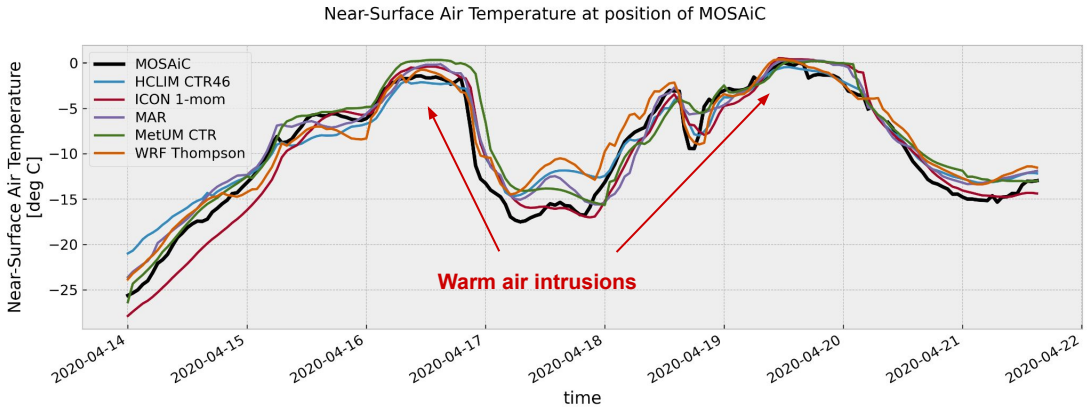
MOSAiC Model Intercomparison Project

Cloud and aerosol analysis during two warm air intrusions



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September 5, 2024

PolarRES
Exploring future polar climates

Small domain 2.5 km resolution

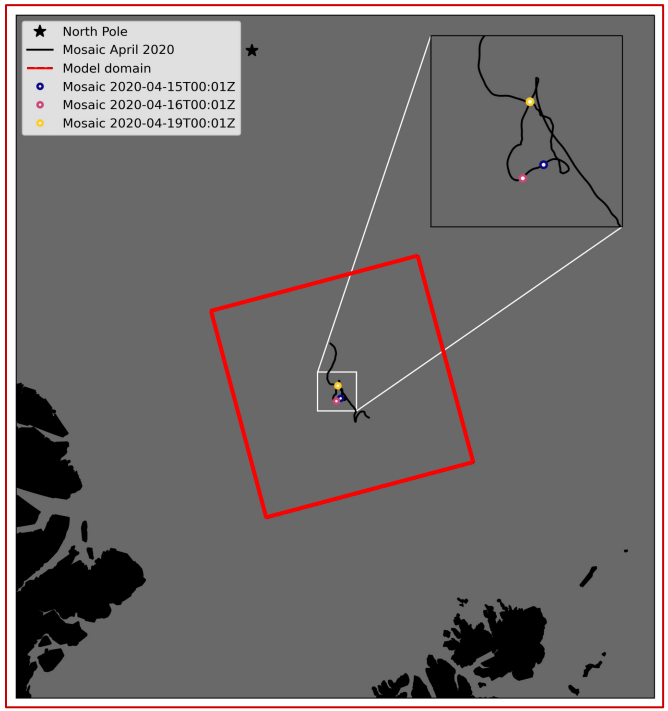

Photo by Stephanie Arndt/Alfred Wegener Institute

Models (sensitivity experiments):

HCLIM:

- ICE-3 and ICE-T microphysics
- Cycle 43 and cycle 46
- High and low CCN
- UKCA NRT aerosols

ICON:

- 1-momentum and 2-momentum (low and high CCN) microphysics

MAR

- Standard model setup

WRF:

- Thompson and Morrison microphysics

MetUM:

- Low and high CCN
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SNAP

- Standard model setup on pan-Arctic domain

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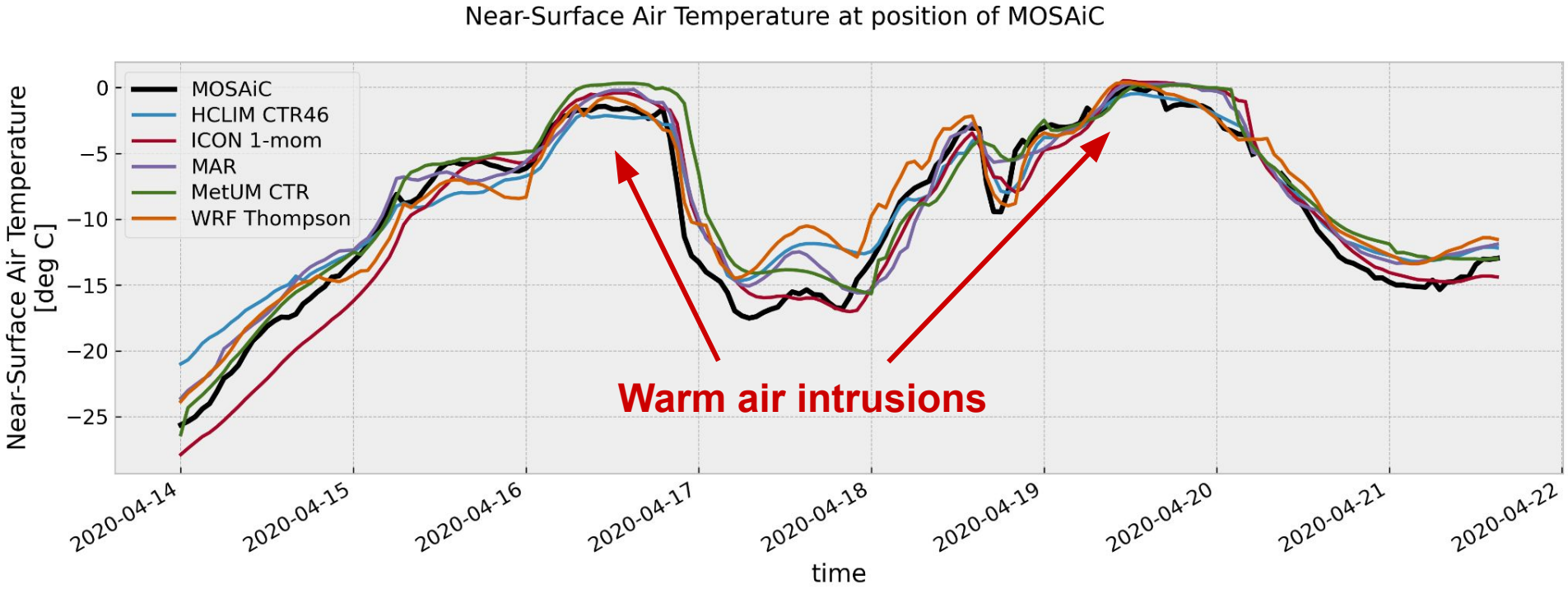
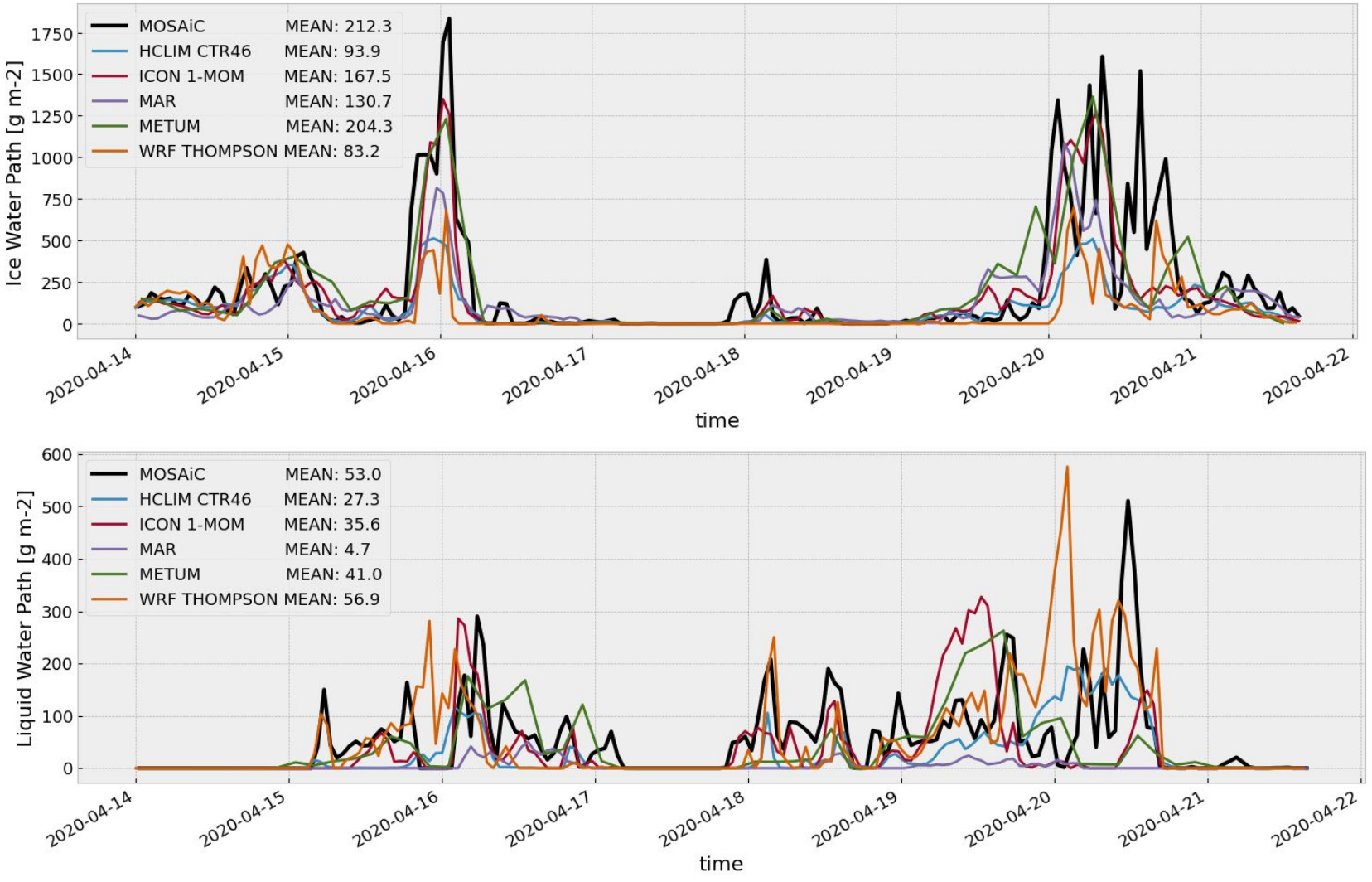
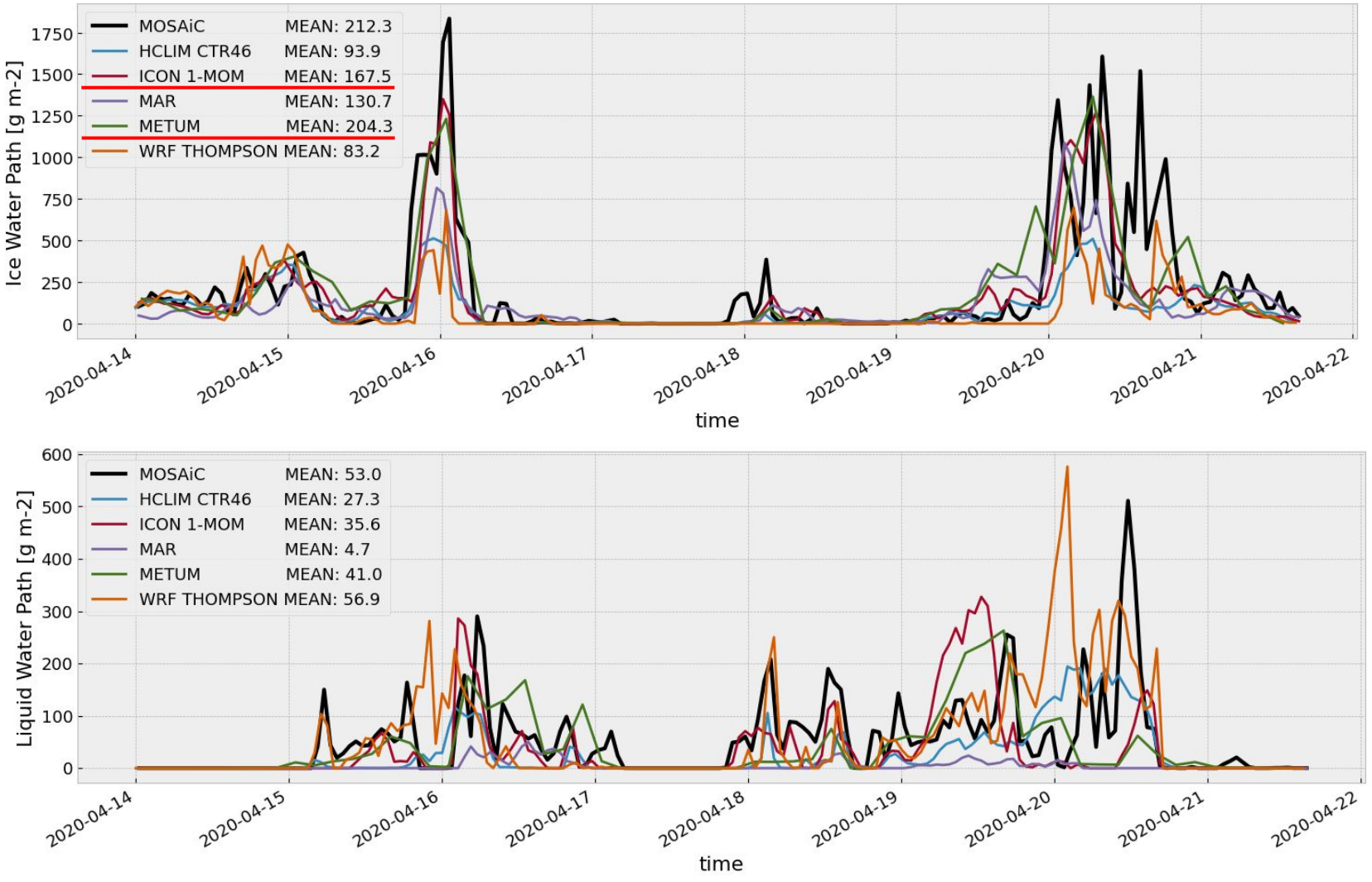

