World Meteorological Organization

Weather • Climate • Water

Structured Expert Dialogue (SED) February 2015

Observed State of the Global Climate

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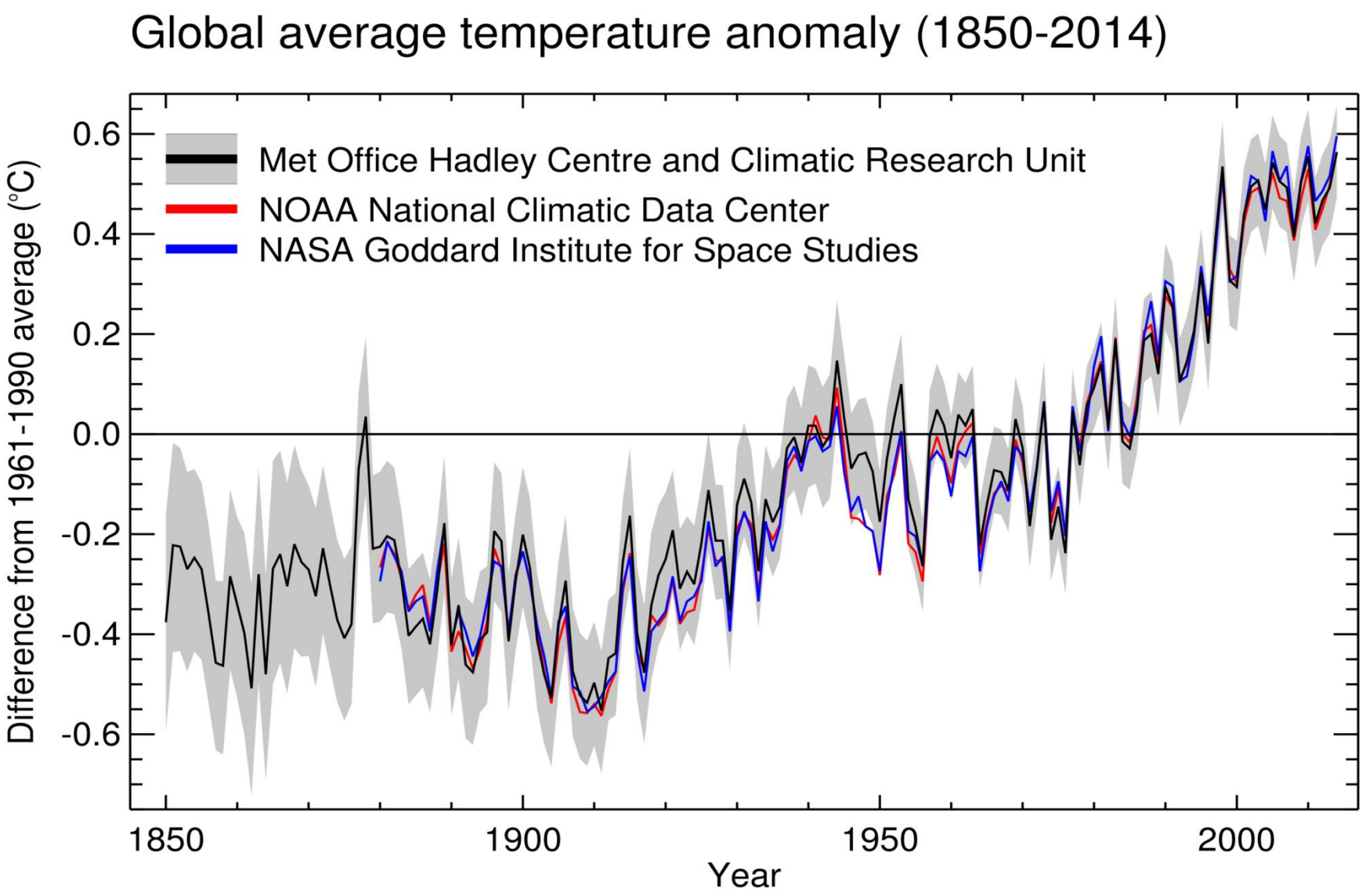
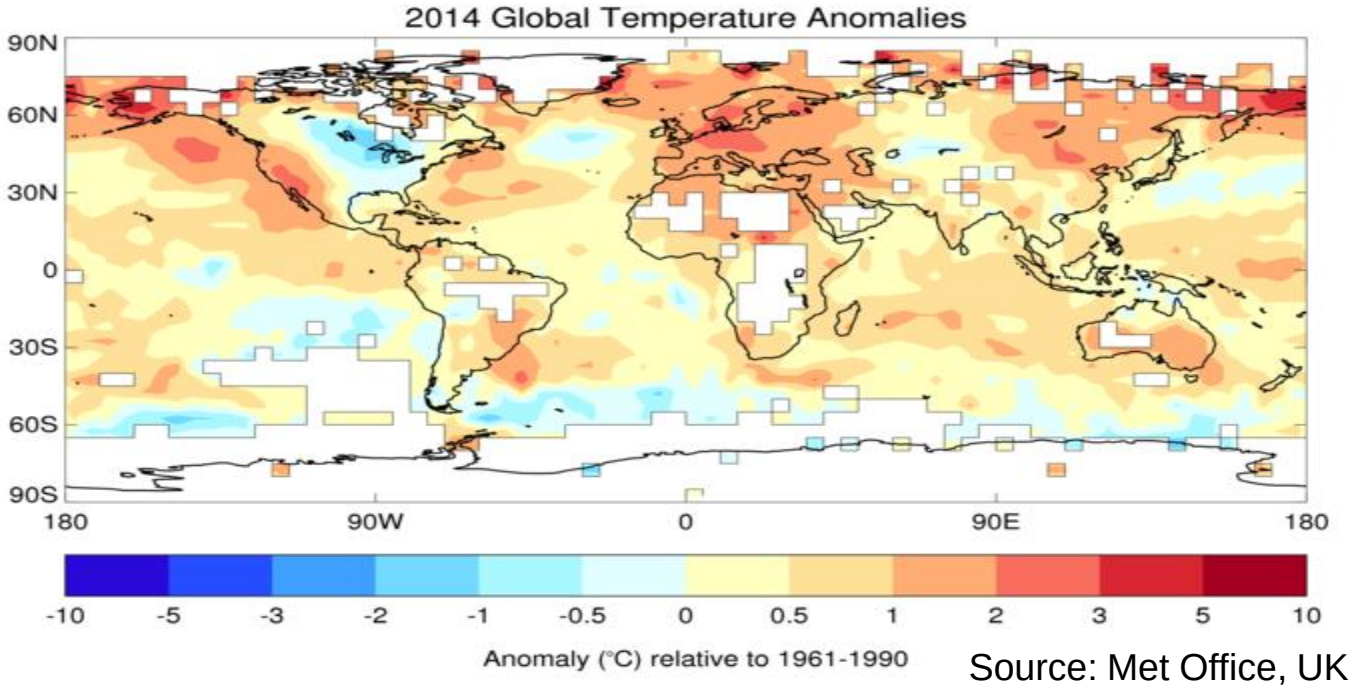
Outline

