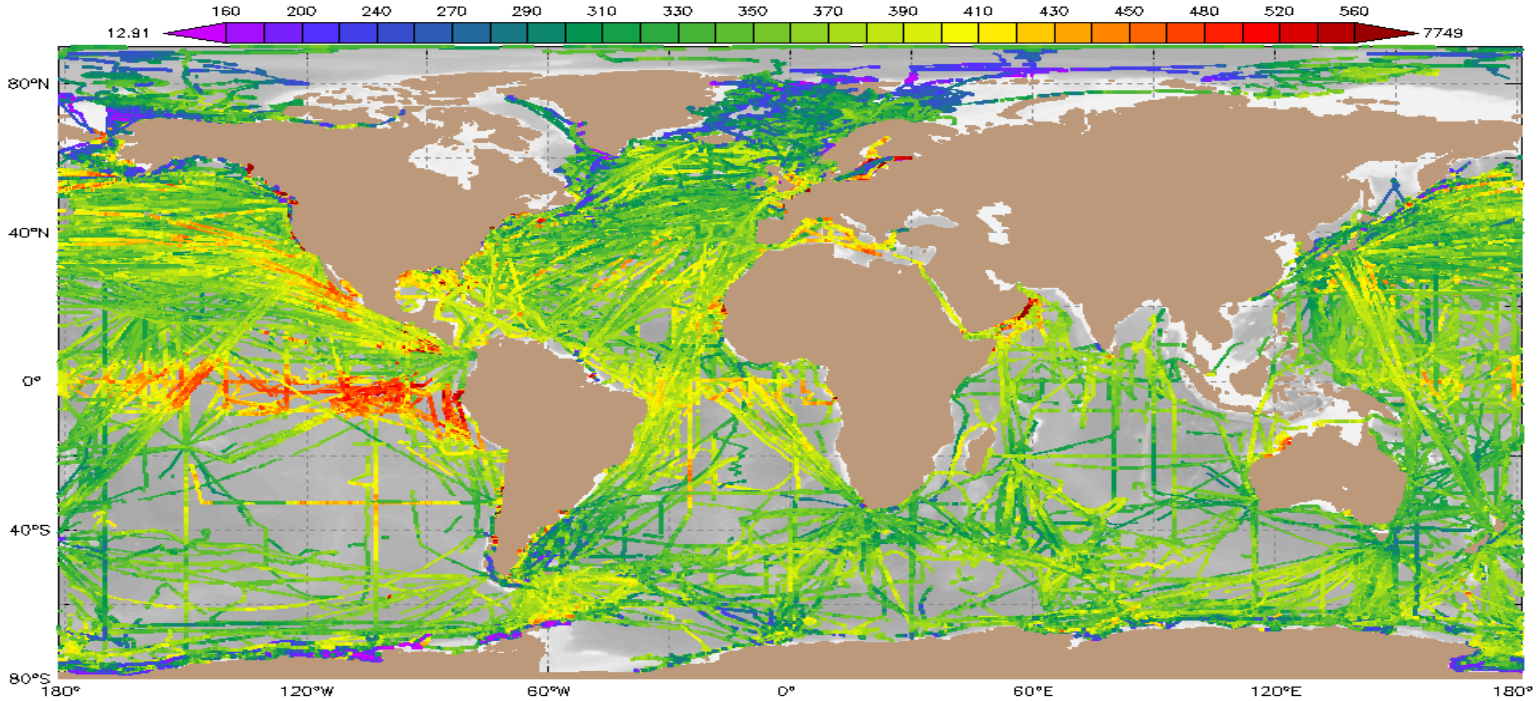
Budget Imbalance:

(the difference between estimated sources & sinks)

6%

2.2 $GtCO_2/yr$

Ocean Acidification



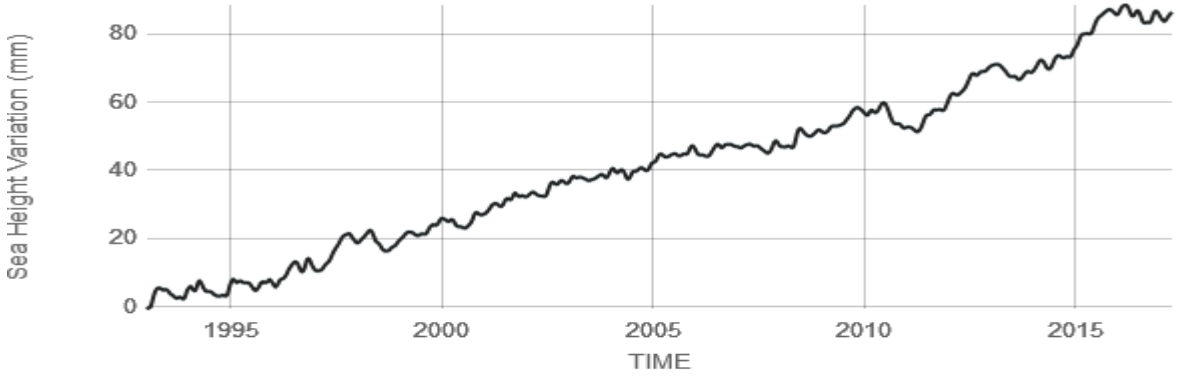
Ocean acidification is a global problem that threatens marine organisms, ecosystems, services and resources and that has potentially considerable ecological and socio-economic consequences (food security, livelihood of fishing communities)

