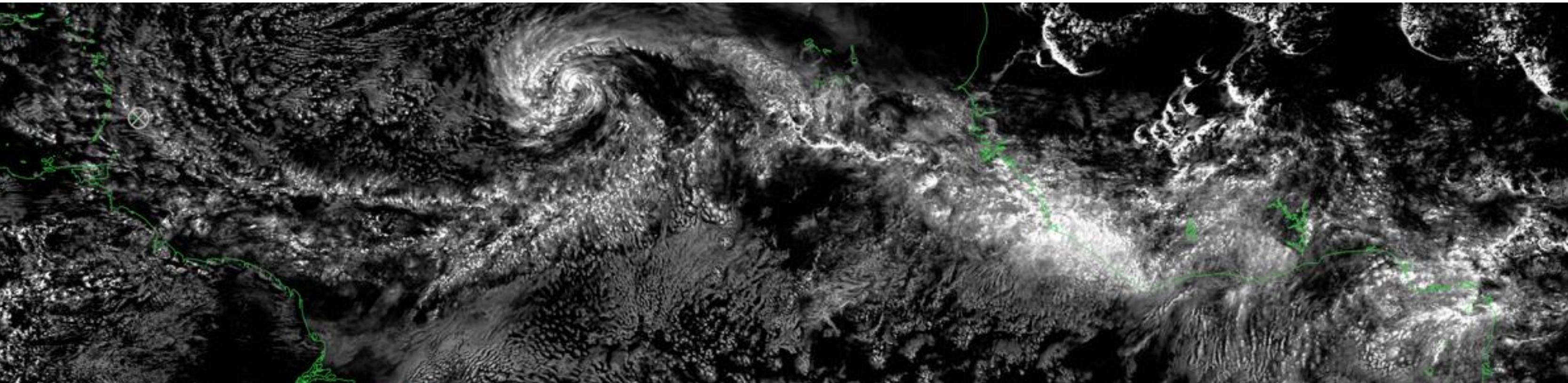


Convection in weather forecasts beyond the grey-zone over summer land and tropical Atlantic

Daniel Klocke & Martin Köhler

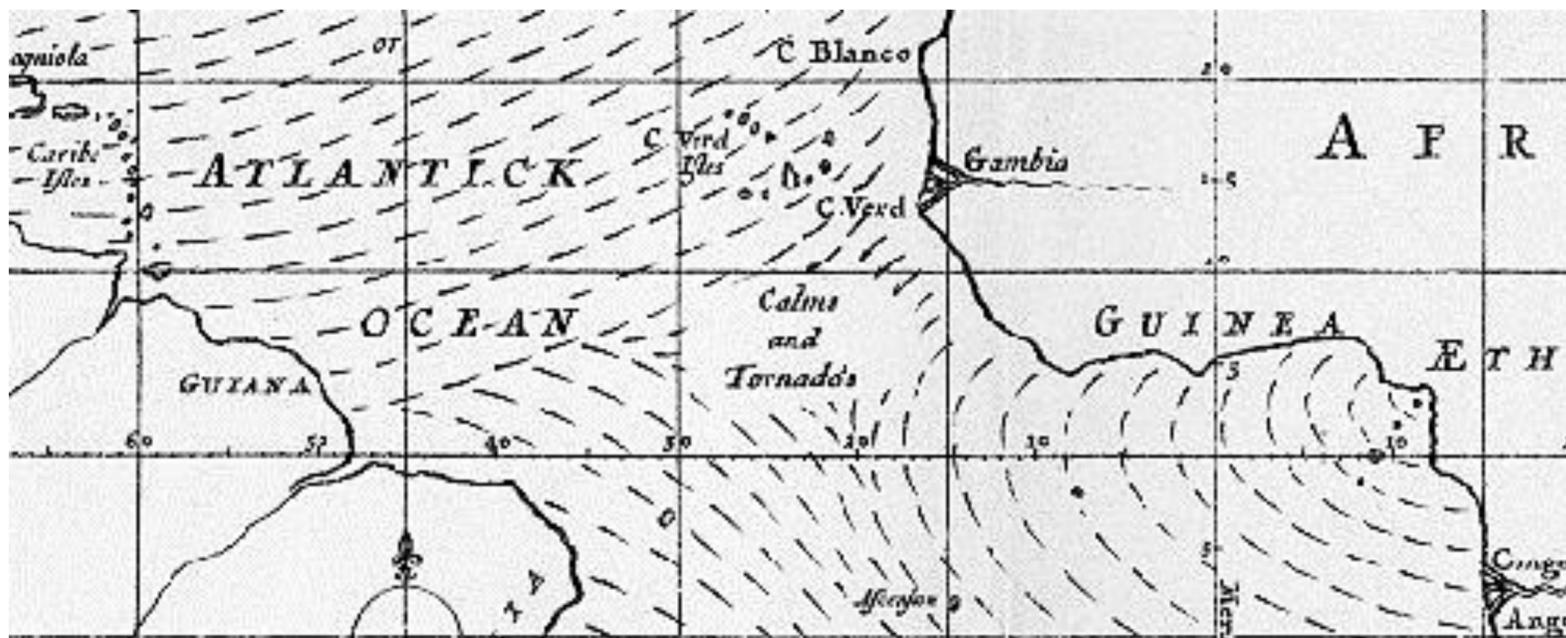


Overview:

The doldrums: large-scale feature of the general circulation, controlled by small-scale process and their coupling with the environment.

Aspects of the atmospheric system emerging from explicitly resolved convection.

New challenges.



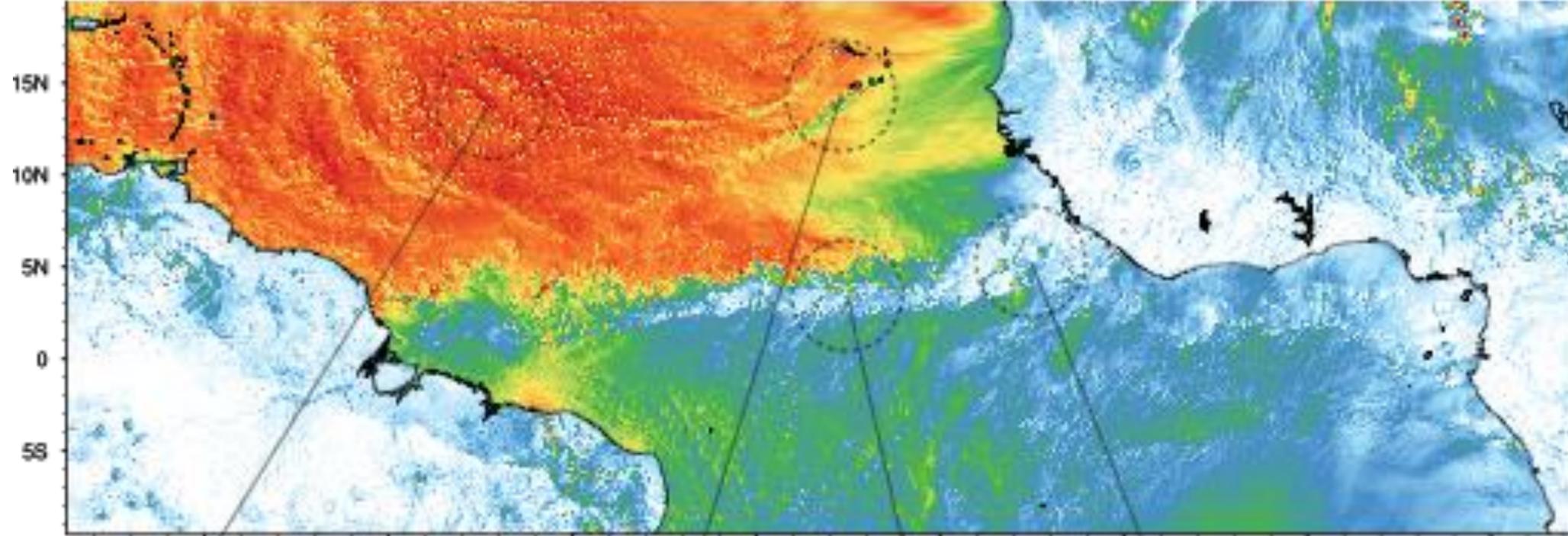
,'Calms and Tornadoes' Halley 1686



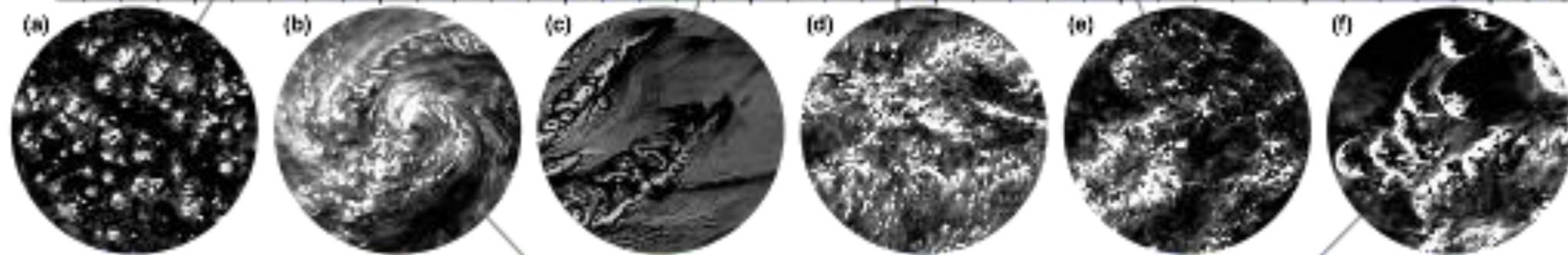
Maury 1864

Configuration:

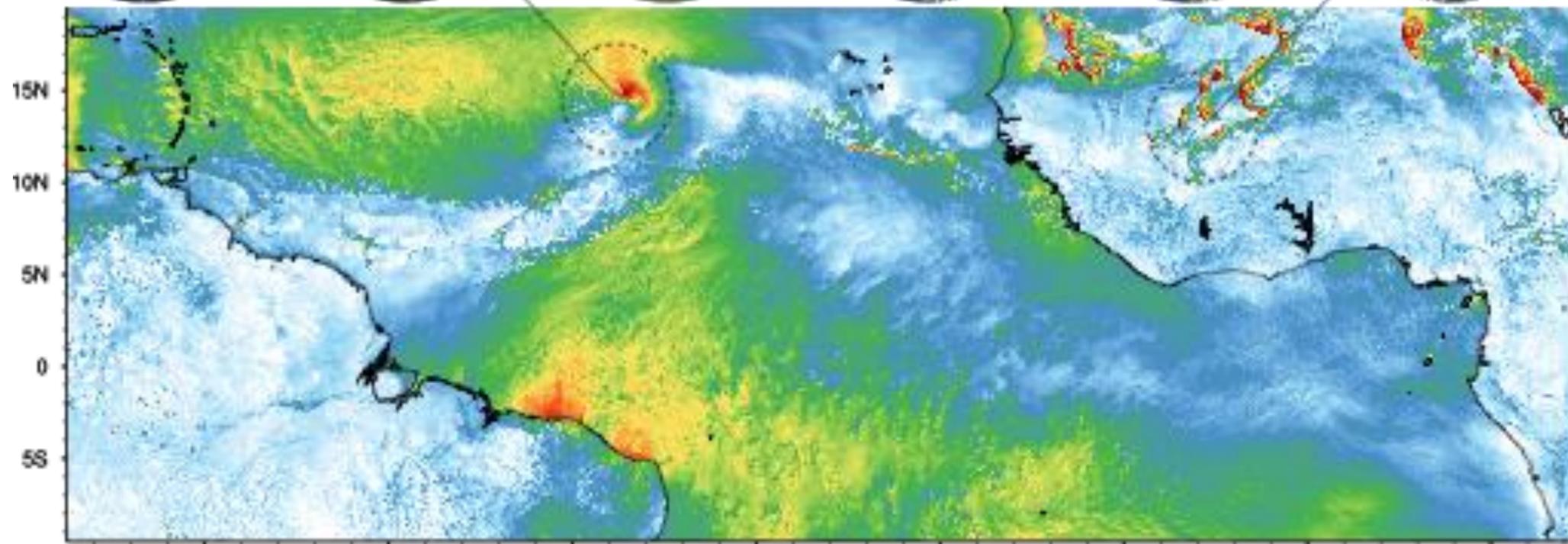
- December 2013 and August 2016. During measurement NARVAL.
- ICON-NWP with 2.5 km resolution 9000 x 3500 km.
 - regional refined to 1.2 km.
- Initial conditions from IFS (16 and 9.5 km) every day at 00 UTC.
- Nudged every 3 hours on the lateral boundaries with IFS forecasts.
- No convection parameterisation, gravity wave drag and sub-grid orography.
 - Graupel as additional prognostic variable in the micro-physics.
- 36 hour forecasts. Only the last 24 hours are discussed.



Wind speed 10m
December



Vertical integrated
liquid water



Wind speed 10m
August



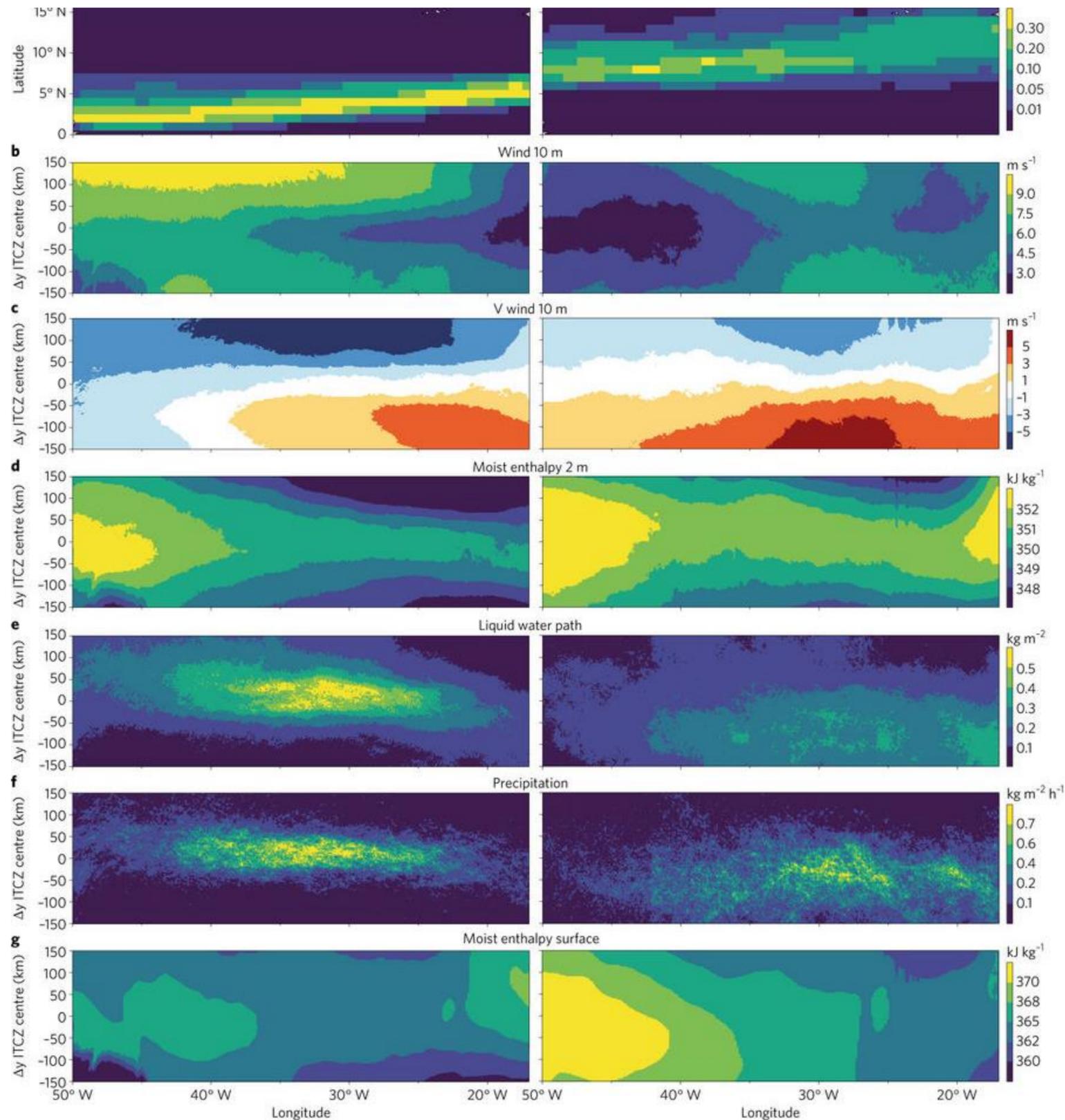
670 km
—

December

August

Composite on ITCZ center:

