

Atmosphere-Ocean Single-Column Model (AOSCM)

A tool to help improve coupled models

Gunilla Svensson

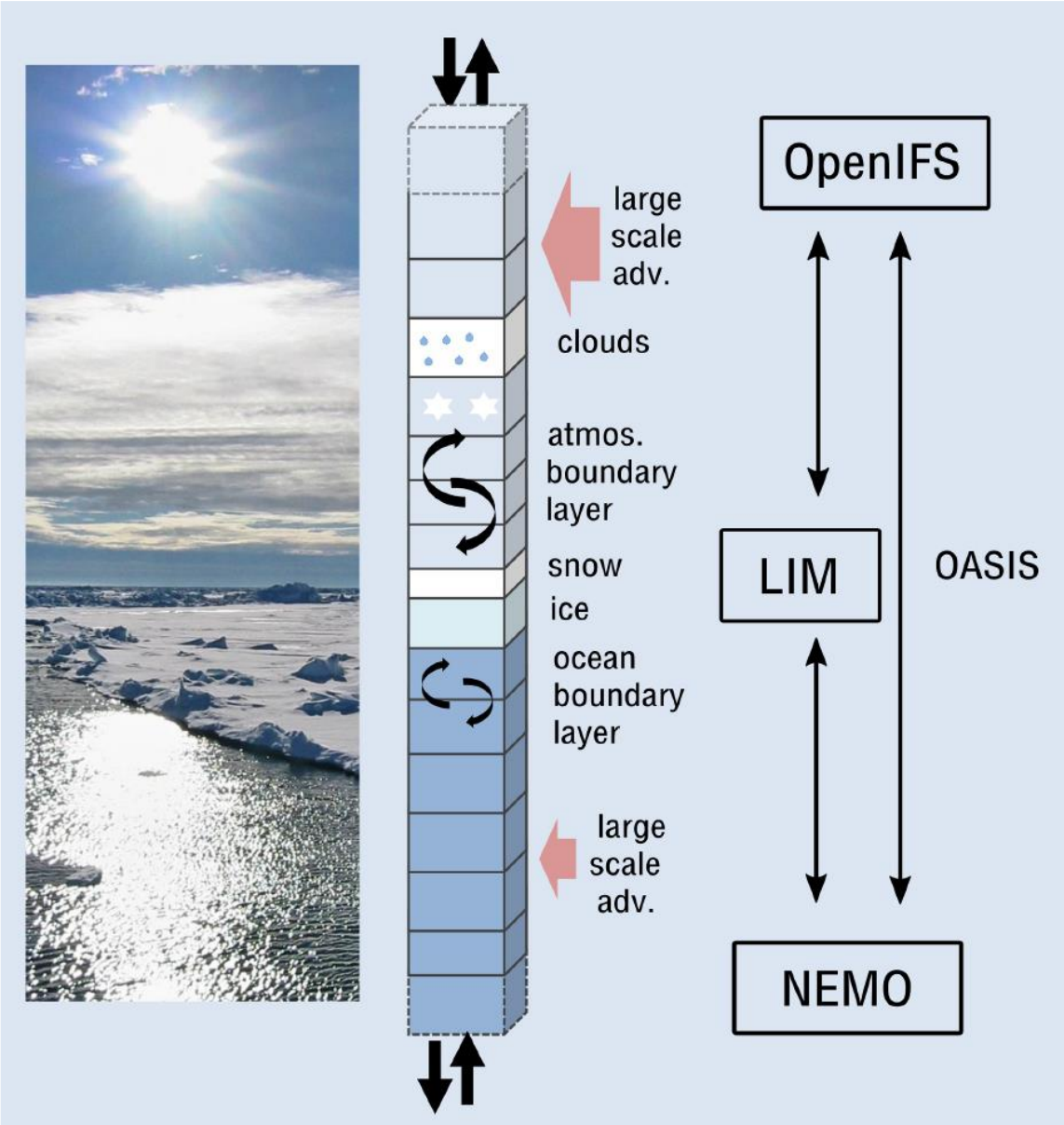
Department of Meteorology,
Bolin Centre for Climate Research and
Swedish e-science Research Centre (SeRC)

Kerstin Hartung, LMU, Munich, Germany, and **Hamish Struthers**, NSC,
Linköping, Sweden

Thanks to **Filip Vana**, **Glenn Carver**, **Nils Wedi**, **Jareth Holt**, **Michael Tjernström** and **Georgia Sotiropoulou**

Accelerating model development work

Single-column model – a link between scales and models



AOSCM.v1_EC-Earth3

OpenIFS cycle 40r1/43r3
OASIS3-MCT
LIM3
NEMO3.6

Hartung et al., 2018
GMD

APPLICATE.eu 
Advanced prediction in
polar regions and beyond

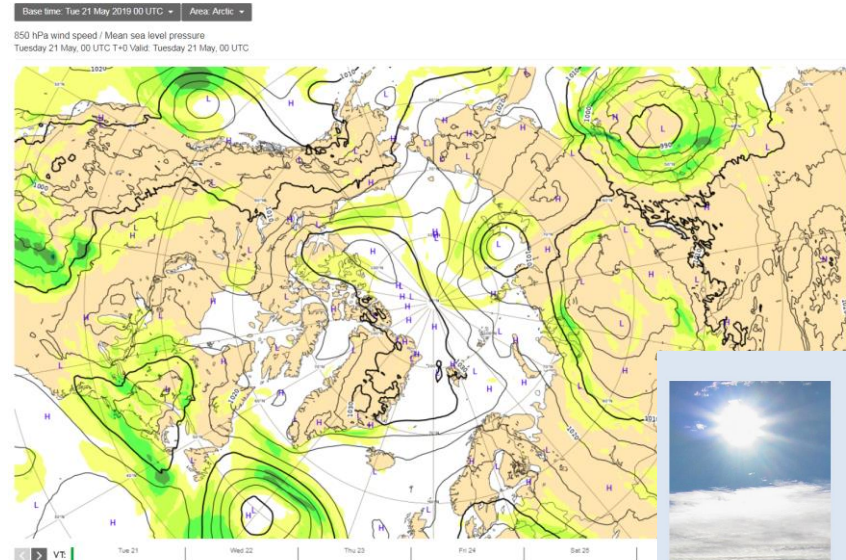
Atmosphere-Ocean Single-Column Model

Same model components from weather to climate



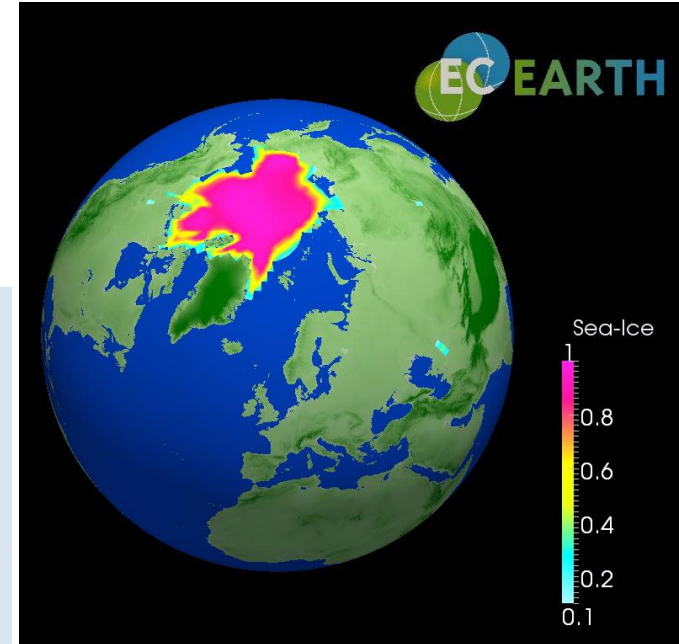
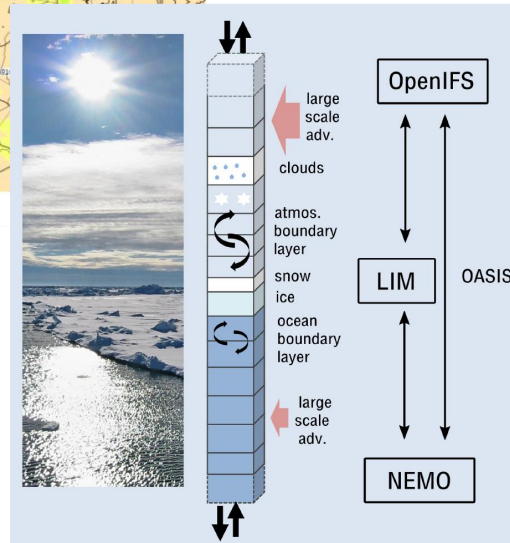
Stockholm University

