

FLEXPART forward ~~and backward~~
trajectories during IOP1 ~~and IOP2~~ based
on 700m resolution winds from WRF
simulations

*Presented by Henrique Barbosa,
Universidade de São Paulo,
on behalf of many partners of GoAmazon2014/15*



*GoAmazon2014/15 Workshop
Harvard, May 20th*

WRF and Flexpart

Goal:

- Use winds from a high resolution WRF simulation to force FLEXWRF Lagrangian Trajectory Model

Deliveries:

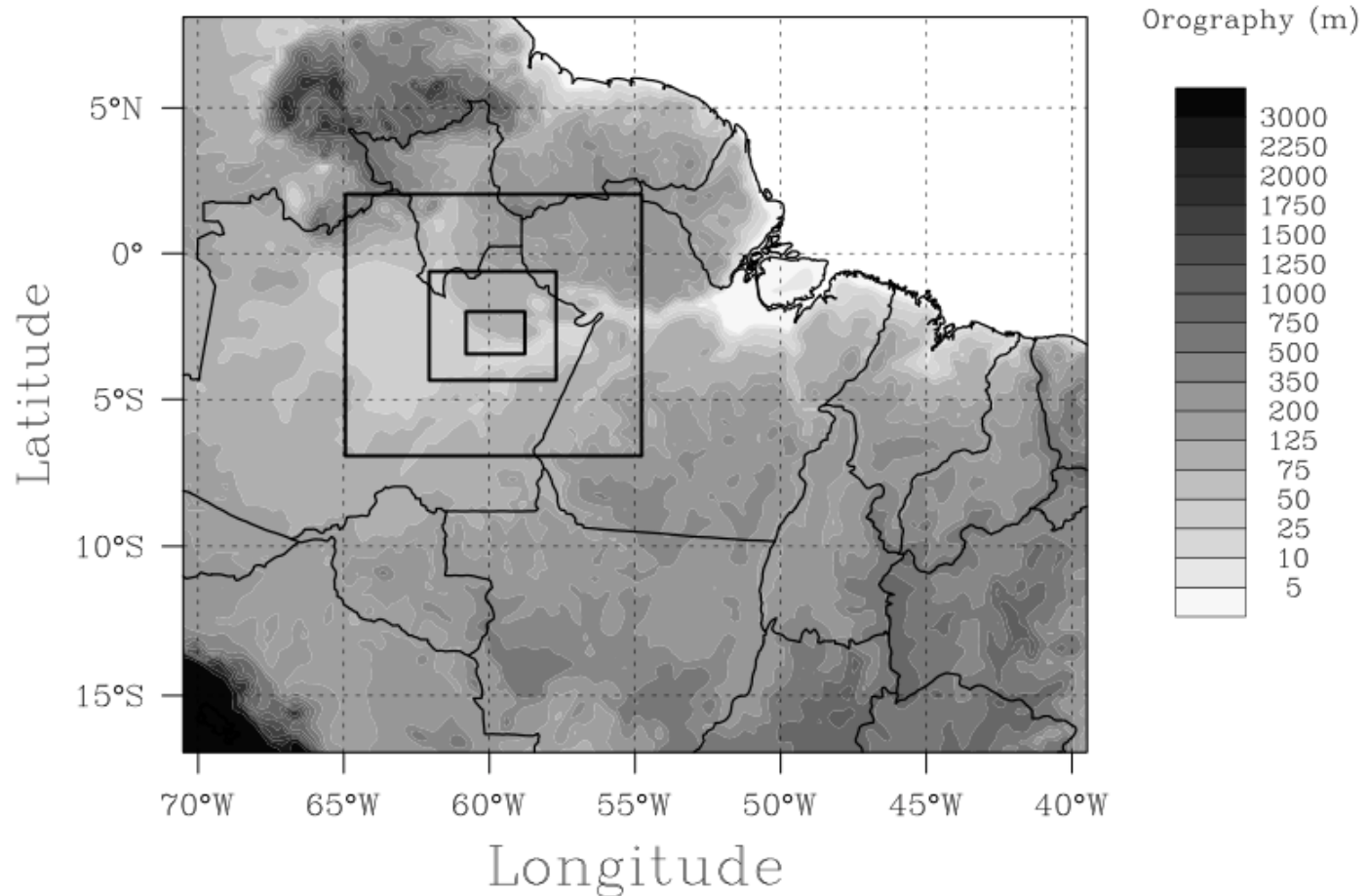
- Backward and forward trajectories (clusters);
- Times' plume is forecasted over each site;

WRF 3.6.1

- Period: 27jan2014 to 1apr2014
- Initial & Boundary cond.
 - Climate Forecast System Reanalysis – CFSR / NCAR
 - 0.5 x 0.5 deg, every 6h
- 4 Grids (700m, 2.1km, 6.3km, 18.9km)
- Parameterizations:
 - Microphysics: Thompson
 - Radiation: RRTMG
 - PBL: Mellor-Yamada-Janjic
 - Land-Surface: unified Noah
 - Cumulus: Kain-Fritsch (not for 700m)
- Output every 30min

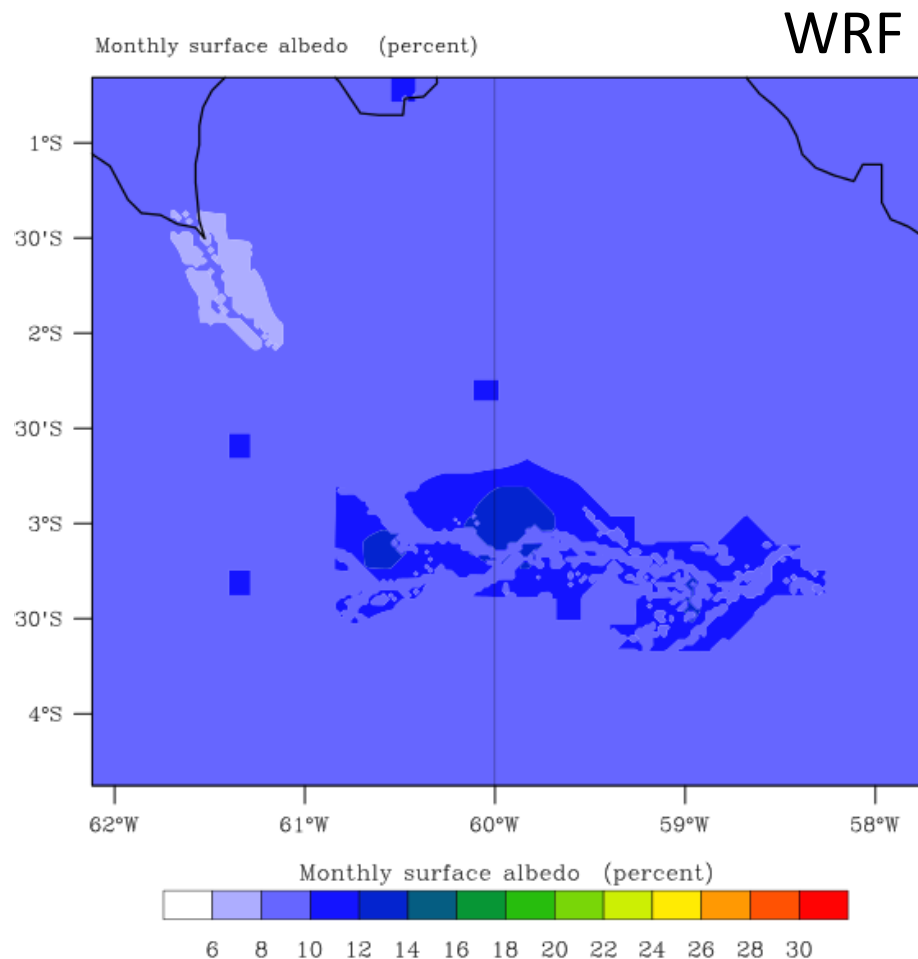
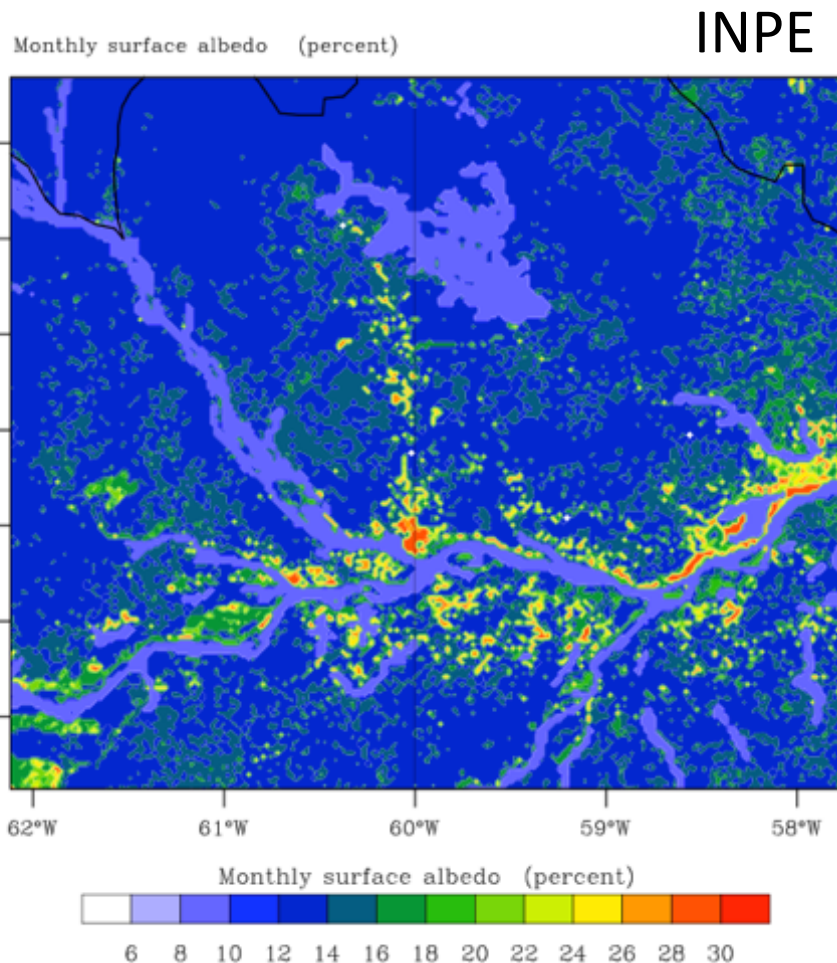
Grids