cost function based on near-surface wind, divergence and relative humidity



FoO ICTZ center

10 m Wind Speed

10 m V Wind

2 m Moist Enthalpy

LWP

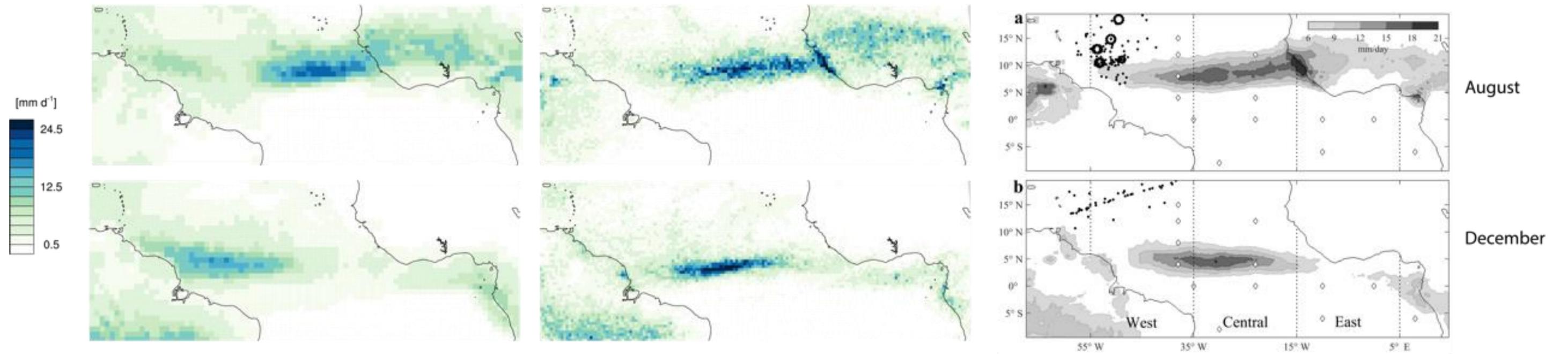
Precipitation

Surface Moist Enthalpy

Parameterised

Explicit

Observed



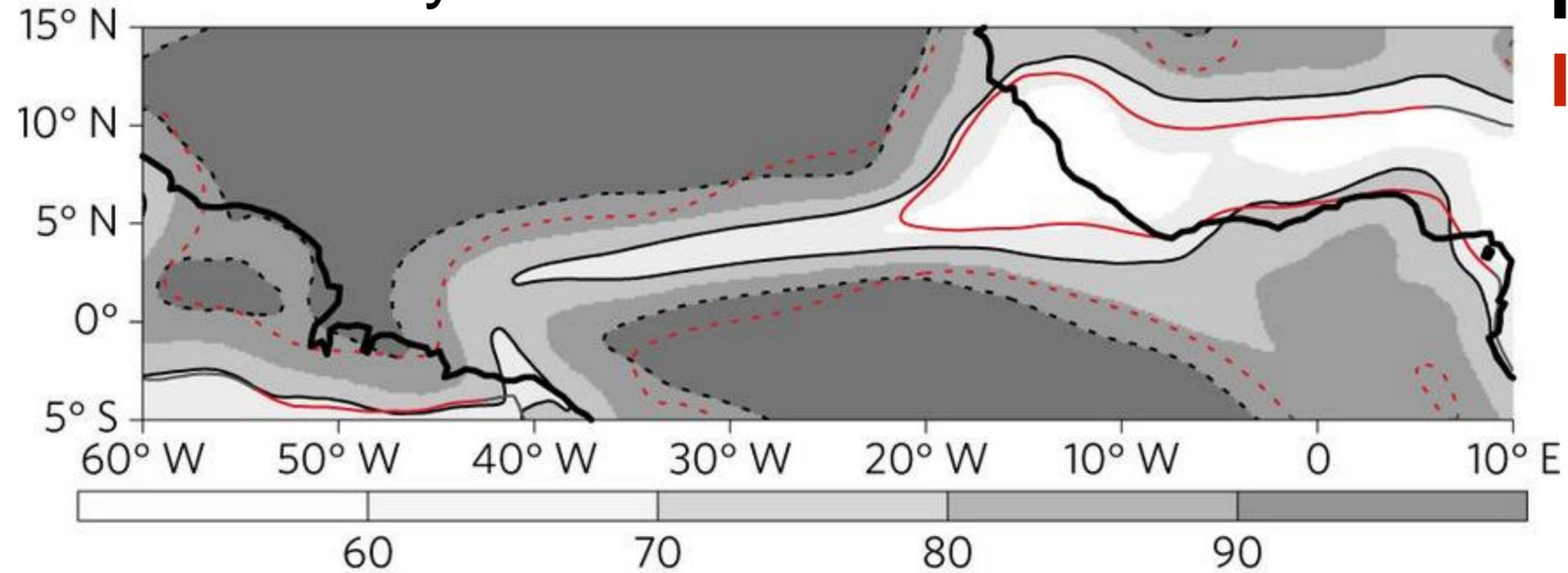
Coupling to the wind field

Coupling to the surface

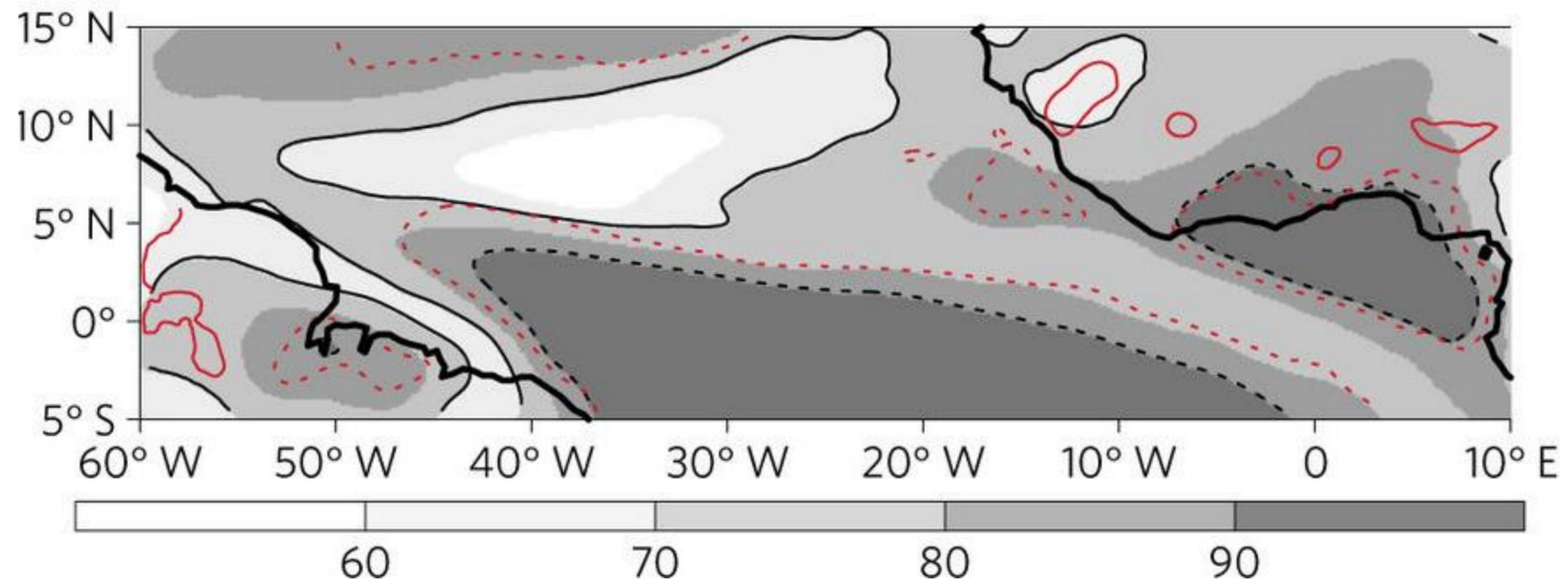
Variability of wind direction:

ICON 2.5 km
IFS operational

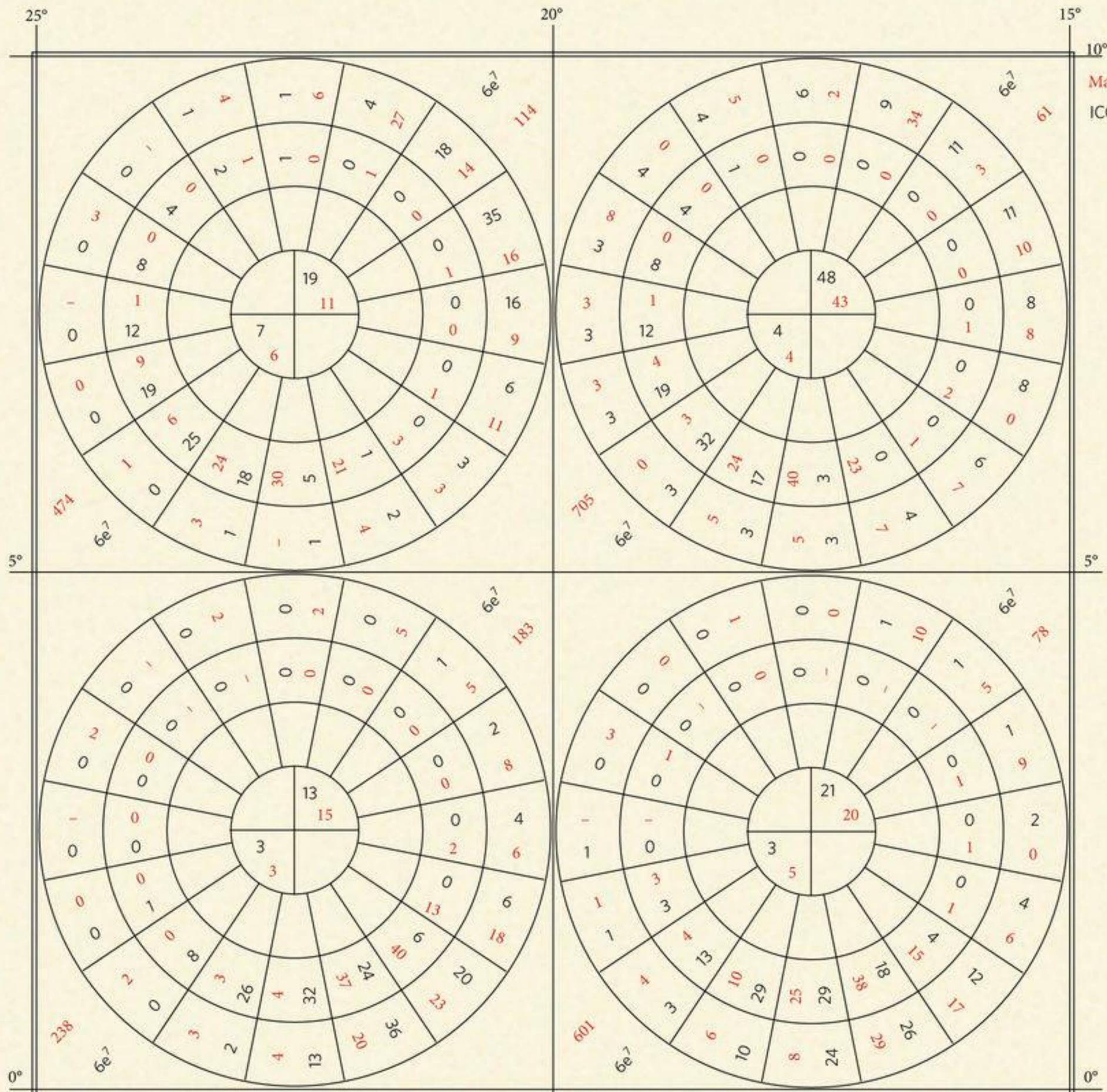
December



August



Percentage of time the wind is blowing in the mean wind direction (%)

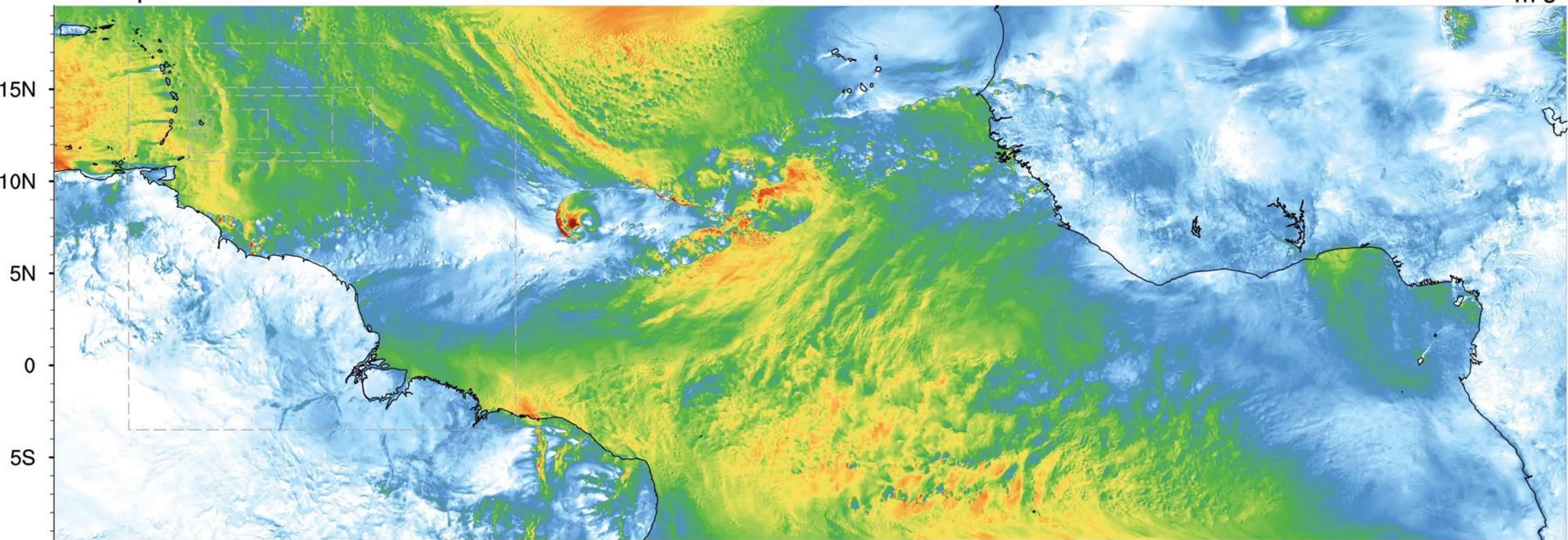


Maury 1854
 ICON 2.5 km

ICON NARVAL 20160816 +12.0h

Wind Speed 10 m

m s⁻¹

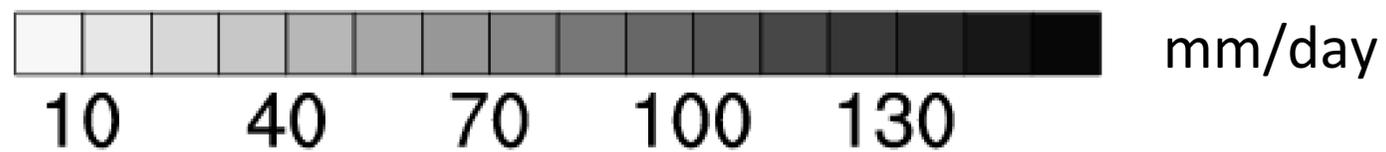
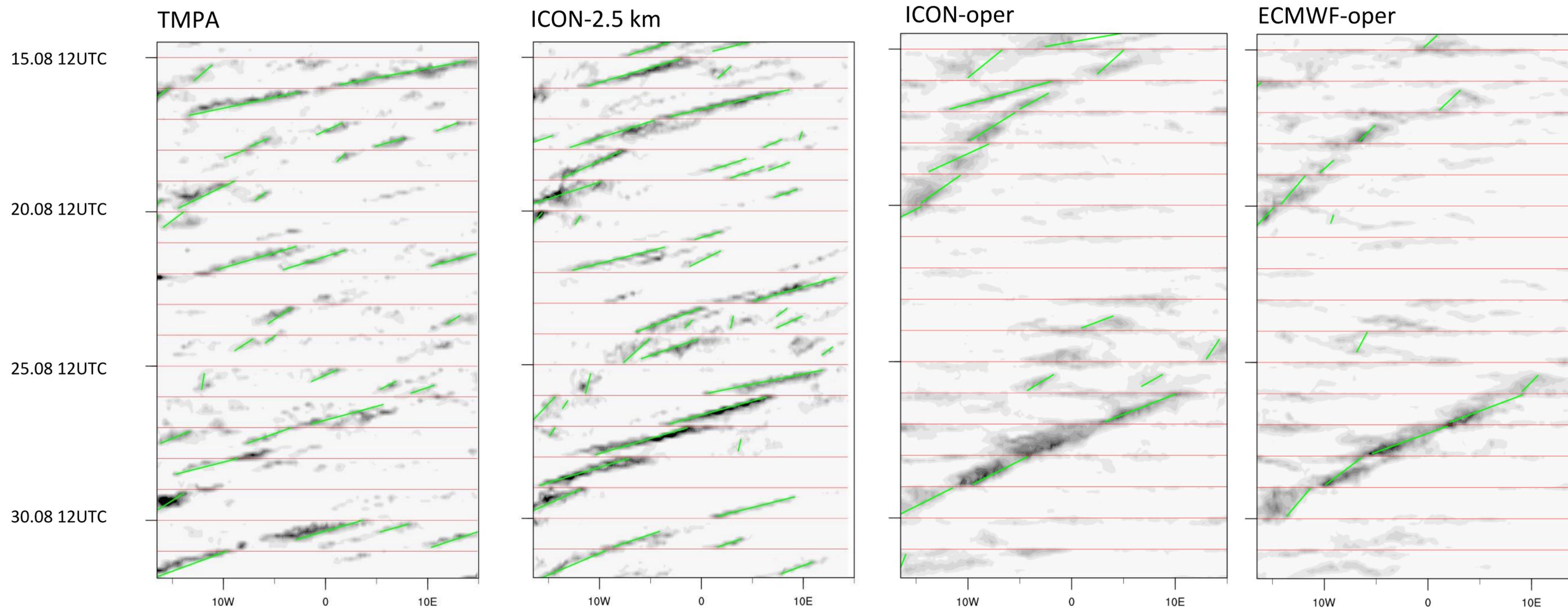