Mean sea level pressure and wind speed at 850 hPa



ECMWF IFS 10-day forecast

AOSCM



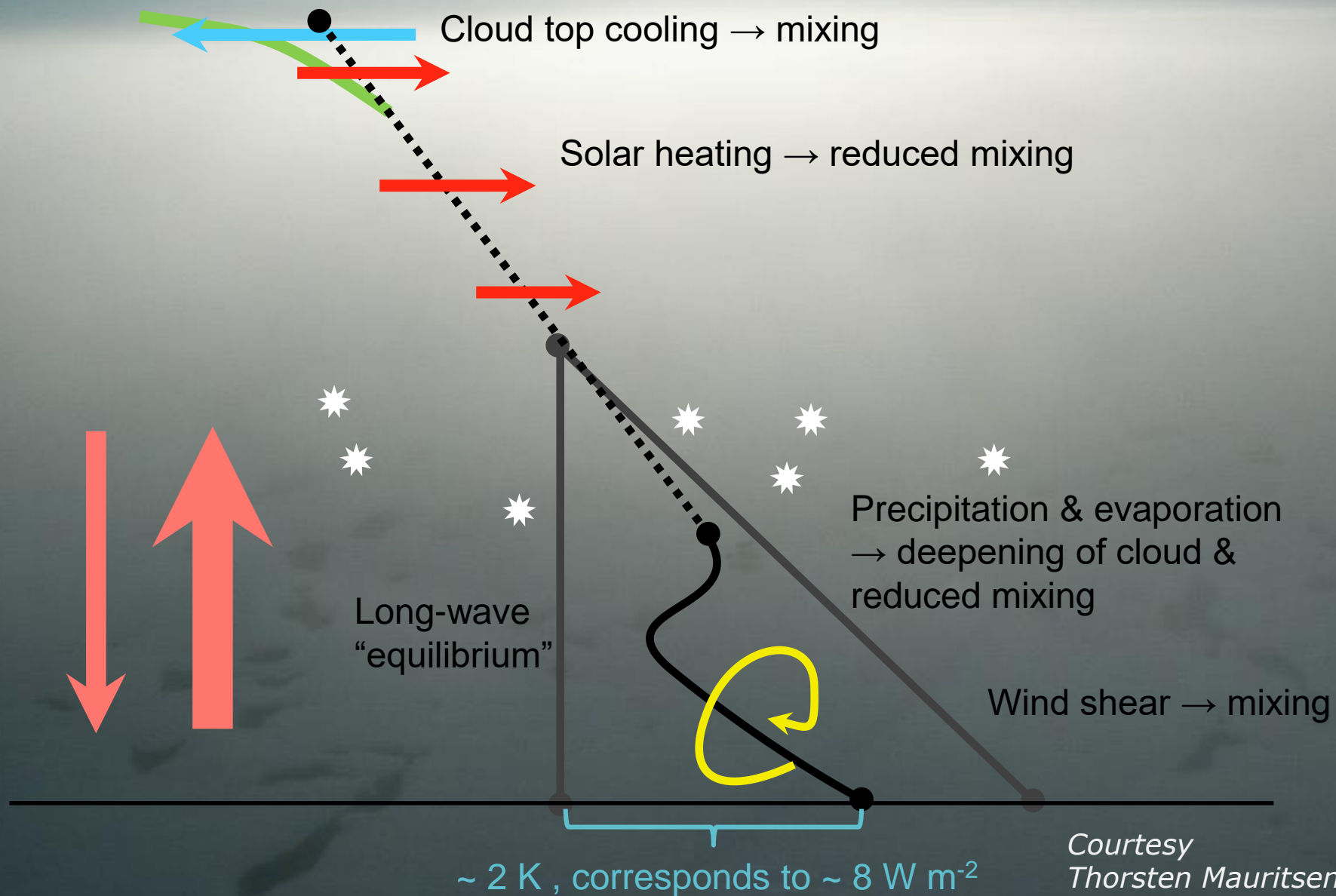
Sea-ice concentration in EC-Earth

Allows for studies of fast processes in all model components and the coupling between them

APPLICATE.eu
Advanced prediction in polar regions and beyond

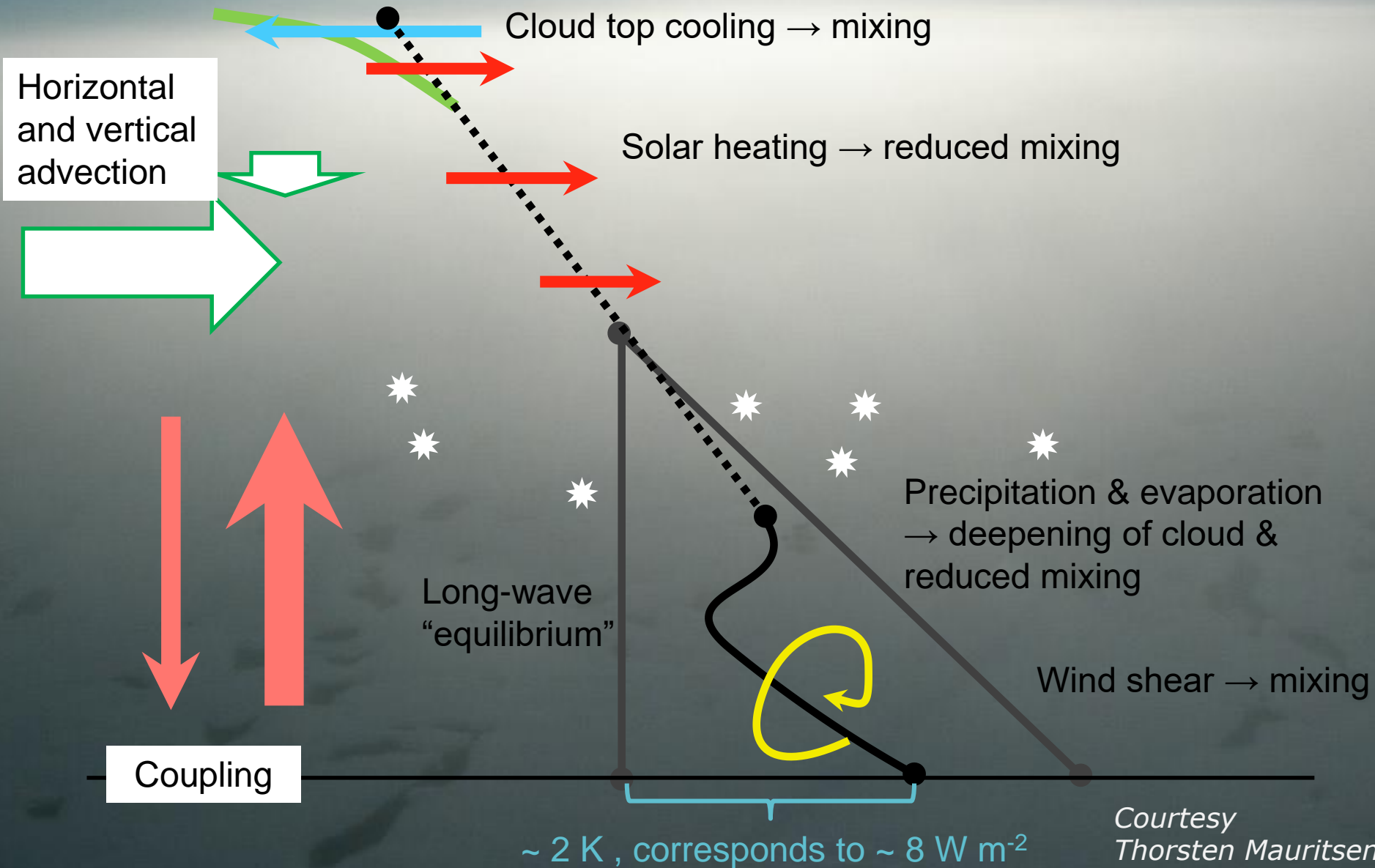
Focusing on surface energy budget:

What atmospheric processes do we need to get right?



Focusing on surface energy budget:

What atmospheric processes do we need to get right?

