AMAP: Climate change Issues:
SWIPA report on cryosphere changes and contribution to IPCC work

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Article 2. 1 (a) of the UNFCCC Paris agreement reads “This Agreement, in enhancing the implementation of the Convention, including its objective, aims to strengthen the global response to the threat of climate change, in the context of sustainable development and efforts to eradicate poverty, including by:

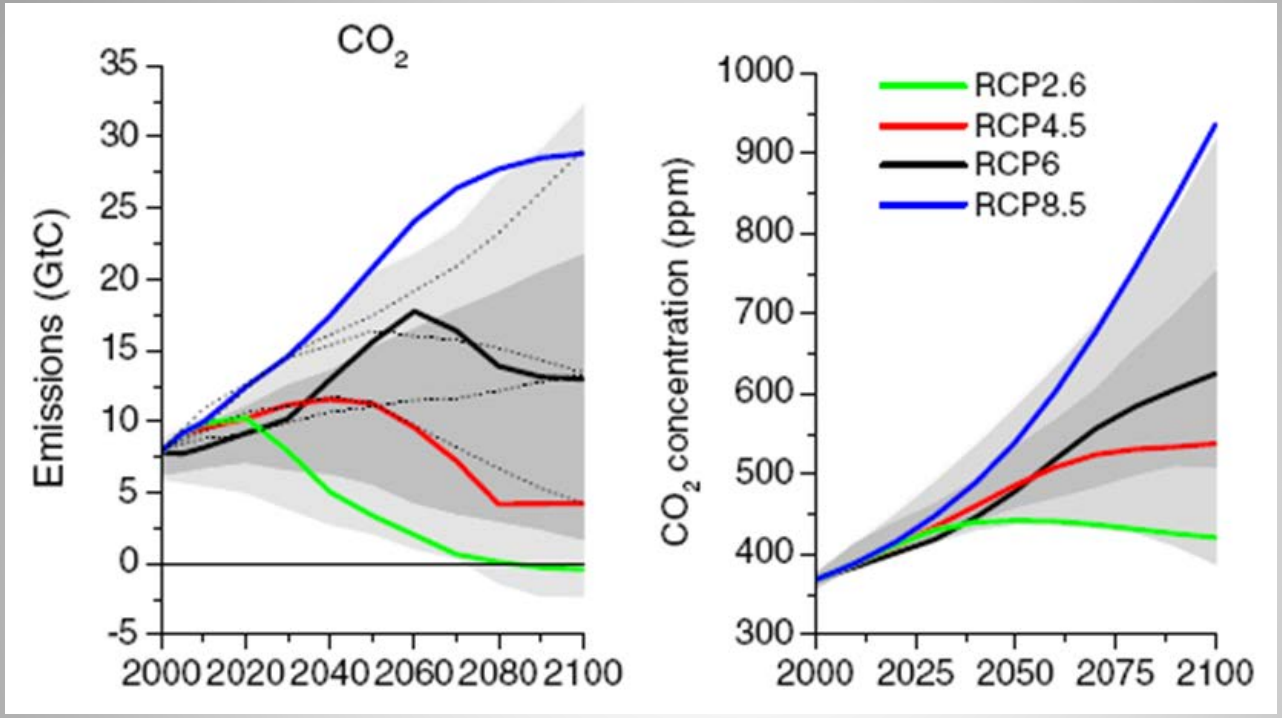
“Holding the increase in the global average temperature to well below well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change”

Meeting report of SAO/Fairbanks (March 2016): “AMAP will present to the Arctic States on what the Paris agreement, if fully implemented, would mean for the Arctic cryosphere over the next century”.

Background

- AMAP is currently finalizing its cryosphere report (SWIPA follow up).
- The SWIPA update provides an assessment of Arctic climate effects:
  - Assuming the goal of the Paris agreement of a global average warming of well below 2 ^{o}C (mean 1.8, range 1.1-2.6 ^{o}C) is met.
  - Assessing consequences of what the double of that warming could be.
- The Intergovernmental Panel on Climate Change (IPCC) is the leading international body for the assessment of climate change.
- IPCC produces Assessment Reports; Special Reports; Methodology Reports; Technical Papers; and Supporting Material.
- As a follow up to the Paris agreement the IPCC has decided to produce two Special Reports:
  - Implications of a 1.5°C warming world (2018).
  - Climate change, oceans and the cryosphere (2019).
- AMAP will facilitate scientific work which can contribute to these IPCC Special Reports and it is expected that SWIPA follow up scientist will be nominated and selected to participate in the IPCC work.