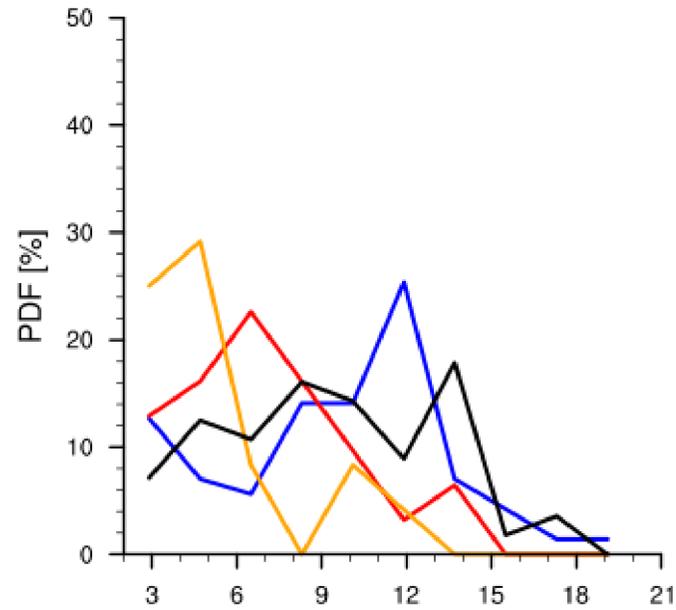
Daniel Klocke (DWD,HERZ) and Matthias Brueck (MPI-M)

1

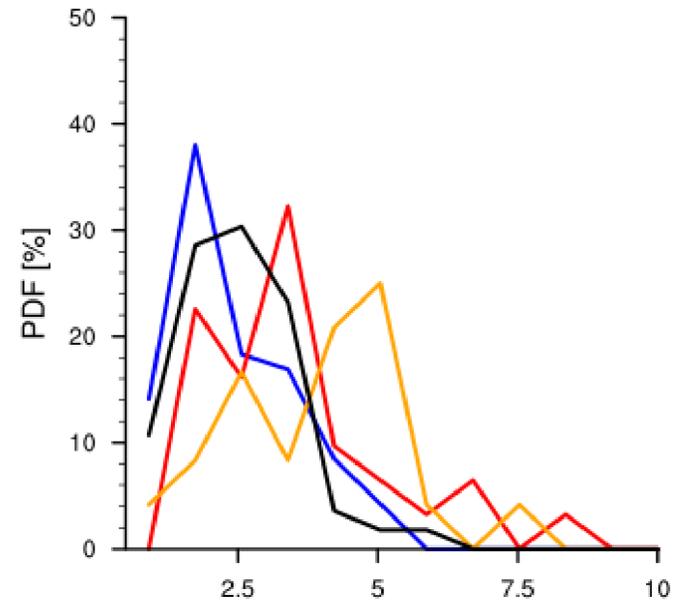
7.9

15

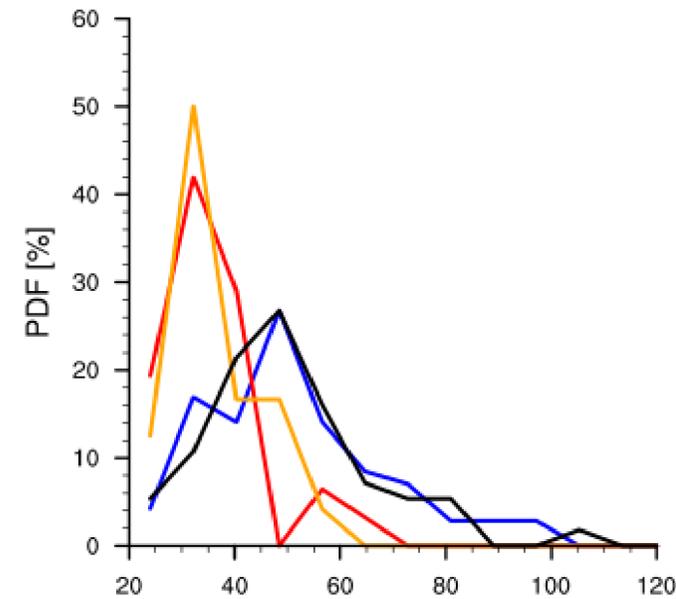




Propagation speed (m/s)



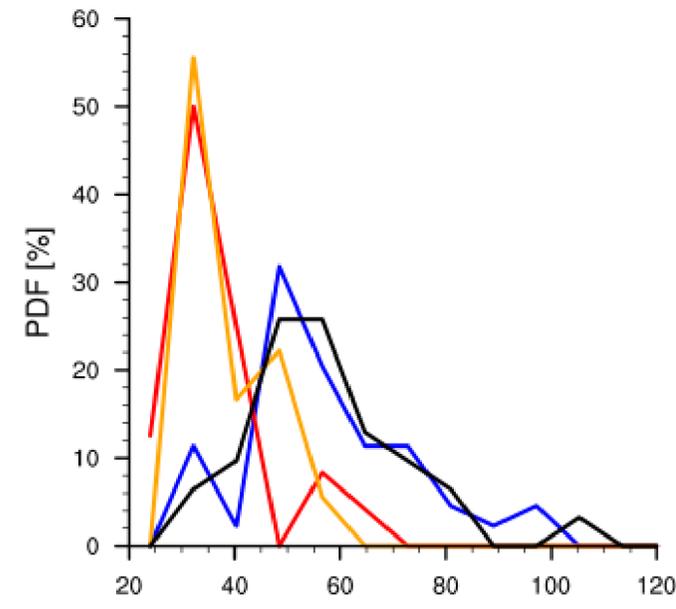
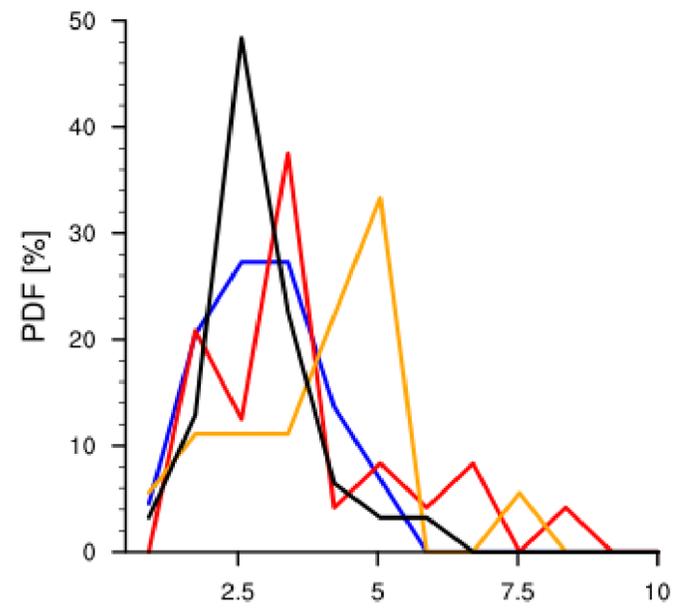
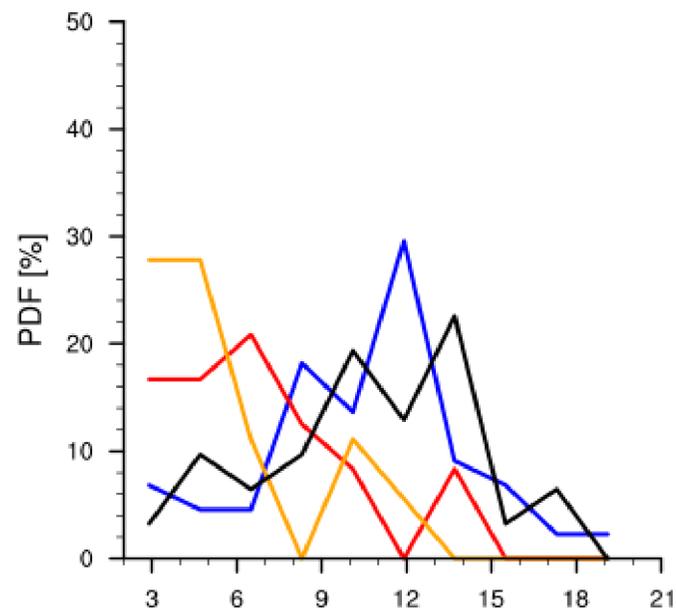
Extent in Lon-direction (°)



