Arctic- and Antarctic Amplification in CMIP6

Silje Iversen
Group 1
Assistant: Sara

Introduction

- Arctic region is warming faster than the rest of the globe:
  - Changes in the atmospheric circulation
  - Changes in the ecosystem
  - …
  - Such changes in the Arctic can impact other areas

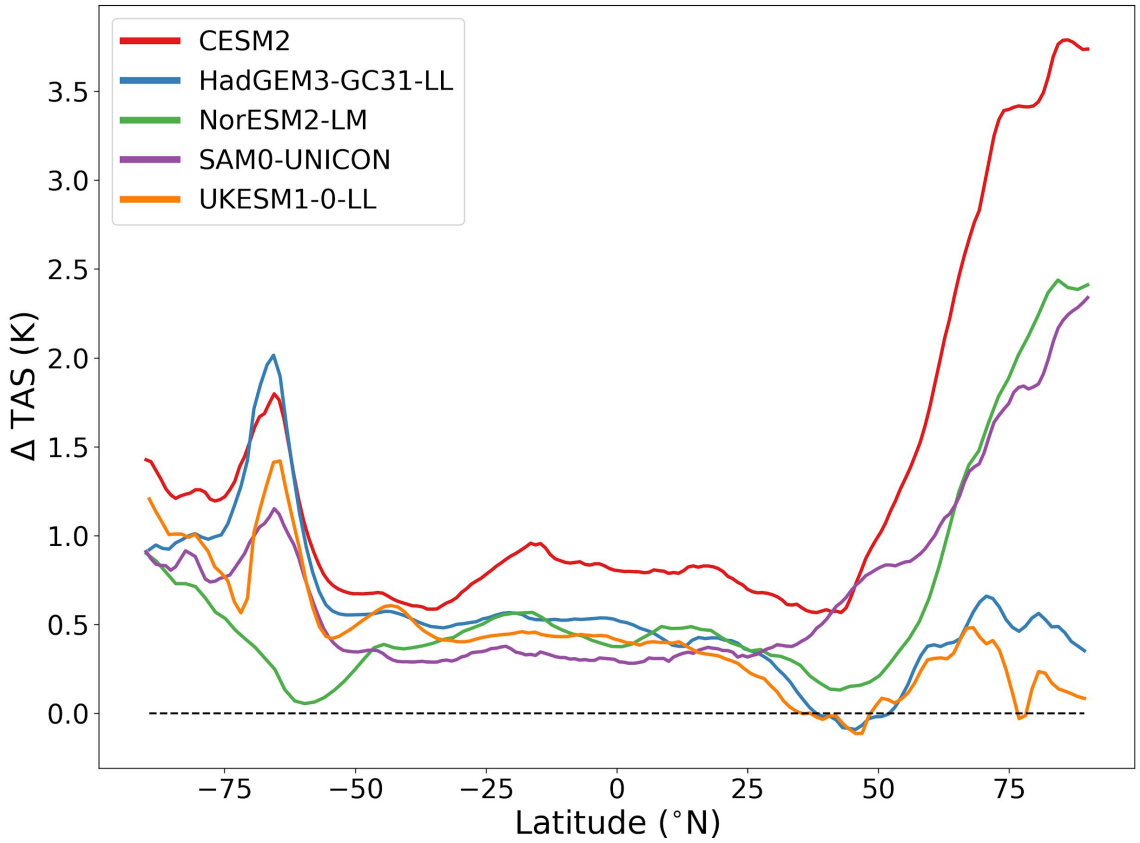
- Important to study the reasons for this high latitude warming:
  - Can do this by using models, in this case models in CMIP6

- So far:
  - Is there a great variation in the amount of high latitude warming among the models?
  - Try to explain the variations by looking at
    - Net radiation flux
      - Outgoing LW radiation
      - Outgoing SW radiation
    - Northward ocean heat transport