- Grid1
18.9 km
- Grid2
6.3 km
- Grid3
2.1 km
- Grid4
700m



ALBEDO

- Vegetation: PROVEG-INPE (Thanks to M. Bela)



Greenness fraction

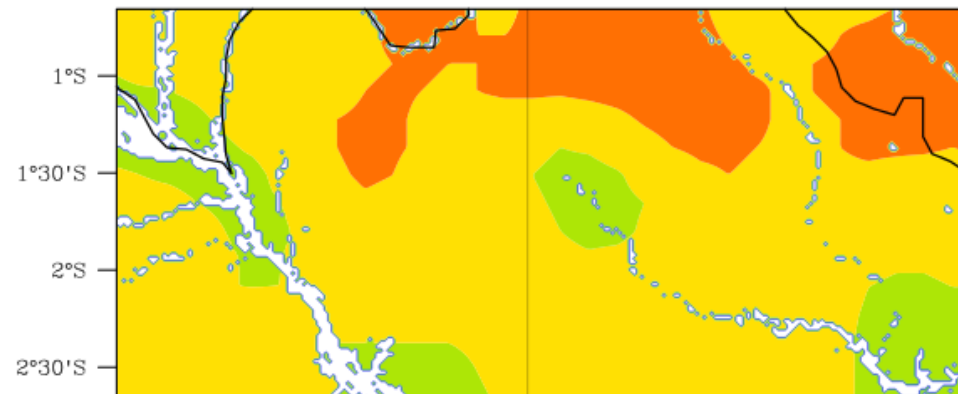
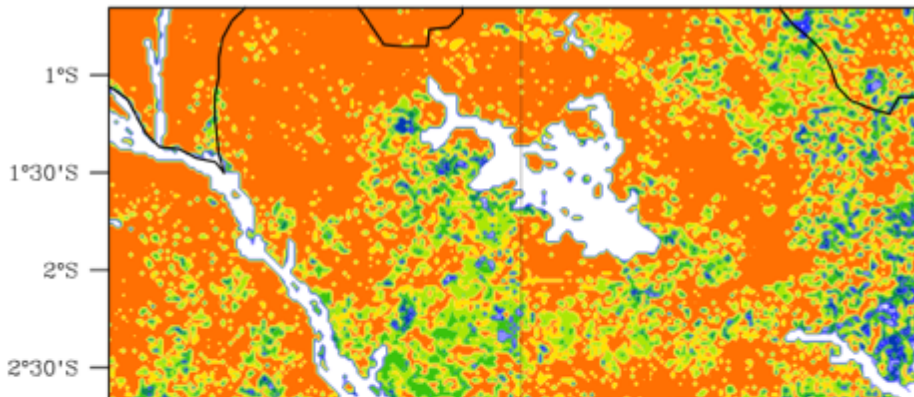
- Vegetation: PROVEG-INPE (Thanks to M. Bela)

Monthly green fraction (fraction)

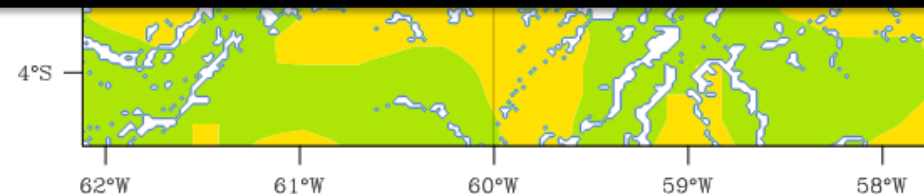
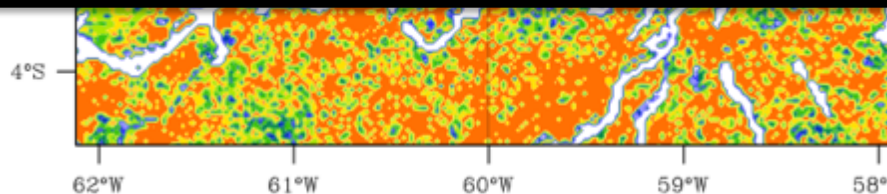
INPE

Monthly green fraction (fraction)

WRF



So how well did the model do?



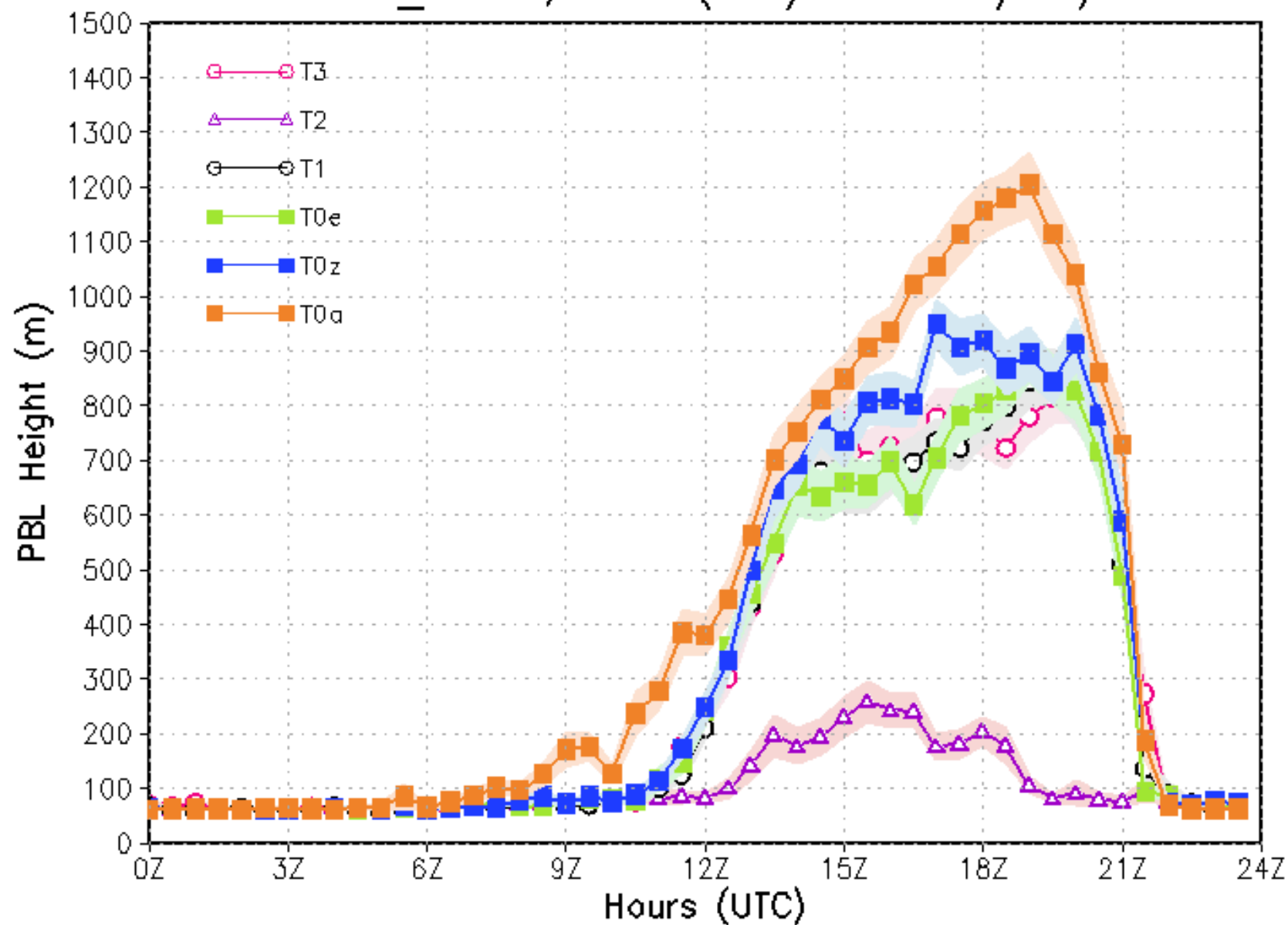
Monthly green fraction (fraction)



