Modeling activities at LaMP

Wolfram Wobrock

Focus on 2 and 7 Feb. 2014, HAIC-Darwin
(due to the differences in ice microphysics)

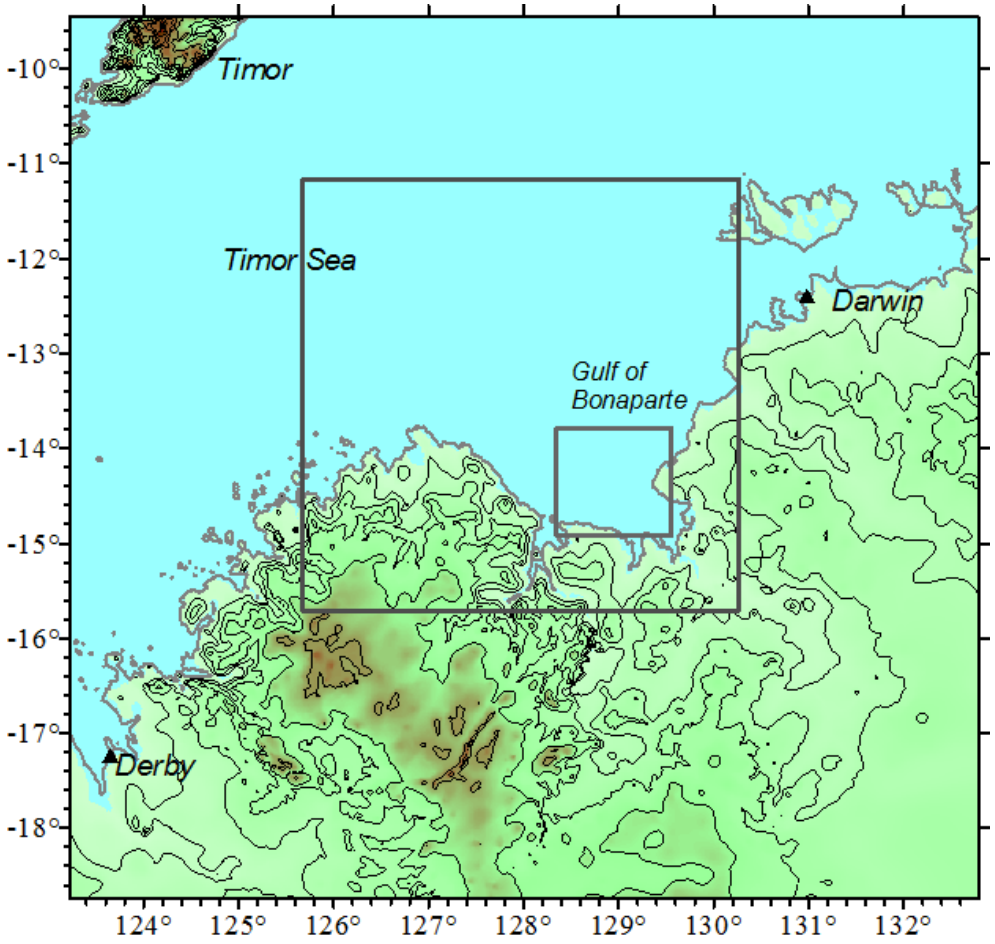
Model: 3D cloud model with bin description for aerosol particles, droplets and ice crystals *(DESCAM-3D)*

Setup: 3 domains: 8 – 2 – 0.5 km resolution in x and y, and 200 m in z.
domain dimensions: 1024^2 –512^2–128^2 km^2, vertical 21 km for the innermost!

