The impact of denying sea ice information on the predictability of atmospheric processes over the Arctic and at mid-latitude regions

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Advanced prediction in polar regions and beyond

Motivation:

To assess the impact of **denying sea ice** information on the **atmospheric conditions**

Contextualization:

- Perfect model framework (model as true reference)

- Long-term (>250 years) control-run with EC-Earth

- Restart the control run from moments characterized by different conditions of Arctic sea ice volume

- Restart the control run from original and climatological Arctic sea ice conditions

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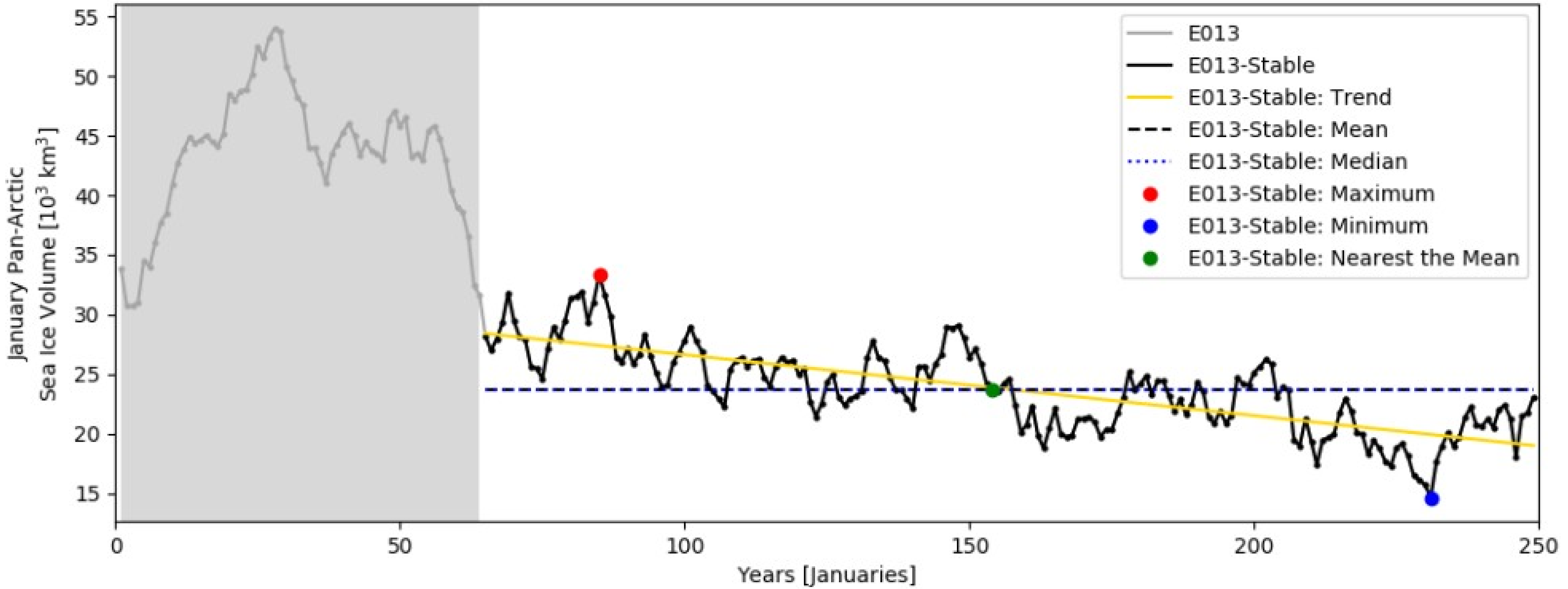
Experimental design:

- Restart from **maximum** and **minimum** Arctic sea ice volume conditions



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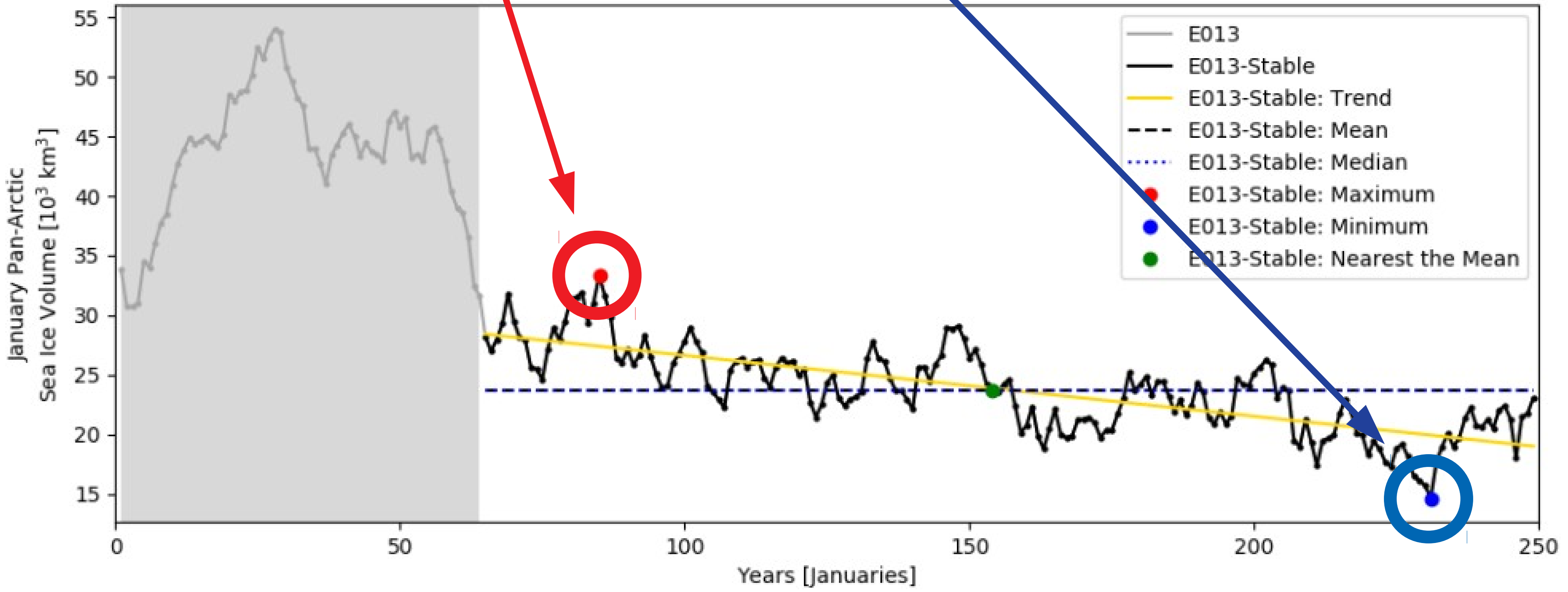
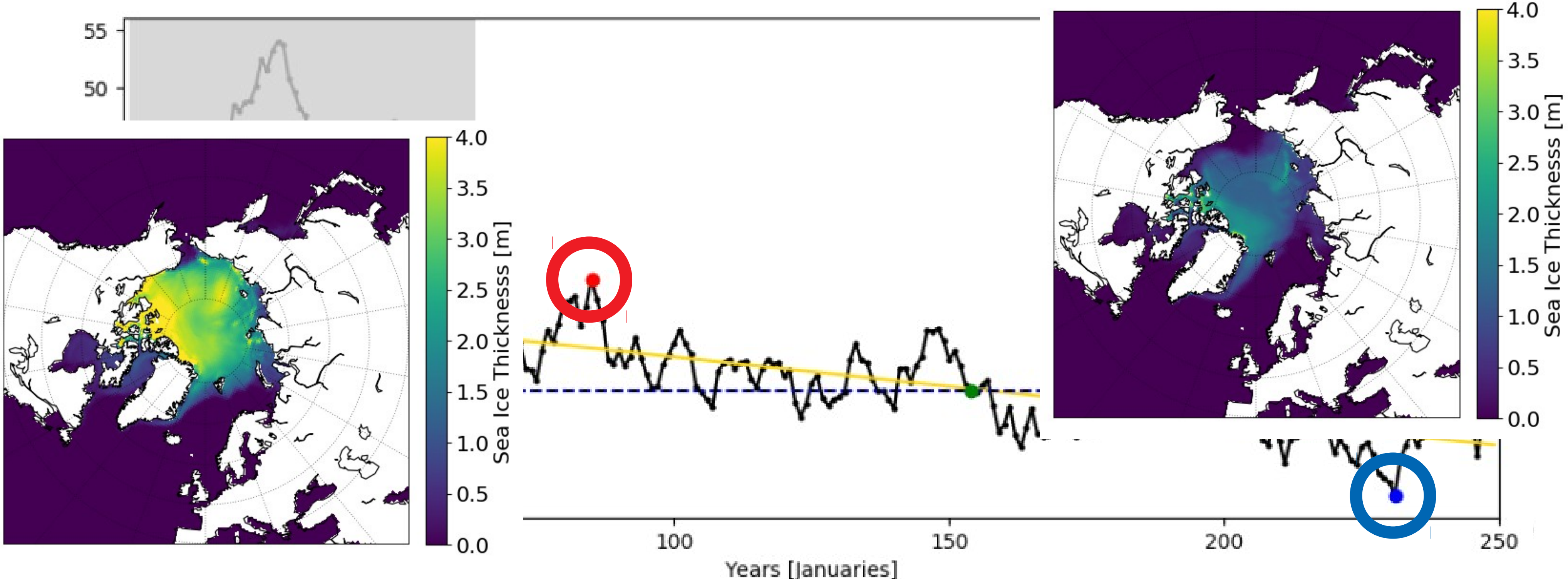


