



# The Demise of the Arctic Sea Ice

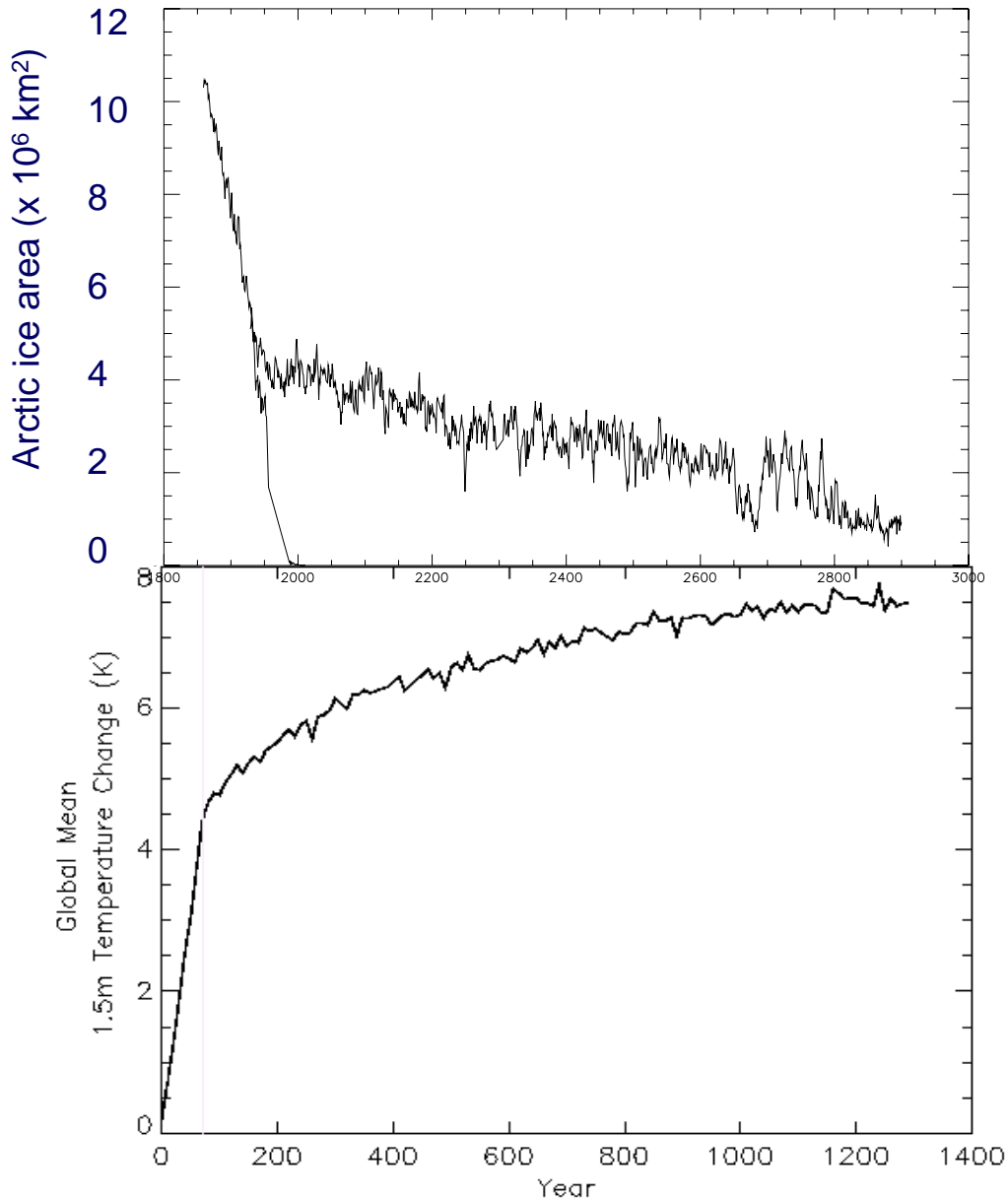
Jeff Ridley

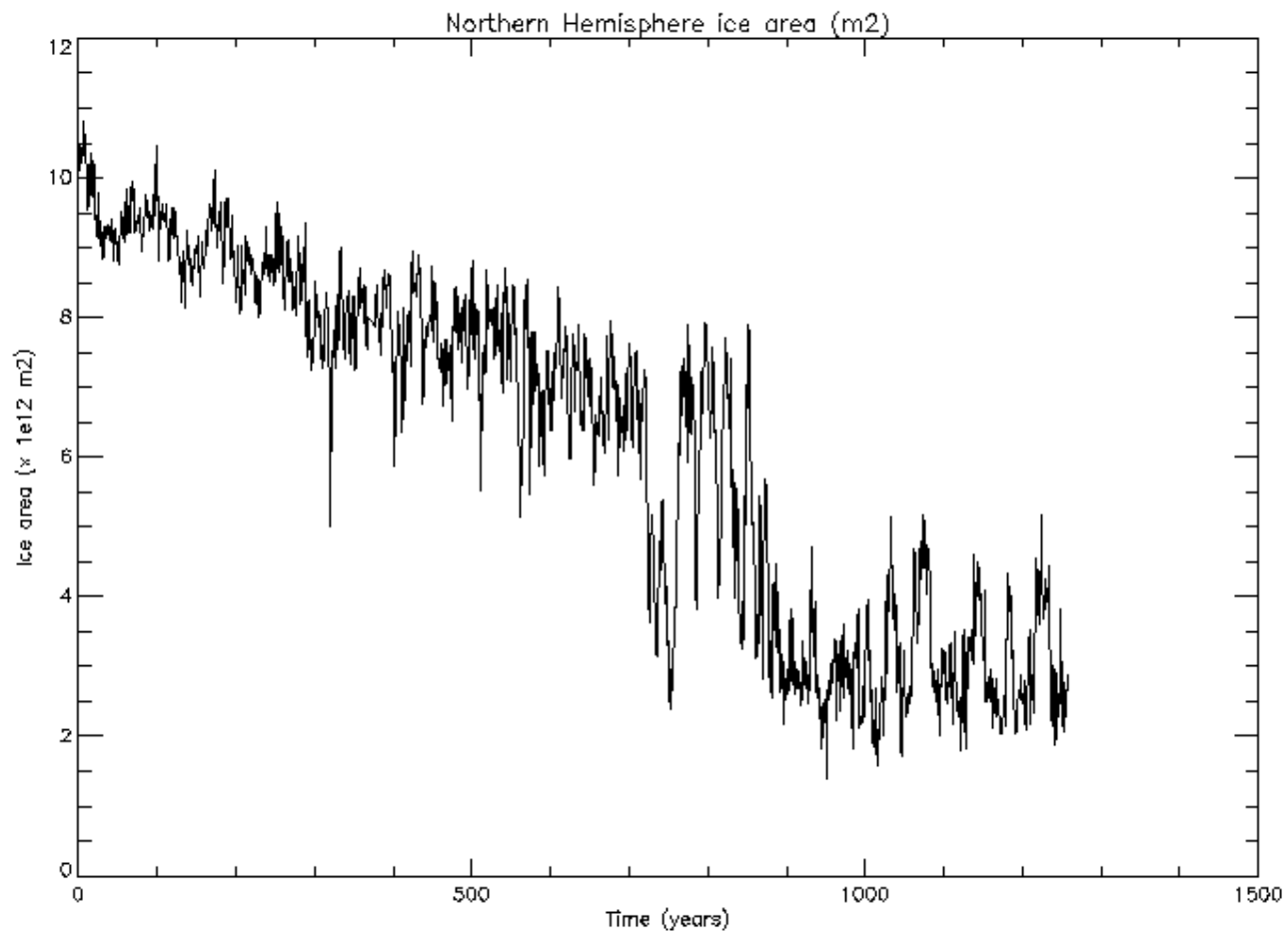
David Simonin

Jason Lowe

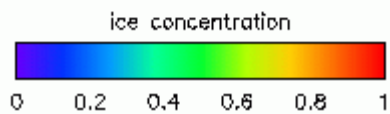
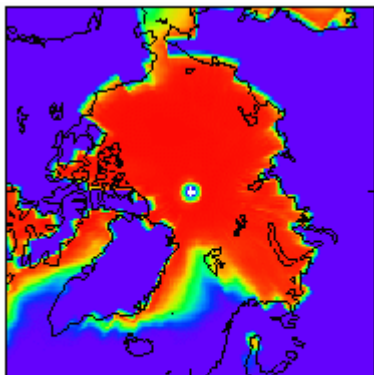
- **HadCM3 Climate at 4xCO<sub>2</sub>**
  - 2% per year increase in CO<sub>2</sub> for 70 years
  - Stabilise at 4xCO<sub>2</sub> for 1000 years
  - Global temperature rise of 5°C