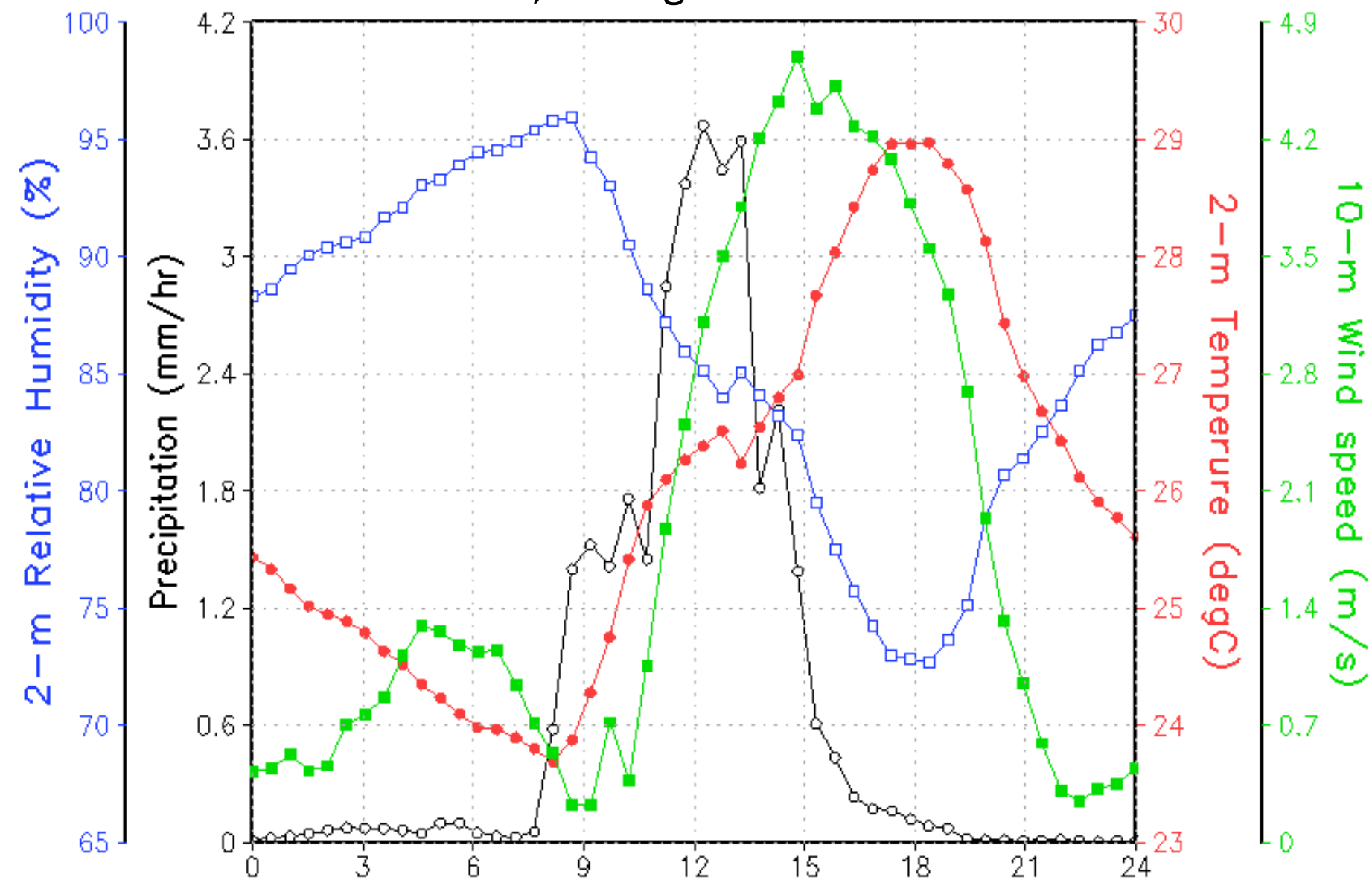
Monthly green fraction (fraction)



WRF_700m, IOP1 (Feb/1 - Mar/31)



IOP1, average over T3 site



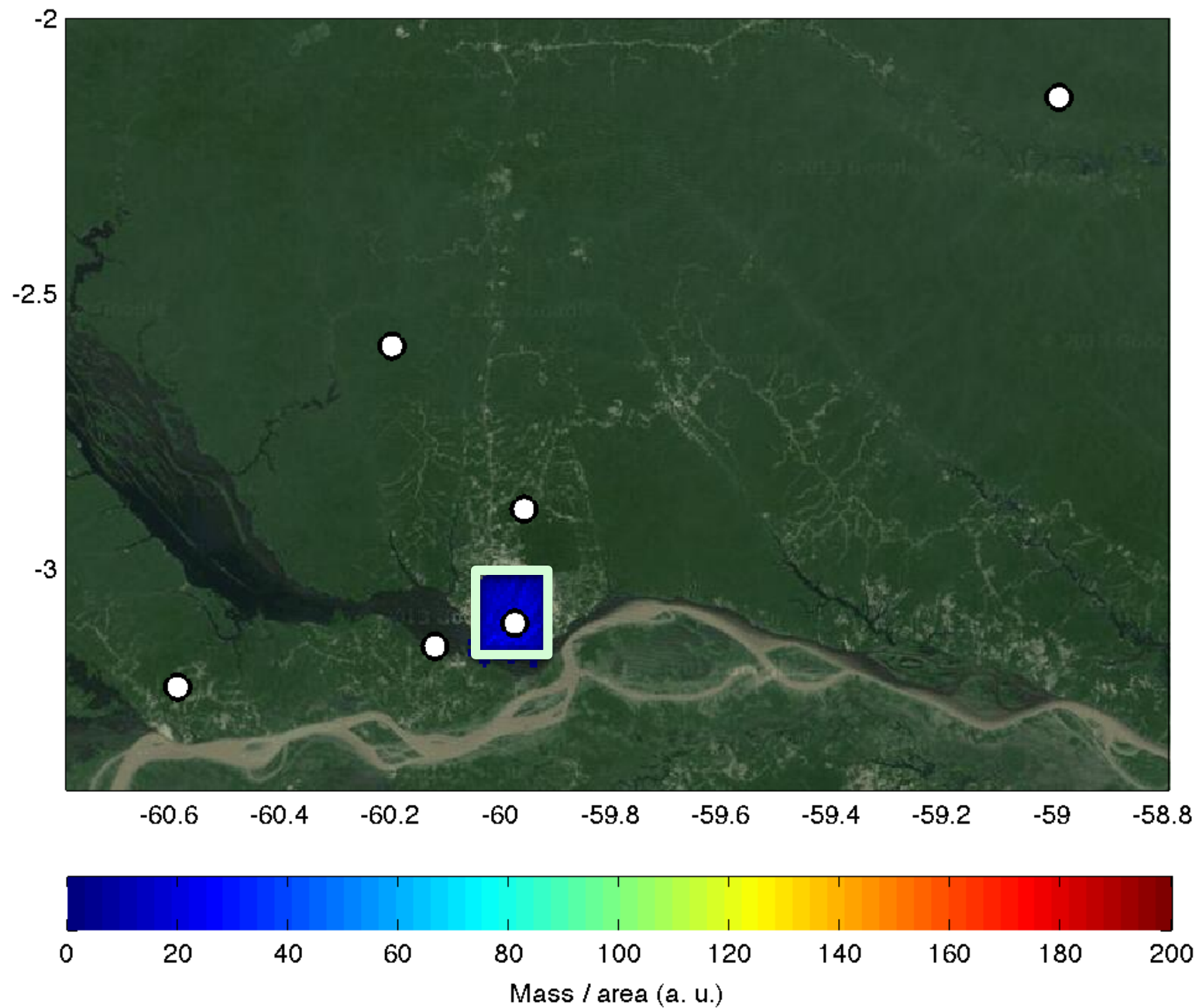
1) How to validate against measurements?