WMO OMM

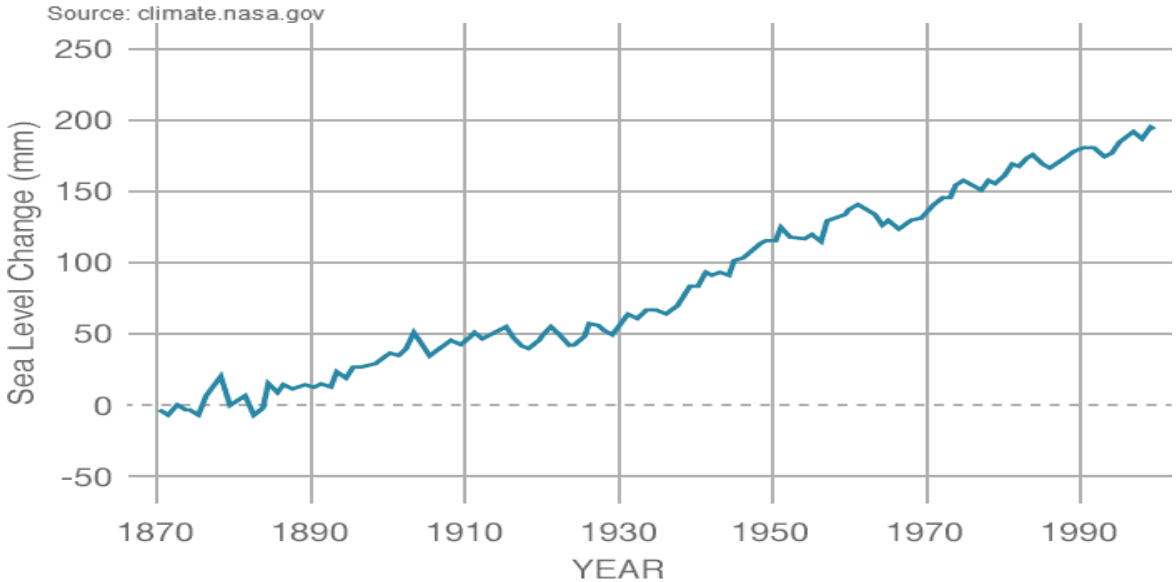
DATA SET: SOCAT v4 Data Collection
VARIABLE: fCO2 recommended (µatm)
01-Jan-1957 00:00 to 31-Dec-2016 00:00

Global sea level rise: + 26 cm 1870-2017

NASA-EUMETSAT Satellites (1993-present)



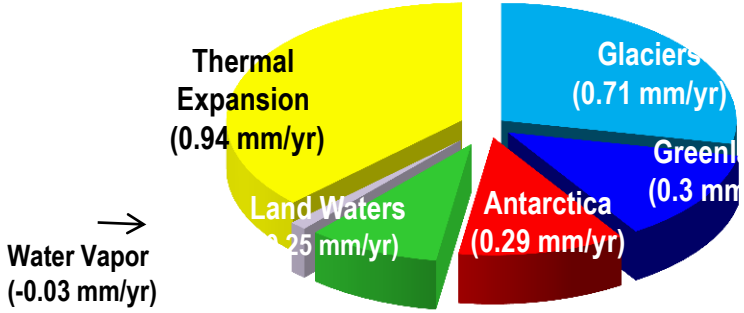
Tide gauges (1870-2000)