Initialization: ERA interim ECMWF for both cases (2 + 7 Feb 2014):
t_0 = 18 h

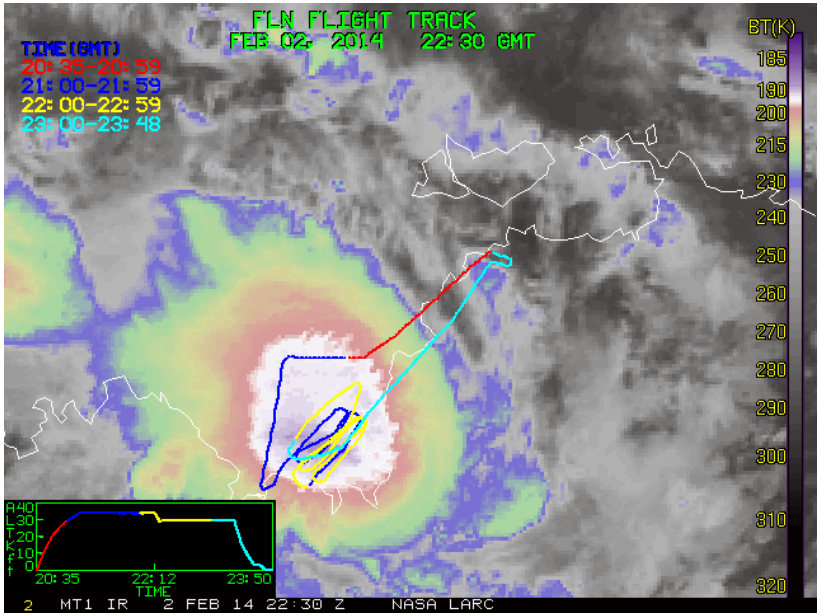
General problem for both cases: the storms develop 100 to 150 km east of the observational regions over the continent and moves only quite slowly
➔ displace the ECWMF data by 1° to the west