Experimental design:

- Two sets of experiments for each restart data [total of 4]:

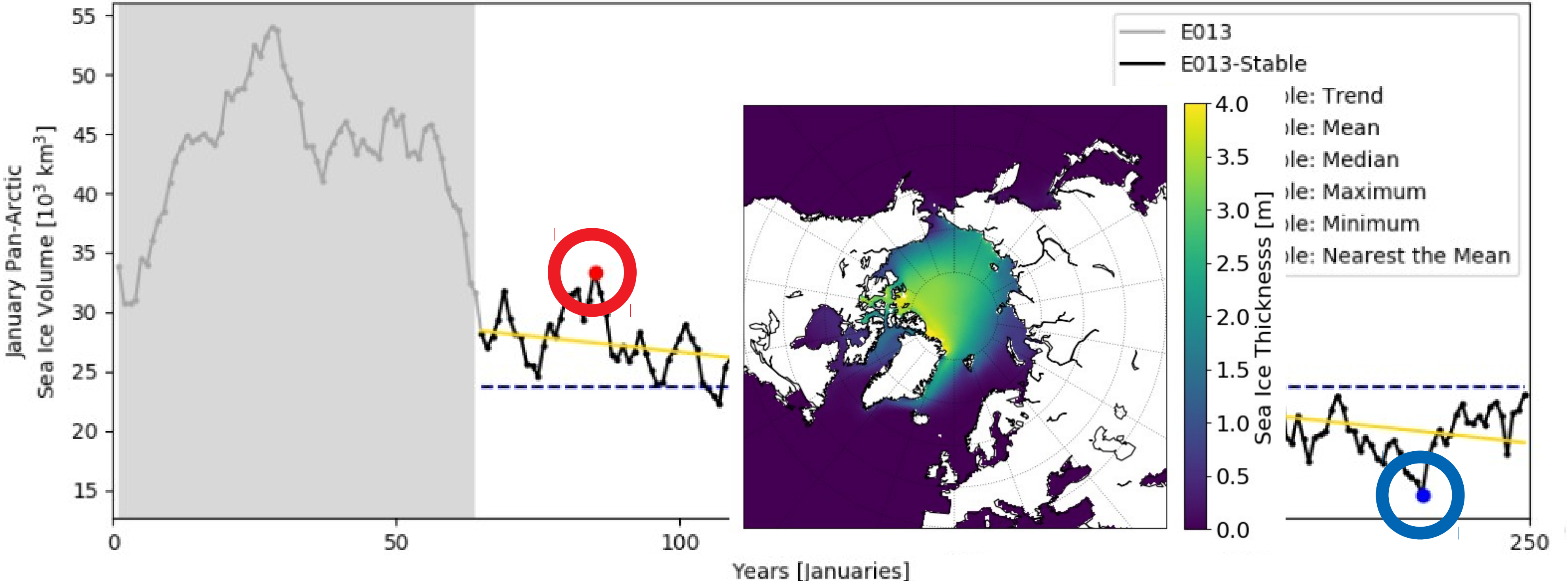
Experiment Reference **[R] = Same ice conditions**



Experimental design:

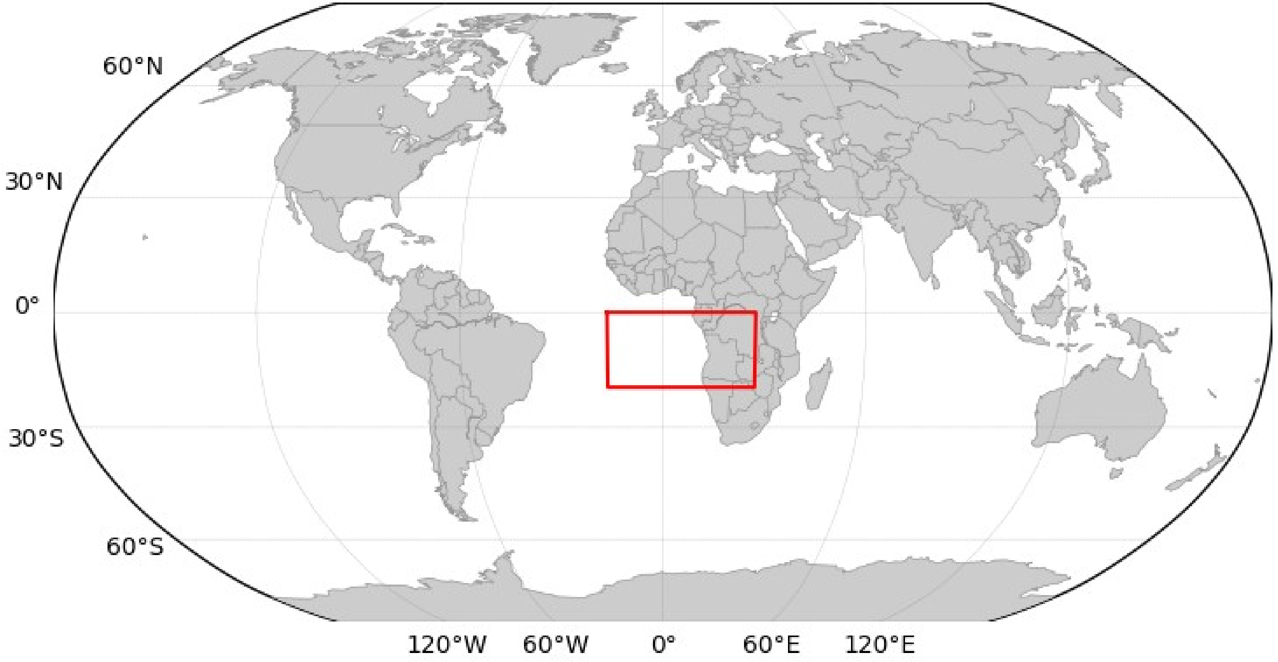
- Two sets of experiments for each restart data:

Experiment Climatological **[C] = climatological ice conditions**



Experimental design:

- 50 members each experiment
- 1 year simulations



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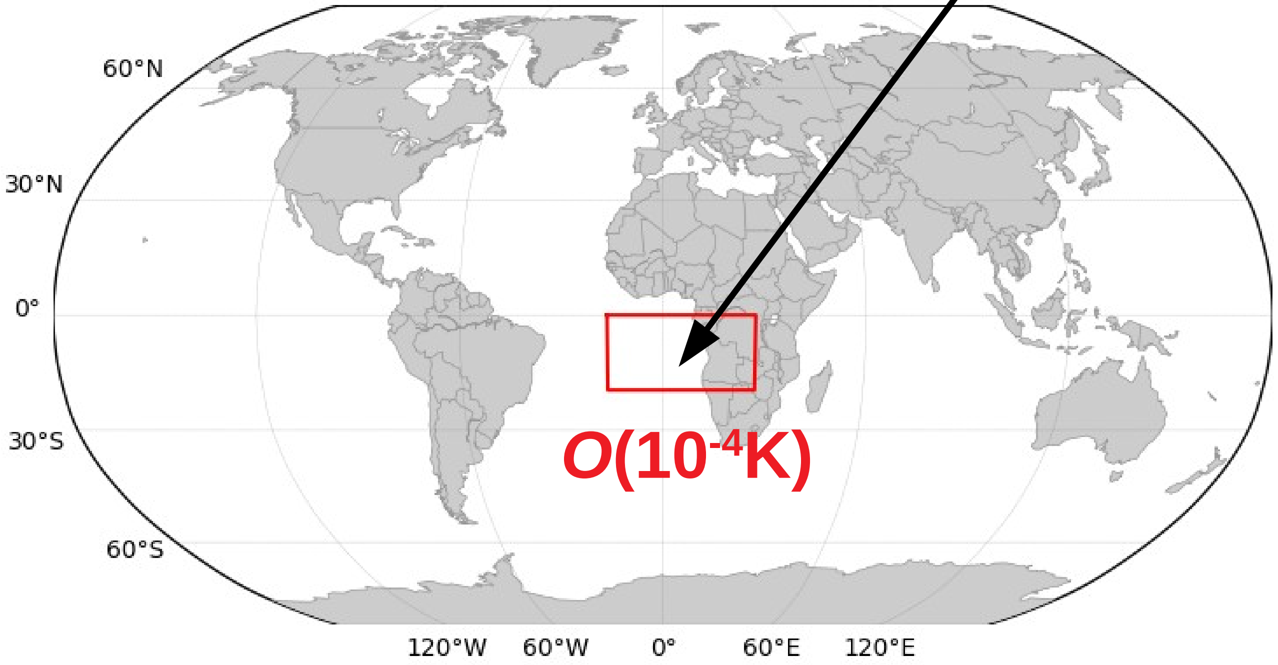
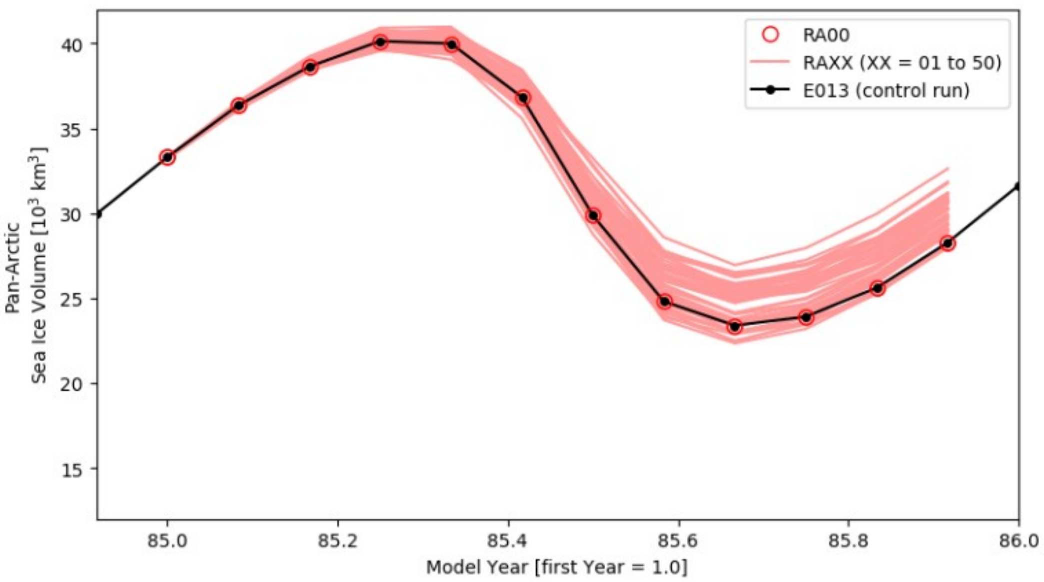
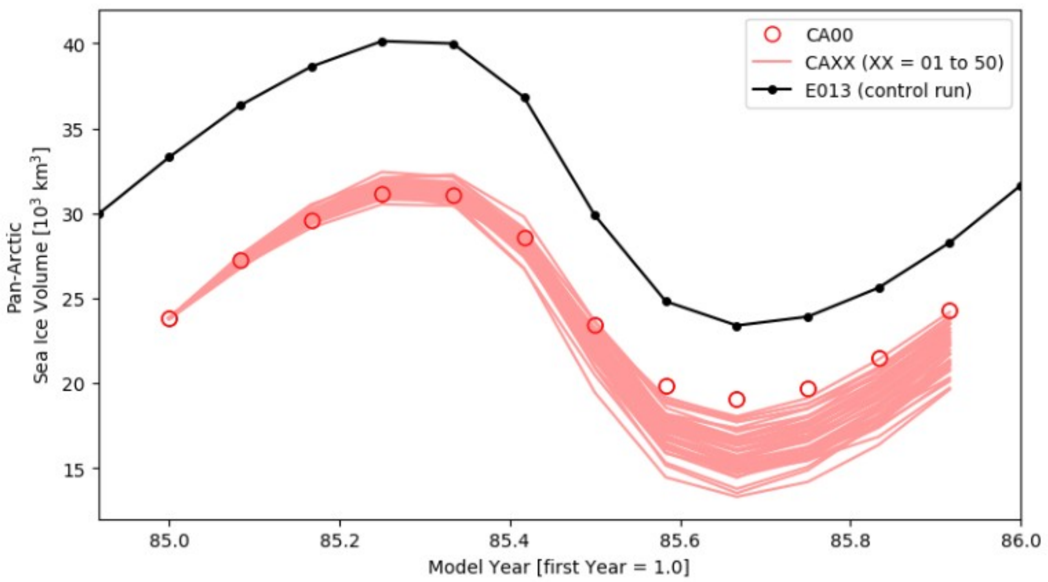
Small perturbation to the SST NEMO field #30