Flexwrf 3.2 (based on PILT/flexpart 6.2)

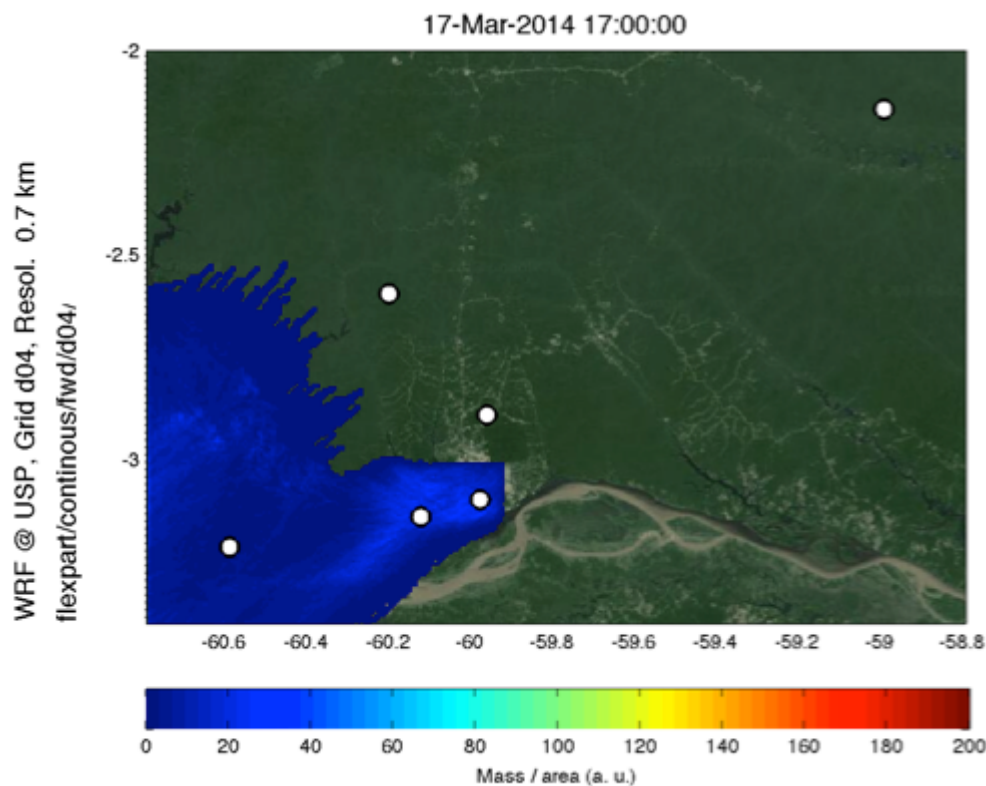
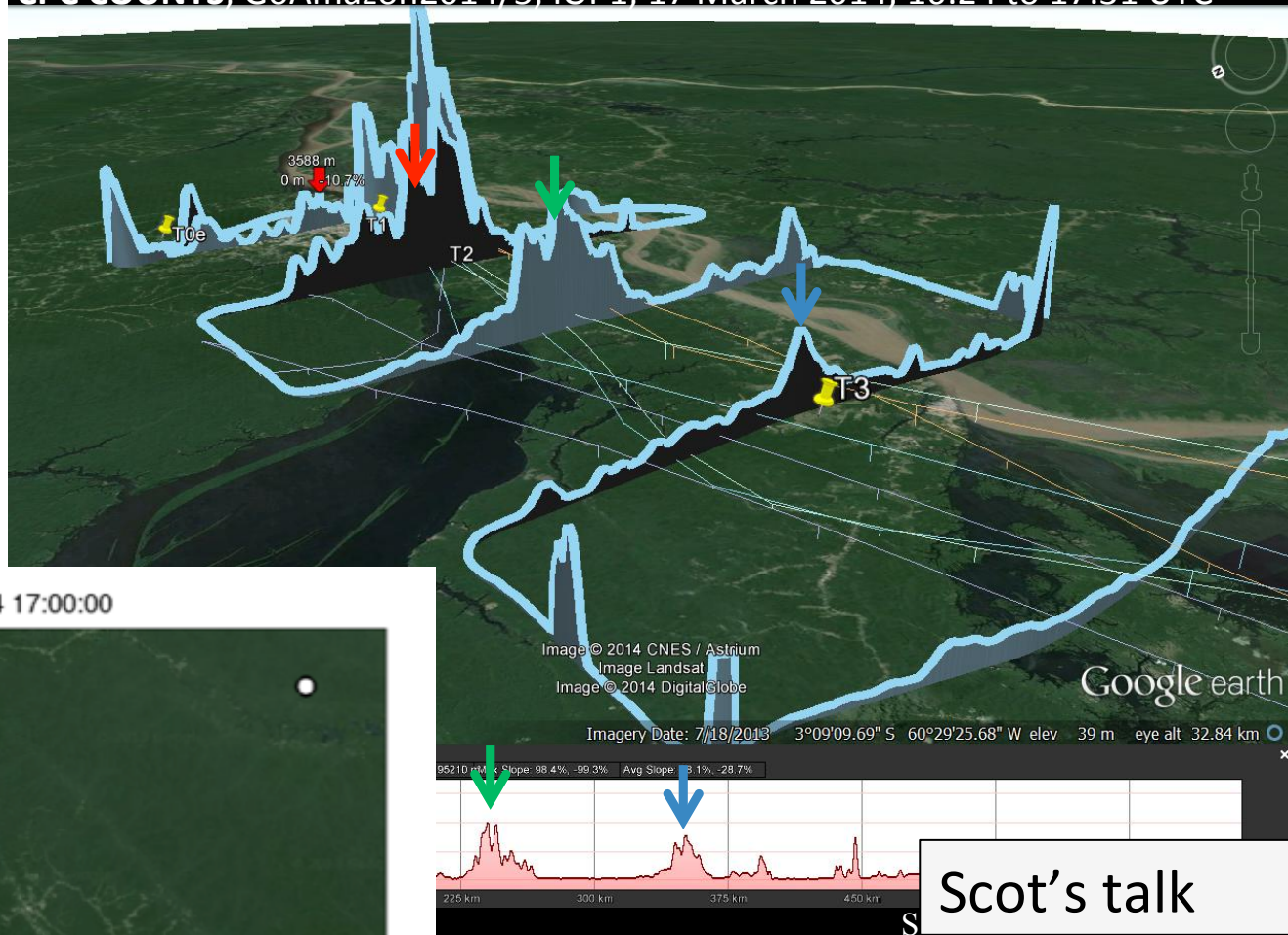
- Continuous forward run
 - Single continuous run (IOP1)
 - Output every 30min
 - Regular grid (@700m) and 14 vertical levels
 - 50m, 100, 200, 300, 600, 1km, 1.2 1.5, 2, 3, 4, 5, 6, 10
 - Particle releases
 - 2000 passive tracers every 30min (no diel cycle)
 - 50m to 150m above Manaus box