setup for 2 Feb. 2014, flight 12



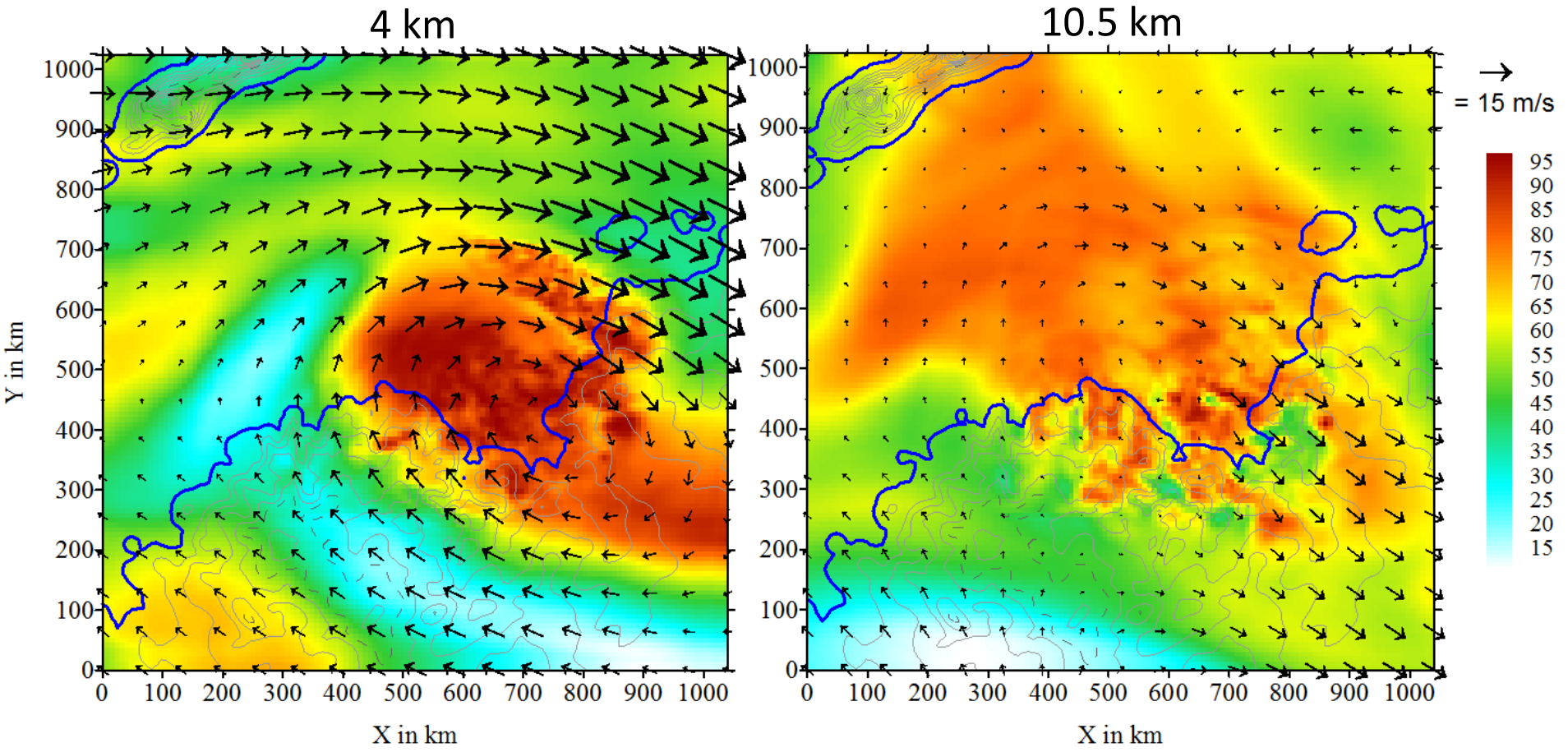
Model setup with 3 domains

Observation were made in the southern part of the Gulf of Bonaparte



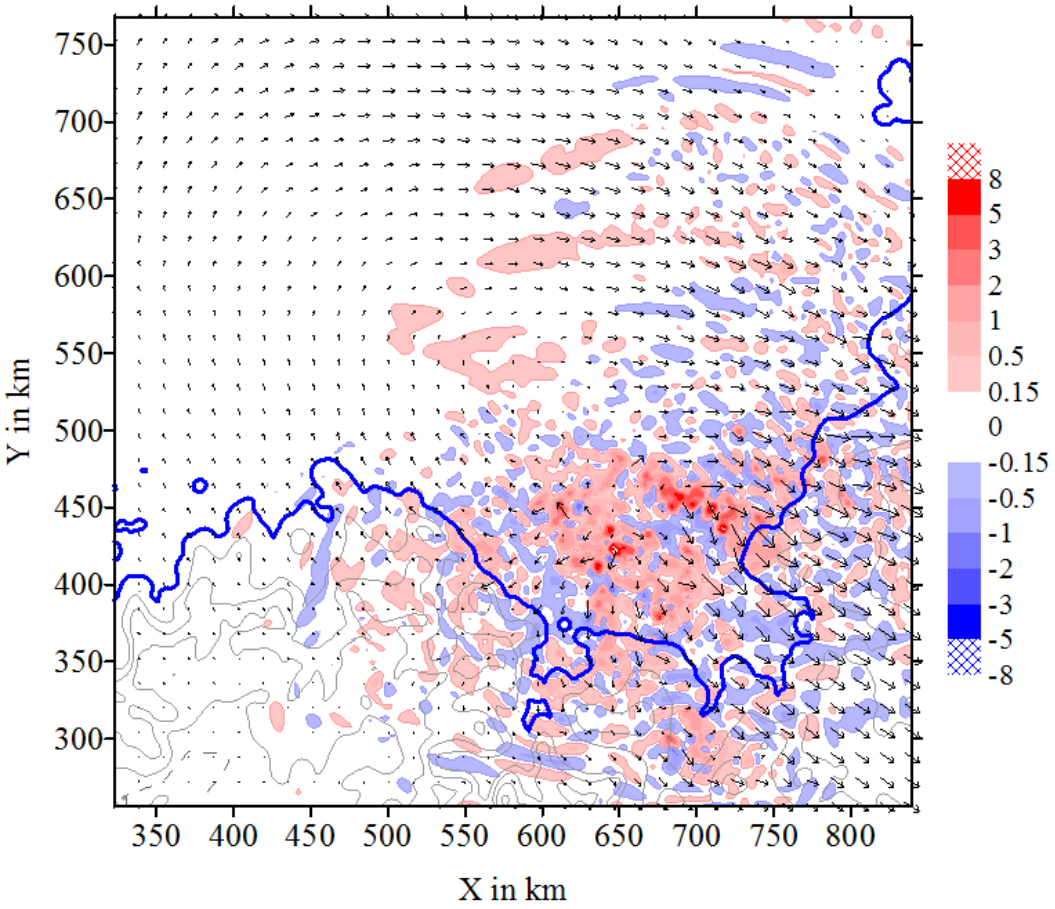
Wind and RH field

outmost domain at 20:30h: low winds in the upper level