Near-Surface Air Temperature at position of MOSAiC
MOSAiC
HCLIM CTR46
ICON 1-mom
MAR
MetUM CTR
WRF Thompson
Warm air intrusions
Near-Surface Air Temperature [deg C]
0
−5
−10
−15
−20
−25
2020-04-14
2020-04-15
2020-04-16
2020-04-17
2020-04-18
2020-04-19
2020-04-20
2020-04-21
2020-04-22
time


MOSAiC MEAN: 212.3
HCLIM CTR46 MEAN: 93.9
ICON 1-MOM MEAN: 167.5
MAR MEAN: 130.7
METUM MEAN: 204.3
WRF THOMPSON MEAN: 83.2
Ice Water Path [g m-2]
0
250
500
750
1000
1250
1500
1750
2020-04-14
2020-04-15
2020-04-16
2020-04-17
2020-04-18
2020-04-19
2020-04-20
2020-04-21
2020-04-22
time
MOSAiC MEAN: 53.0
HCLIM CTR46 MEAN: 27.3
ICON 1-MOM MEAN: 35.6
MAR MEAN: 4.7
METUM MEAN: 41.0
WRF THOMPSON MEAN: 56.9
Liquid Water Path [g m-2]
0
100
200
300
400
500
600
2020-04-14
2020-04-15
2020-04-16
2020-04-17
2020-04-18
2020-04-19
2020-04-20
2020-04-21
2020-04-22
time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2020-04-20
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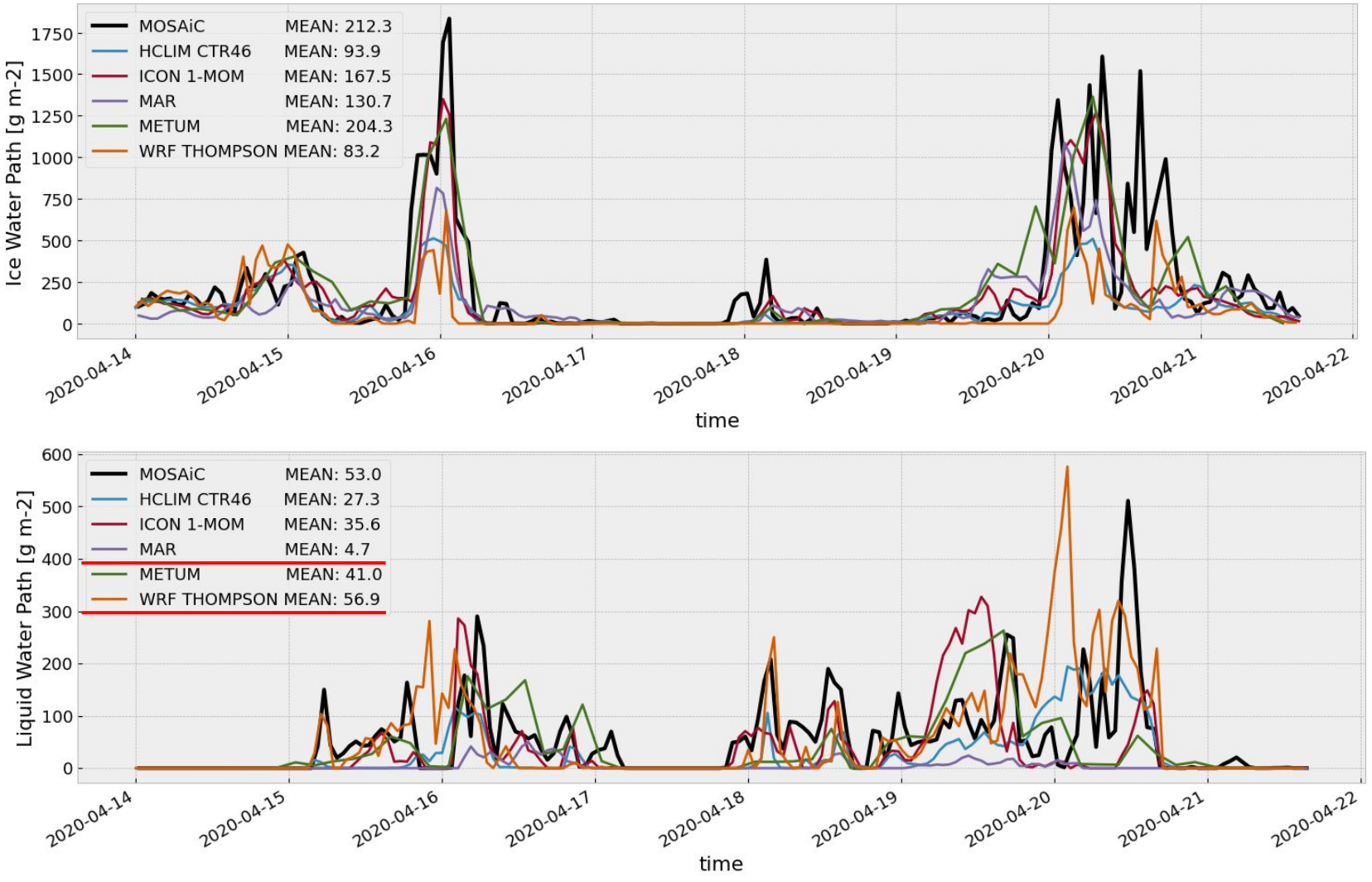
2020-04-22
time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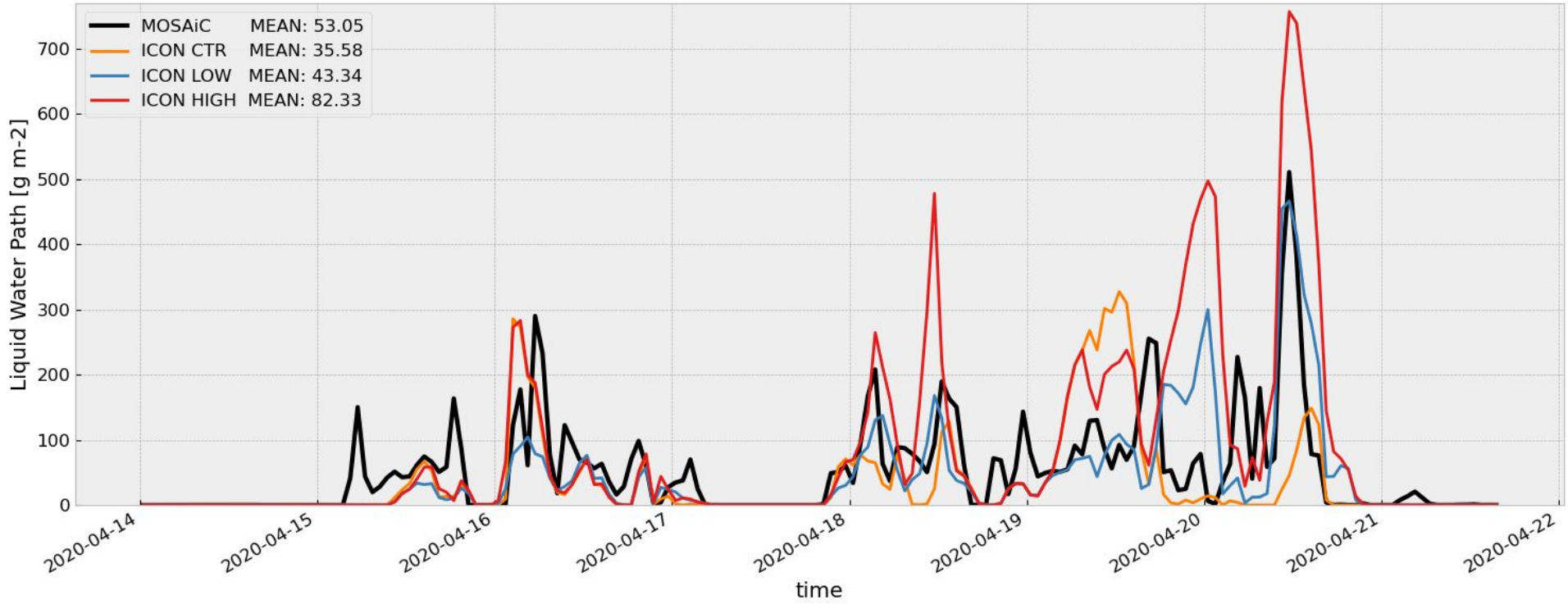
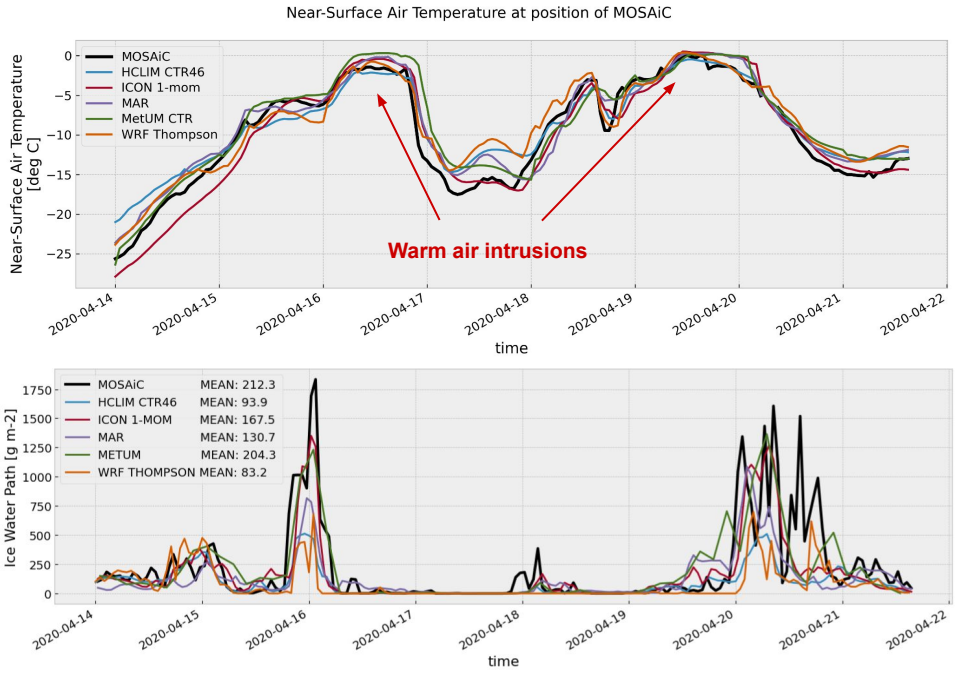
0
100
200
300
400
500
600
2020-04-14
2020-04-15
2020-04-16
2020-04-17
2020-04-18
2020-04-19
2020-04-20
2020-04-21
2020-04-22
time