29-Jan-2014

WRF @ USP, Grid d04, Resol. 0.7 km
flexpart/continous/fwd/d04/

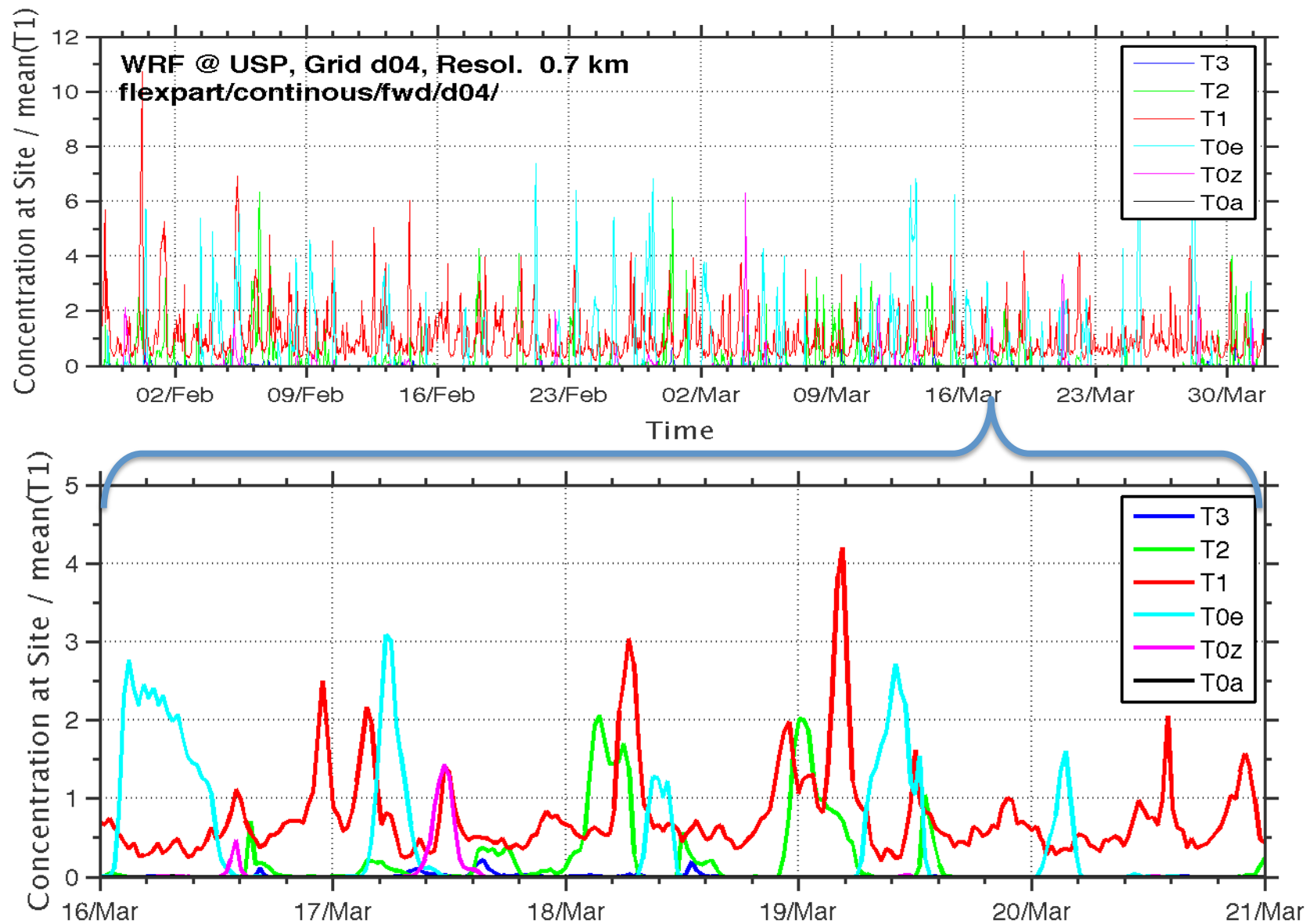


17 March 2014
16:24 to 17:31
UTC



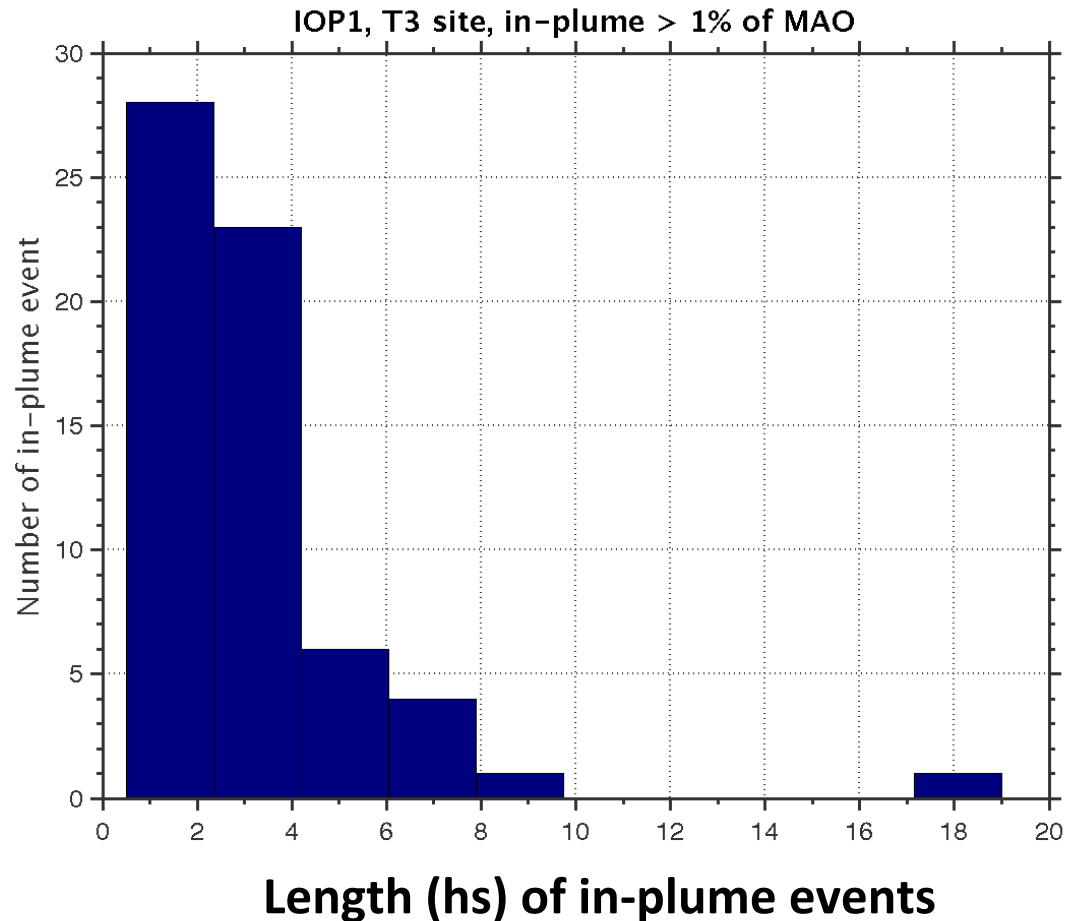
Good agreement with
G1 measurements (for
this case!)

Ground “concentration”



Length of plume events

	Time (h) Inside plume
T3	2.9 ± 2.8
T2	4.3 ± 4.3
T1	---
T0e	6.1 ± 4.7
T0z	4.0 ± 3.6
T0a	0.5



2) Is that what we get @ ground level?