  - THC decreases by 35% but recovers to just 10% down
  - Precipitation over Arctic and river runoff up by 20%
  - Greenland runoff from surface melt 10% of total runoff

# Climate at 4xCO<sub>2</sub>

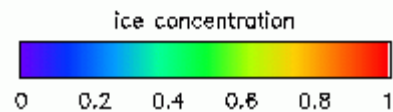
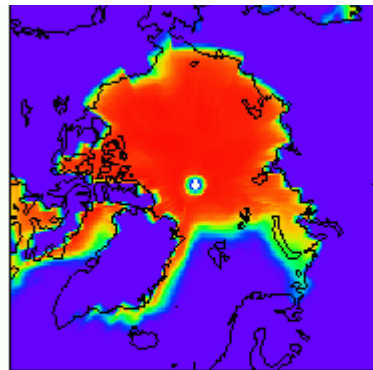




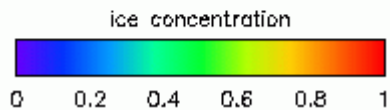
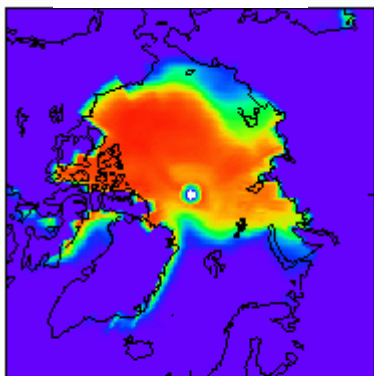
## Basic state 1xCO2