- Observed state of the global Climate – latest evidence
  - What do we know of GHG in the atmosphere
    - How can we address our knowledge gaps

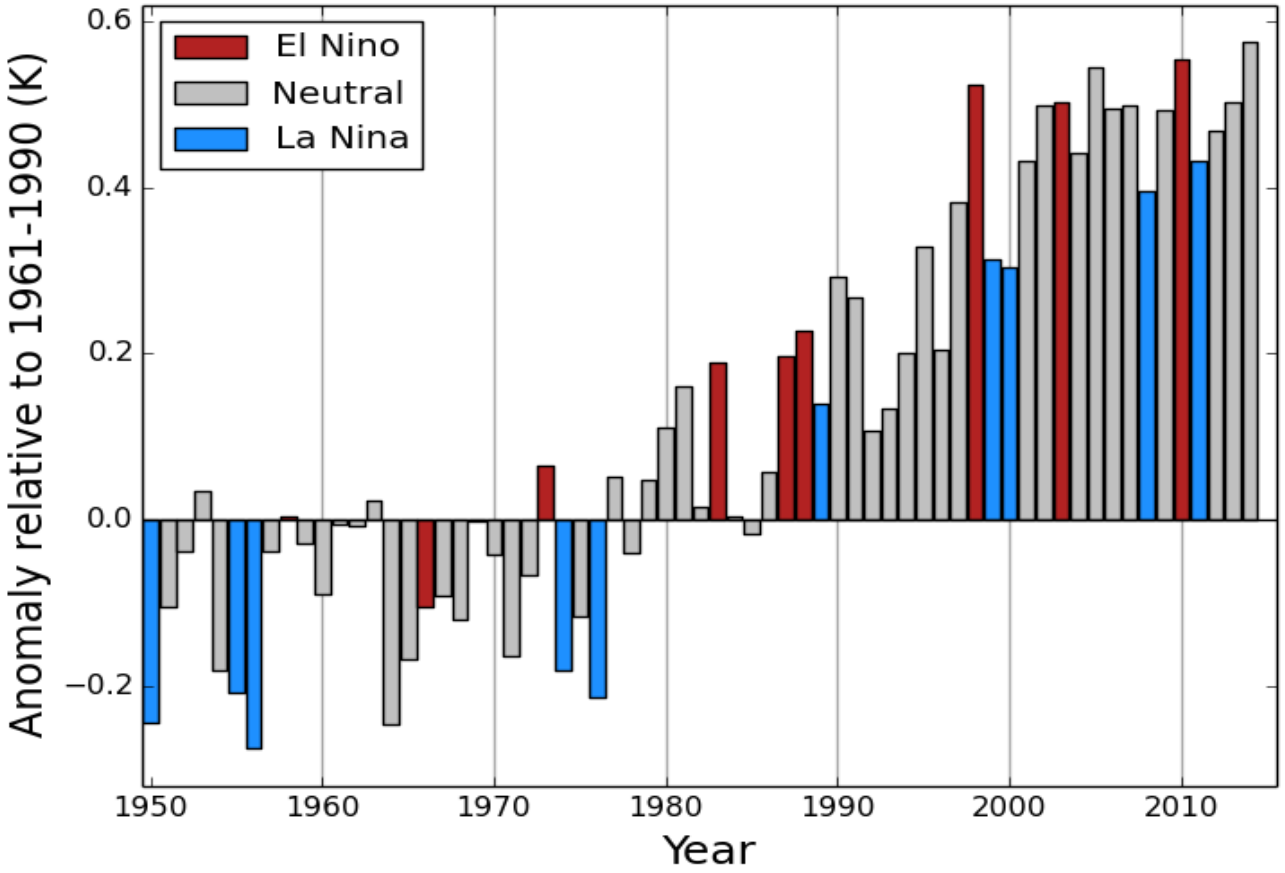
‘We cannot manage what we do not measure’