MOSAiC MEAN: 53.05
ICON CTR MEAN: 35.58
ICON LOW MEAN: 43.34
ICON HIGH MEAN: 82.33
Liquid Water Path [g m-2]
0
100
200
300
400
500
600
700
2020-04-14
2020-04-15
2020-04-16
2020-04-17
2020-04-18
2020-04-19
2020-04-20
2020-04-21
2020-04-22
time

Summary

- Temperature
- Ice and Liquid water paths
- Impact of CCN concentrations



PolarRES
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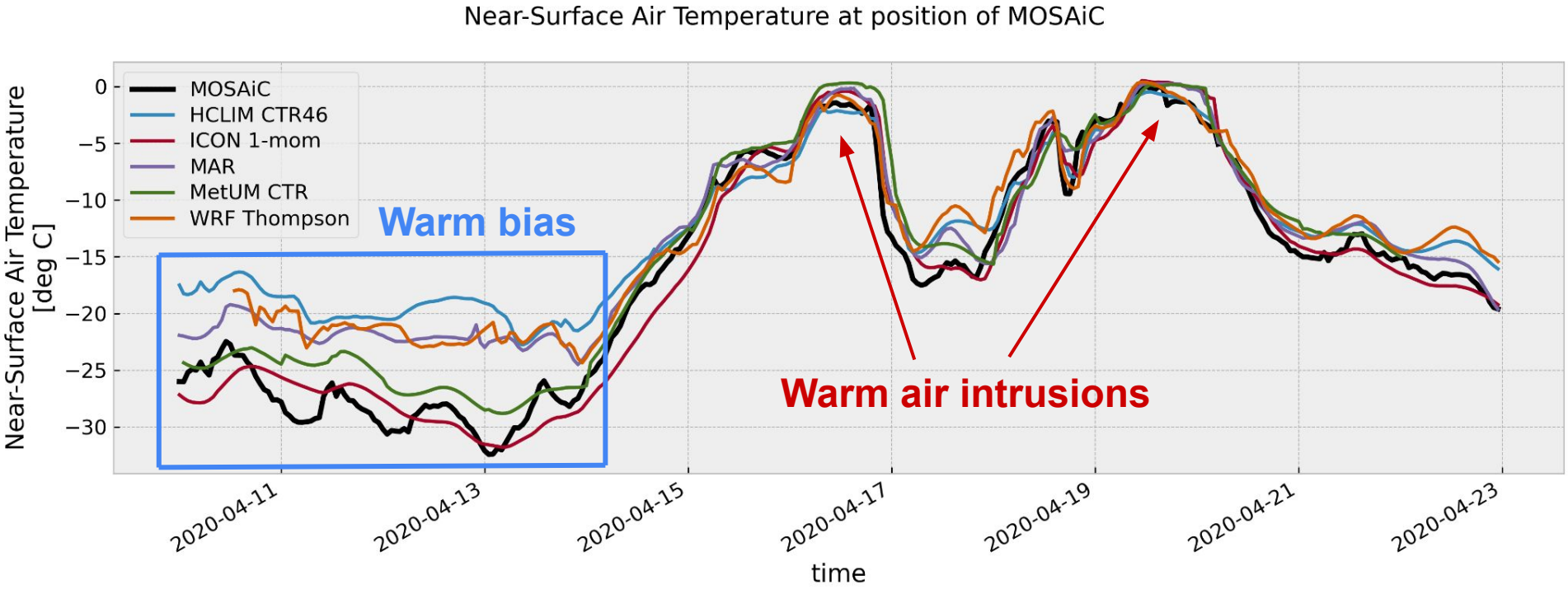
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0
−5
−10
−15
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−25
−30
MOSAiC
HCLIM CTR46
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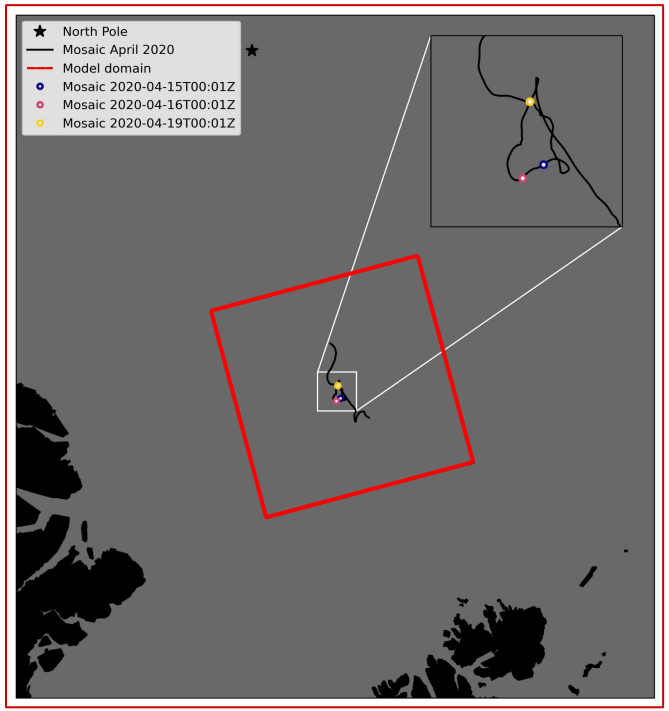
Warm bias
Warm air intrusions
2020-04-11
2020-04-13
2020-04-15
2020-04-17
2020-04-19
2020-04-21
2020-04-23
time