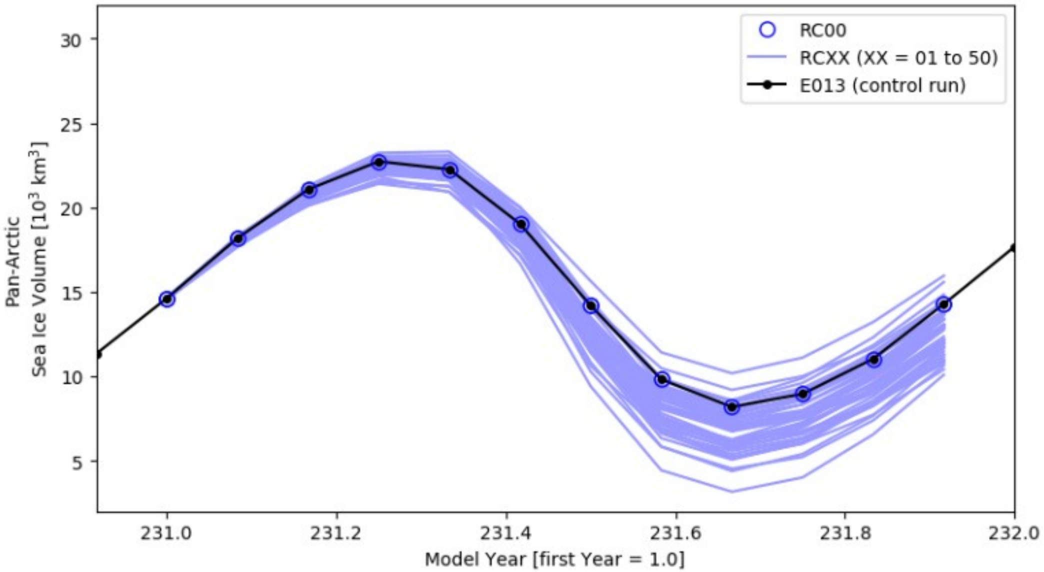


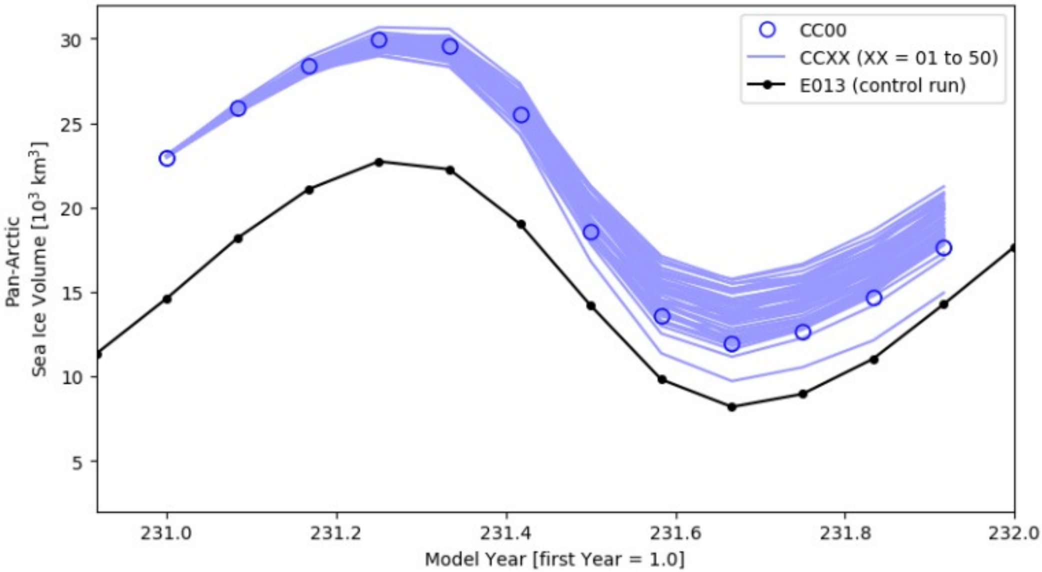
Diagnostics: Sea Ice Volume



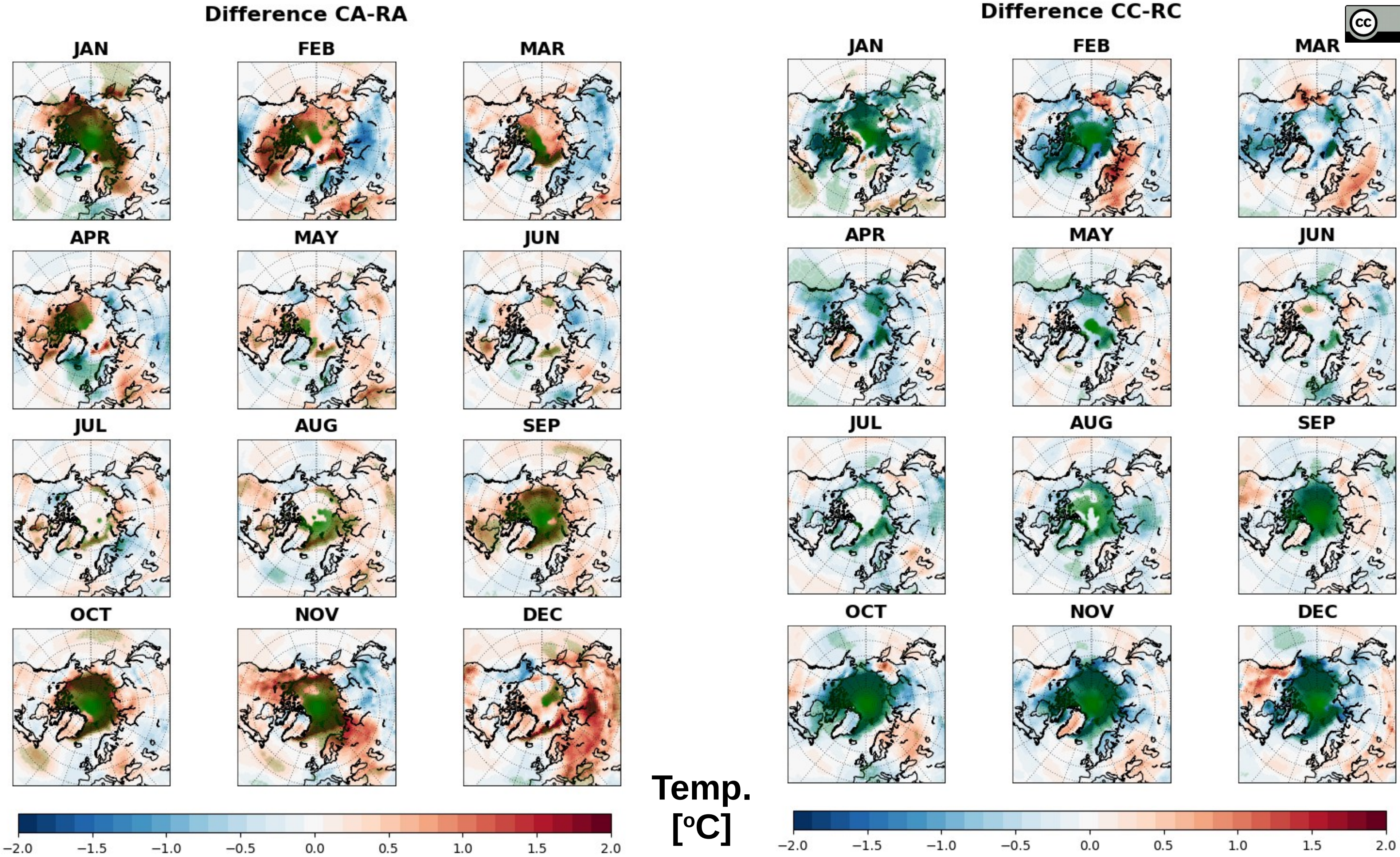


Diagnostics: Sea Ice Volume

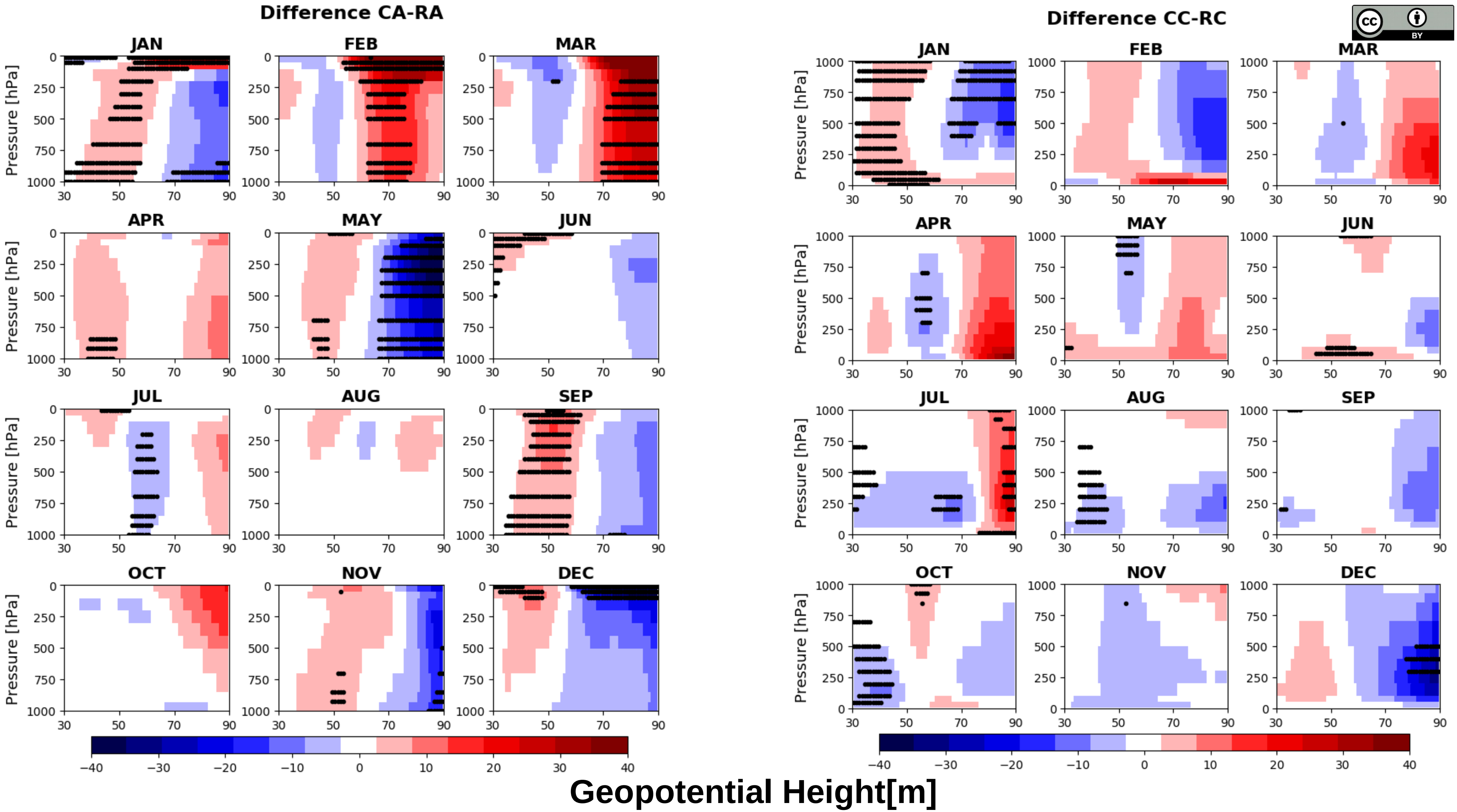




Diagnostics: 2 m air temperature [^{o}C]


Difference CA-RA
Difference CC-RC
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
−2.0
−1.5
−1.0
−0.5
0.0
0.5
1.0
1.5
2.0
Temp.
[°C]

Diagnostics: geopotential height


Difference CA-RA
Difference CC-RC
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
Pressure [hPa]
0
250
500
750
1000
30
50
70
90
−40
−30
−20
−10
0
10
20
30
40
Geopotential Height[m]

Preliminary Results and Final Remarks:

- Underestimation (overestimation) of January sea ice leads to air temperature warming (cooling) mainly in autumn and winter, although the response is not mirrored

- From May to August it seems that internal variability is stronger than the air temperature response to the modified ice conditions

- Underestimation of sea ice drives a cooling in the Northern Asia associated to an increase in the geopotential height

- Main impacts are constrained to the Arctic

- Maybe more members are needed to bring robustness to the statistical tests(?)

- Identical experiments are being developed by University of Reading with HadGEM