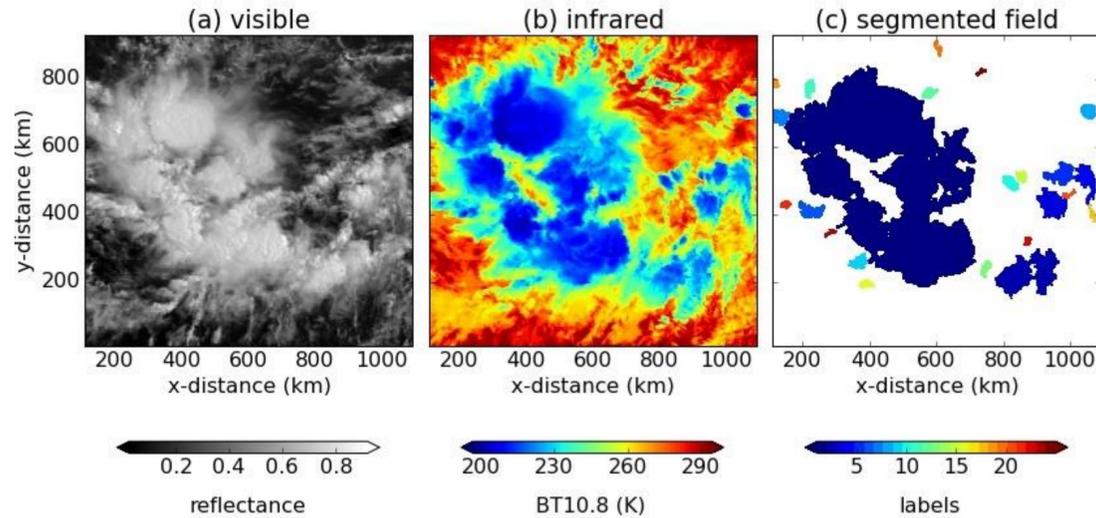
Mean precip. of feature (mm/d)

All features

TMPA
NARVAL
IFS
ICON



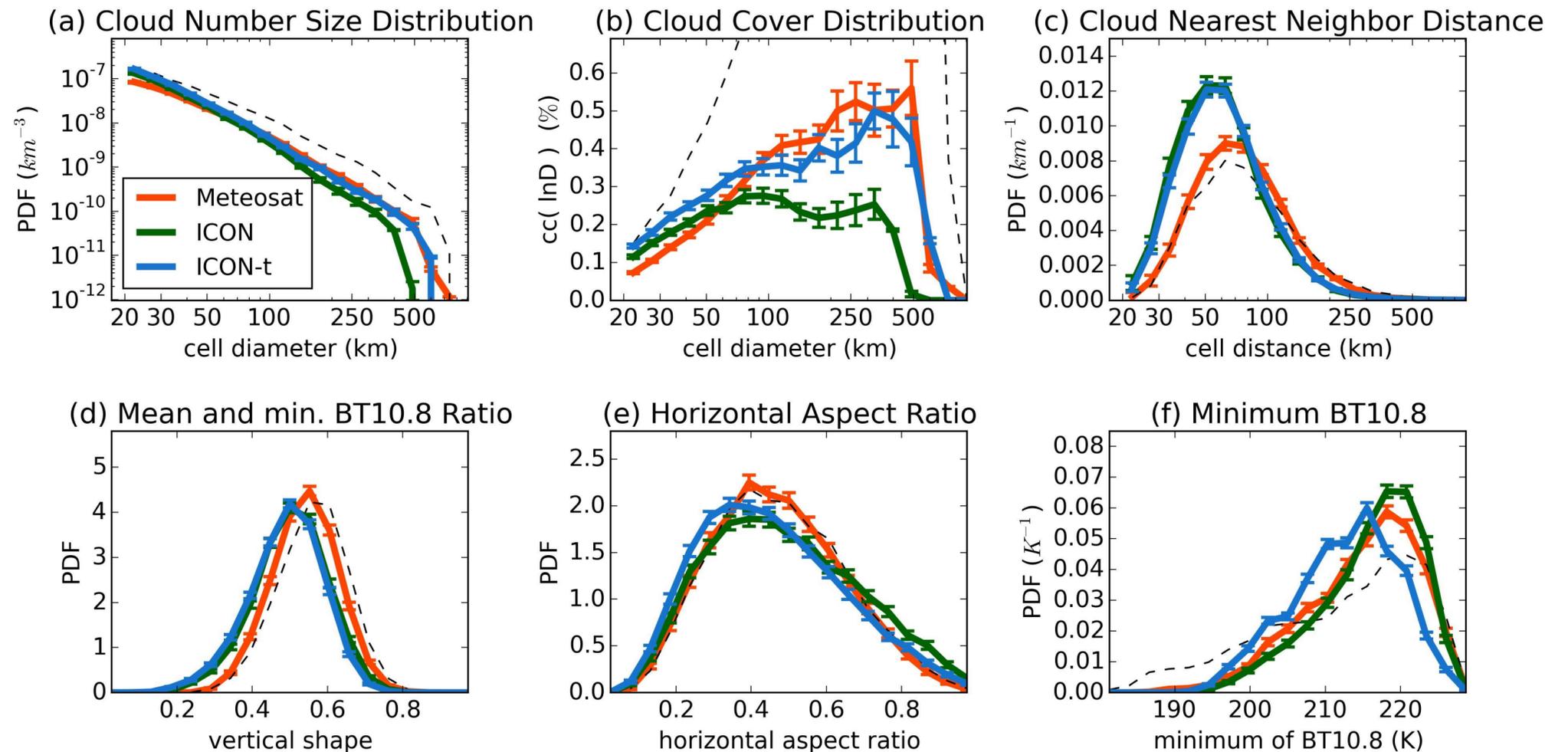
Features with $w > 12$ m/s



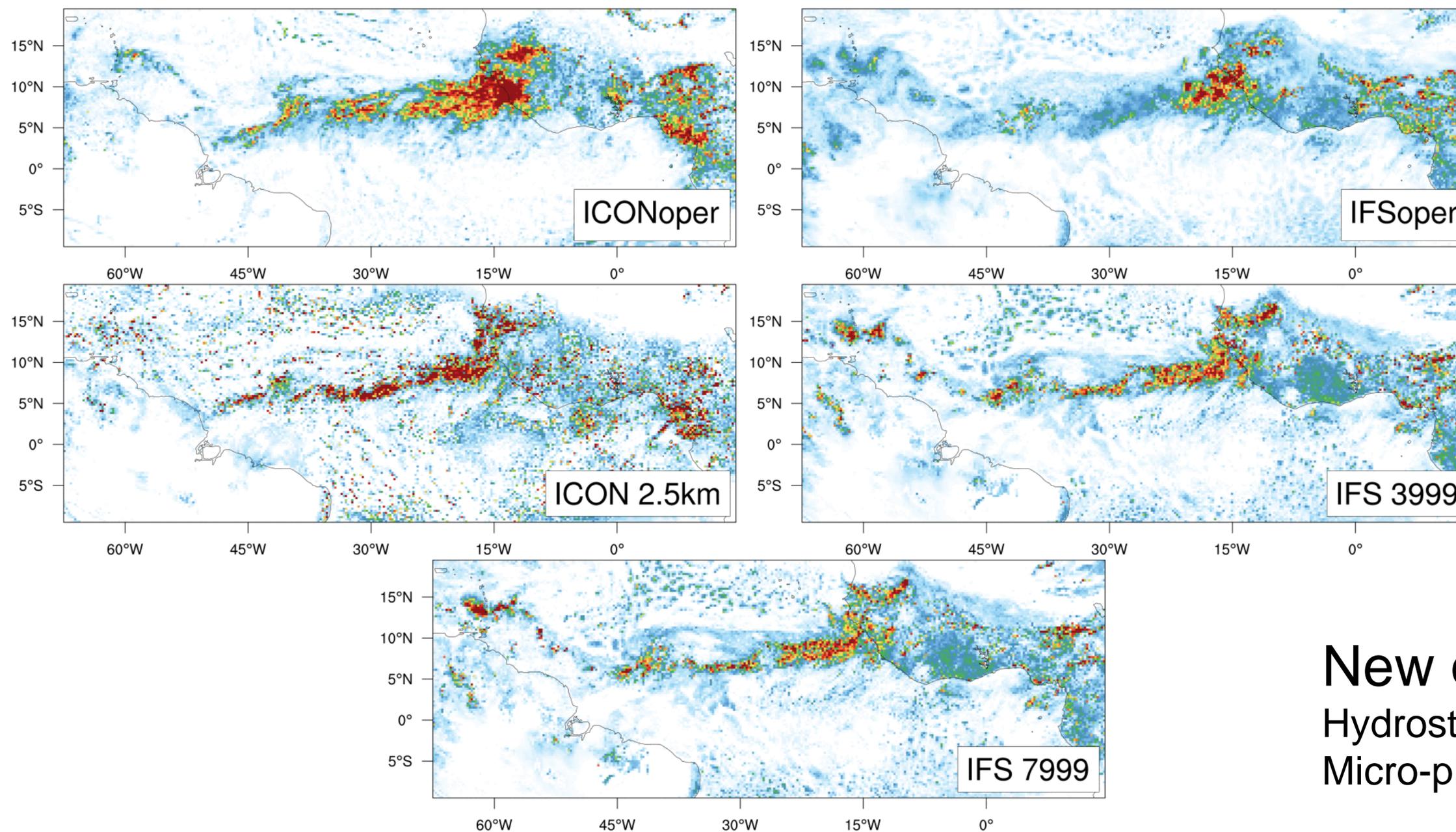
Too few of the very large clouds
(especially ocean)