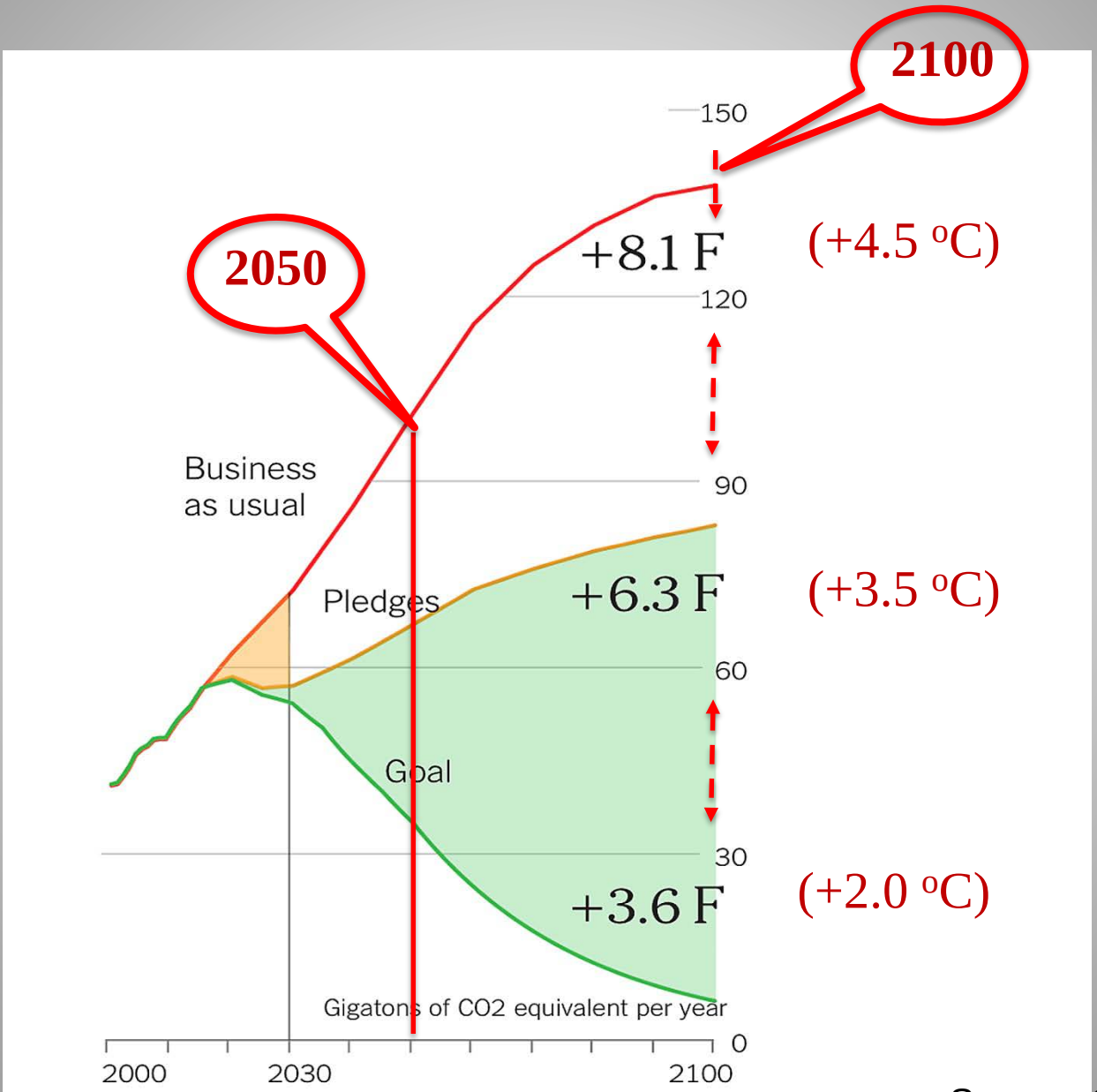
Representative Concentration Pathways



van Vuuren et al. Climatic Change (2011) 109: 5. doi:10.1007/s10584-011-0148-z

- The RCPs (projections based on population size, economic activity, lifestyle, energy use, land use patterns, technology and climate policy) describe four different 21st century pathways of GHG emissions and atmospheric concentrations, air pollutant emissions and land use.
- The RCPs include a stringent mitigation scenario (RCP2.6), two intermediate scenarios (RCP4.5 and RCP6.0) and one scenario with very high GHG emissions (RCP8.5)
- Scenarios without additional efforts to constrain emissions (’baseline scenarios’) lead to pathways ranging between RCP6.0 and RCP8.5
- RCP2.6 is representative of a scenario that aims to keep global warming likely below 2°C above pre-industrial temperatures