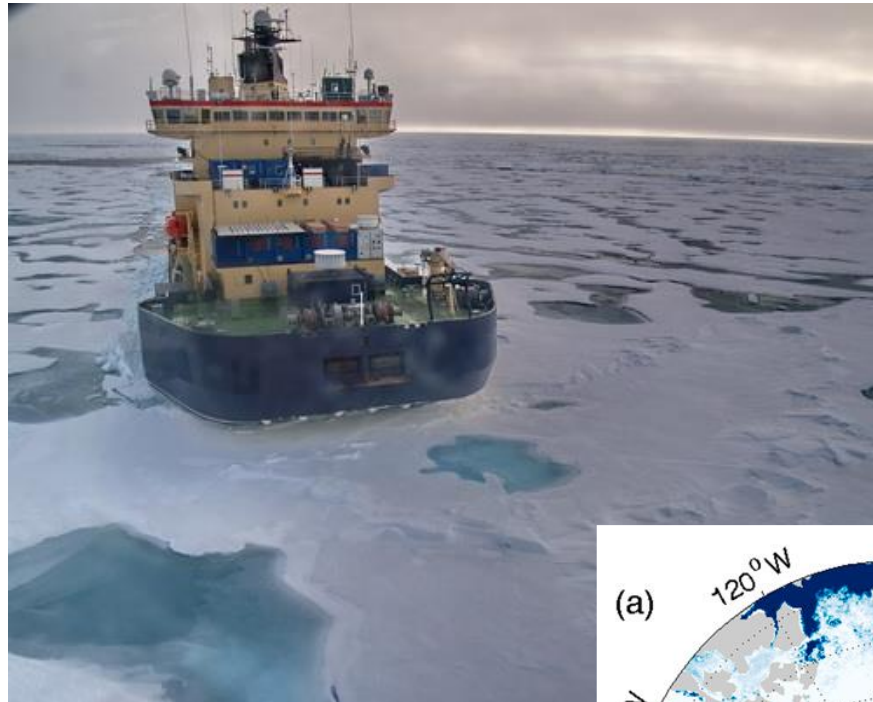


Courtesy
Thorsten Mauritsen

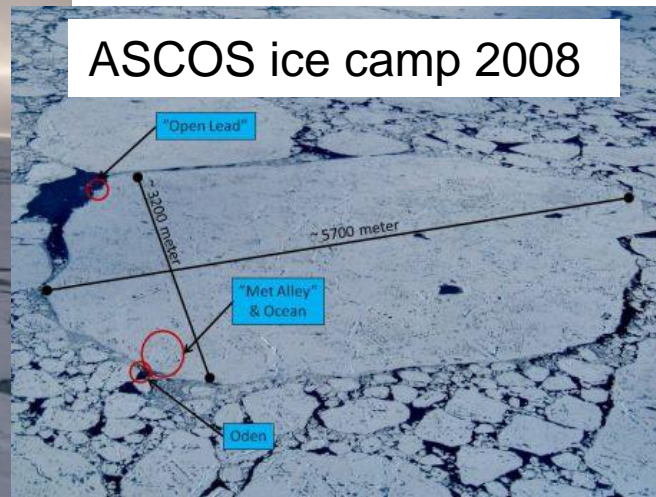
AOSCM and observations



Stockholm University

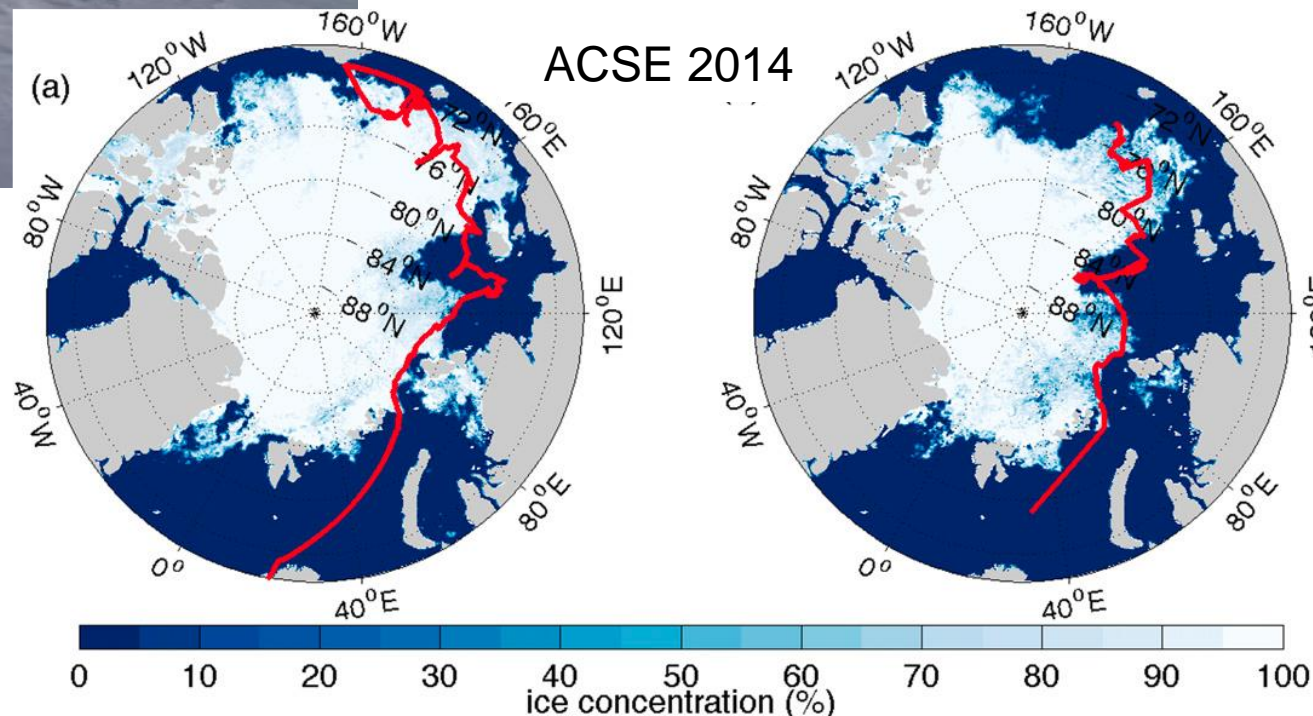


Icebreaker Oden



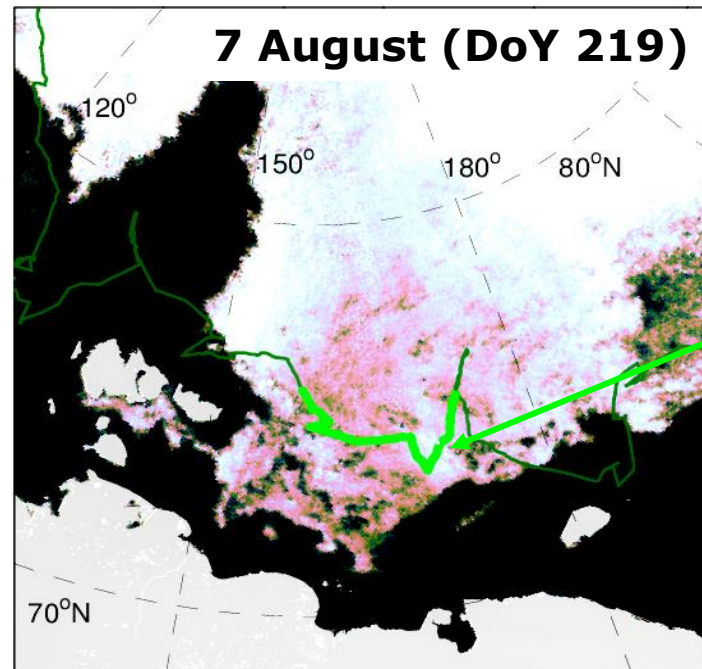
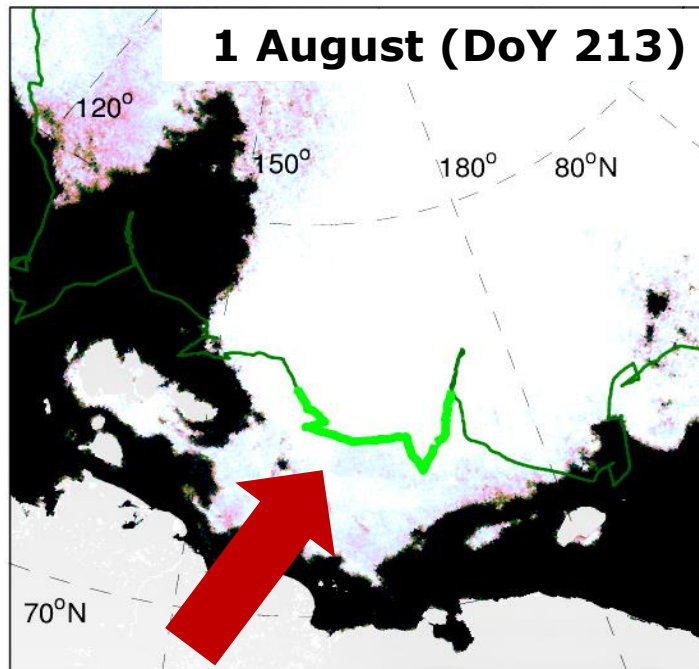
ASCOS ice camp 2008