Global average temperature anomaly (1850-2014)
Met Office Hadley Centre and Climatic Research Unit
NOAA National Climatic Data Center
NASA Goddard Institute for Space Studies
Difference from 1961-1990 average (°C)
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
1850
1900
1950
2000
Year



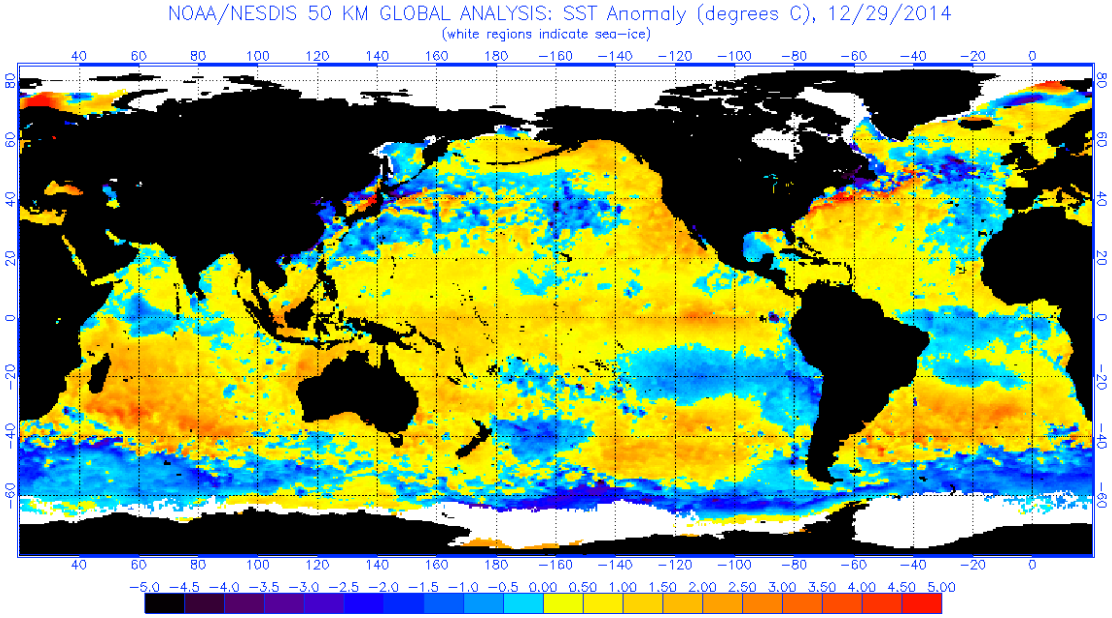
Source: Met Office, UK

Global average temperature for Jan-Dec 2014 was 0.57 °C above the 1961-1990 average of 14 °C (Combined NOAA-NASA-UK Data sets)



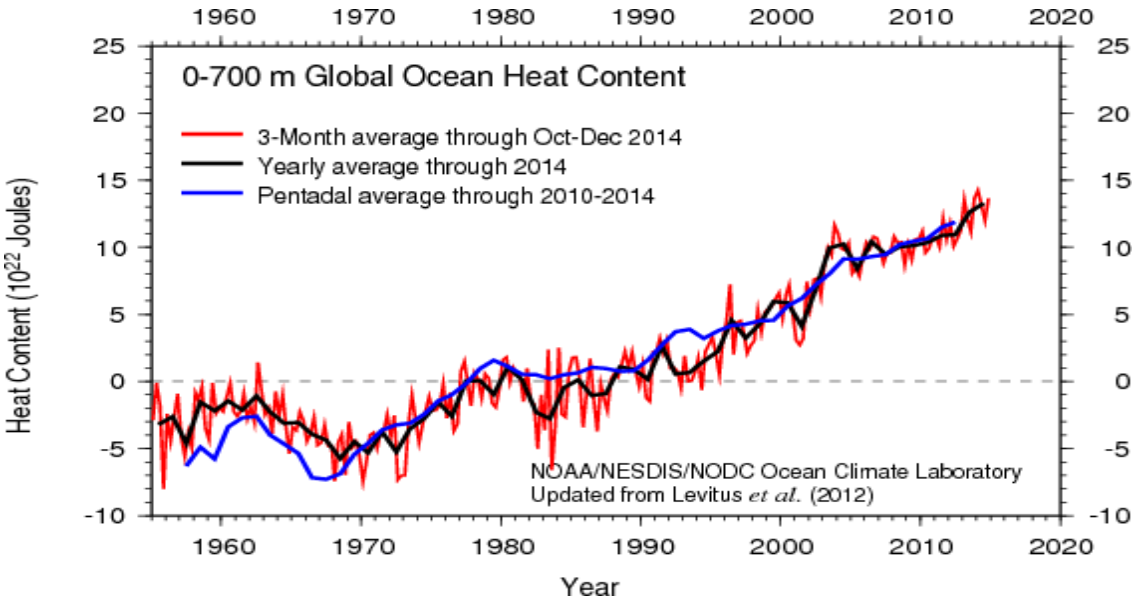
Data used: Combined NOAA-NASA-UK Data sets

Comparing 2014 to earlier years, ranks 2014 as the warmest year on record



Averaged Global Sea Surface Temperature for Jan-Dec 2014 were estimated 0.48°C(*) above the 1961-1990 long term average, a record high value.