WMO OMM

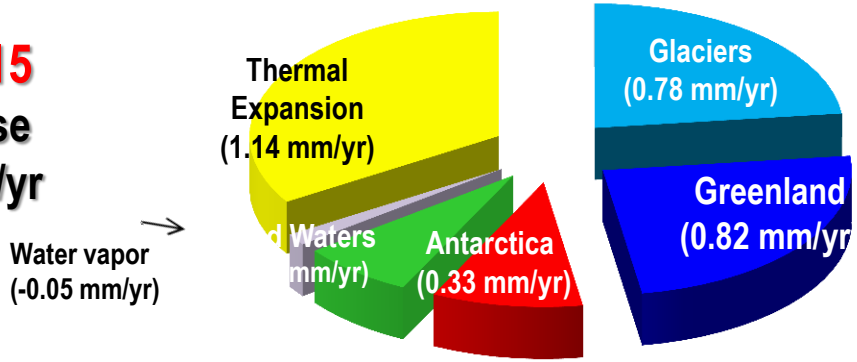
Contributions to global sea level rise

1993-2004
GMSL rise
= 2.7 mm/yr



→ *Total land ice: 47%*

2004-2015
GMSL rise
= 3.5 mm/yr

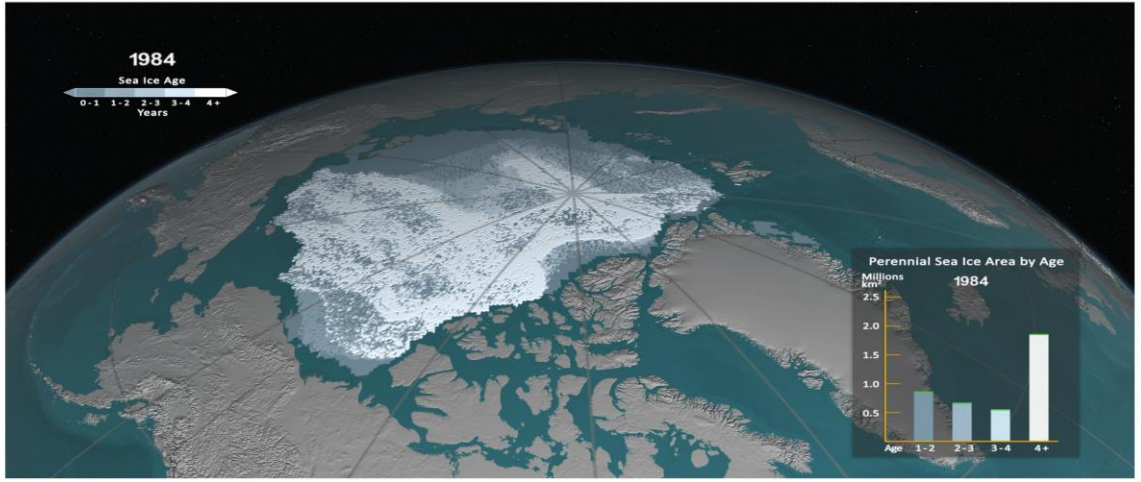


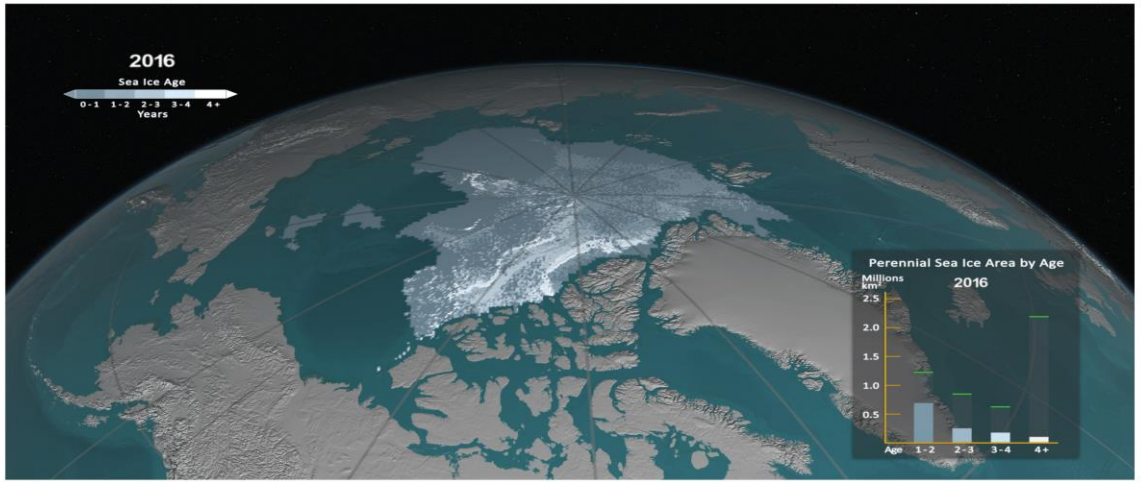
→ *Total land ice: 55%*

WMO OMM

Source: LEGOS