Small domain 2.5 km resolution

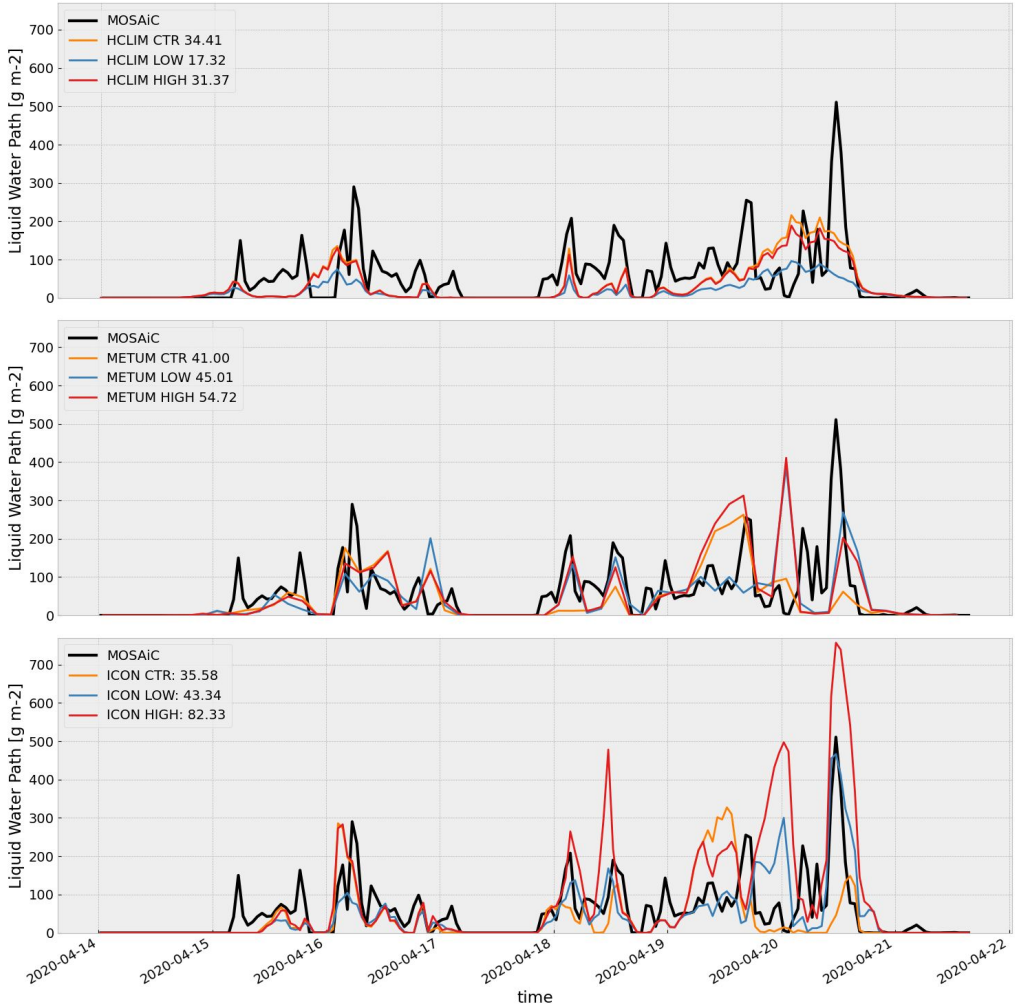


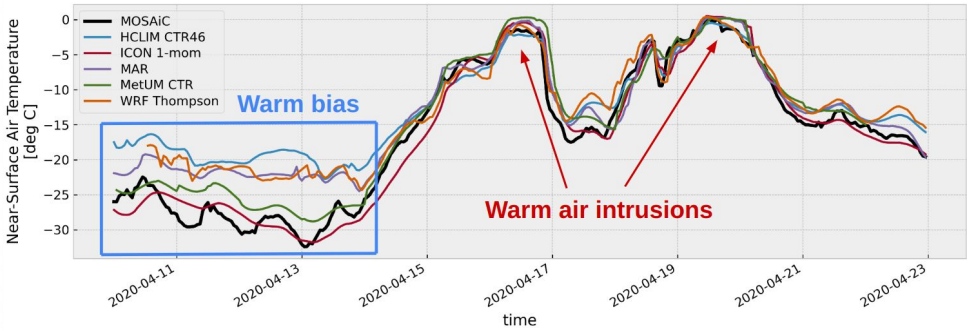
Pan-Arctic 11 km resolution

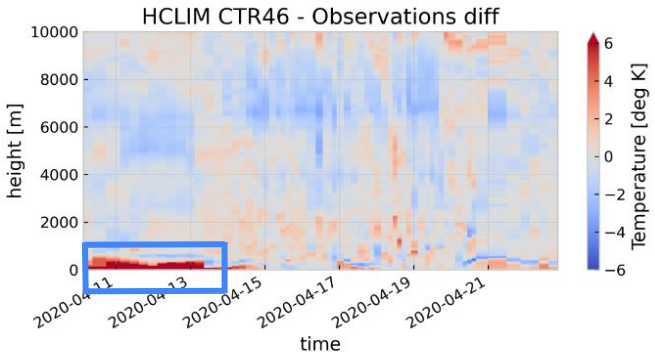
HCLIM

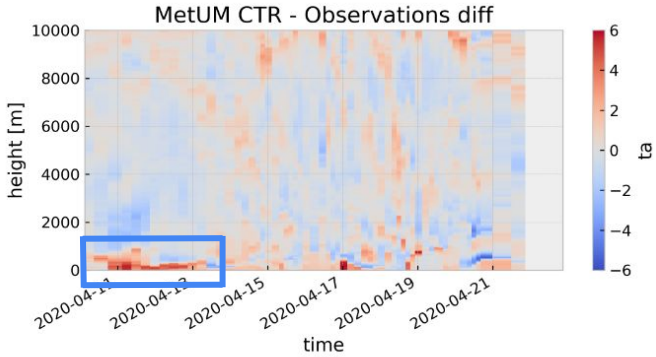
MetUM

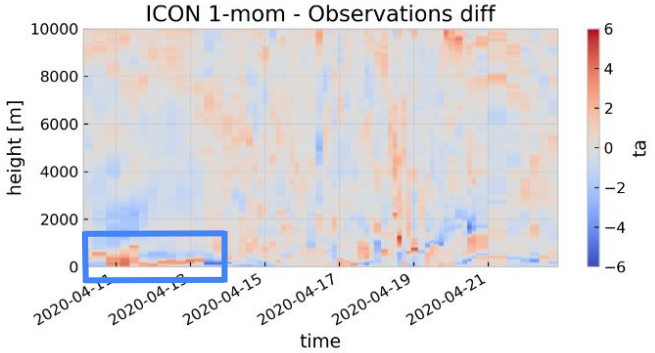
ICON

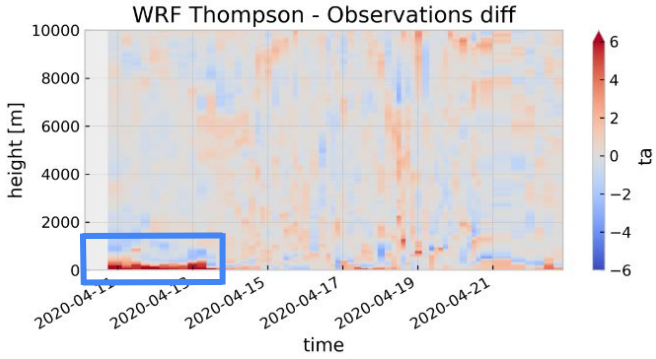


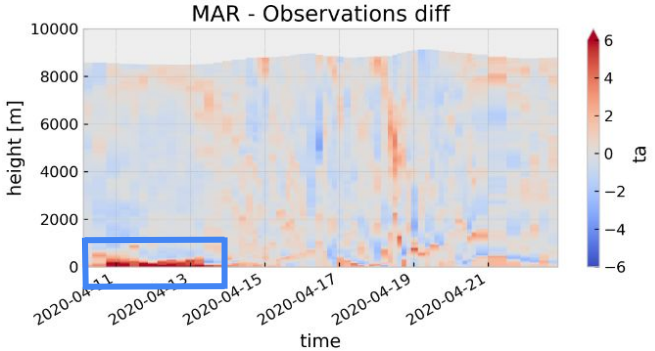

MOSAiC
HCLIM CTR46
ICON 1-mom
MAR
MetUM CTR