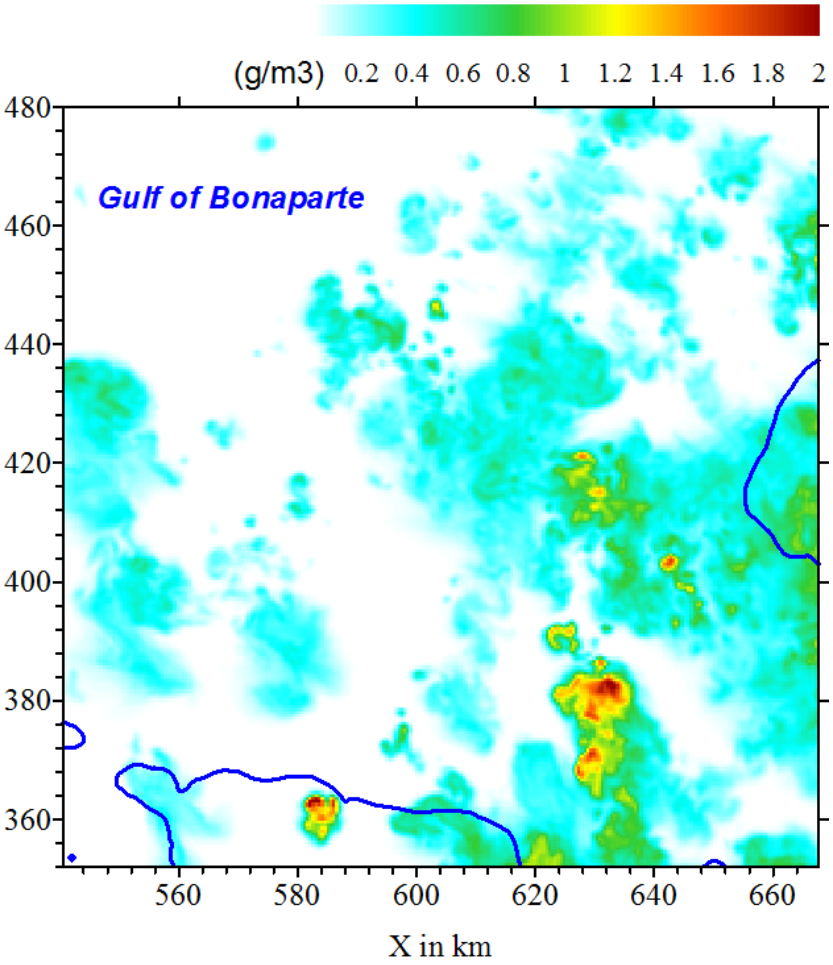


Vertical wind and IWC field

2nd domain:
vertical wind
in 11 km at 21.00



3rd domain with
IWC at 11 km



Comparing IWC from IKP with model results

Frequency distribution of IWC for flight 12

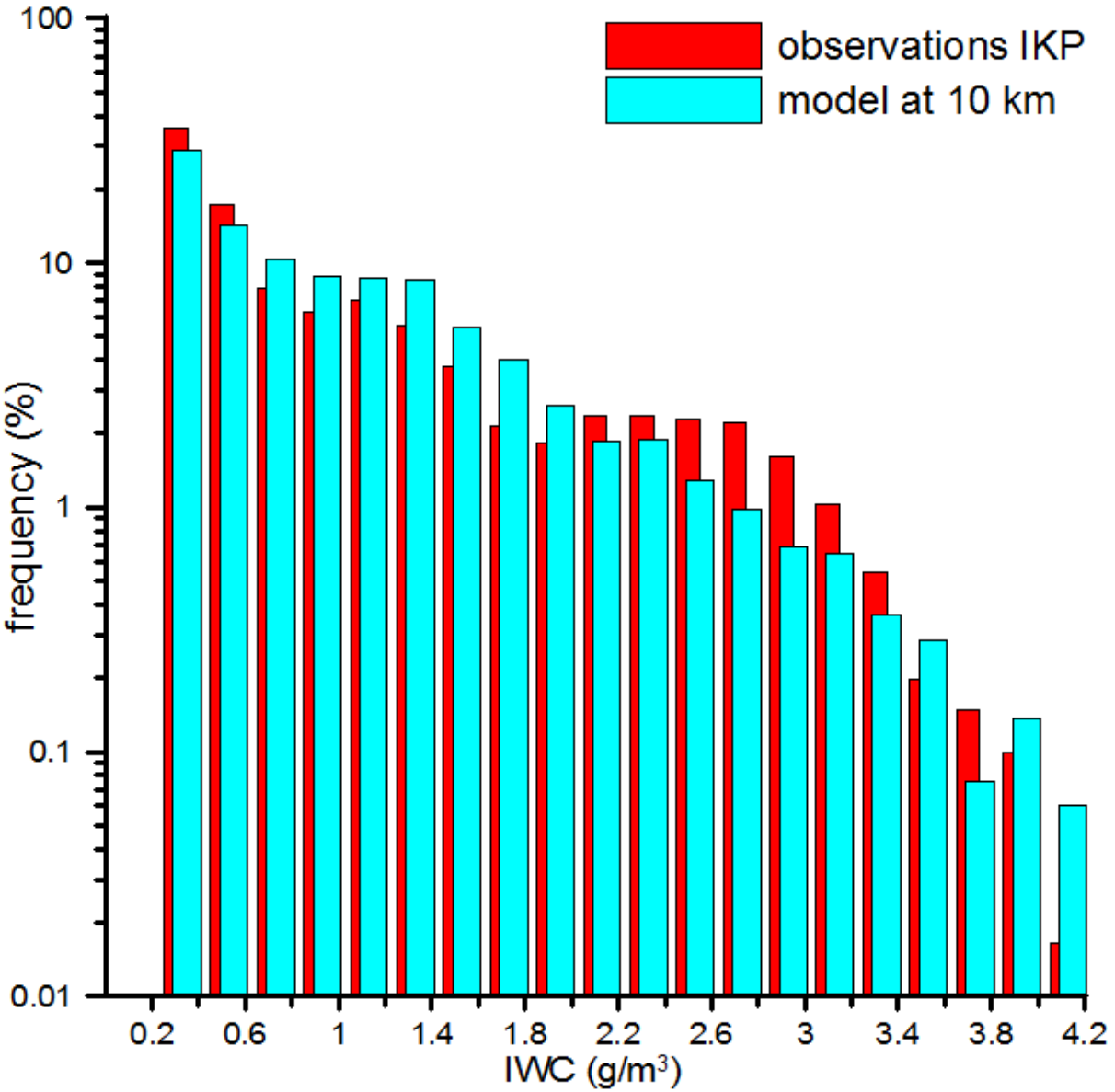
bin size: ΔIWC = 0.2 g/m^3