The Paris CoP-21 Agreement



Source: ClimateInteractive

Representative Concentration Pathways (RCPs) used in SWIPA follow up

	Global average mean temperature change °C (and likely range) 2046-2065	Global average mean temperature change (and likely range) 2081-2100
RCP 4.5	1.4 (0.9-2.0)	1.8 (1.1-2.6)
RCP 8.5	2.0 (1.4-2.6)	3.7 (2.6-4.8)

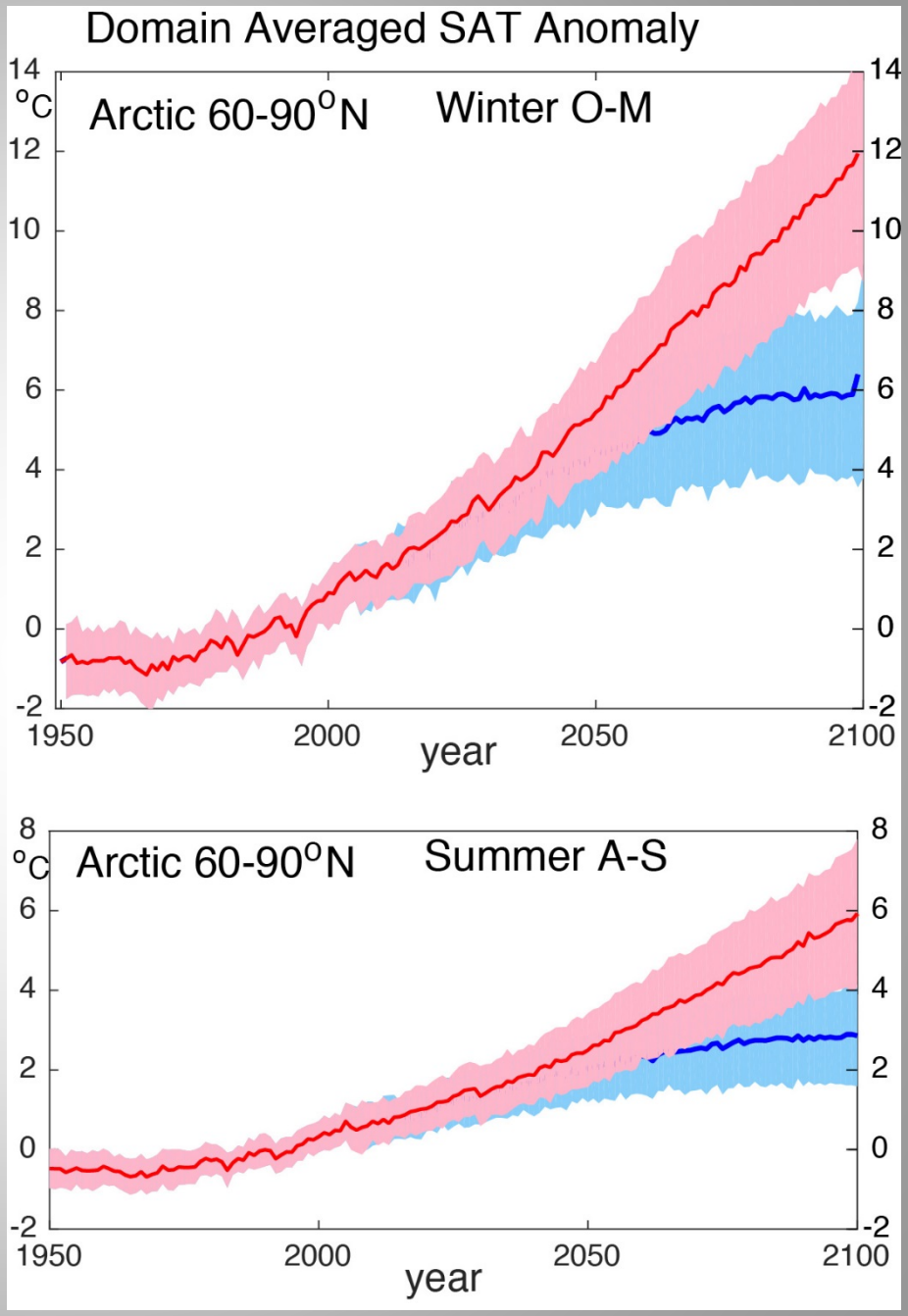
(RCP 2.6 1.0 (0.4-1.6) 1.0 (0.3-1.7))