Methods

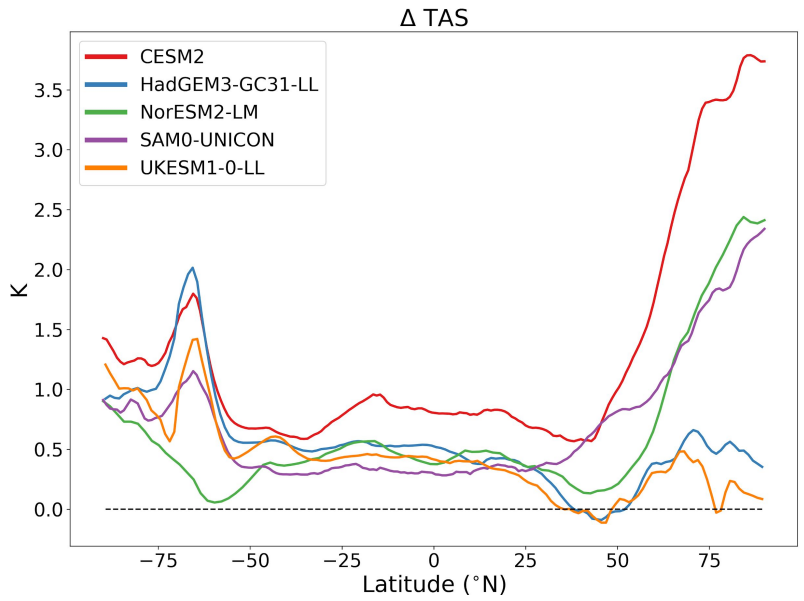
- CMIP6
  - Five different models
  - Temperature variable: tas
  - Radiation variables: rsut, rlut, rsdt
  - Heat transport: hfbasin
- For every variable i calculate a change
  - Historical run > 30 year average of the last 30 years
  - Pre-industrial Control run > 30 year average of the first 30 years
  - Find the change by subtracting the pre-industrial control run from the historical run
- Tools
  - Jupyter lab
  - Python’s xarray
  - CDO