Allows for detailed comparison with observations



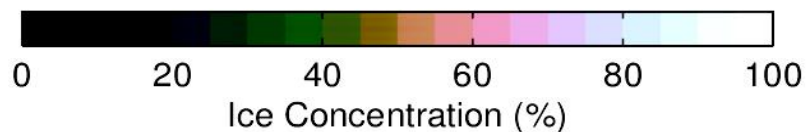
An extreme warm advection episode

Observations on icebreaker Oden, ACSE 2014



Icebreaker
Oden track

Siberia

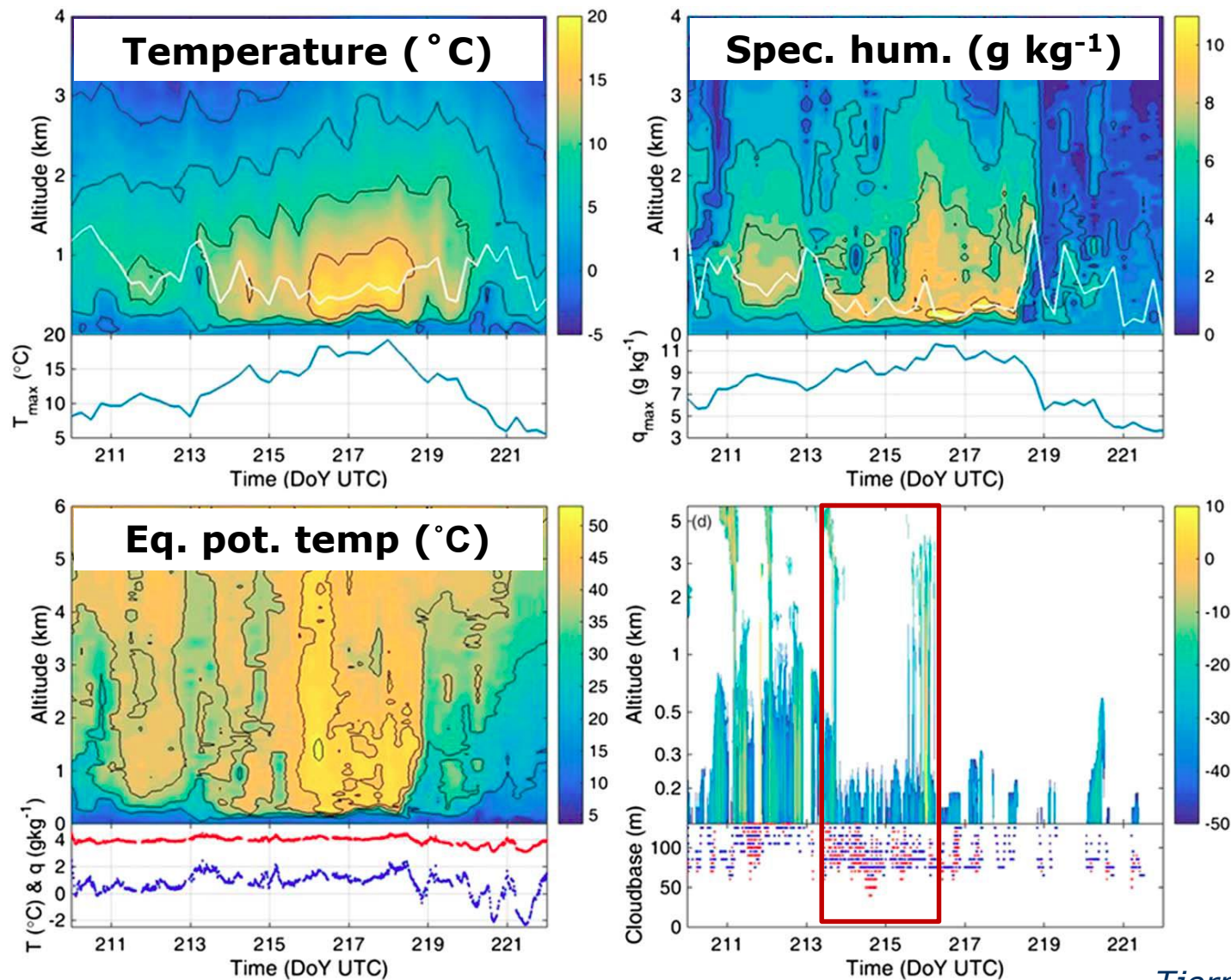


An extreme warm advection episode

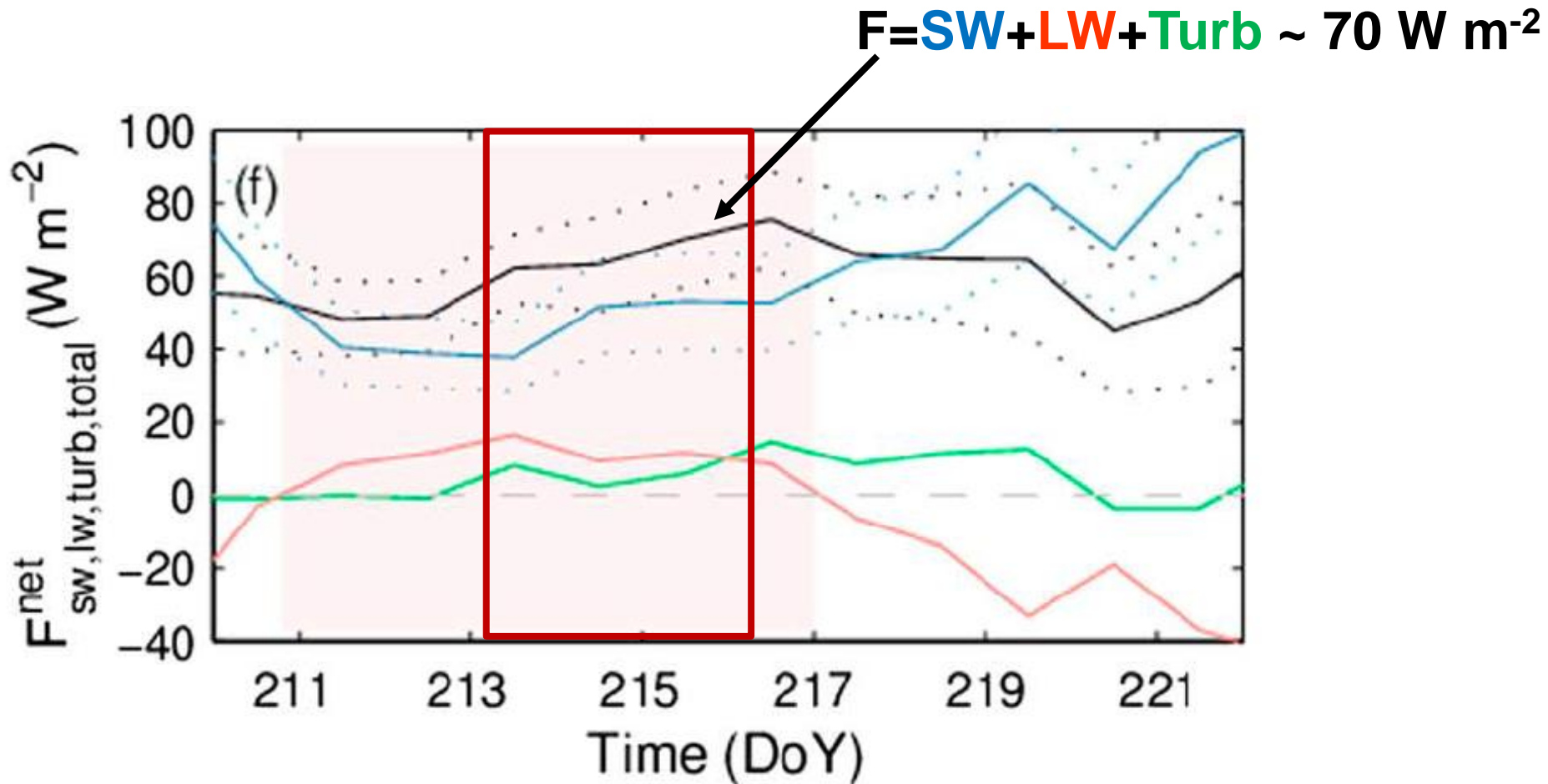
Observations on icebreaker Oden, ACSE 2014



Stockholm
University



Observed surface energy budget (atmospheric point of view)