Arctic Temperature Projections

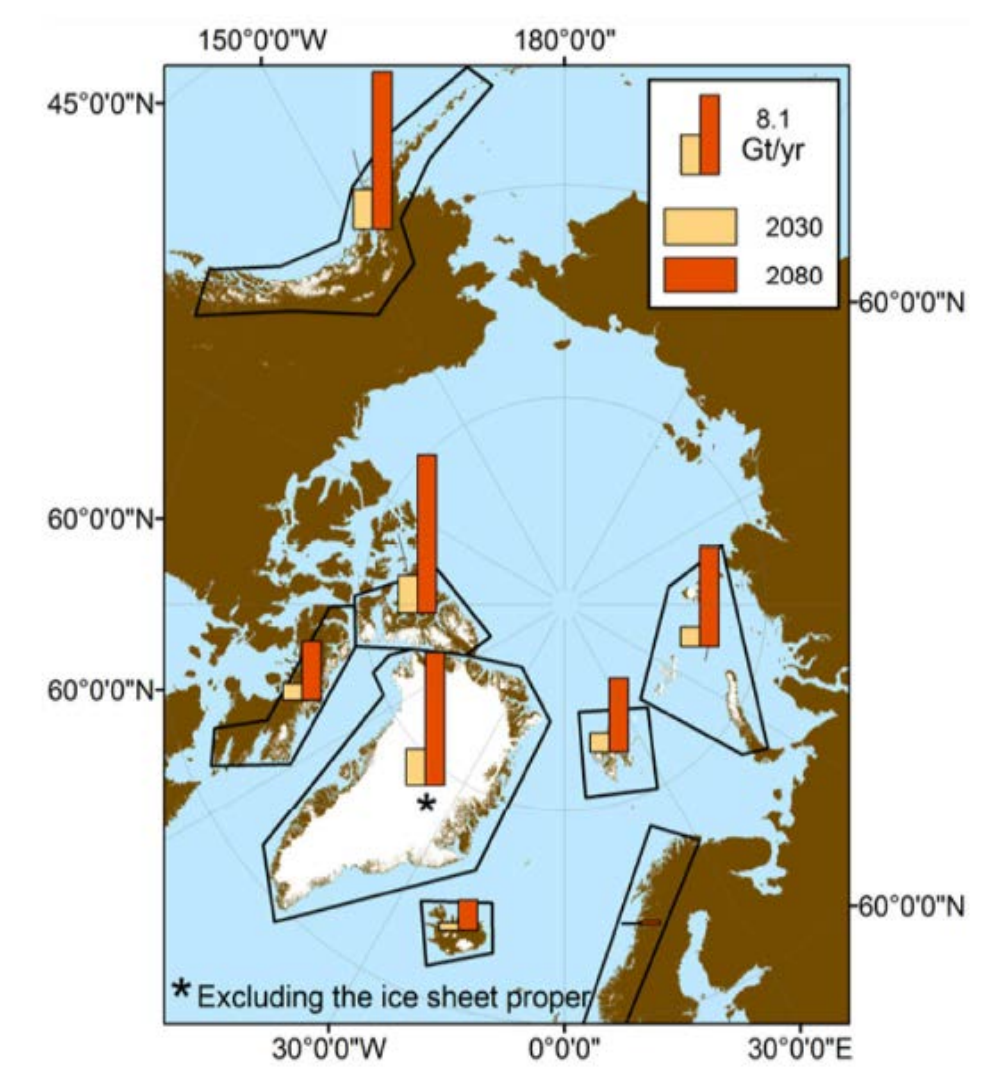
RCP 4.5 (blue) vs. RCP 8.5 (red)

Driven by Radiation (thermodynamics)

[from Overland et al., 2014]