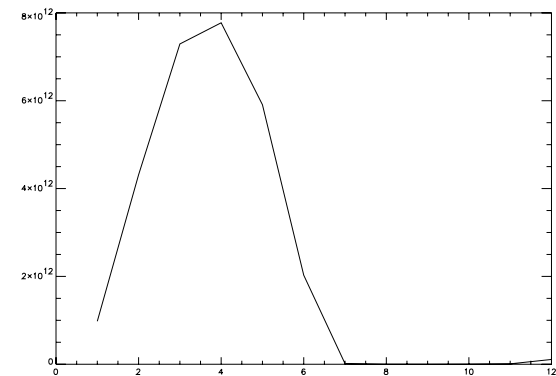
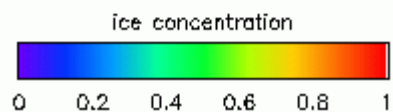
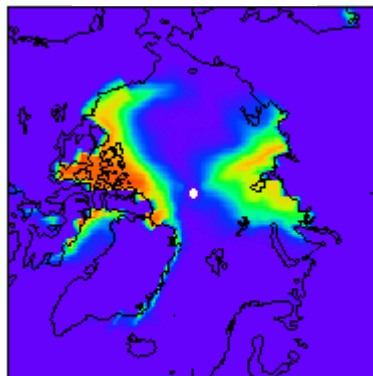
## Basic state 4xCO2