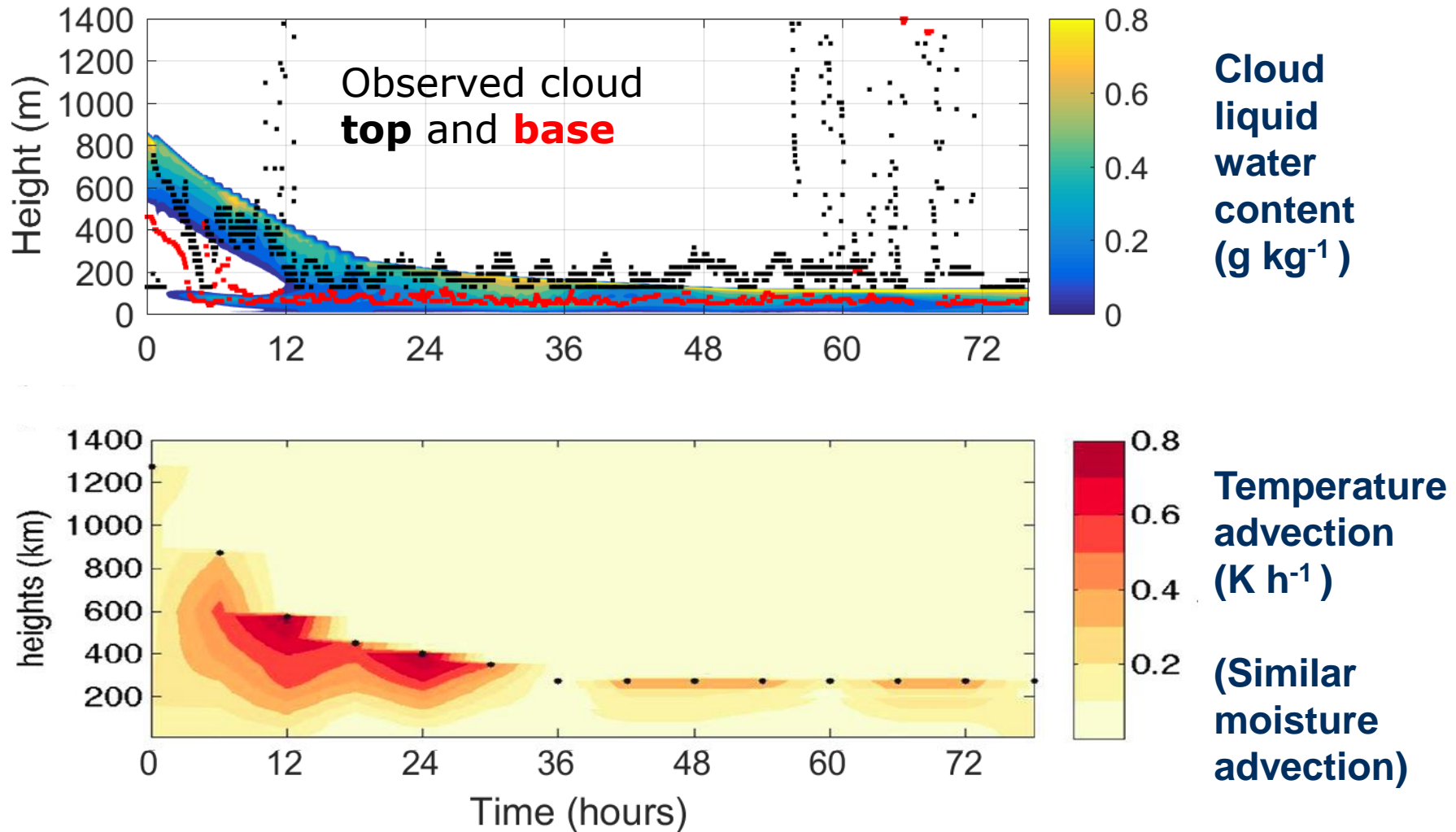


Idealized LES simulation

MIMICA, 06 UTC 1 Aug (DoY 213 + 76 h)



Stockholm University

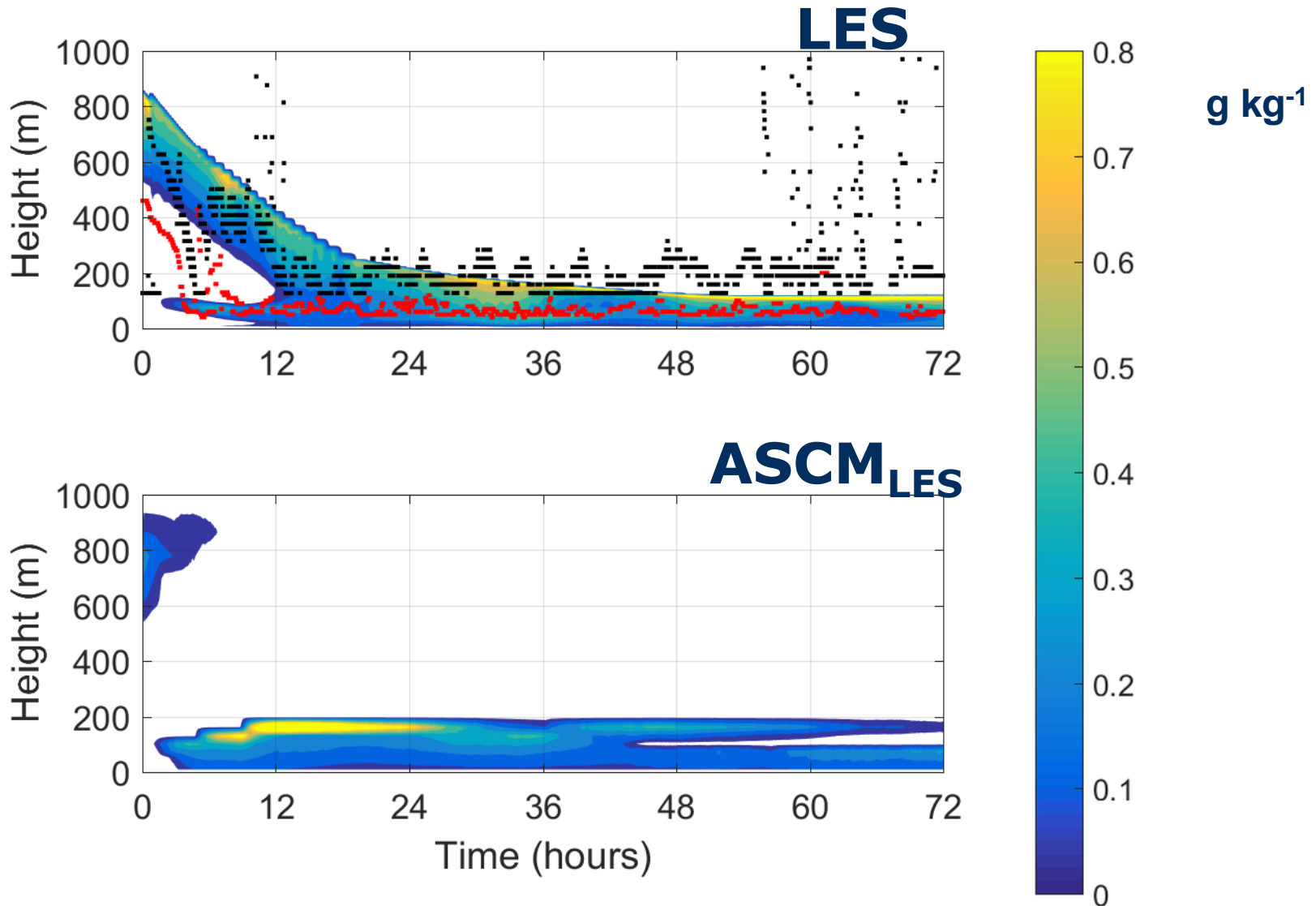


Prescribed surface conditions and pressure gradient

Sotiropoulou et al., 2018

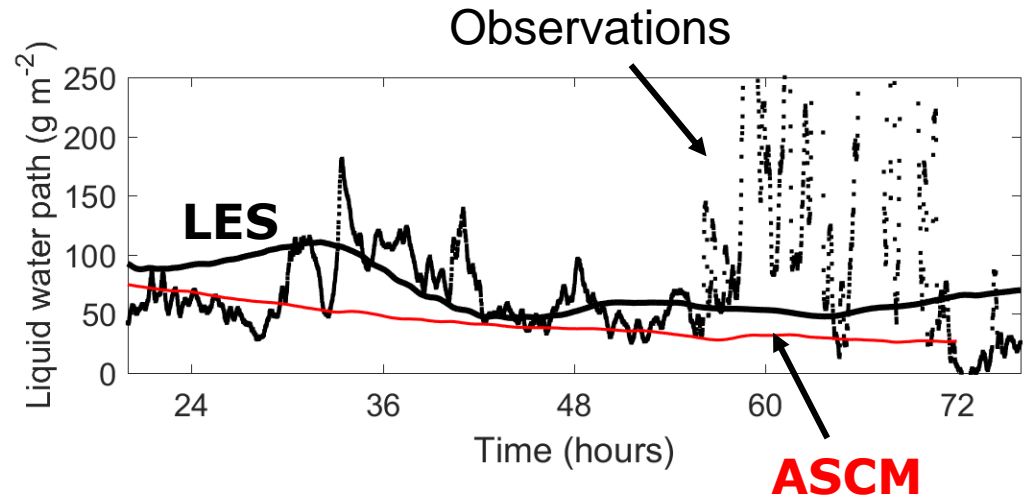
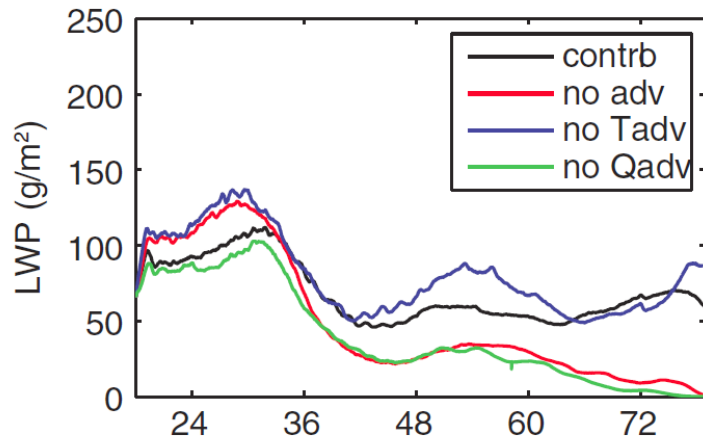
LES and ASCM