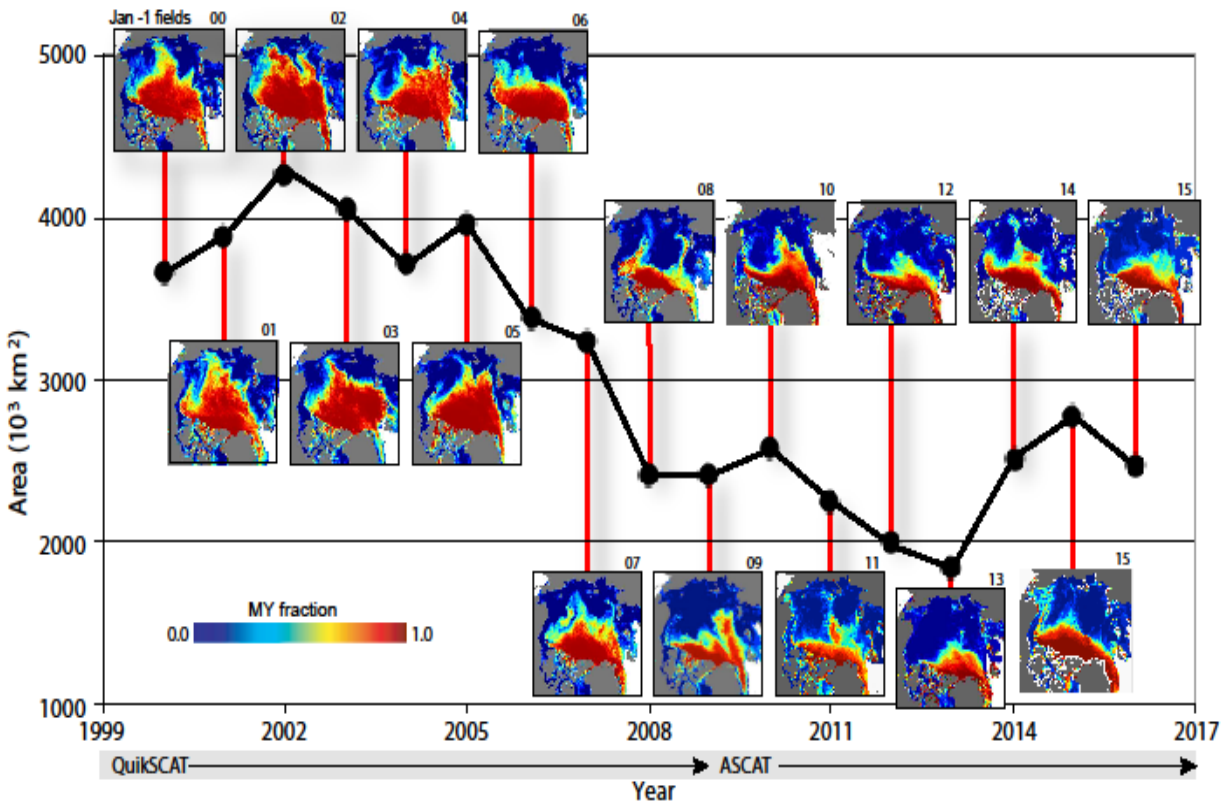


Projected mass loss from local glaciers and icecaps in the Arctic in 2030 and 2080 based on four studies compiled to represent an RCP 6.5 scenario



Source: SWIPA follow up report

Observed loss of multi-year sea ice (red)



Source: R. Kwok, NASA Jet Propulsion Laboratory, SWIPA follow up report

Key messages from SWIPA report

- The past five years (2011-2015) have been the warmest of the instrumental record.
- Sea ice thickness in the central Arctic Ocean has declined from an average of 3.6 m to 1.3 m over 1975 to 2012. The nine lowest sea ice extents have occurred in the last nine years (2007-2015).
- New evidence shows that the Arctic is the dominant regional source of global sea-level rise. Two-thirds of the Arctic's contribution to sea level rise comes from Greenland .
- Permafrost and mass loss from glaciers may have accelerated impacts in the second half of the century for continued high greenhouse gas input.
- There is emerging evidence that Arctic warming impacts mid-latitude weather, especially during the winter season in eastern Asia.
- It is likely that average autumn and winter Arctic temperatures will increase by 4° C by 2040, and an essentially sea-ice-free late summer Arctic is a distinct possibility within the next few decades.