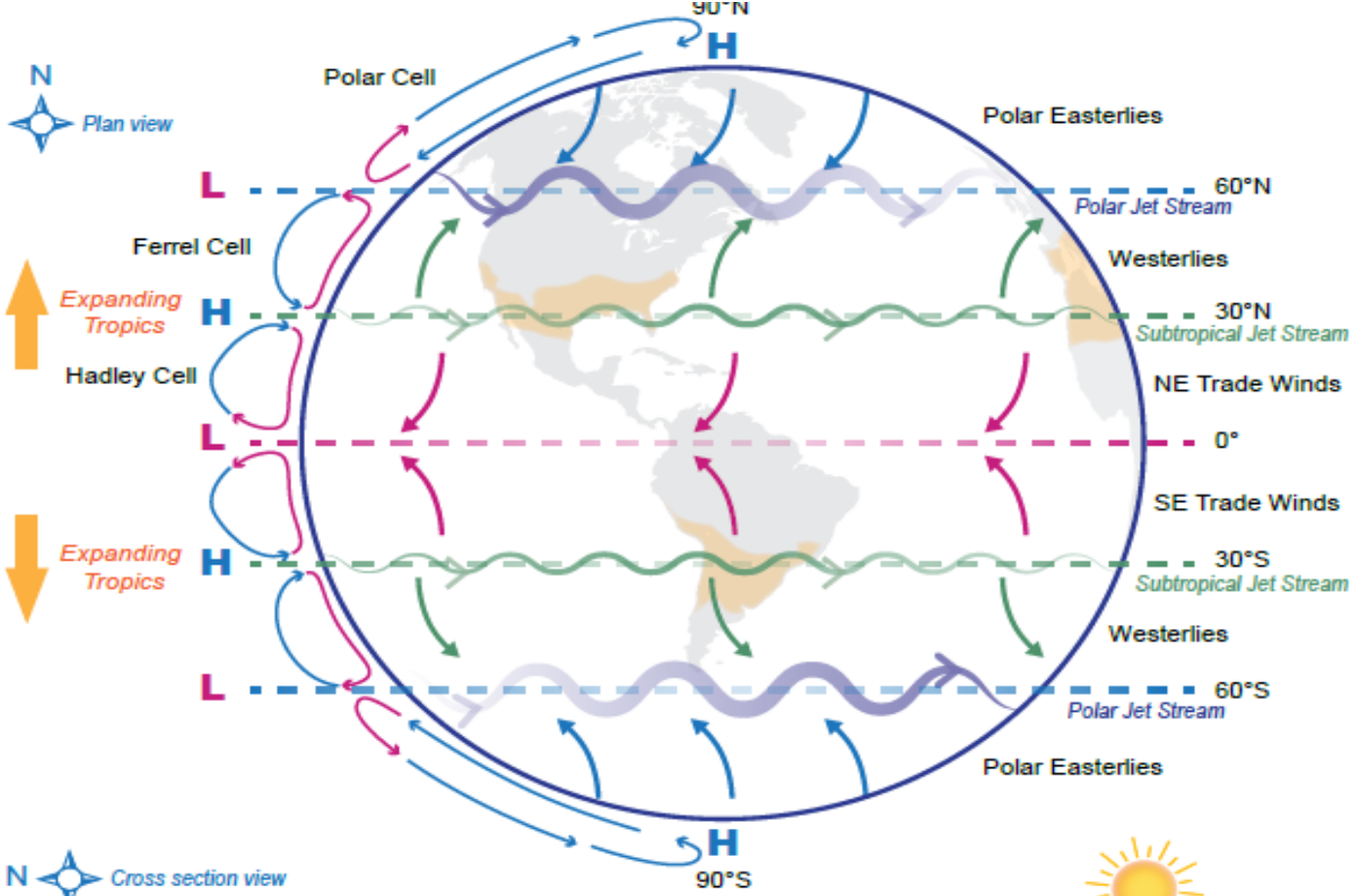
Multi-year ice 1984 and 2016





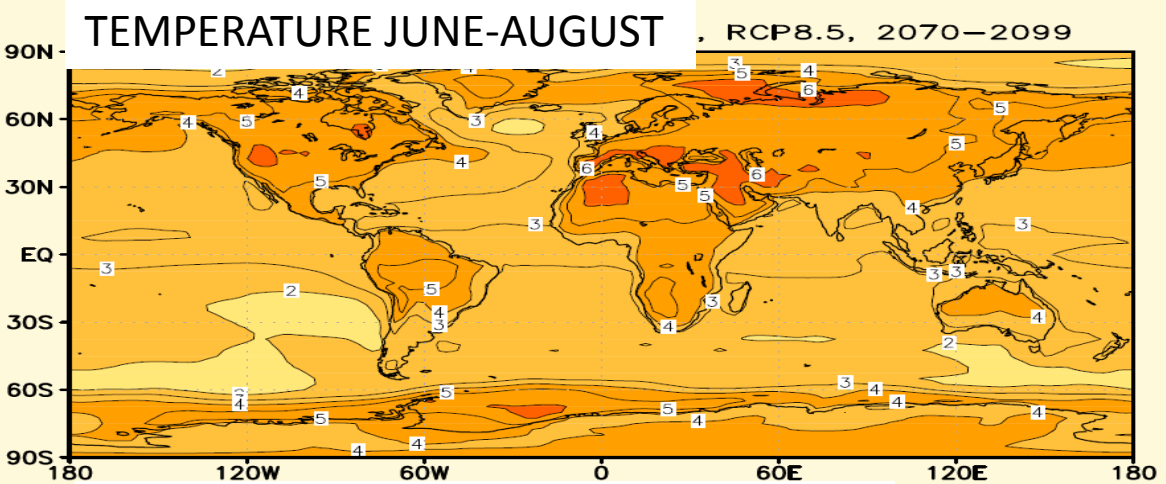
WMO OMM

Changes in the Arctic affect weather globally

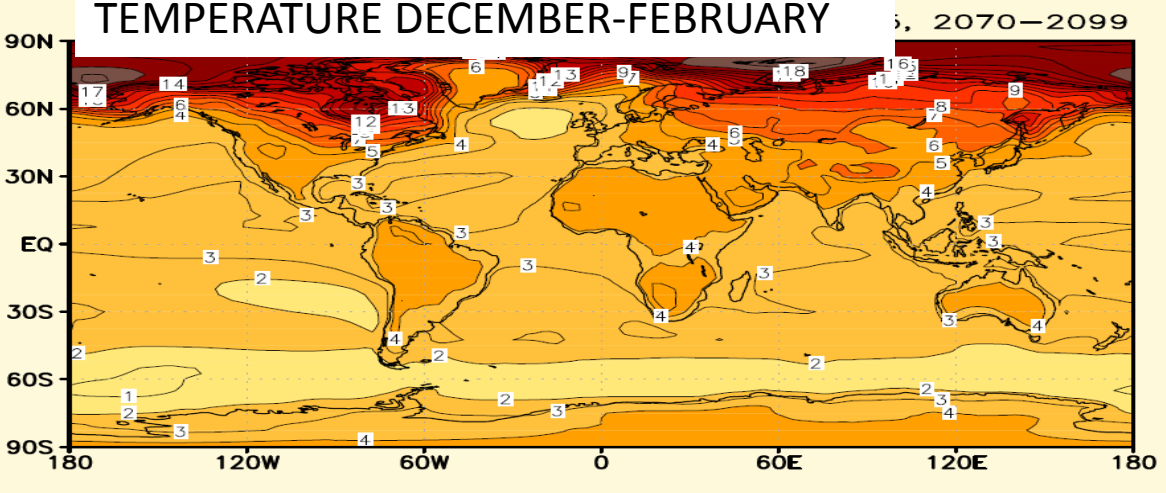


Temperature change =>2070-99, RCP 8.5

TEMPERATURE JUNE-AUGUST

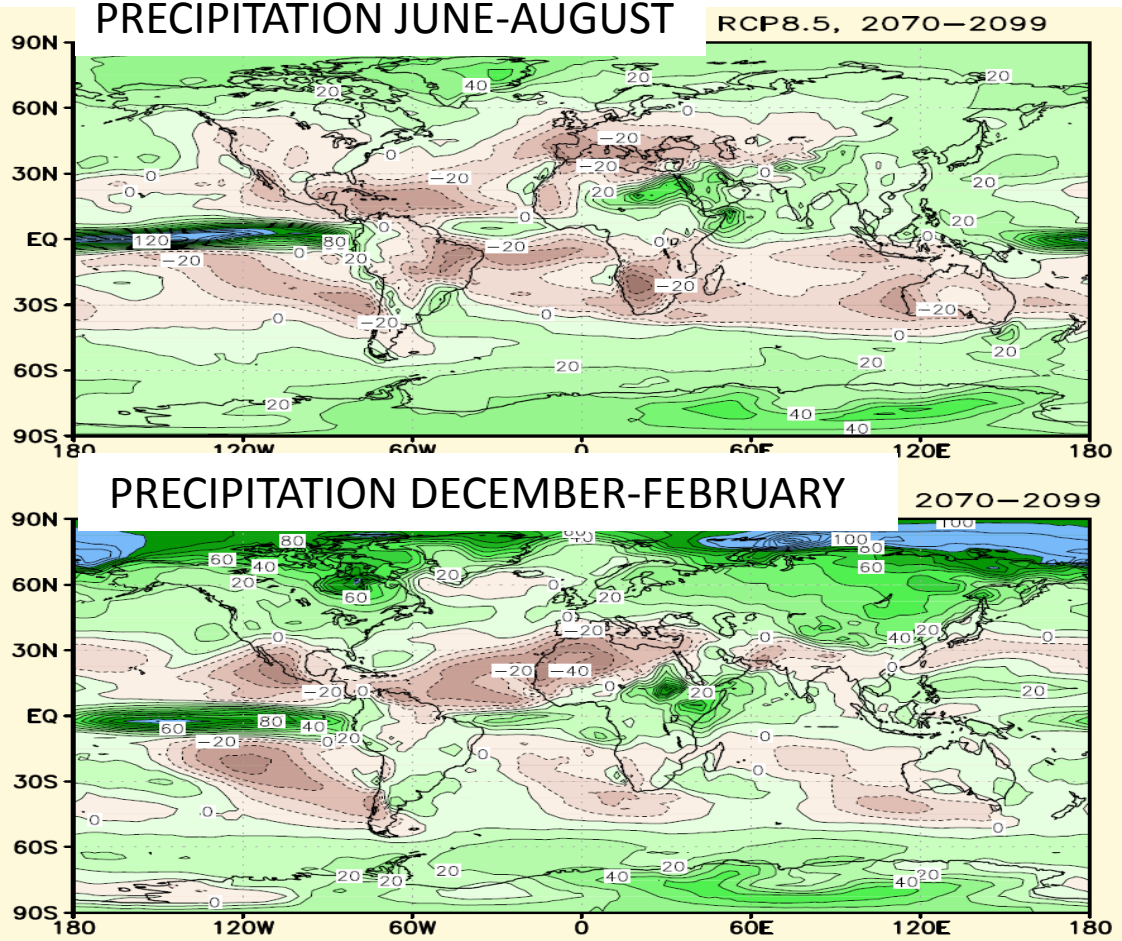