## High state



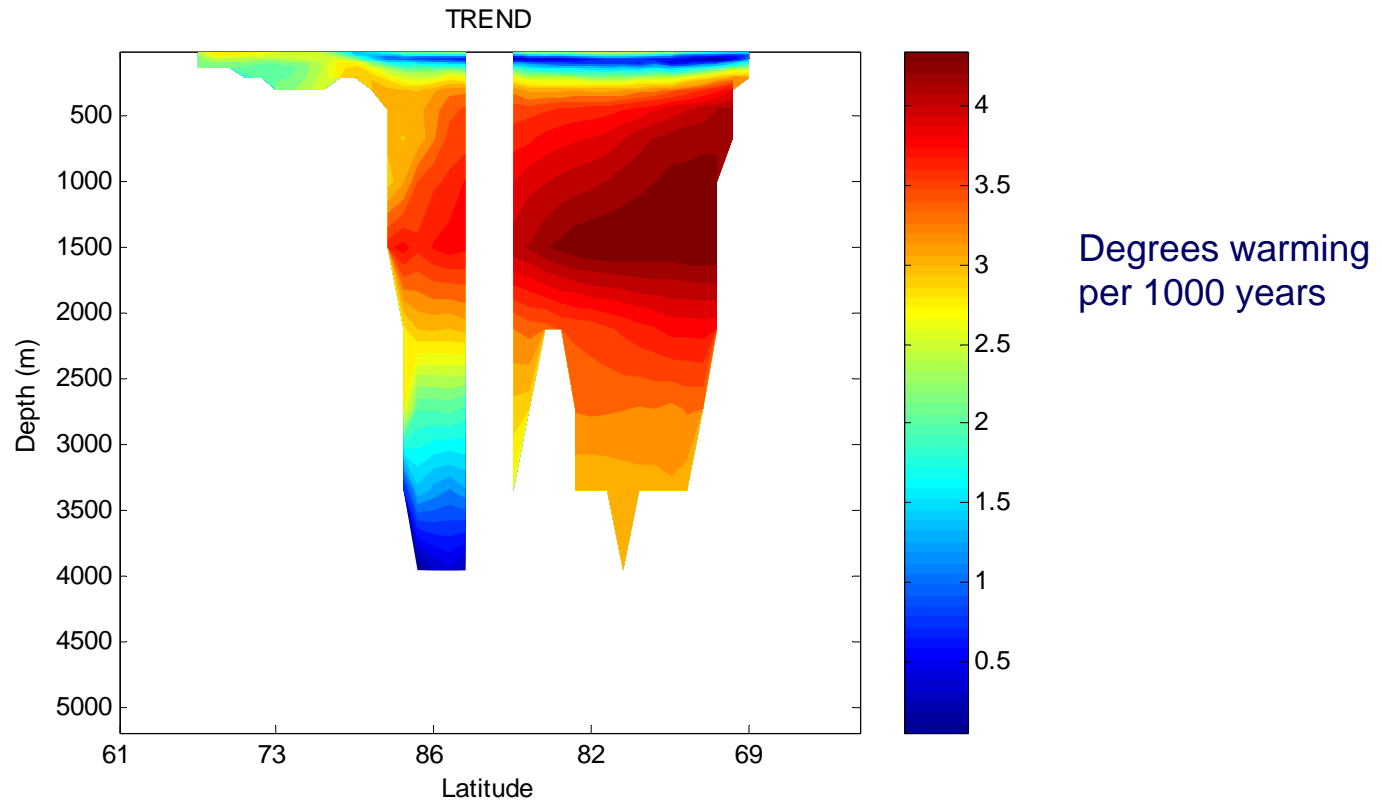
## Low state



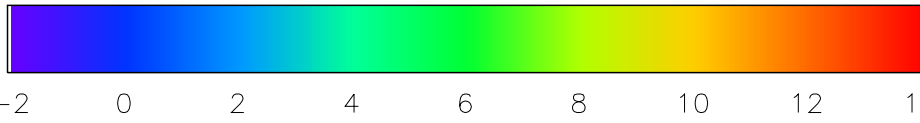
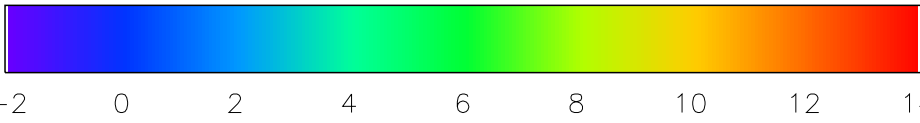
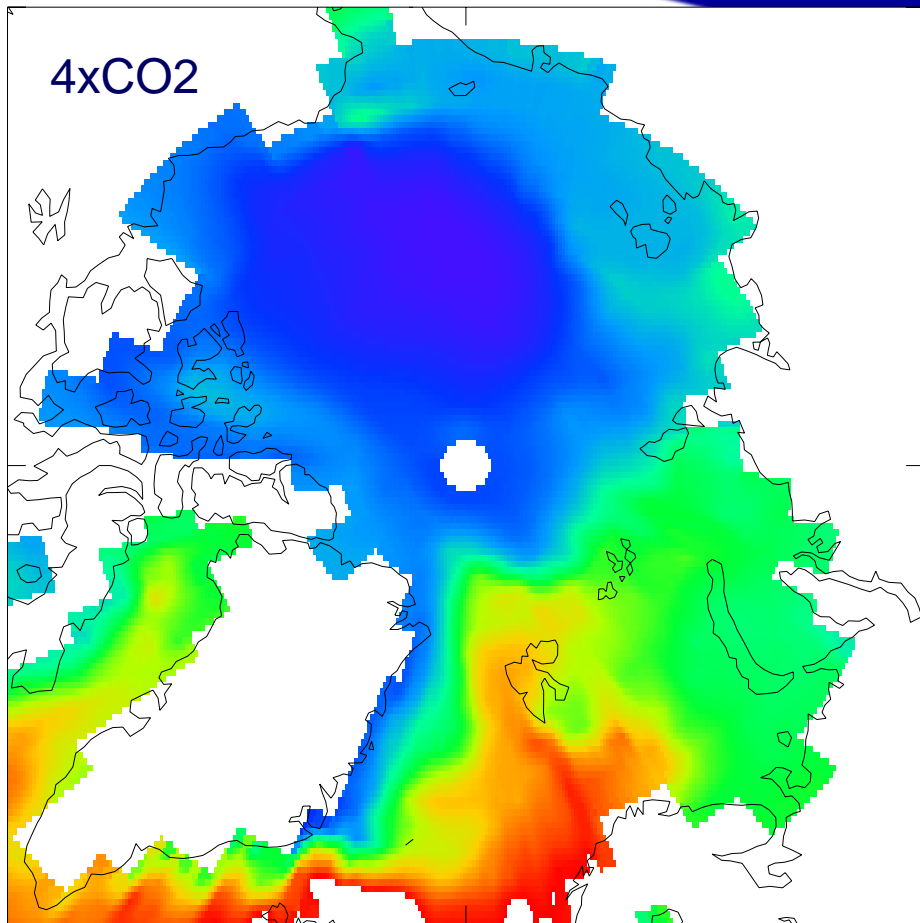
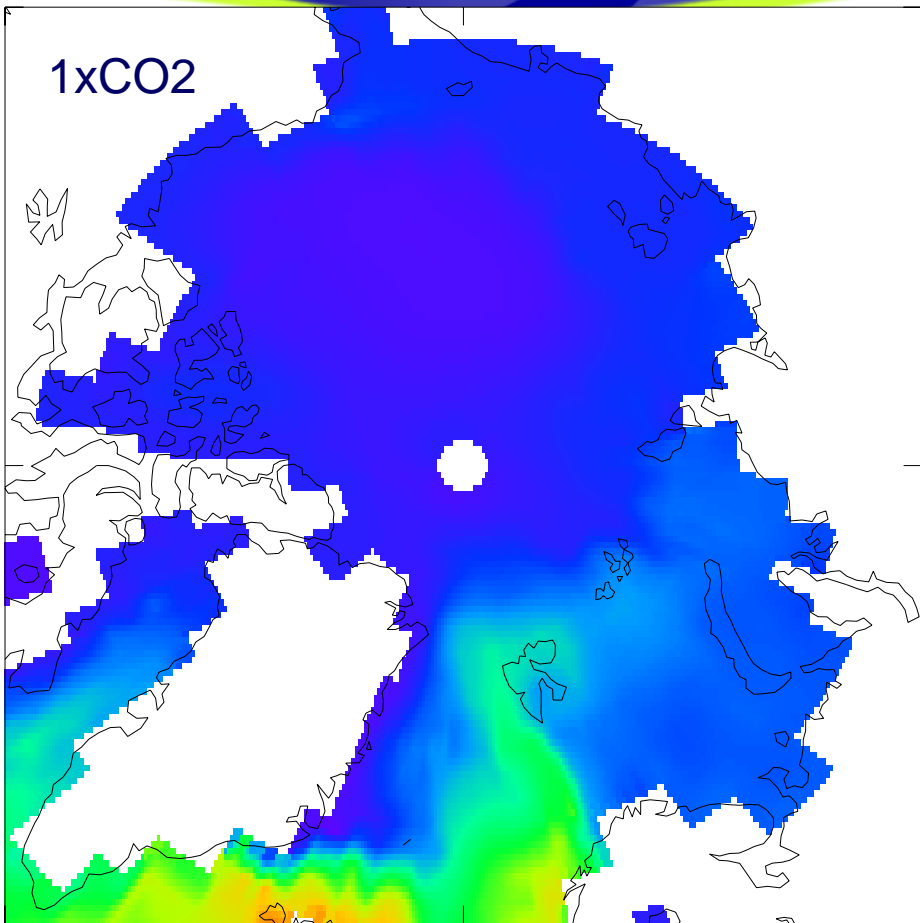
Annual cycle