(*) Source: Hadley Centre SST Data set. The uncertainty estimate is +/- 0.07°C

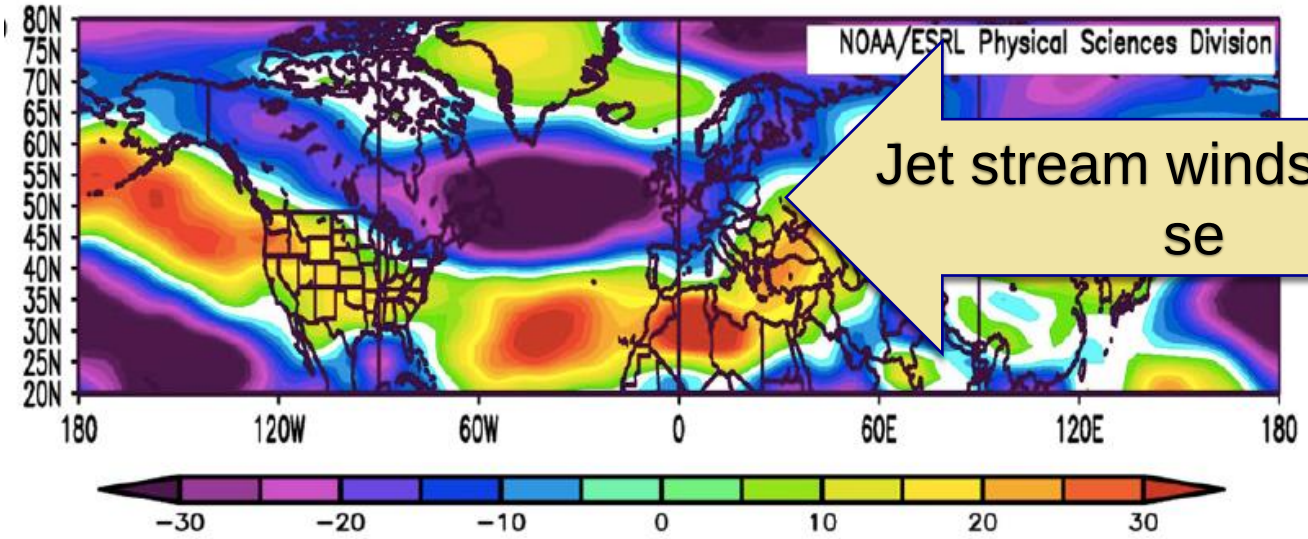


➢In 2014, the yearly average of the ocean heat content estimated for the 700-m and 2000-m layers were higher than, any earlier year in the record

WCRP World Climate Research Programme

As the Arctic warms:

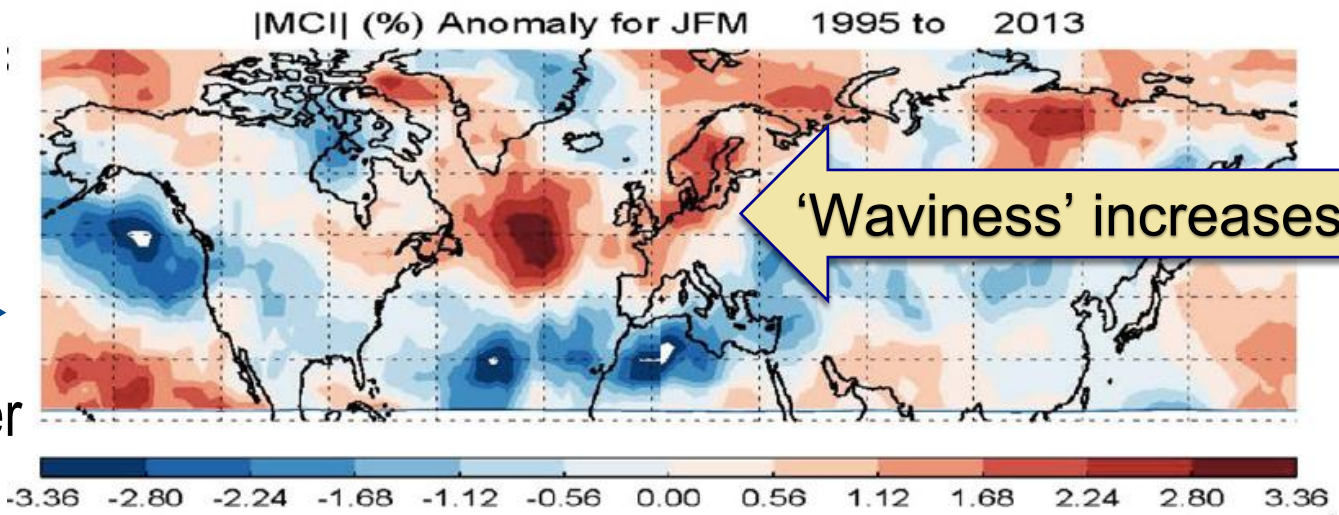
Francis & Vavrus 2015



Jet stream winds decrease

Wavier

Smoother

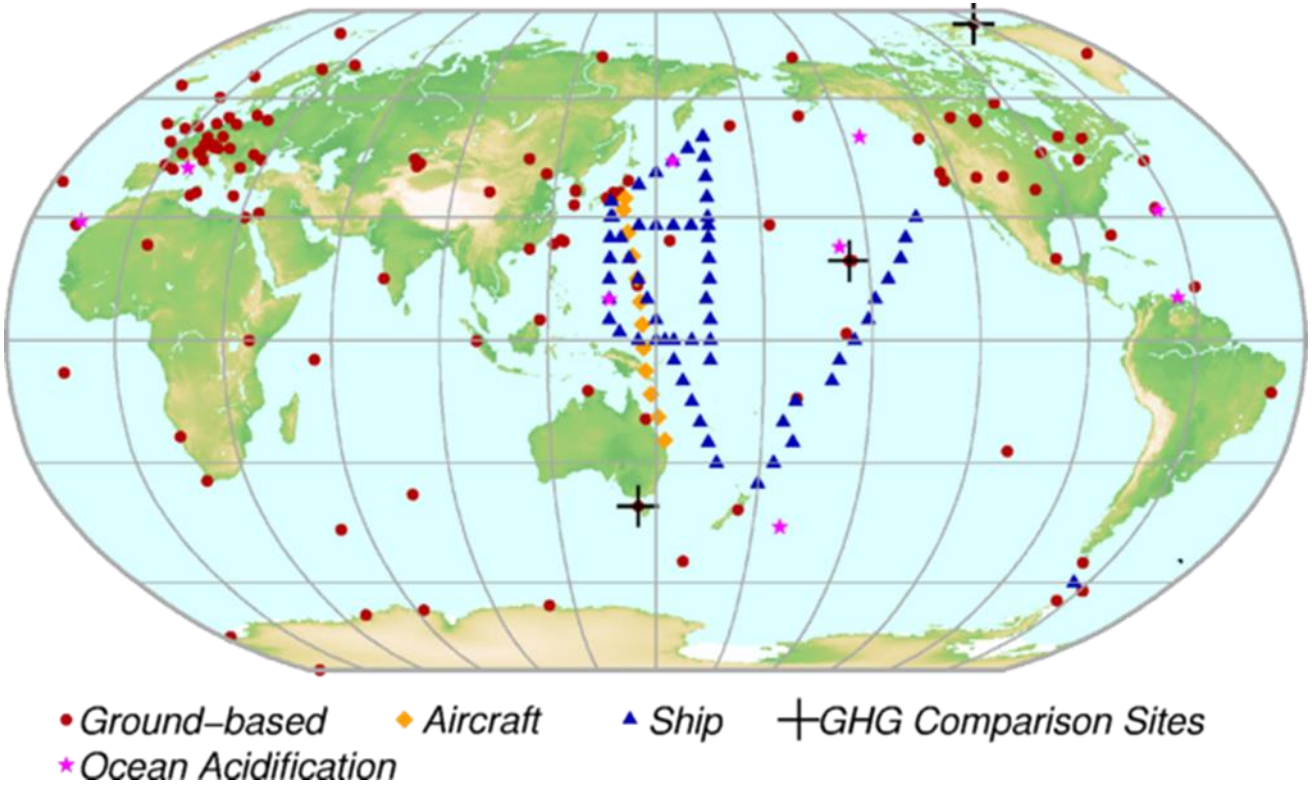


'Waviness' increases

WMO IOC ICSU International Council for Science

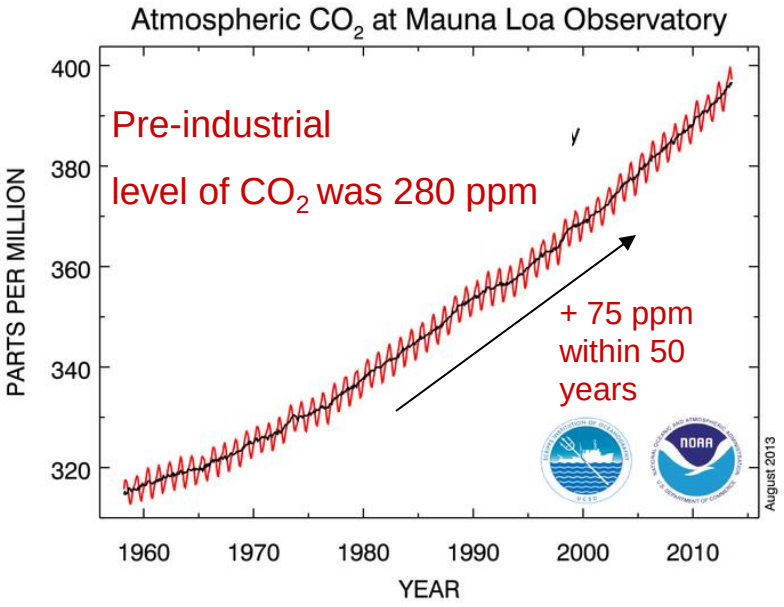
What do we know about Greenhouse Gases in the atmosphere