Cloud liquid water content



Sensitivity to advection

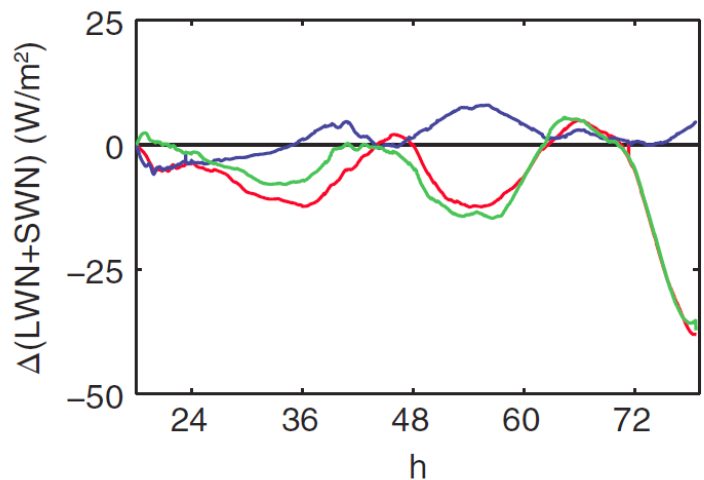
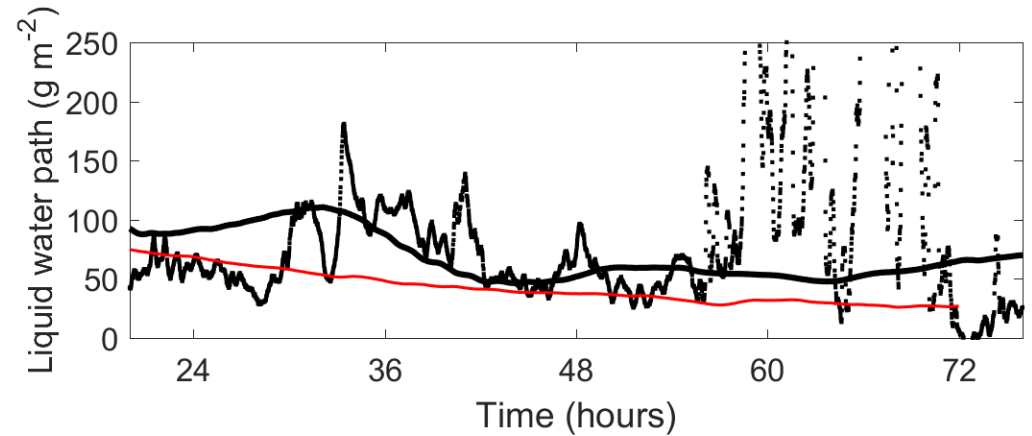
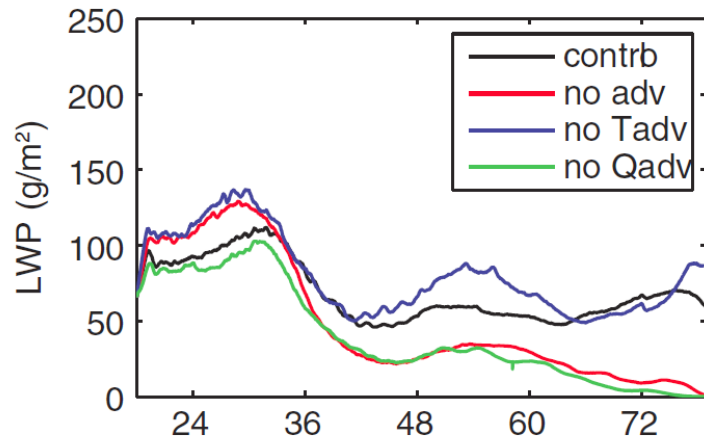
LES (MIMICA) and ASCM simulation of ACSE case



Moisture advection
necessary to maintain
the cloud

Sensitivity to advection

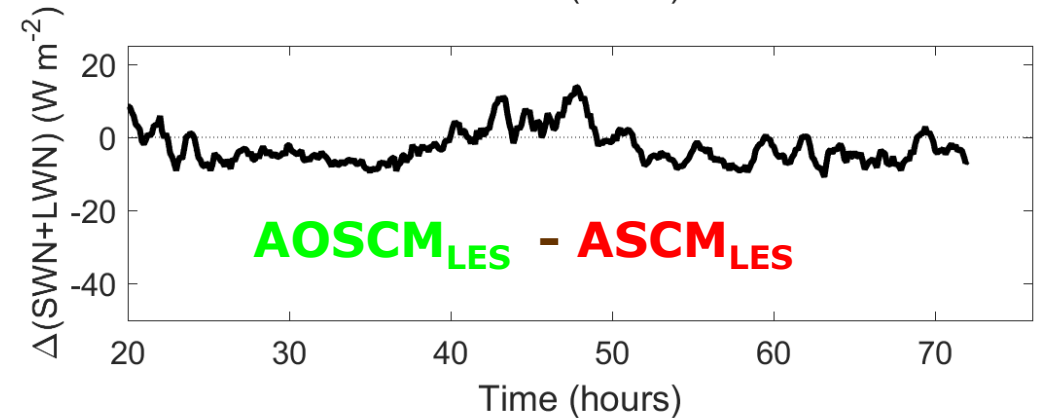
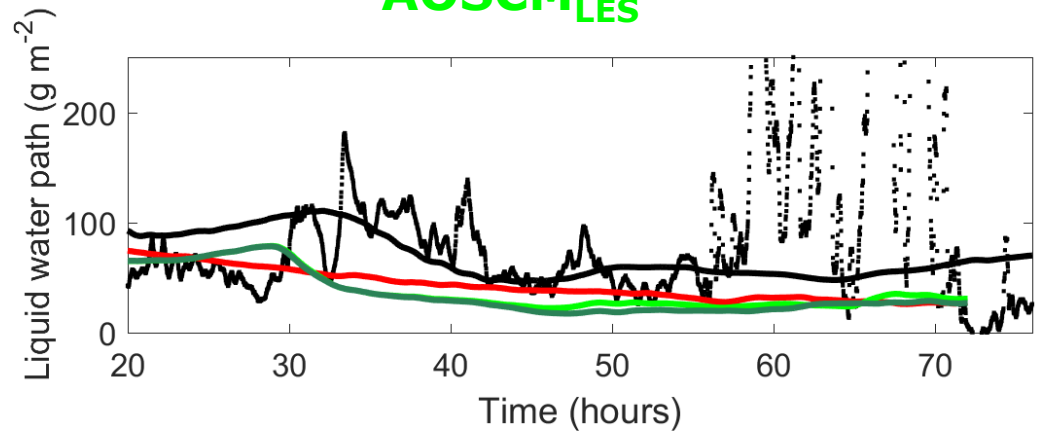
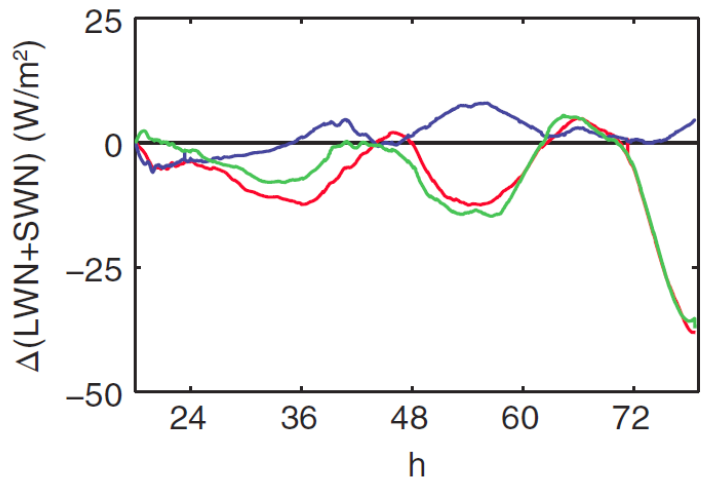
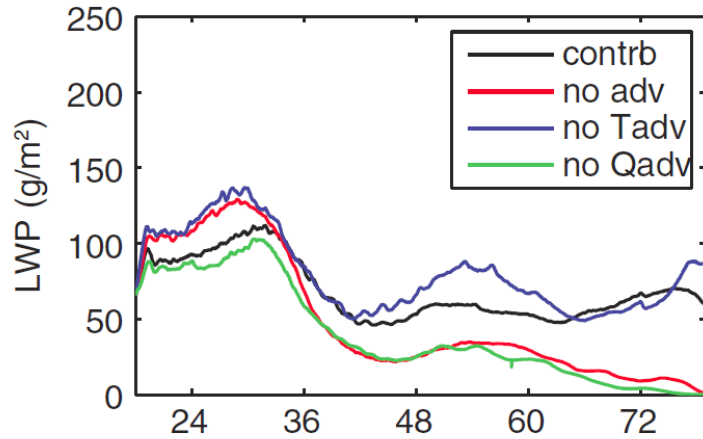
LES (MIMICA) simulation of ACSE case