- Change in atmospheric circulation
  - but, pressure system constant- no change in AO
- Change in surface forcing
  - but, cloud cover increase compensates for ice decline
- Change in THC and ocean heat transport
  - THC variable but no shift in regime
- Internal redistribution of oceanic heat

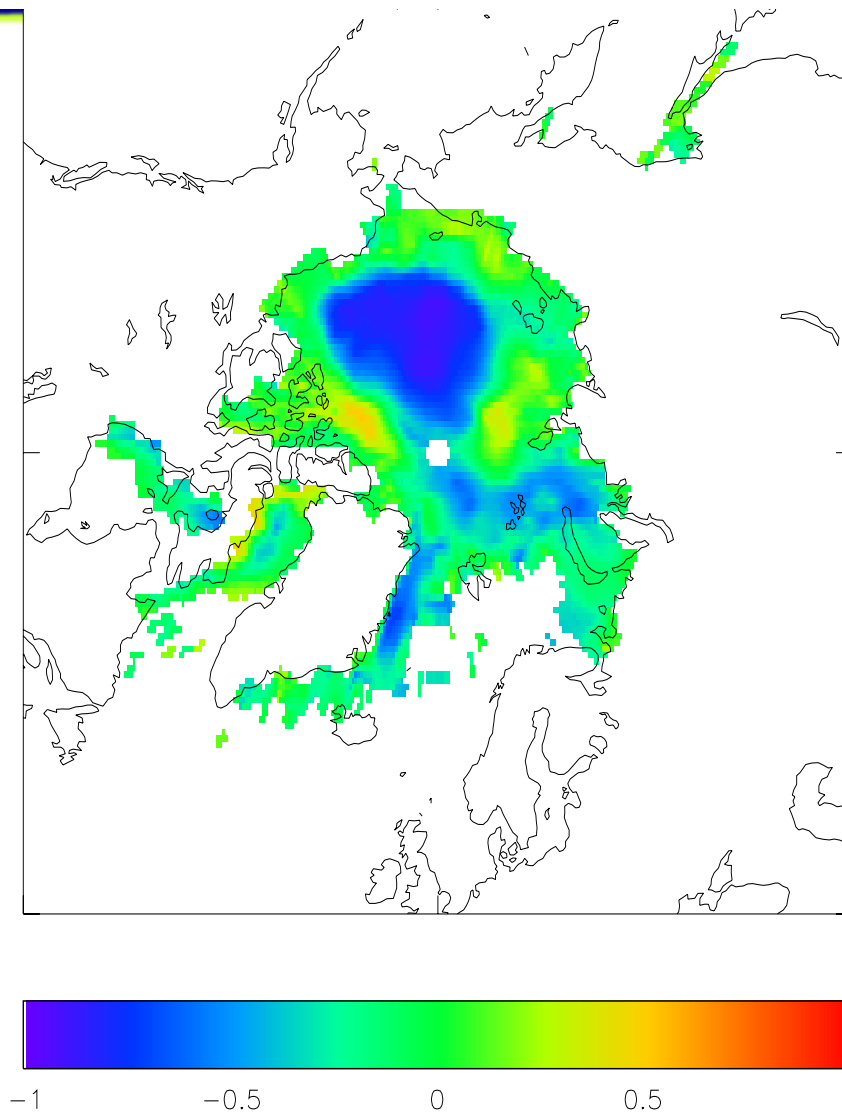
## Cross-section across pole along 45° longitude