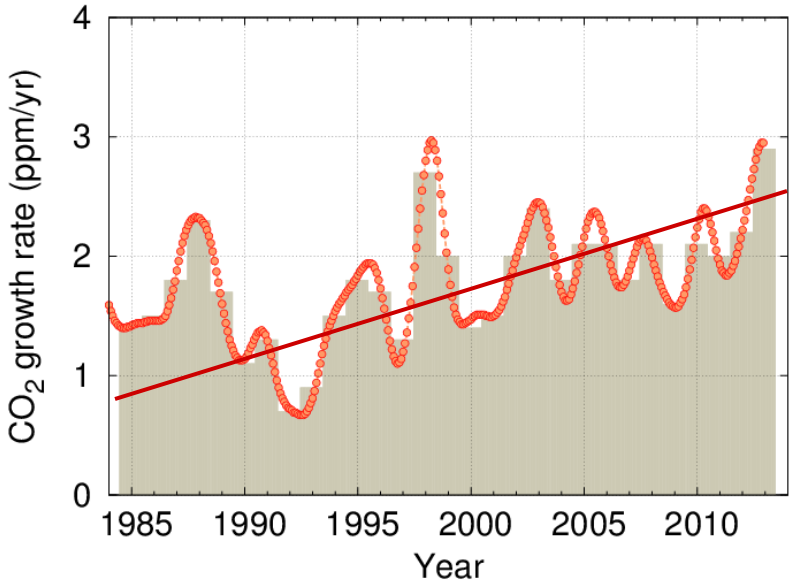
- Everything we learn about state of the greenhouse gases in the global atmosphere is based on the **high quality long-term globally harmonized** observation



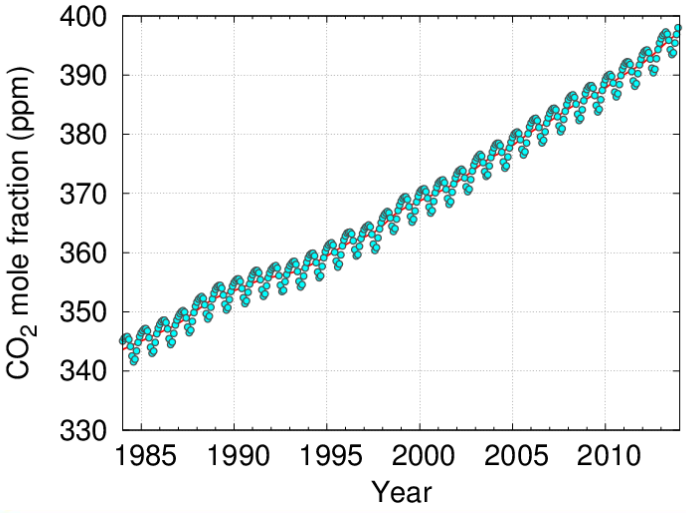
Atmospheric CO_2 - The Primary Driver of Climate Change

- Atmospheric CO_2 continues to increase every year
  - The trend is largely driven by fossil fuel emissions
- The growth rate increases decadally
  - Interannual variability is largely driven by the Earth System
- The Earth System captures 50% of emissions (terrestrial biosphere and ocean uptake) – for how long?