Data ensemble reduced to 6100 1sec-values - as IWC data < 0.2 g/m^3 were excluded

Good agreement with the modeled IWC

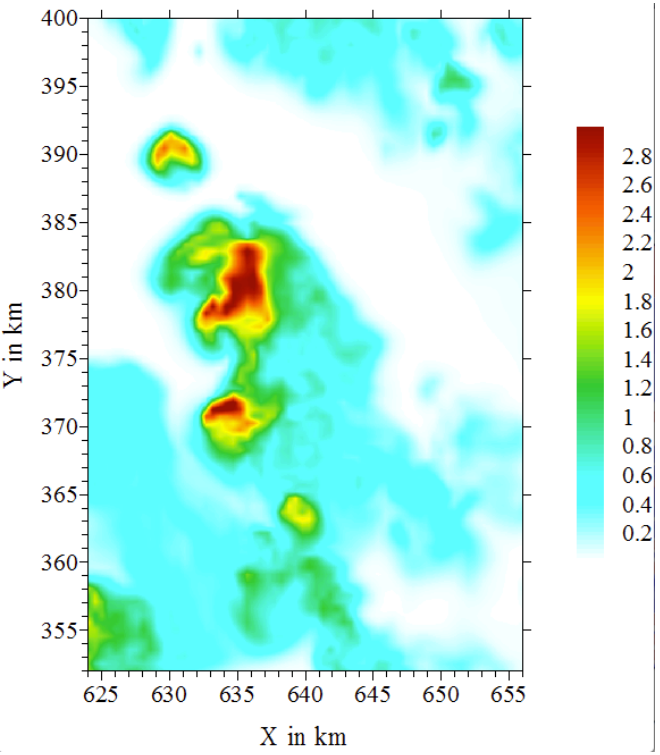
model results were taken from a 12 x 30 km^2 large region collected over 30 min model integration leading to 10000 samples