Ground “Concentration”

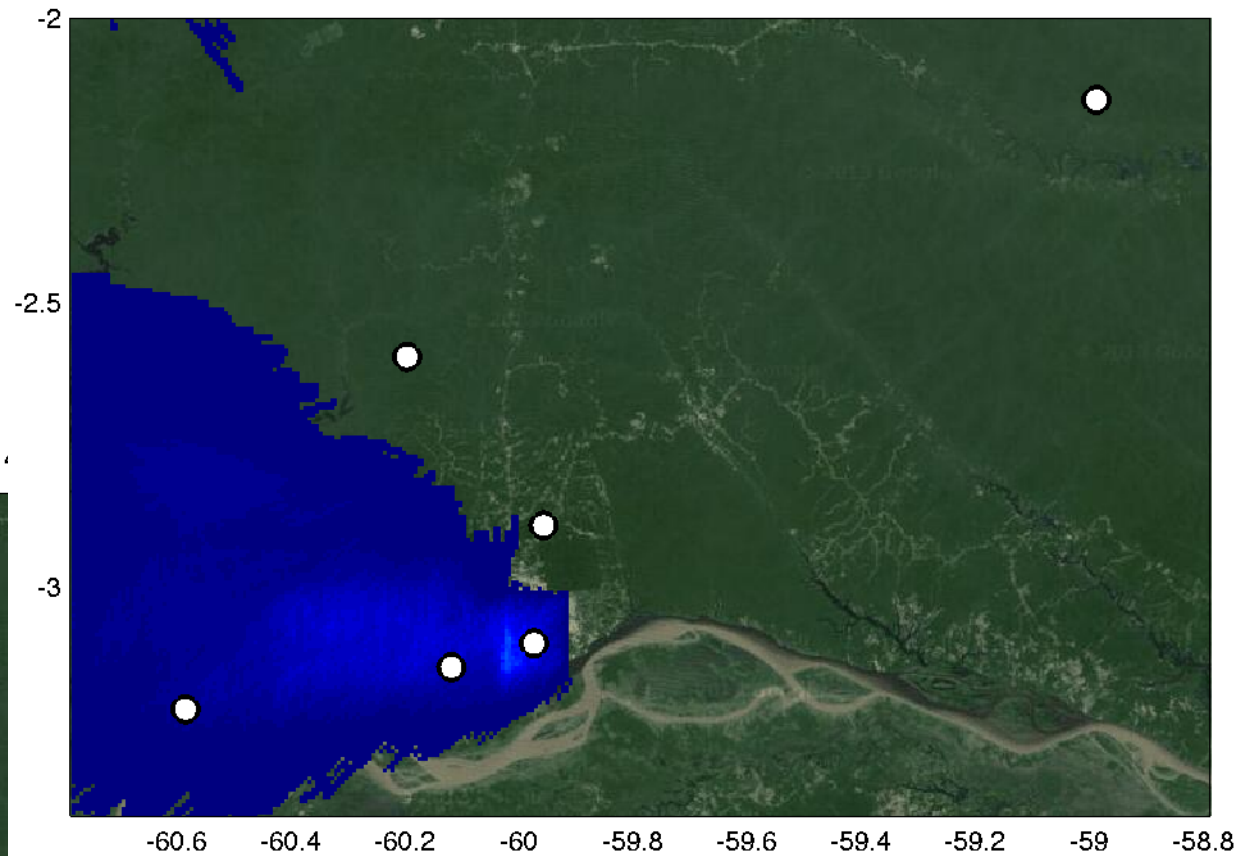
	Average
T3	0.014
T2	0.24
T1	1
T0-embp	0.44
T0-zf2	0.056



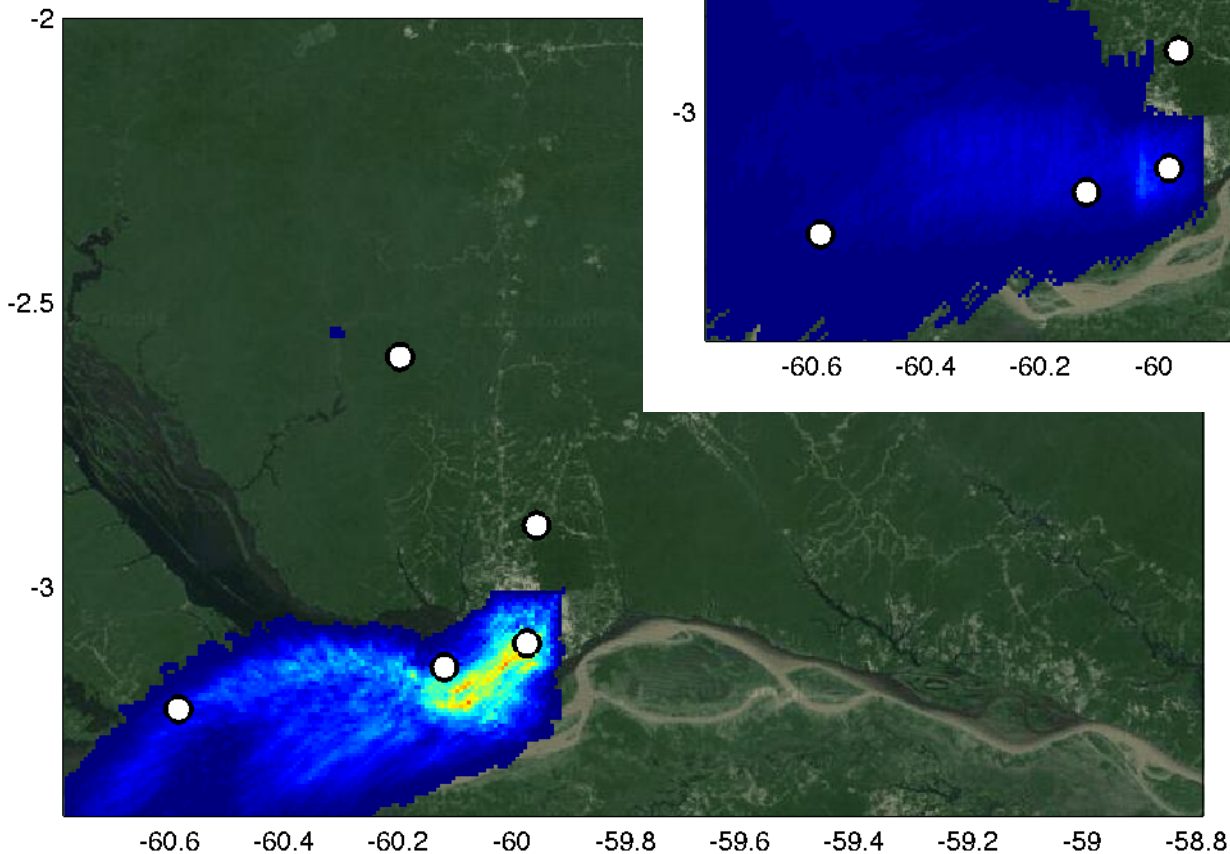
Average concentrations at close up-wind sites seems to be larger then at down-wind sites!

3) Is order of magnitude similar to obs?