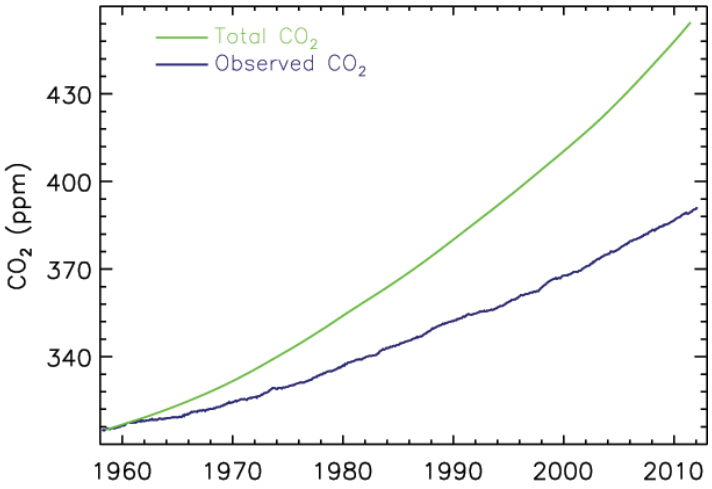


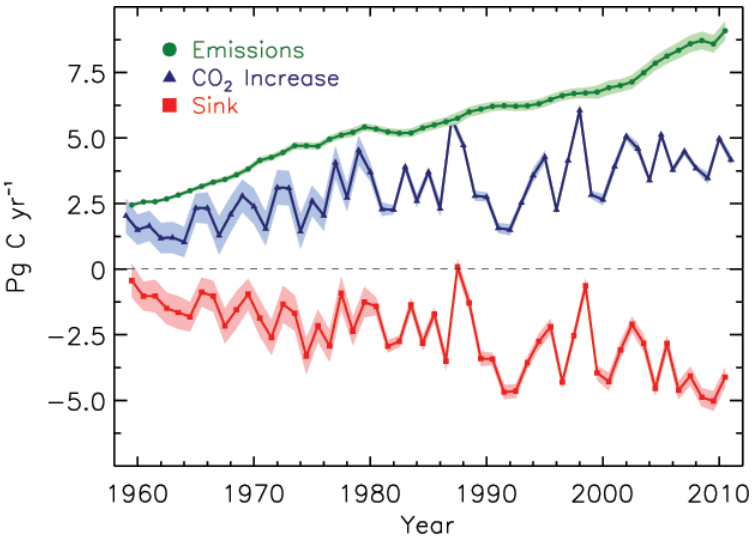
CO_2 global averaged growth rate

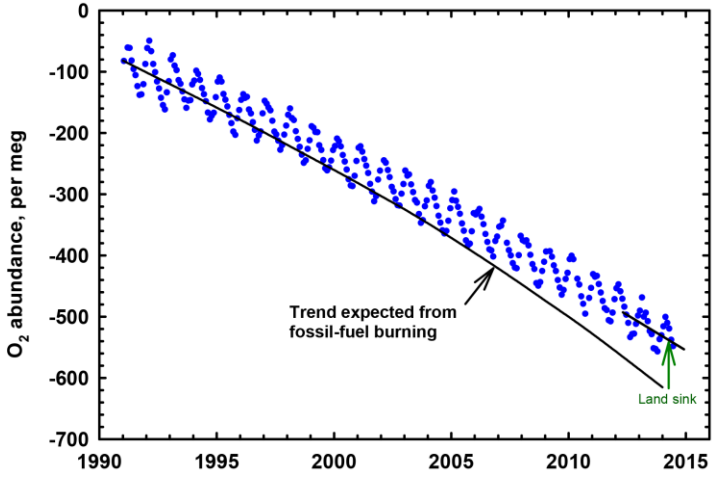


CO_2 global averaged mole fraction

Complexity of carbon cycle

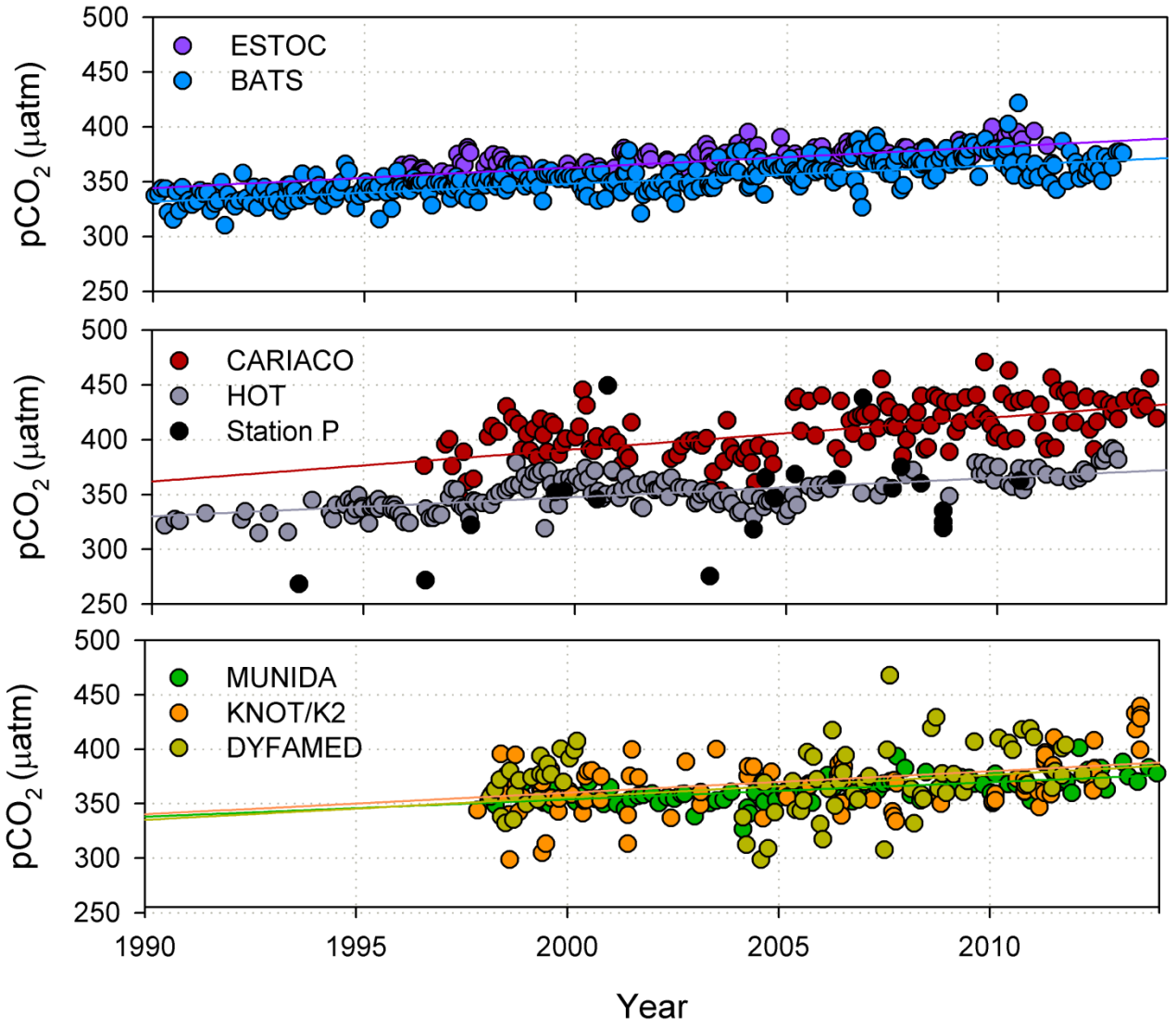






- Identification of sinks needs dedicated measurements
- CO_2 uptake by oceans lead to ocean acidicfication
- Knowledge of terrestrial and ocean sinks is essential for definition of **anthropogenic contribution**