Sensitivity to coupling

LES (MIMICA) simulation of ACSE case

LES
ASCM_{LES}
AOSCM_{LES}



Substantial change in net surface radiation
coupled/uncoupled

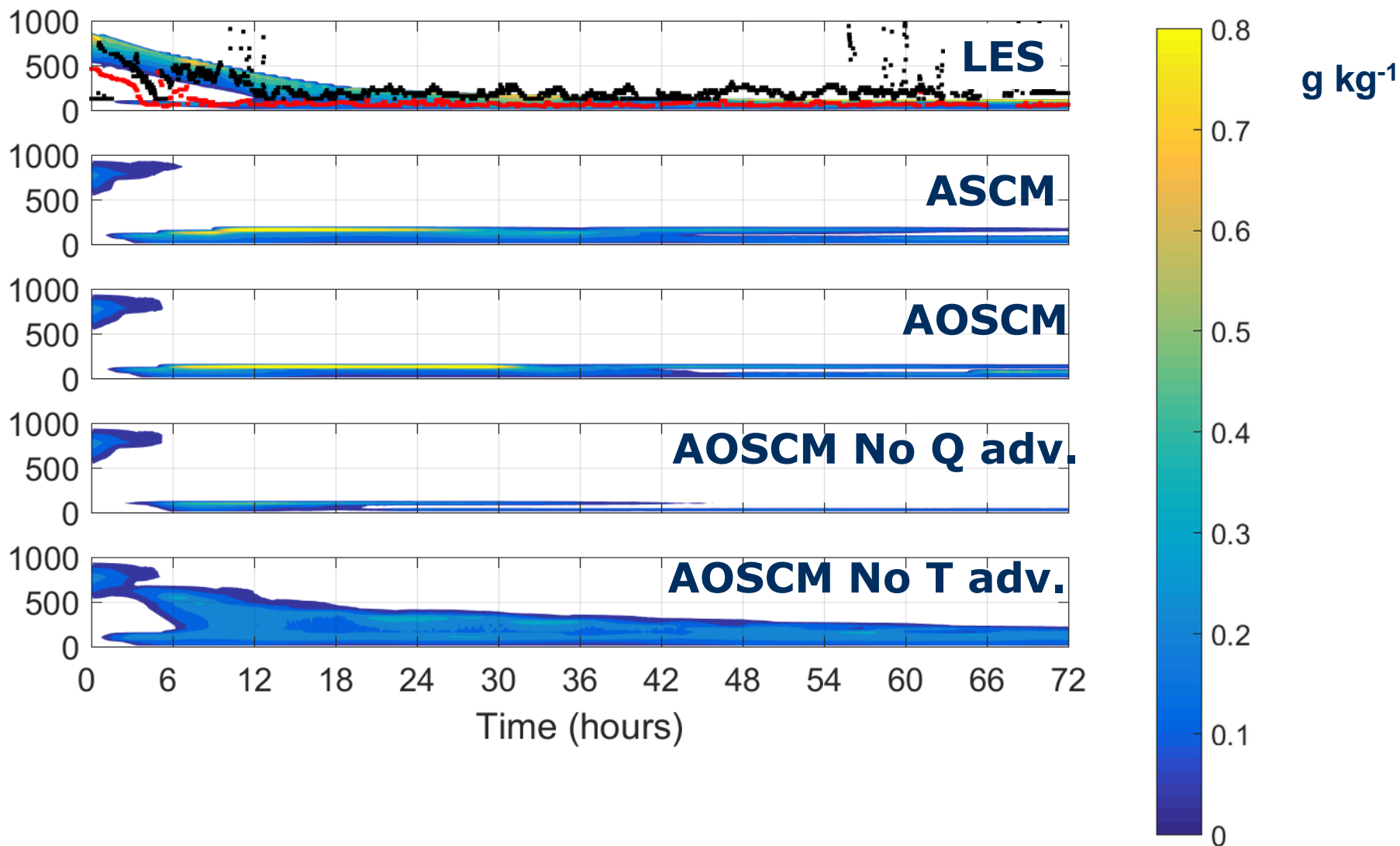
Almost no sea-ice melt and constant mean albedo