Convective object evaluation (BT10.8 < 230 K) with synthetic brightness temperatures vs SEVIRI

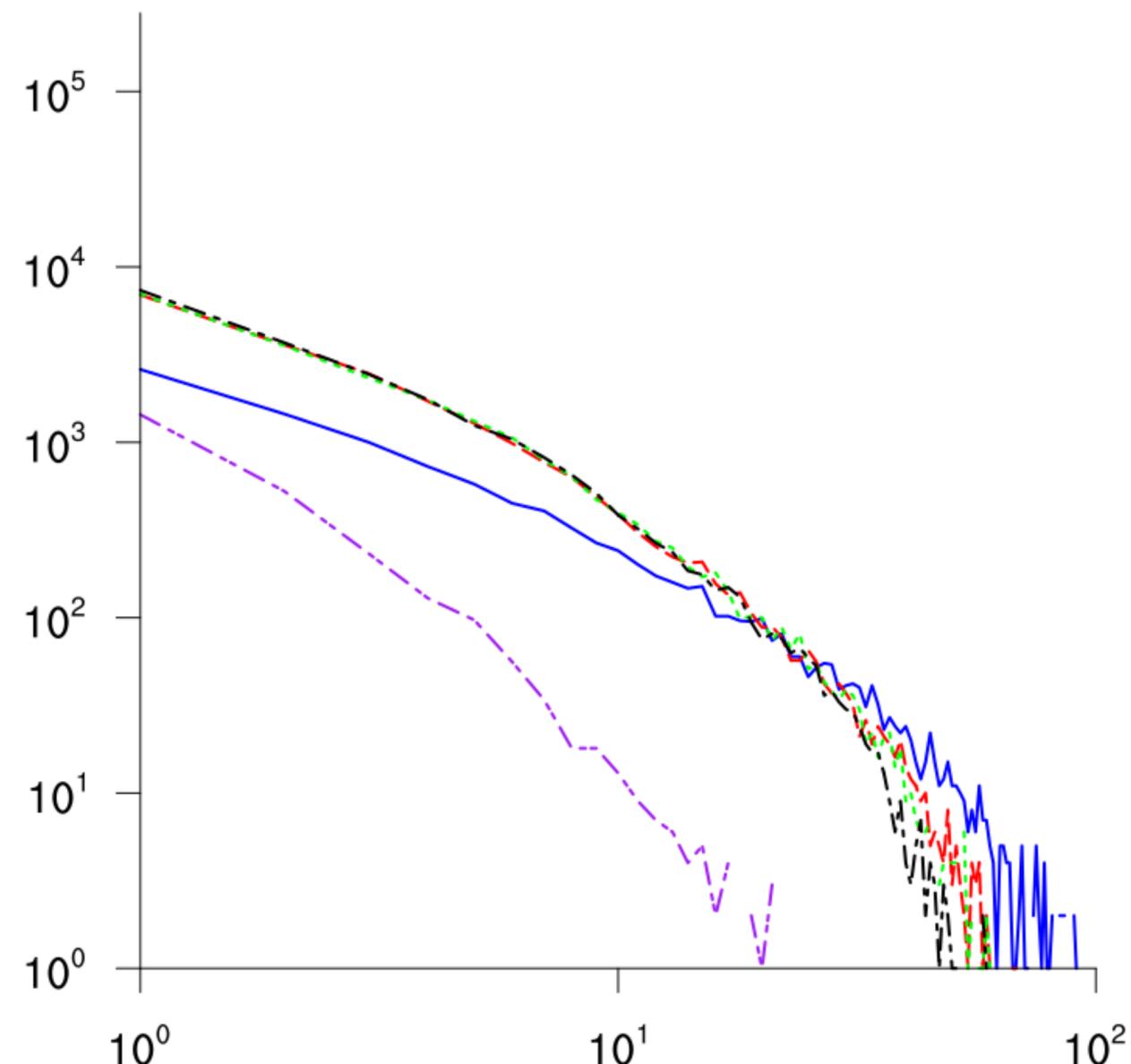
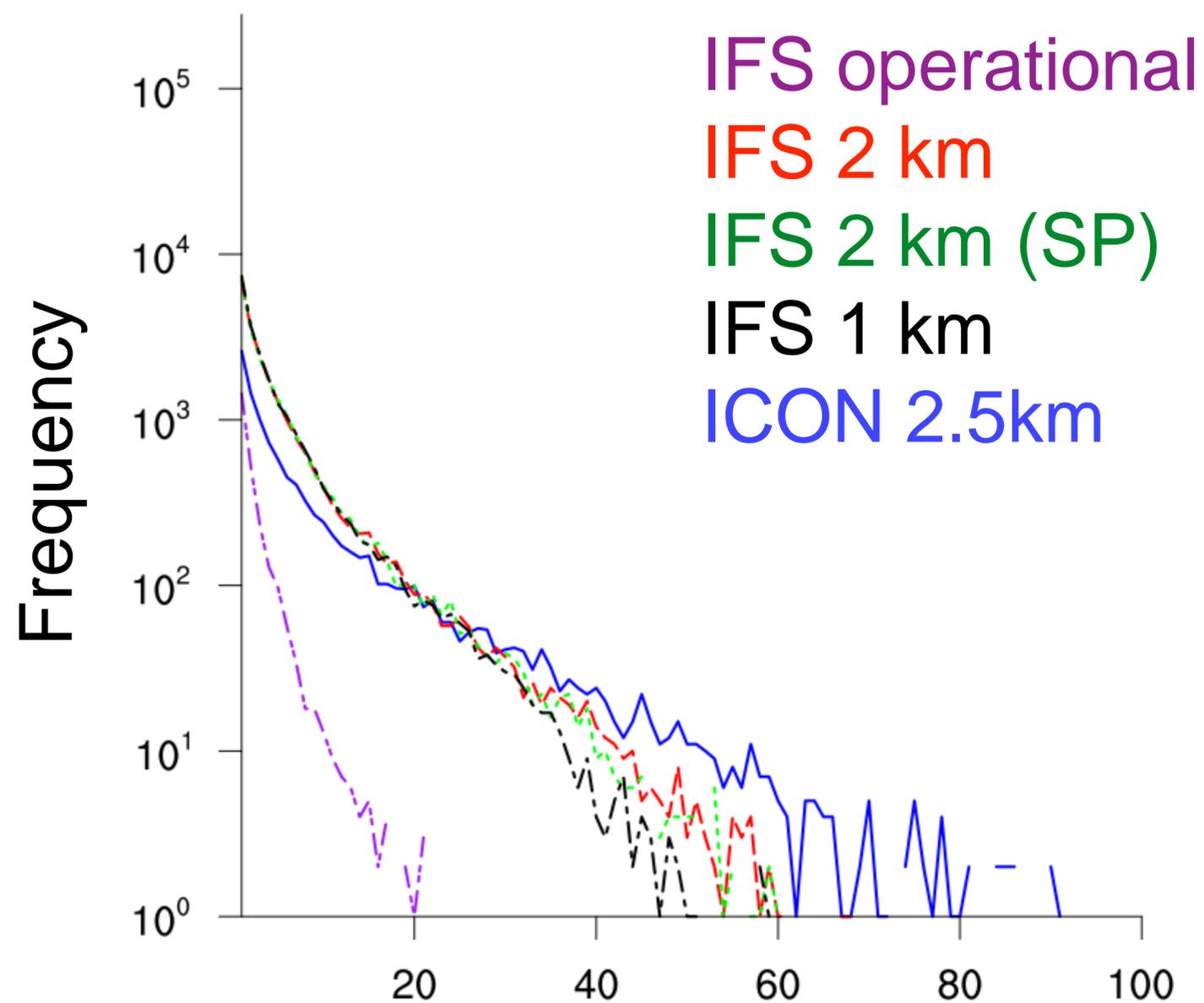
Tropical Atlantic @ 2016-08