Ocean acidification



A global challenge

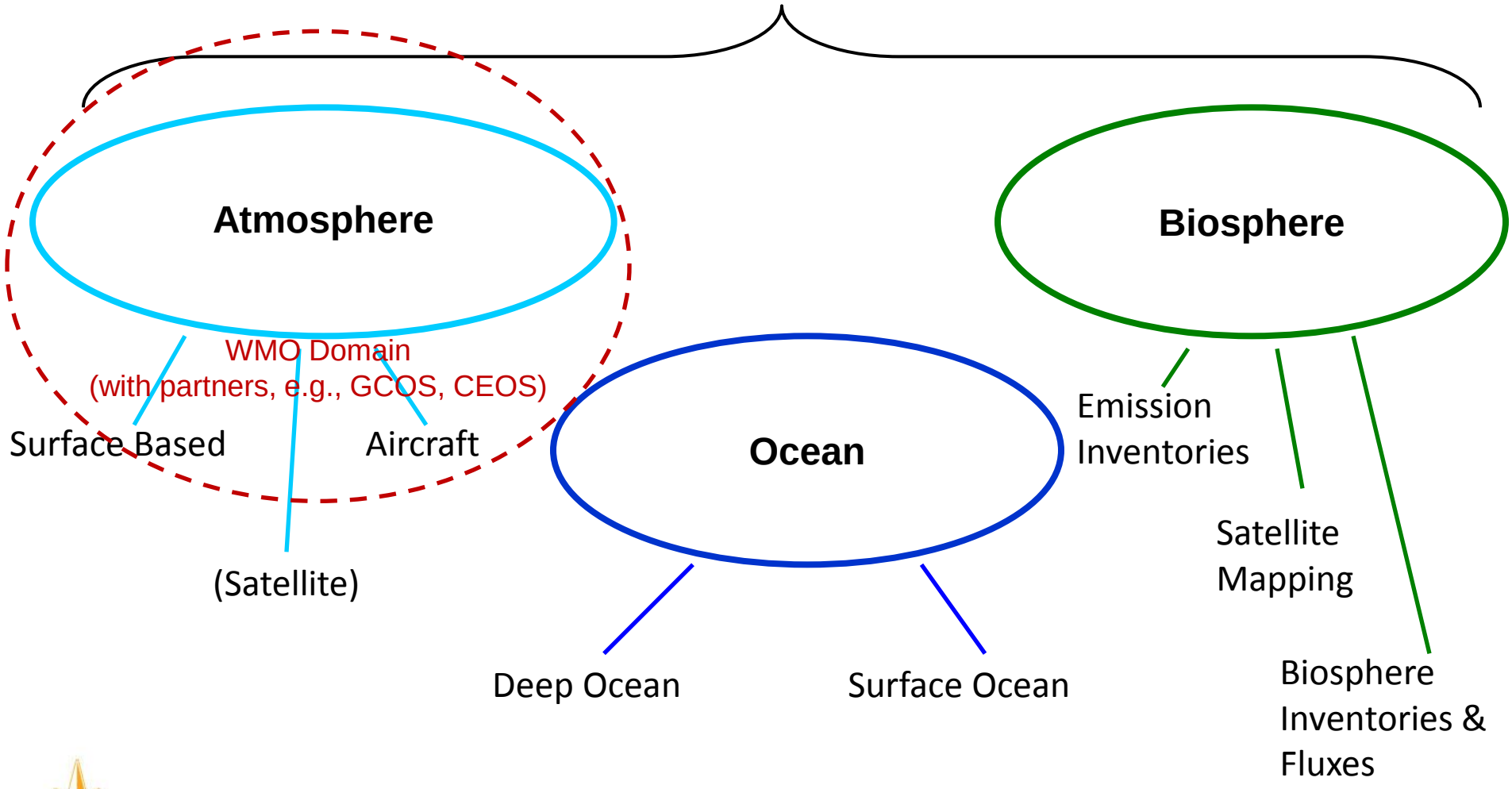
- Society is attempting to advance efforts to reduce CO_2 emissions and will likely do so even more in the future
- Mitigation efforts will vary by nation, region, & emission sector (energy, industry, etc.), and will be diverse in their approach
- The complexity of the carbon cycle is such that tracking the adequacy of aggregate measures to achieve the Convention global goal will require monitoring system enhancements
- Emission reduction approaches all require independent, scientific monitoring to support verification and policy decisions.

Gaps in the current integrated observing system

- Insufficient density of the observations over the ground, sea and in the free atmosphere
- Insufficient measurements of isotopes and co-emitted gases for source attribution
- Incompatible observations on different scales (e.g. global and local observations) and in different media (e.g. atmospheric observations vs. pCO2 observations)
- Insufficient complexity and performance of transport models on global/regional and local scales

CO_2 and Other GHGs

Data Integration ⟶ Products



Conclusions

<u>There is a strong need for</u> :

- Development of the observing system in all domain
- Maximum benefits can be obtained in the short term through investment in observation in the atmospheric domain due to its role in mixing, transport and radiative forcing (increase of spatial coverage and complexity)
- development of the modeling tools to deliver products on the temporal and spatial scales relevant to decision making
- collaboration between the “spheres”
- Inter-agencies coordination

World Meteorological Organization

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Thank you for your attention

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