TEMPERATURE DECEMBER-FEBRUARY



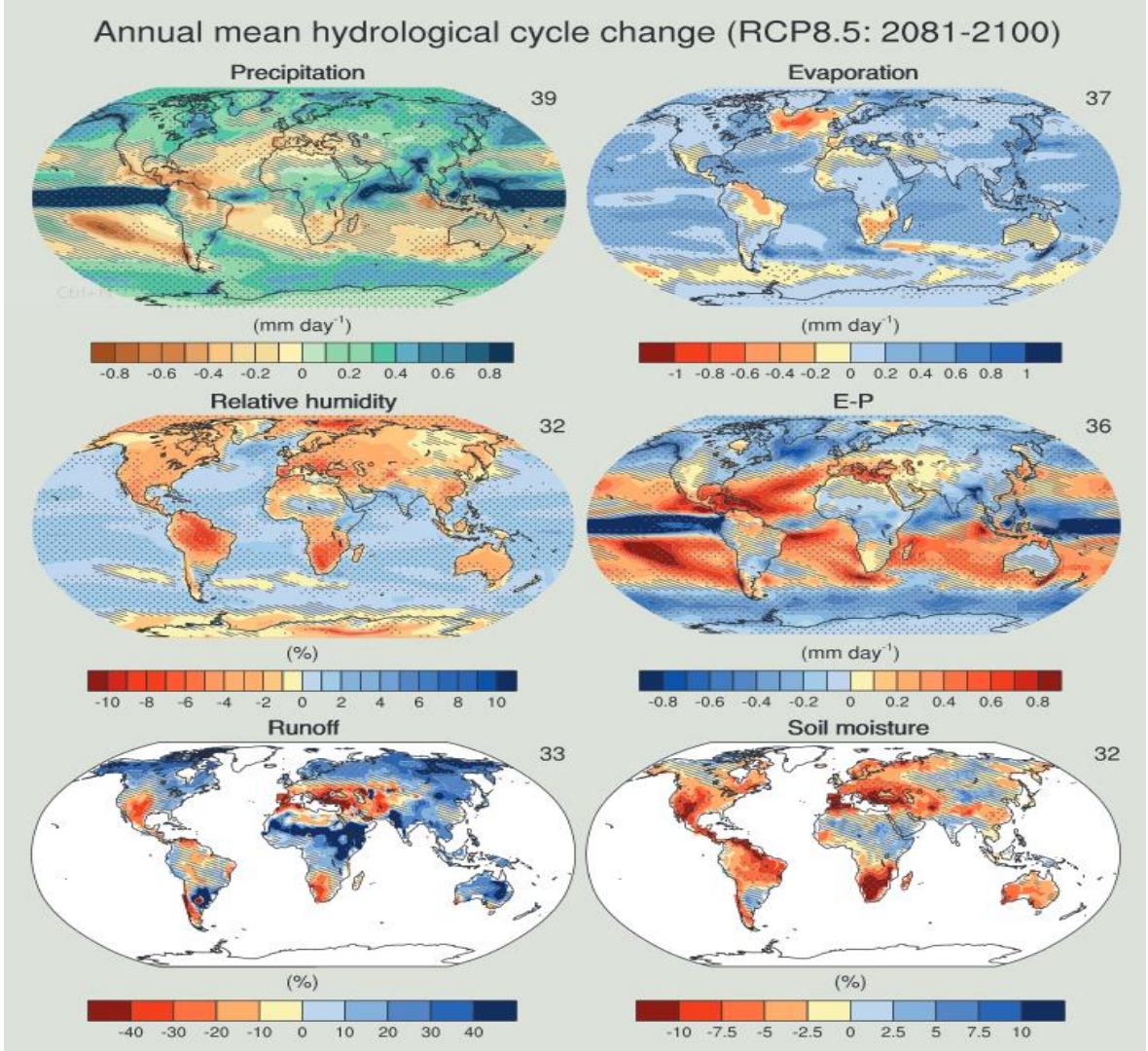
WMO

Precipitation change =>2070-99, RCP 8.5



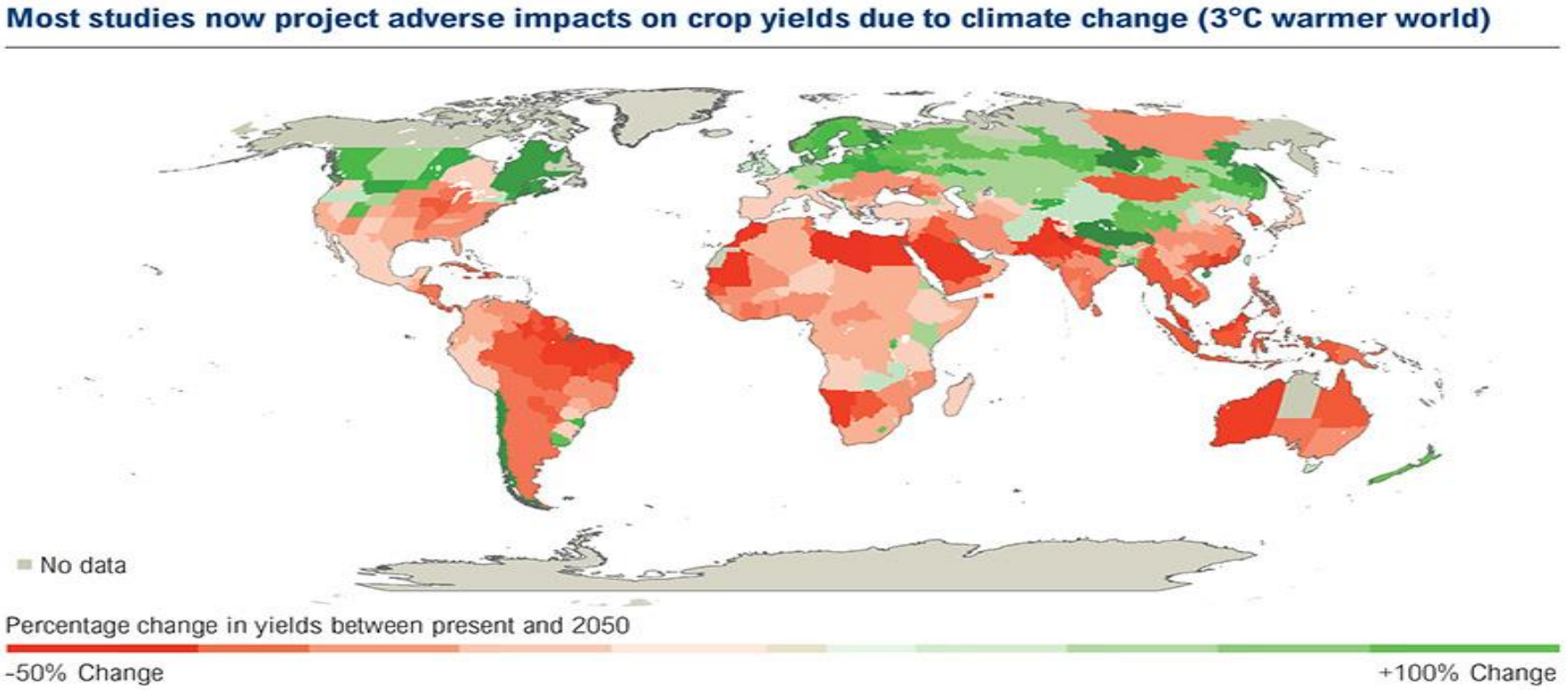
NO EMISSION CUTS

NOW => 2081-2100



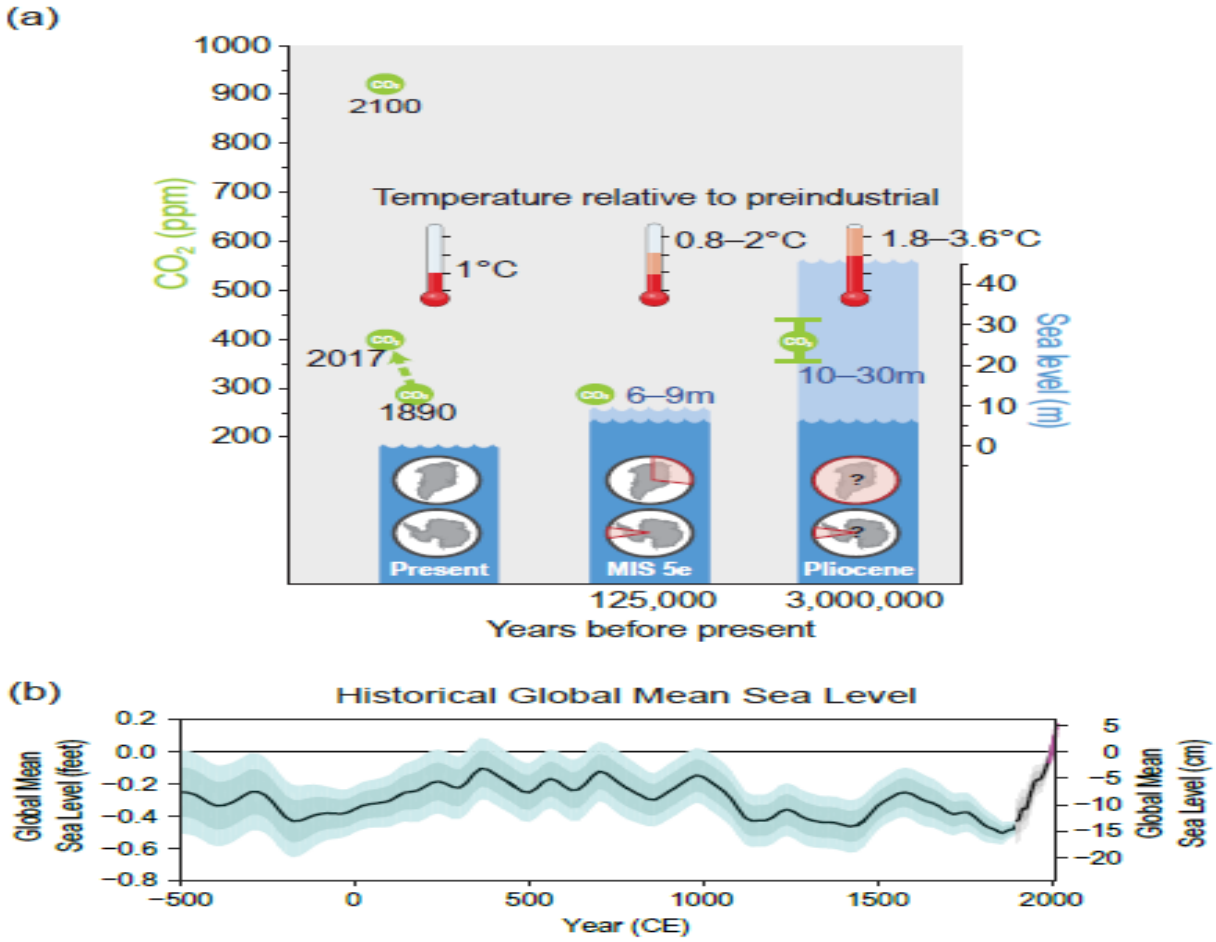
WMO OMM

Impact of 3 C warming on crop yields



WMO OMM