25-Feb-2014 15:30:00

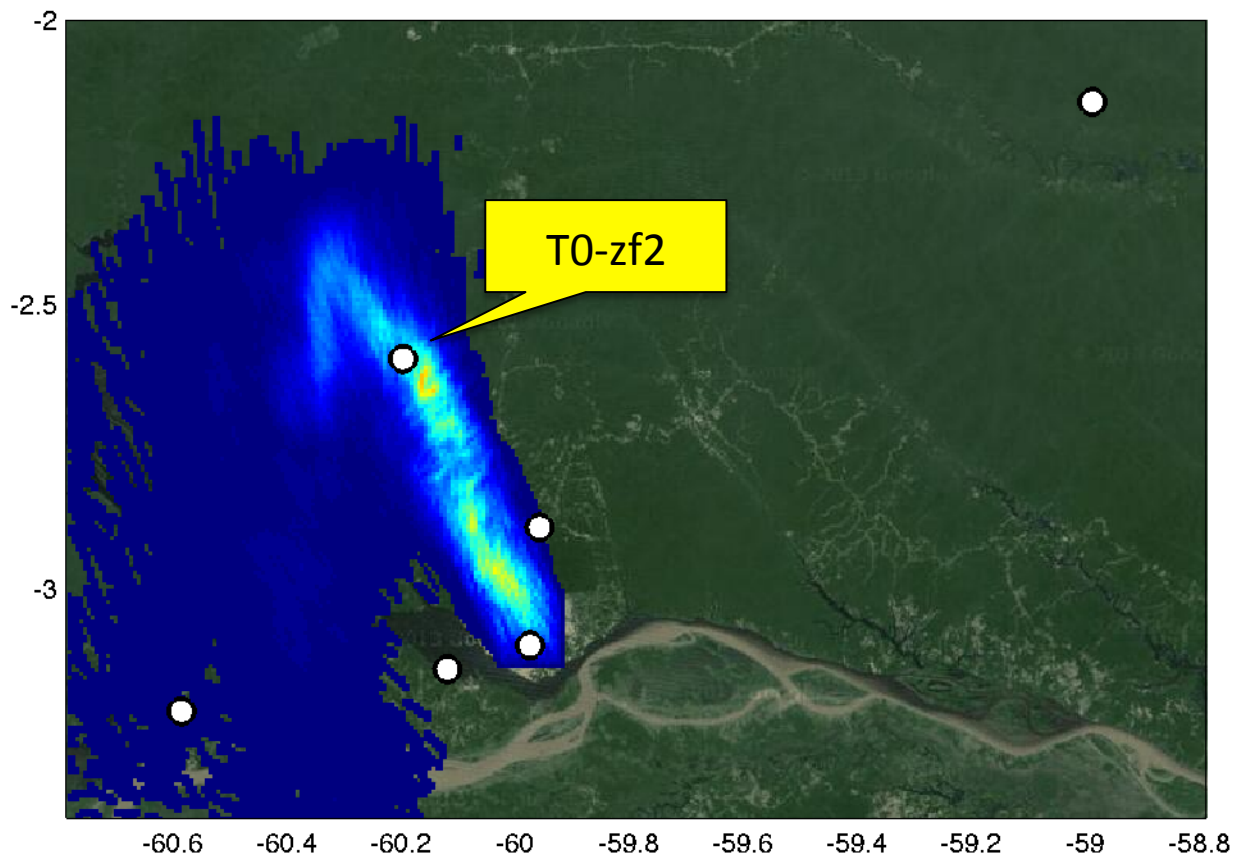


28-Feb-2014

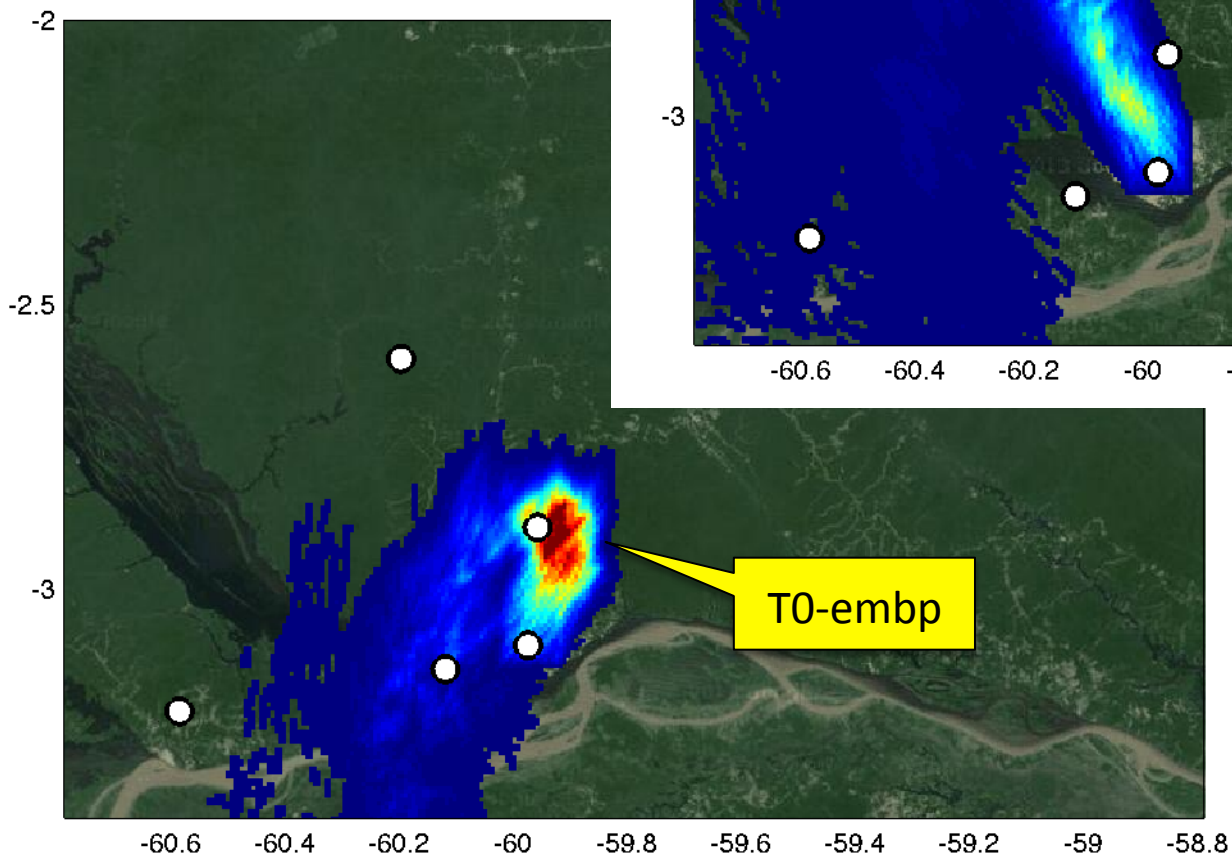


Plume going
forward is
diluted!