(see next picture)

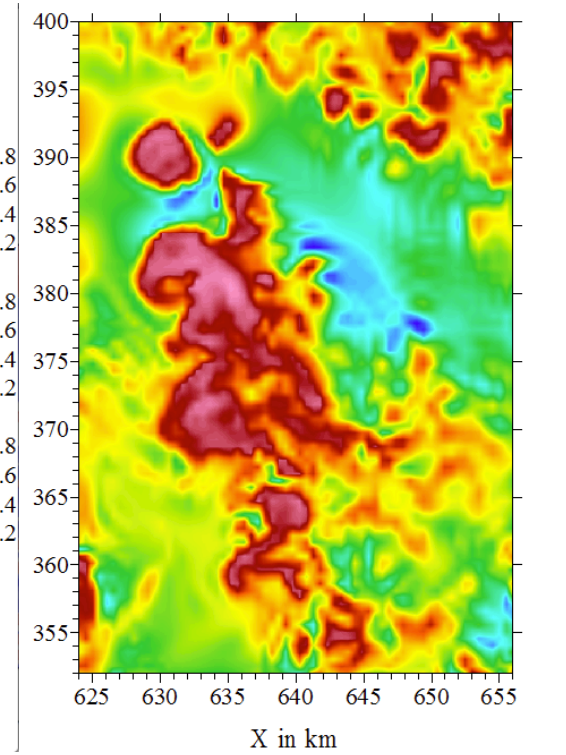


IWC, RH and w during a strong convective period
In the southern Gulf of Bonaparte