# Arctic Ocean Temperature at 100m



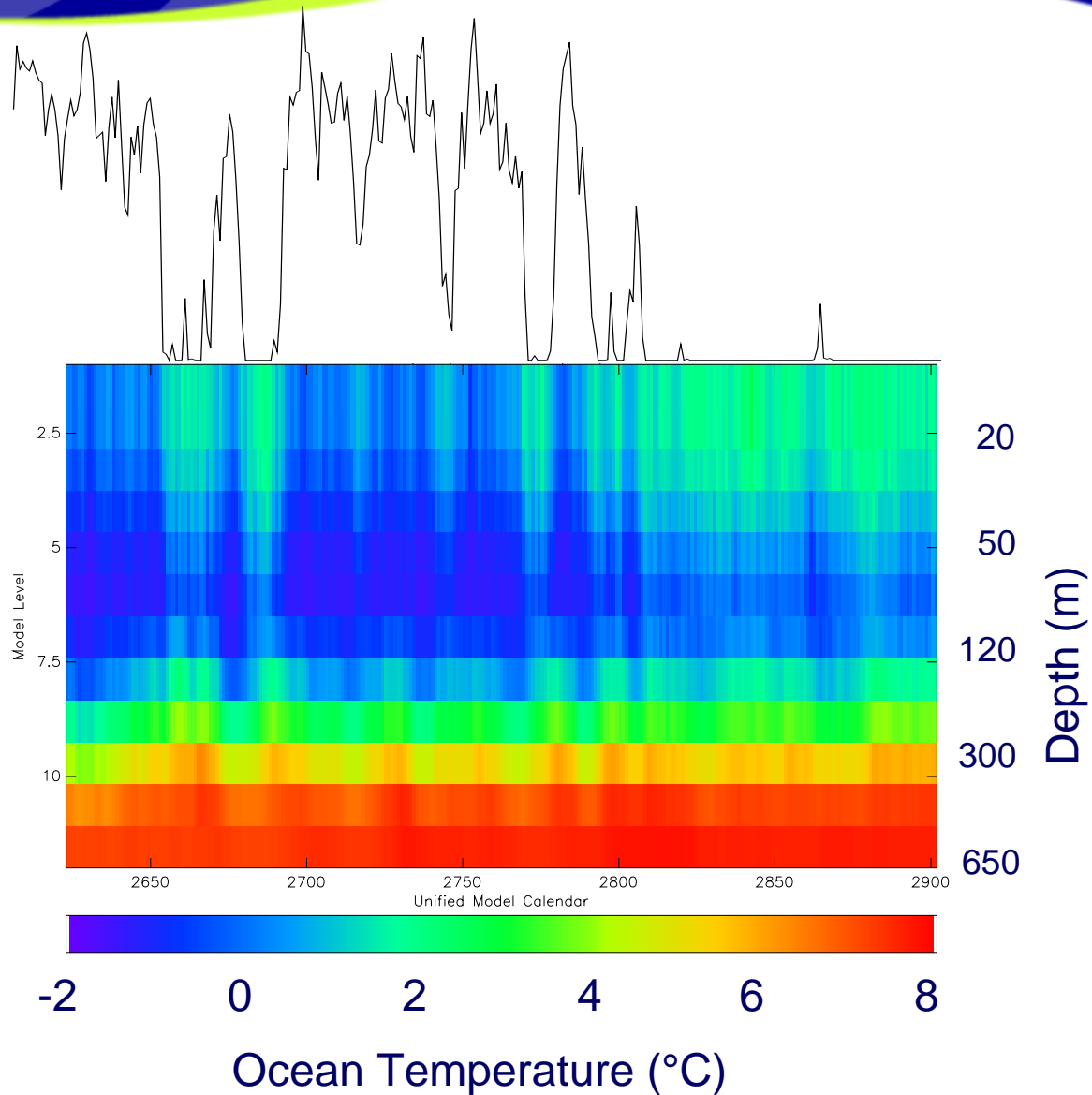
# Correlation between 90m ocean temperature and sea-ice cover