WRF Thompson
Warm bias
Warm air intrusions
Near-Surface Air Temperature [deg C]
time


HCLIM CTR46 - Observations diff
height [m]
Temperature [deg K]
time


MetUM CTR - Observations diff
height [m]
ta
time


ICON 1-mom - Observations diff
height [m]
ta
time


WRF Thompson - Observations diff
height [m]
ta
time


MAR - Observations diff
height [m]
ta
time

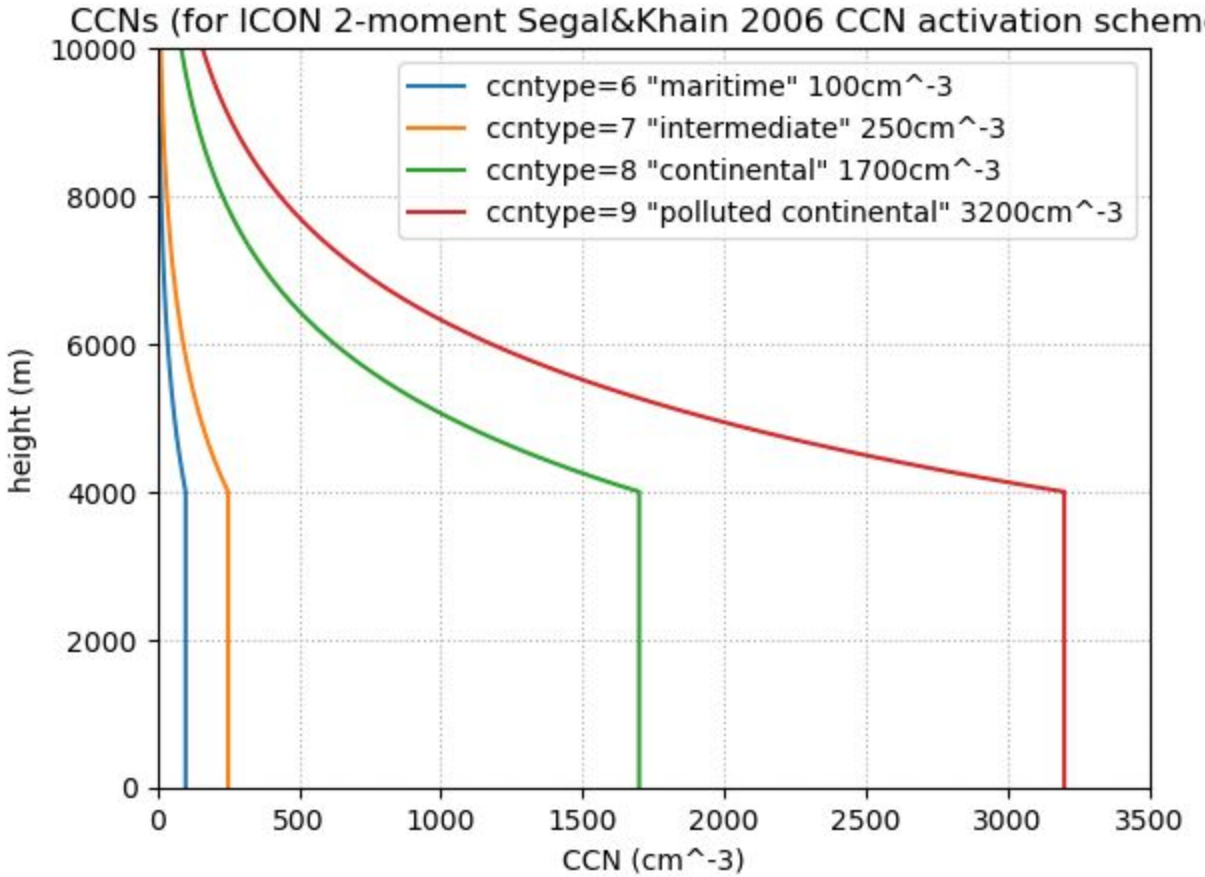


Figure: Jan Landwehrs (AWI)