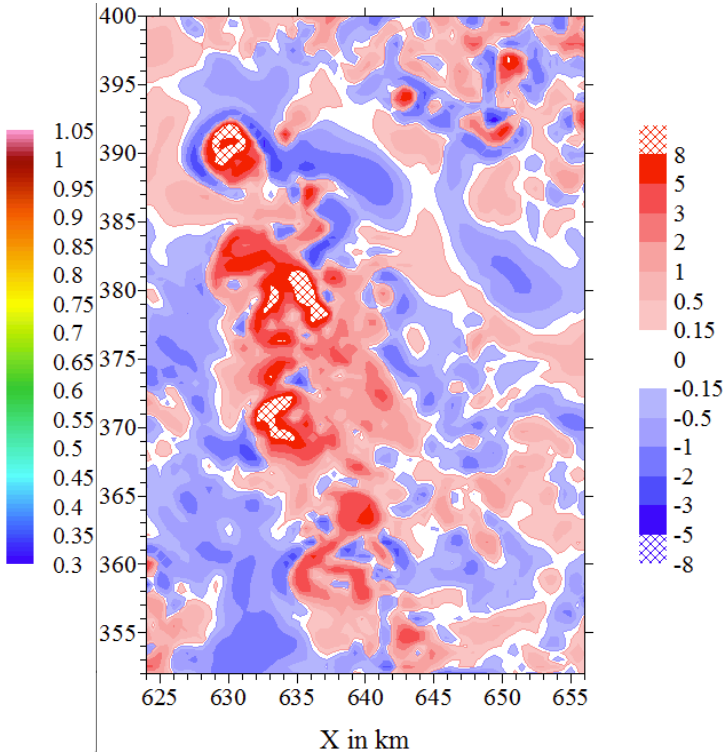
IWC at 10 km



RH at 10 km

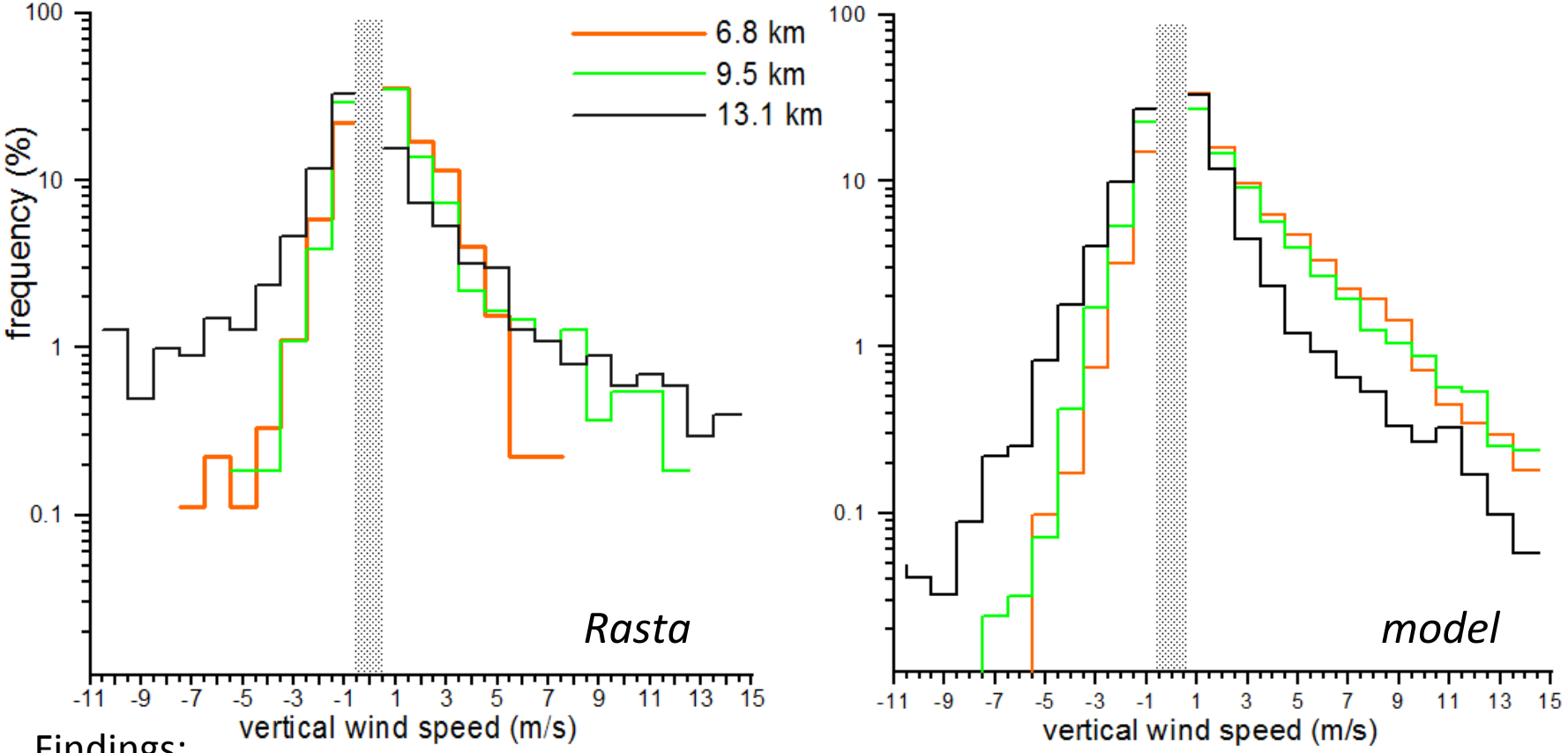


w at 10 km



Comparing vertical wind *w* retrieved from Rasta with model results (Δx=500 m) for different altitudes

Frequency distribution of *w*: *w*-bins = 1m/s, (-0.5 to +0.5 m/s range excluded)



Findings:

I) below 10 km <u>updrafts</u> are dominant in the frequency distribution **II)** strong <u>downdrafts</u> only occur above 11 km and their frequency distribution becomes symmetric !

<u>Model results confirm</u> both findings; strong downdrafts, however, are underestimated.

Vertical winds larger than 6 m/s could not be detected by Rasta below 7km (≠ model !)

Ongoing work …

Continuing the ***model- Rasta*** comparison:

- statistical analysis of vertical wind observations also for flight 16 over all layers from 7 to 15 km
- using the modeled ice crystal spectra to compare with the Rasta reflectivity
- analysis of the individual air parcels arriving in the 10 and 11 km flight level to understand the frequent occurrence of pristine ice crystals (as capped columns

40 minutes back-trajectories of the model results for flight 12

All trajectories start at 10.1 km altitude