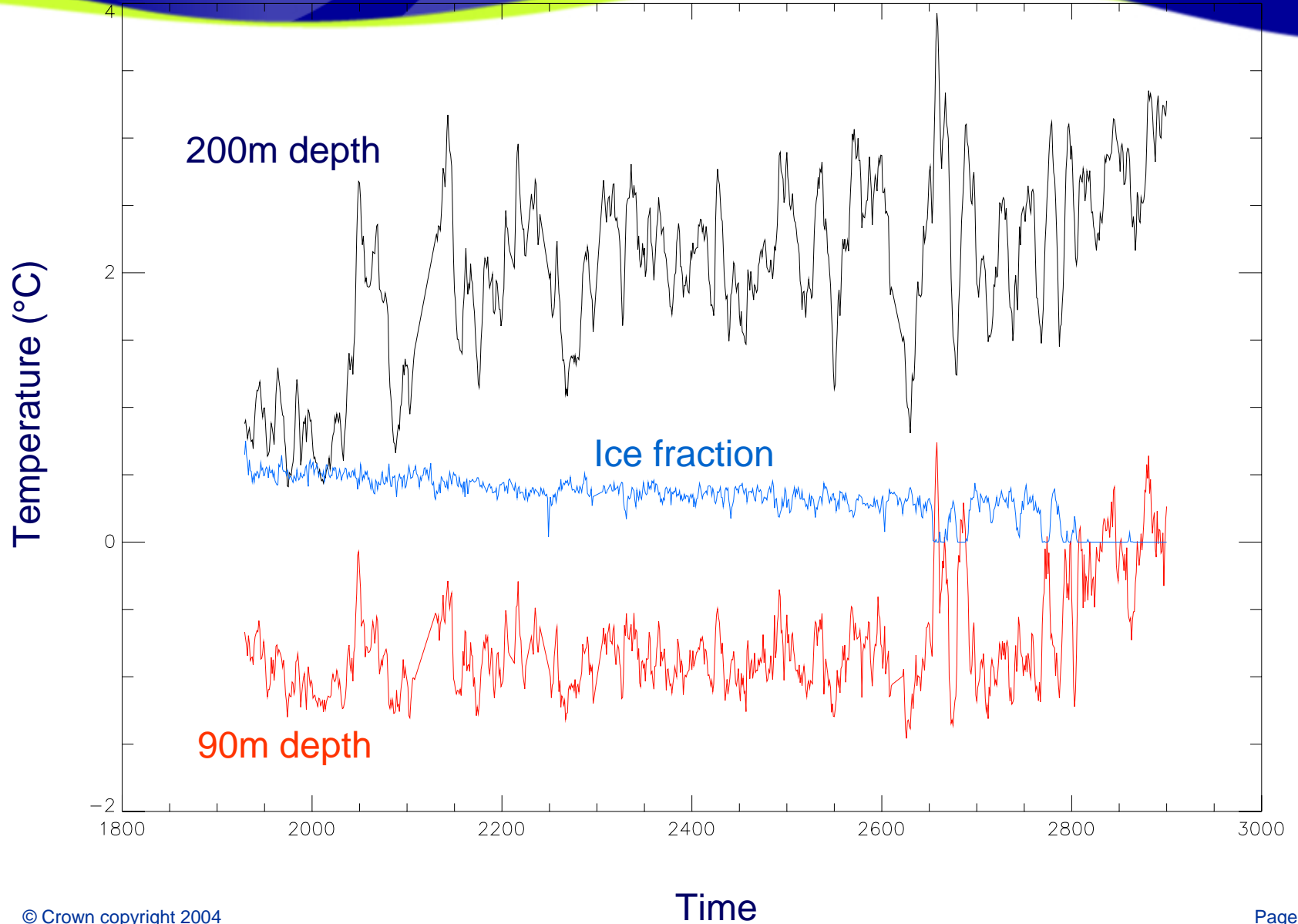
# Ocean time series (Beaufort Gyre)