TQI+TQC 2016081100 +13h



New questions:
Hydrostatic
Micro-physics



Precipitation mm/h

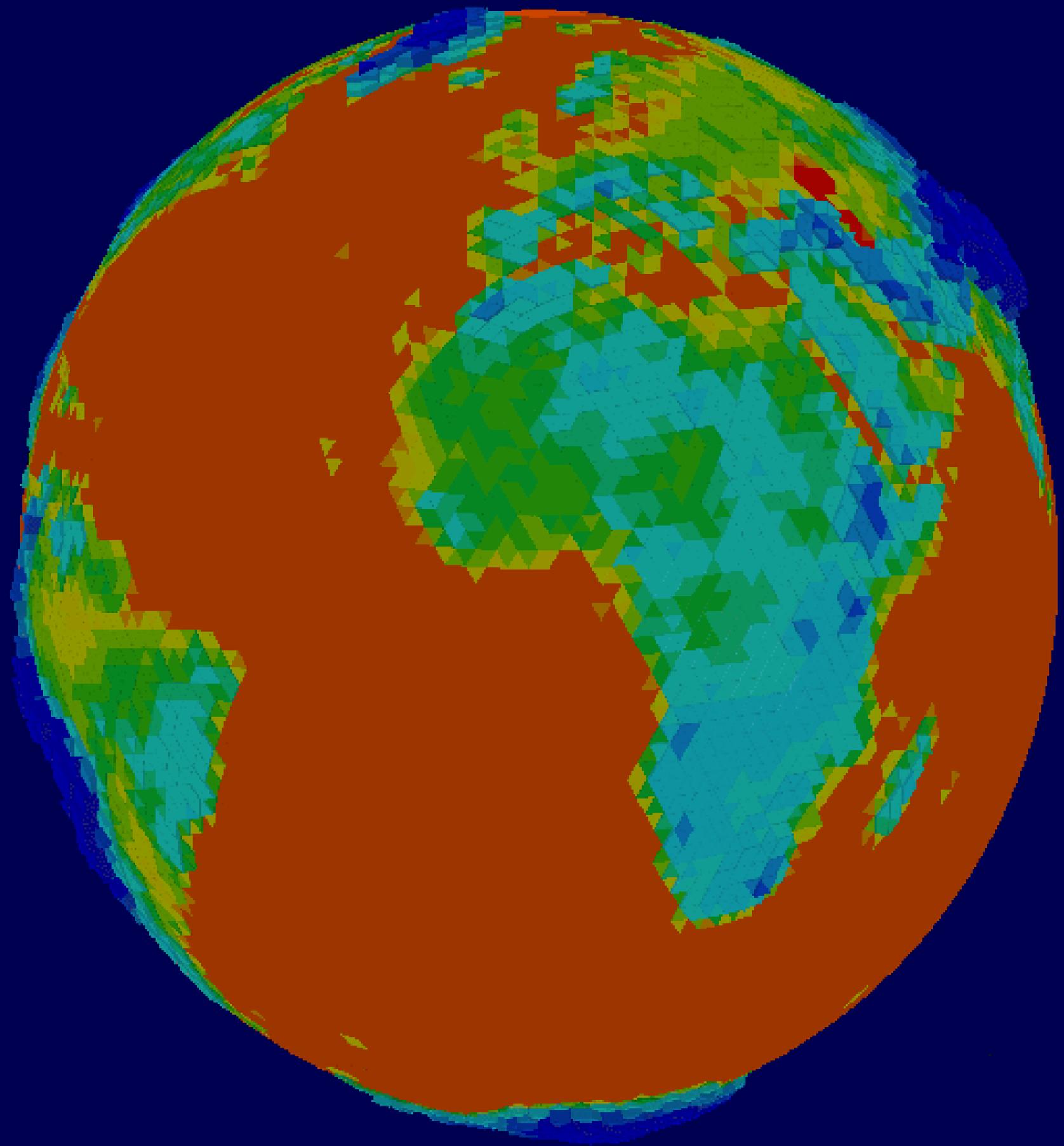
Conclusion:

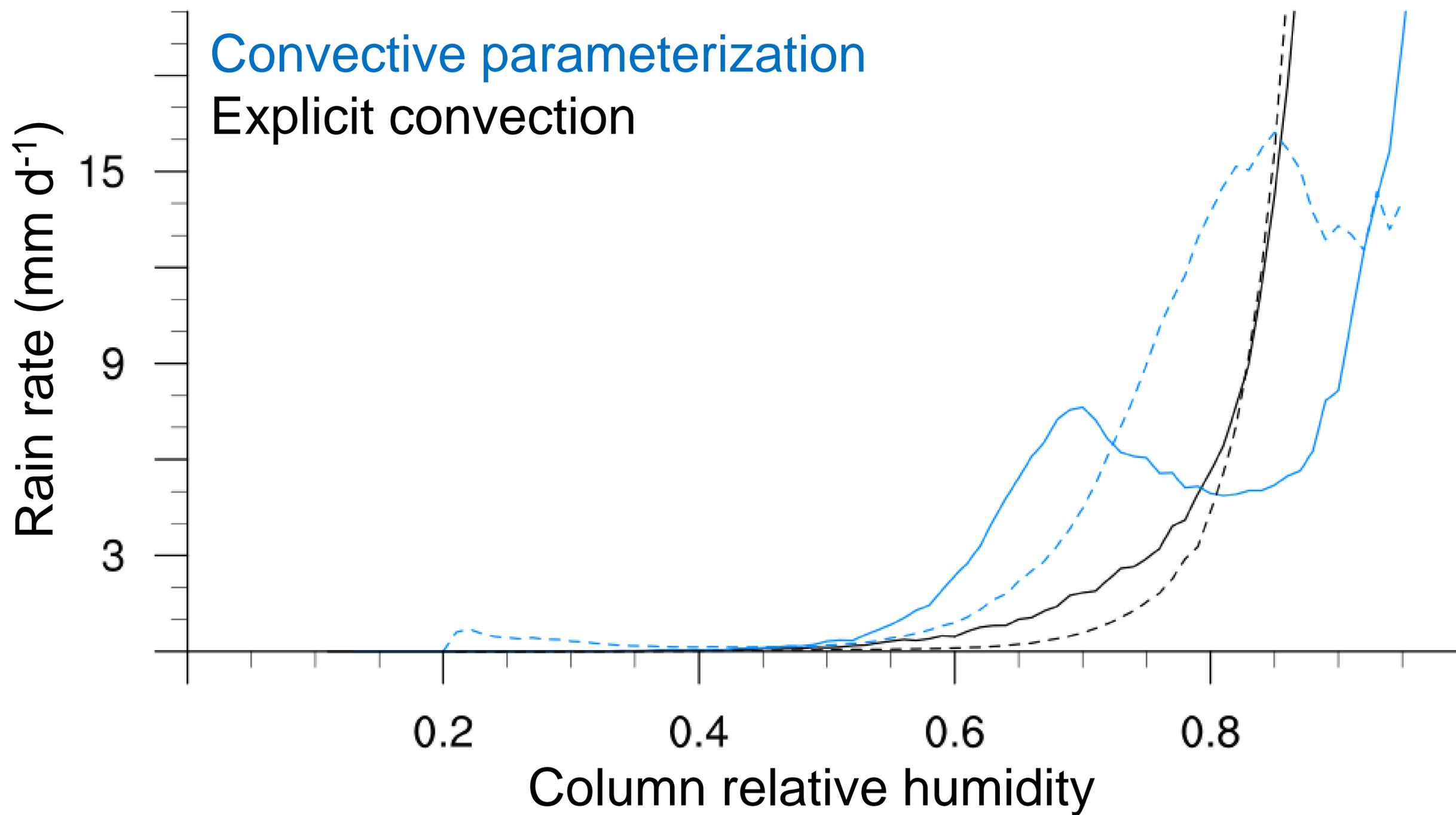
The ‚calms and tornados‘ are not separable and demand more of convection parameterisations than current approaches allow.

Large-scale circulation pattern suffer and lead to biases.

New challenges move forward. But maybe also become easier to solve (eg. micro-physics actually get up/down drafts to work on).

Outlook: We are not too far away from global cloud resolving NWP





Convective parameterization
Explicit convection

Dashed ocean
Solid land