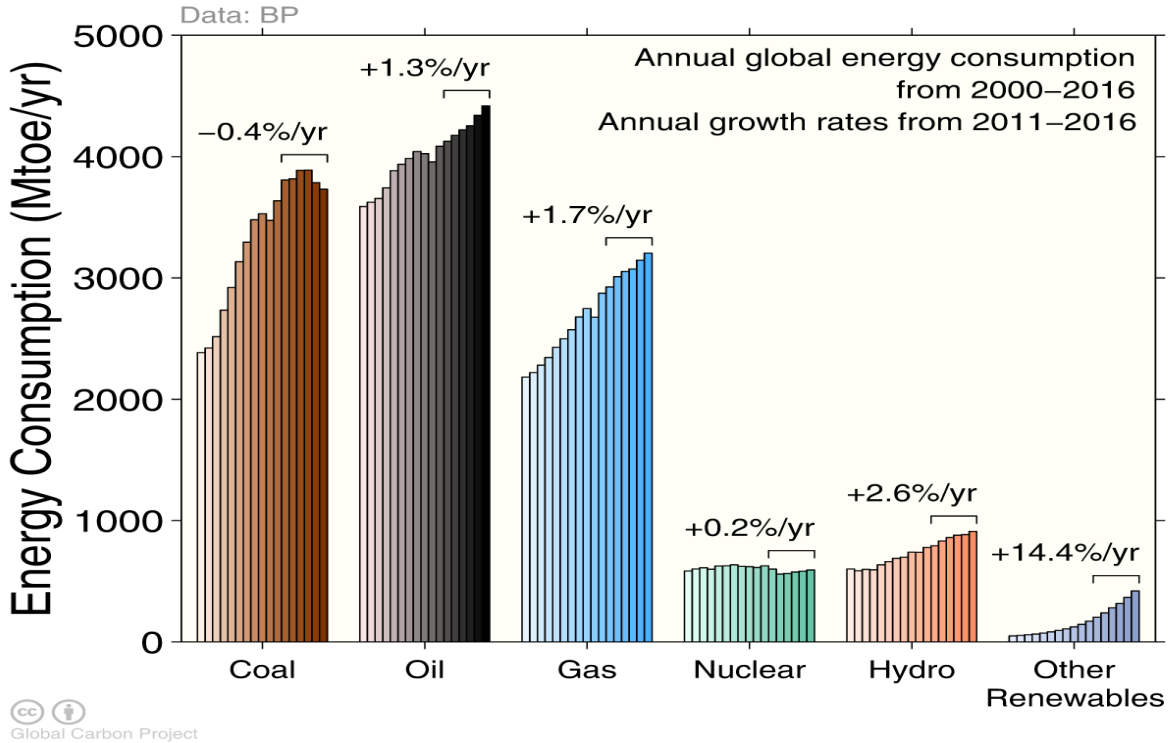
Historical CO_2-temperature-sea level



WMO

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



Source: BP 2017; Jackson et al 2017; Global Carbon Budget 2017

Climate-agriculture, conclusions

1. Climate change has already affected agricultural productivity especially in the Southern Hemisphere and developing world
2. At high latitudes warmer and more rainy winters have enhanced the leaching of fertilizers from farmlands to e.g. Baltic Sea
3. In 3 C warmer climate large part of current agricultural capacity may be lost => potential for severe (military) crisis & migration
4. Ocean acidification and warming affects the fish catchments
5. Sea level rise & coastal storms => salination of farmlands
6. Population growth and urbanization also special challenges

Thank you
Kiitos

WEATHER CLIMATE WATER
TEMPS CLIMAT EAU

WMO OMM

World Meteorological Organization
Organisation météorologique mondi