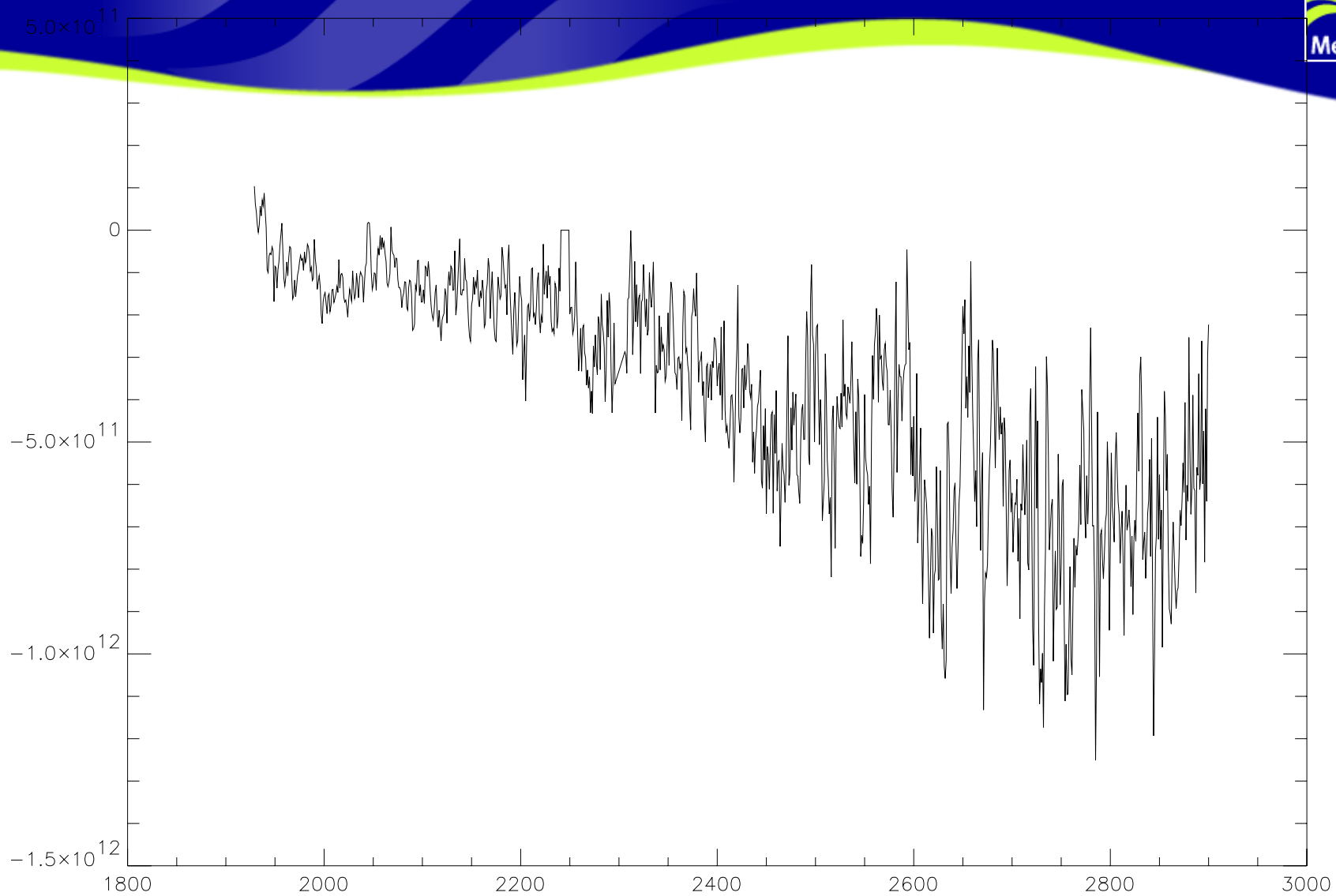


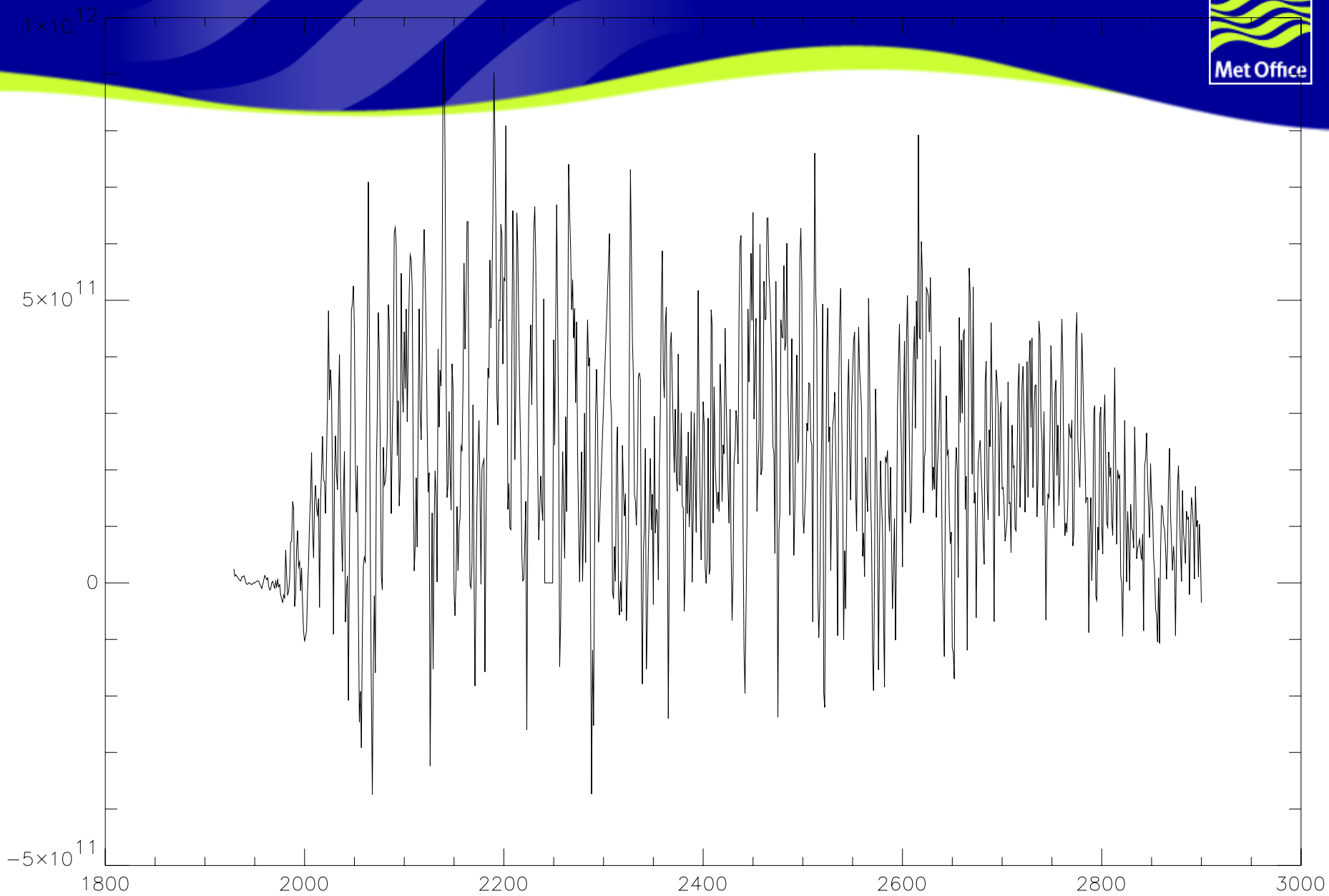
Ice Concentration



# Ocean Temperatures in Beaufort Gyre







- Climate forcing reduces ice area primarily by surface melt
- Halocline layer is very stable and does not warm
- Large variations in heat transport in Beaufort Gyre break down Halocline insulation
- Once broken the ocean heat flux removes remaining ice