AOSCM_{LES}

Cloud liquid water content

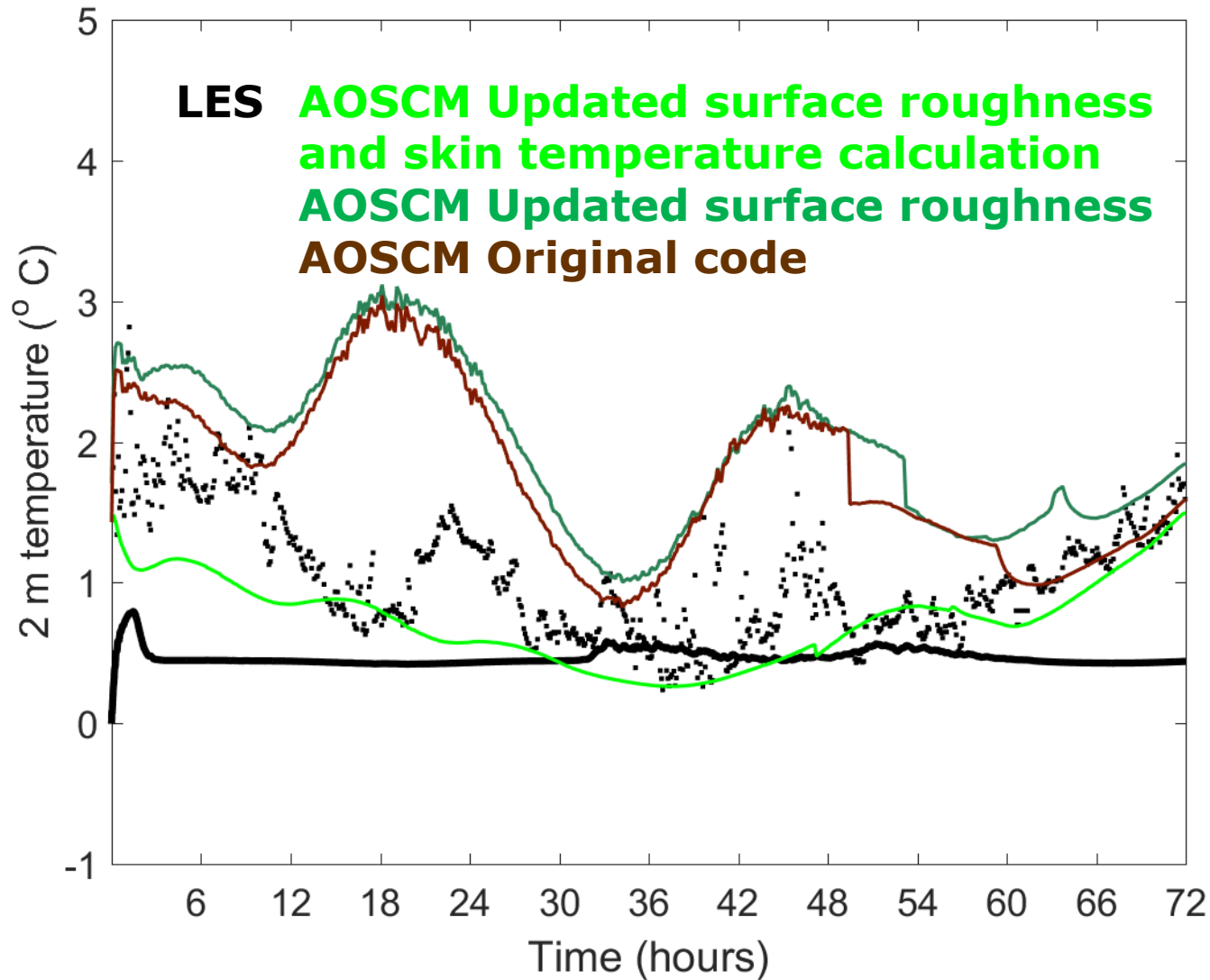


Stockholm
University



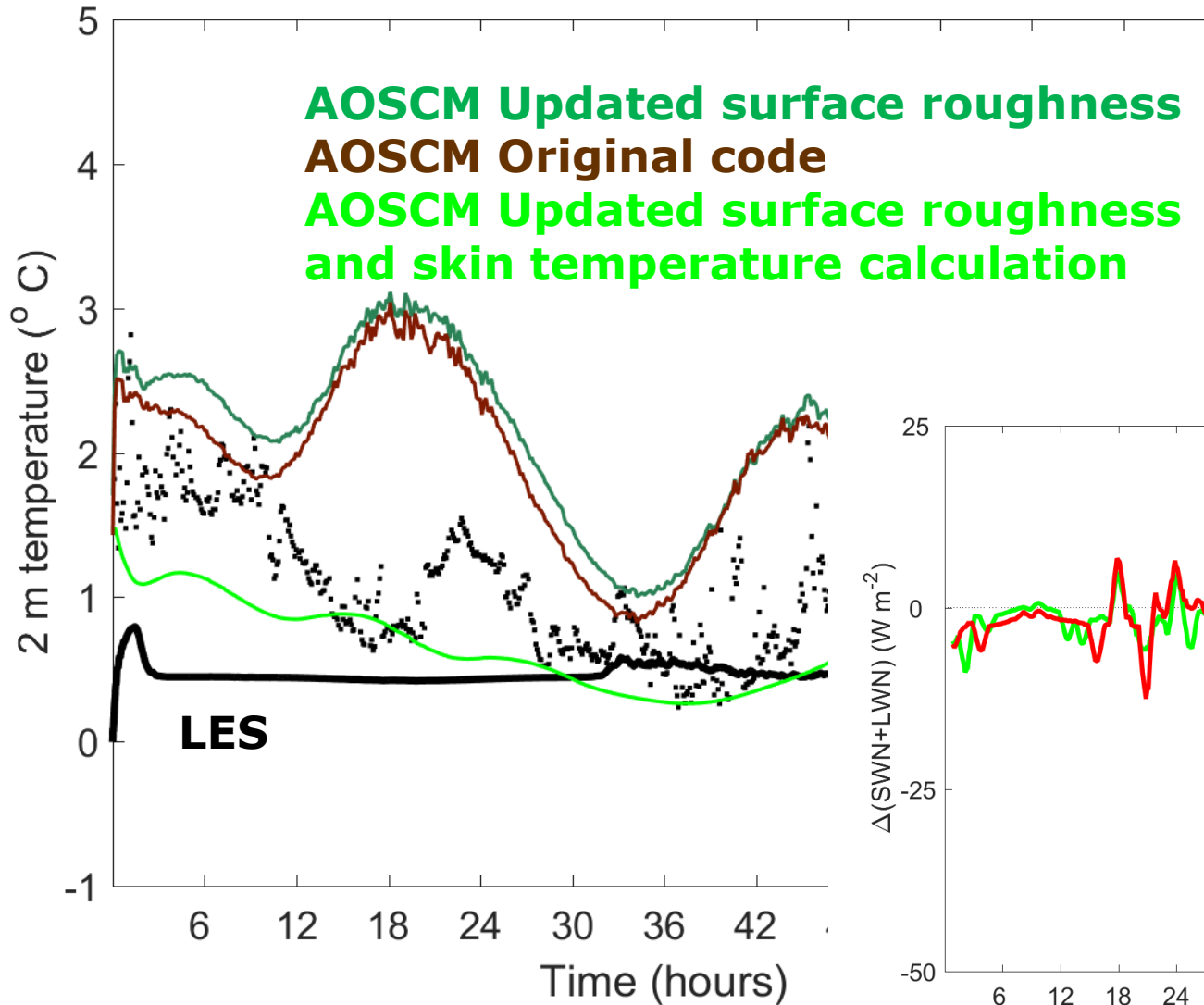
AOSCM

Surface coupling

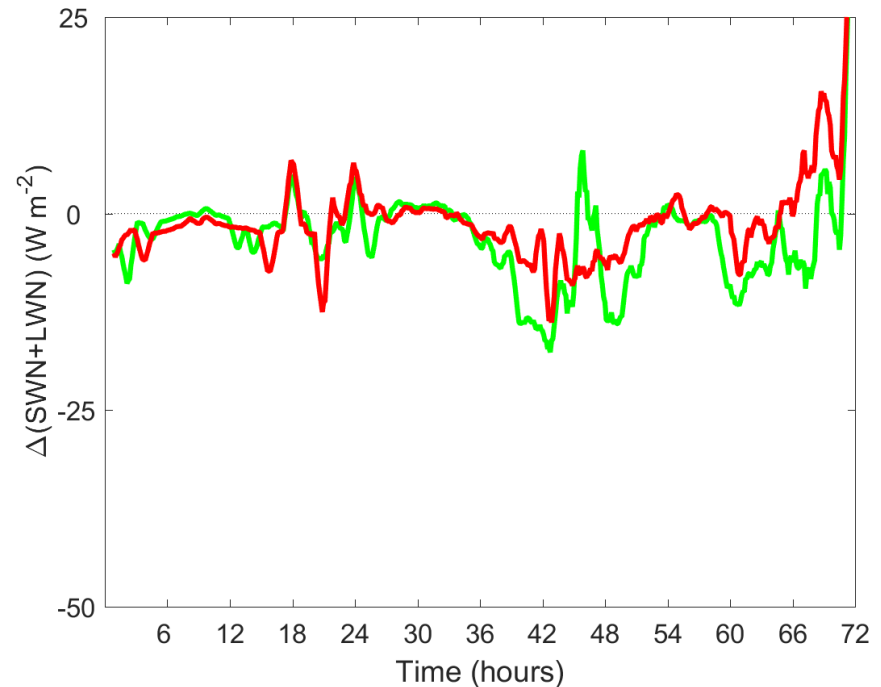


AOSCM

Surface coupling



These changes also gives rise to surface energy budget difference...



Concluding remarks

AOSCM makes it possible to study interactions ocean/sea-ice/snow/atmosphere with focus on vertical coupling processes, physical and technical

Large-scale advection and local vertical processes can be separated

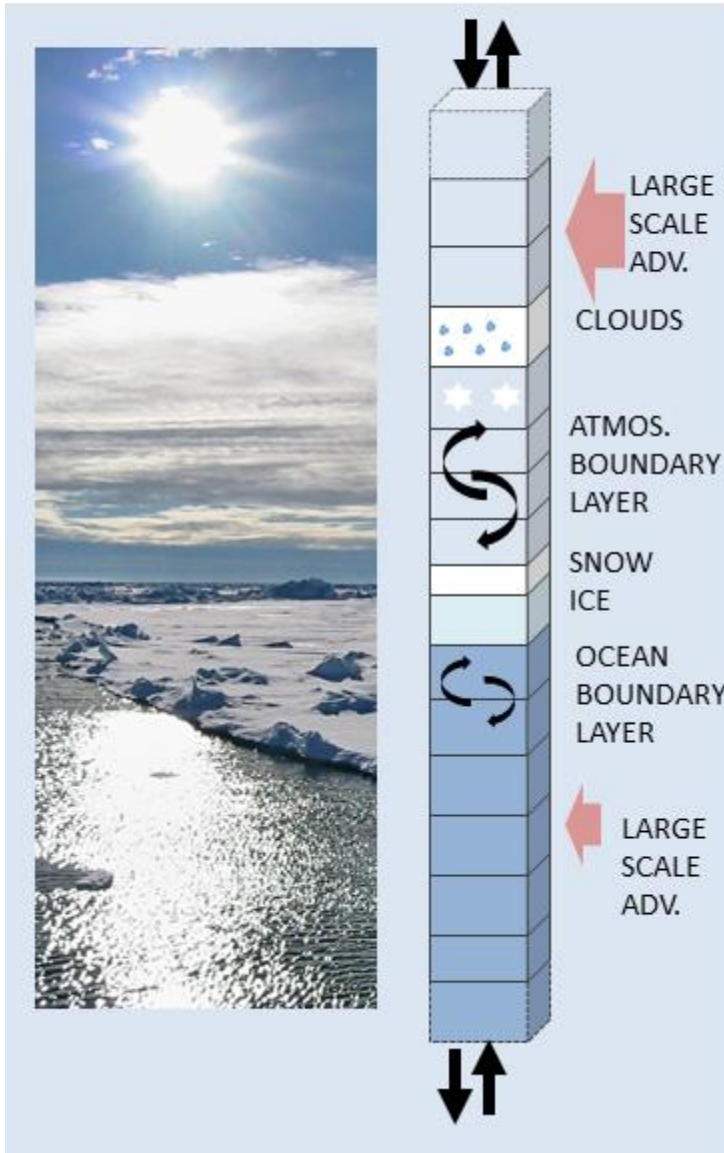
AOSCM is developed and maintained within the EC-Earth development portal can also mimic the NWP model

Simulations of the ACSE case show that the coupling has large impact as well as the advection of moisture

AOSCM and MOSAiC



Stockholm University



<http://www.mosaic-expedition.org>