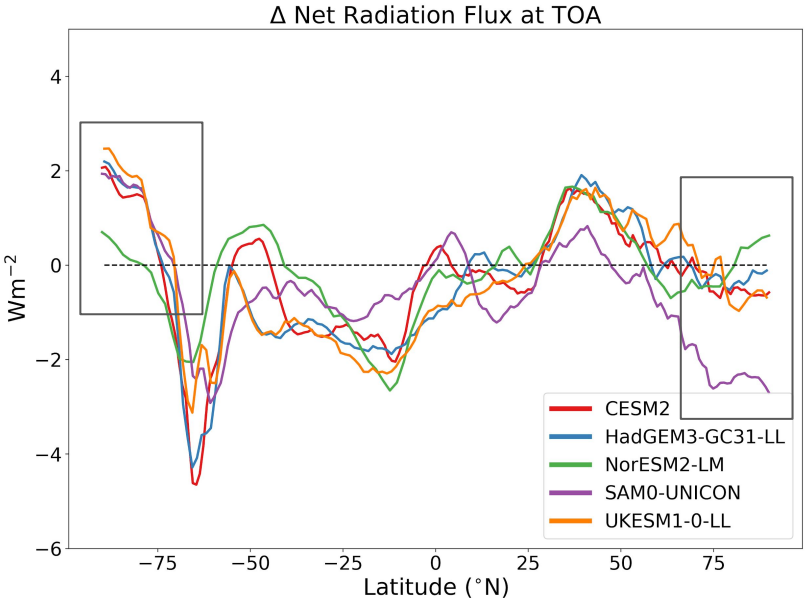
Results: The amplification

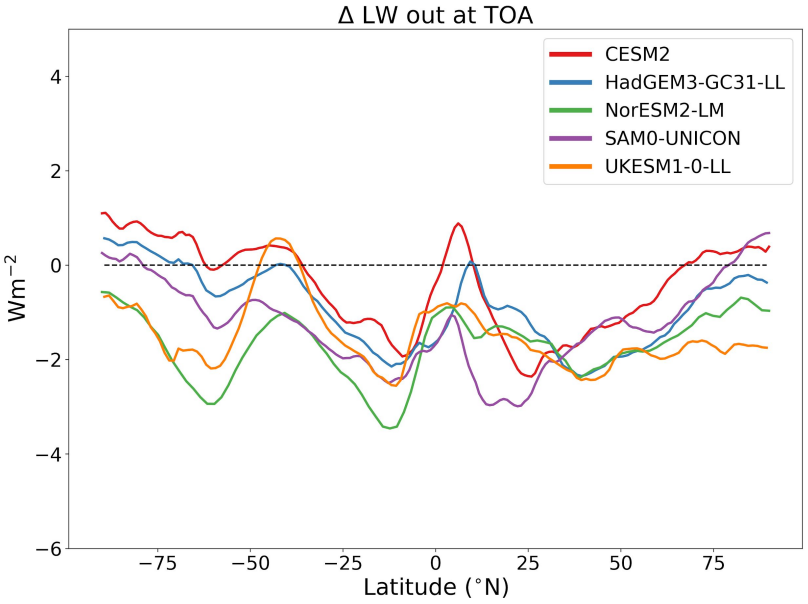


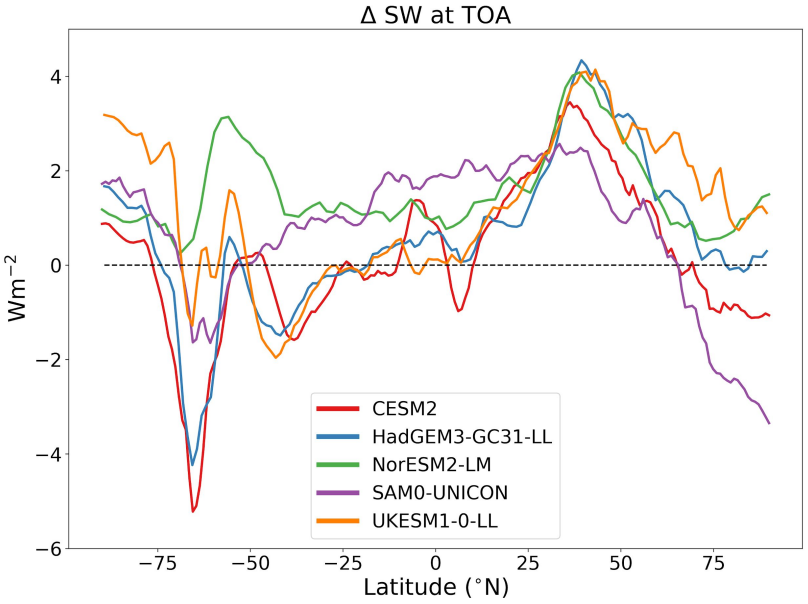
- Agreement about **Antarctic** amplification
- High spread in **Arctic** amplification

Results: Change in outgoing radiation at TOA



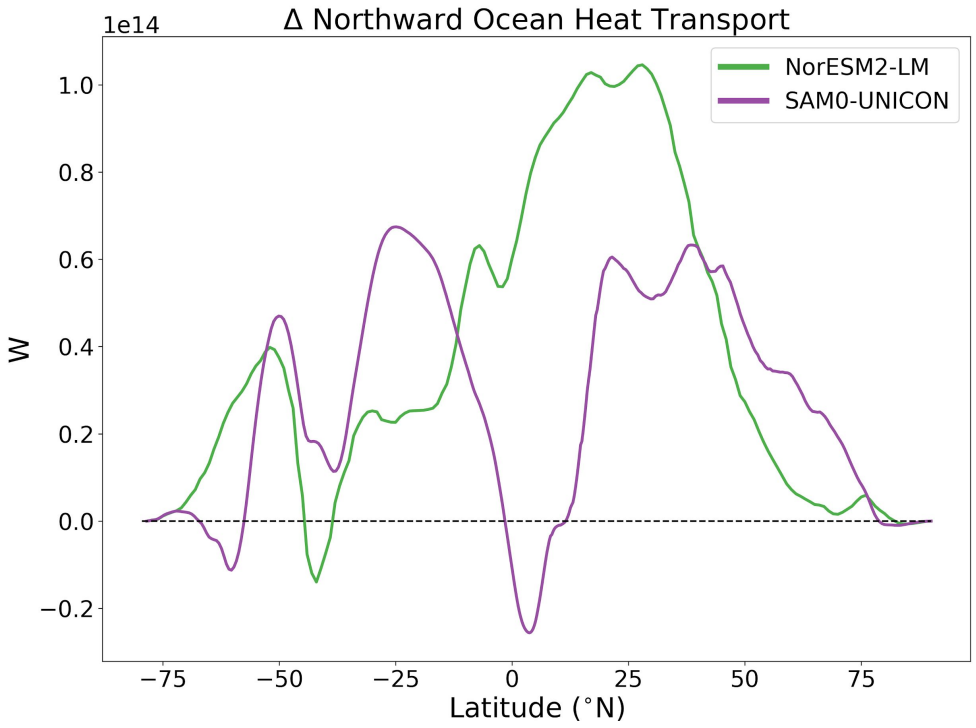






Results: Change in northward ocean heat transport

- Can we explain the amplification with ocean heat transport?
- Antarctic: Seems to have a slowdown of heat transport
  - Cannot explain amplification by transport
- Arctic: Increase in SAM0-UNICON, but no clear change above 60N for NorESM2-LM
- Plot seems to be unsymmetrical?
  - Increase in northward OHT dominates
  - Indicates slowdown of heat transport to Antarctic and an increase in heat transport to Arctic



Conclusions

- Higher agreement about **Antarctic amplification** between models
  - INET outgoing radiation at TOA: Increased for all models due to more reflected SW radiation
  - But: Lots of variations in LW out and SW out plots (not gathered)
    - Indicates that different processes responsible?

- High spread in **Arctic amplification**
  - NET radiation: Mostly balance, but SAM0-UNICON stands out in the net due to higher absorption of SW

- Ocean heat transport does not seem to explain the amplifications

- Future research
  - For the increase in outgoing SW radiation near the Antarctic: Check sea-ice/cloud/aerosol feedbacks
  - Atmospheric heat transport? Increased intrusion of heat due to lower temperature gradient?