30-Jan-2014 08:00:00

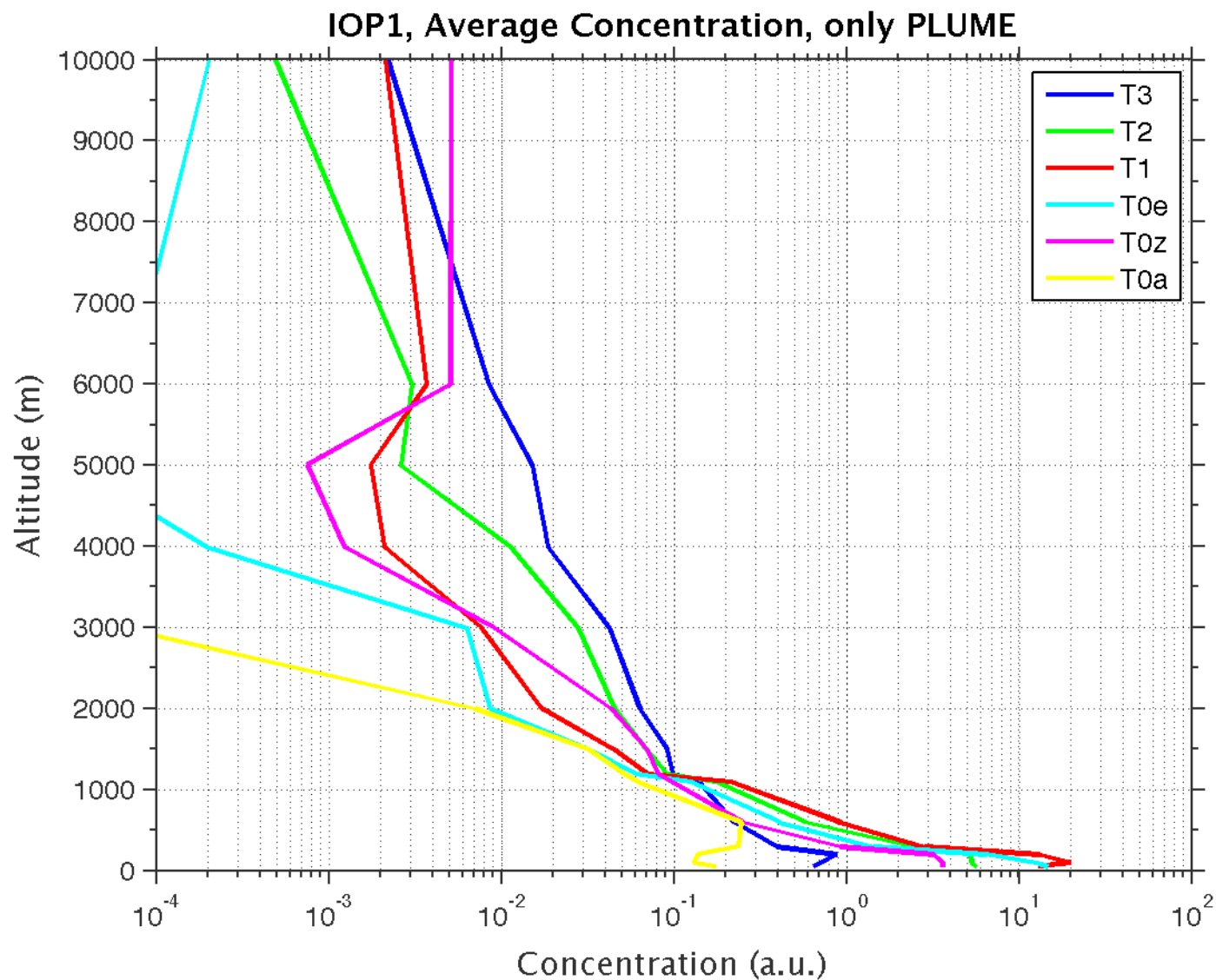


03-Feb-2014

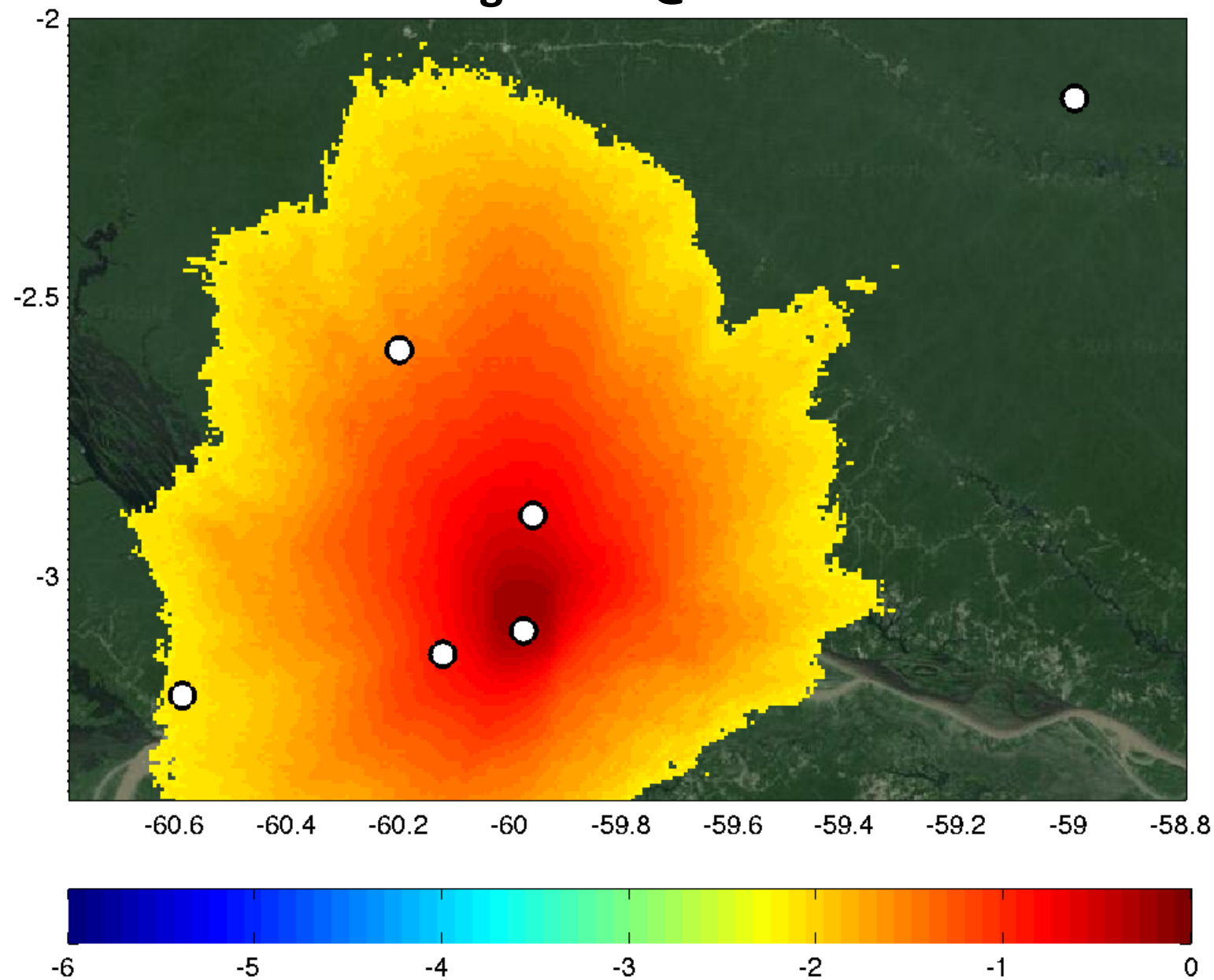


Plume going
backwards is
concentrated!

Vertical profile of “concentration”



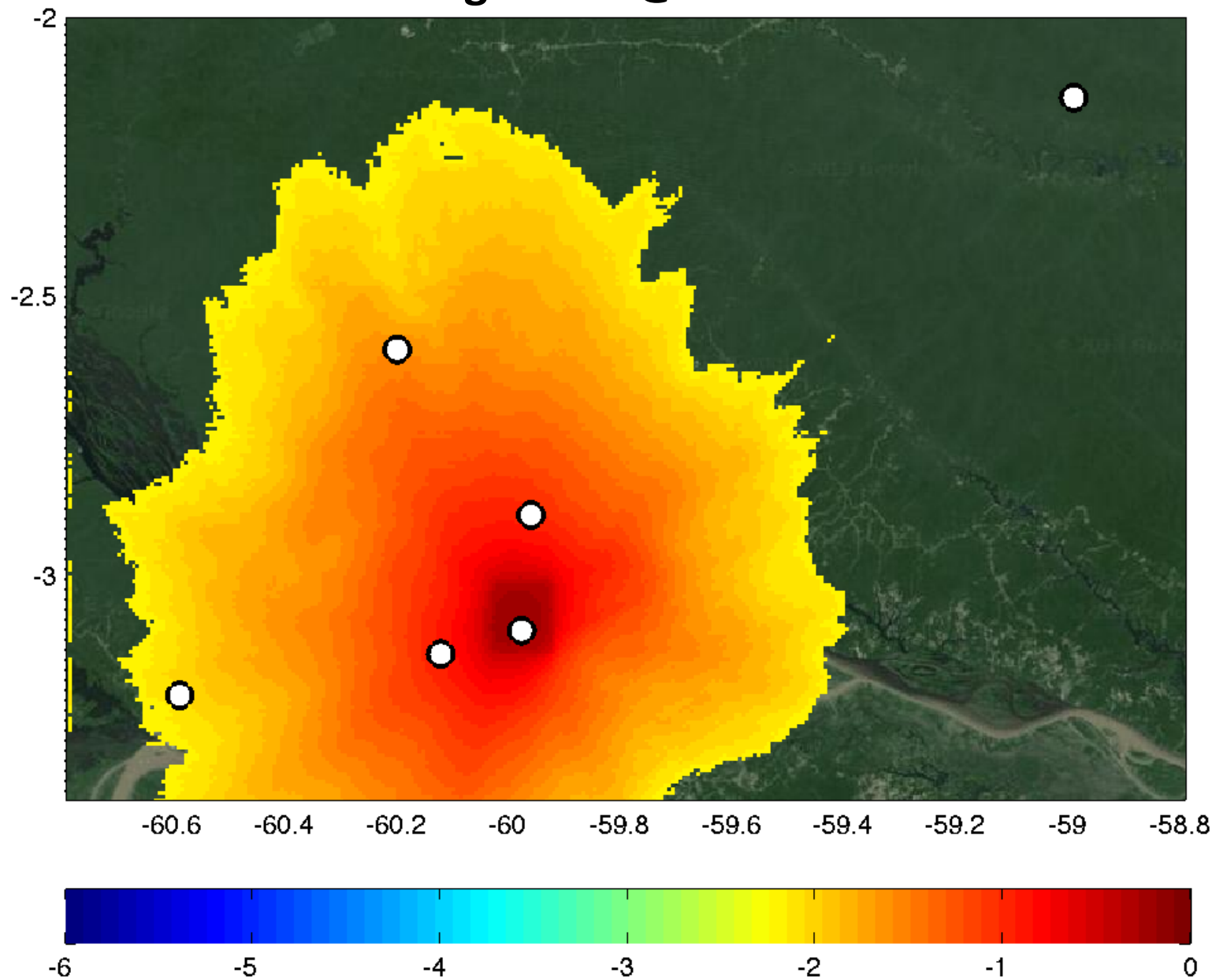
Average IOP1 @ 50m



Average IOP1 @ 200m

WRF @ USP, Grid d04, Resol. 0.7 km

flexpart/continous/fwd/d04/

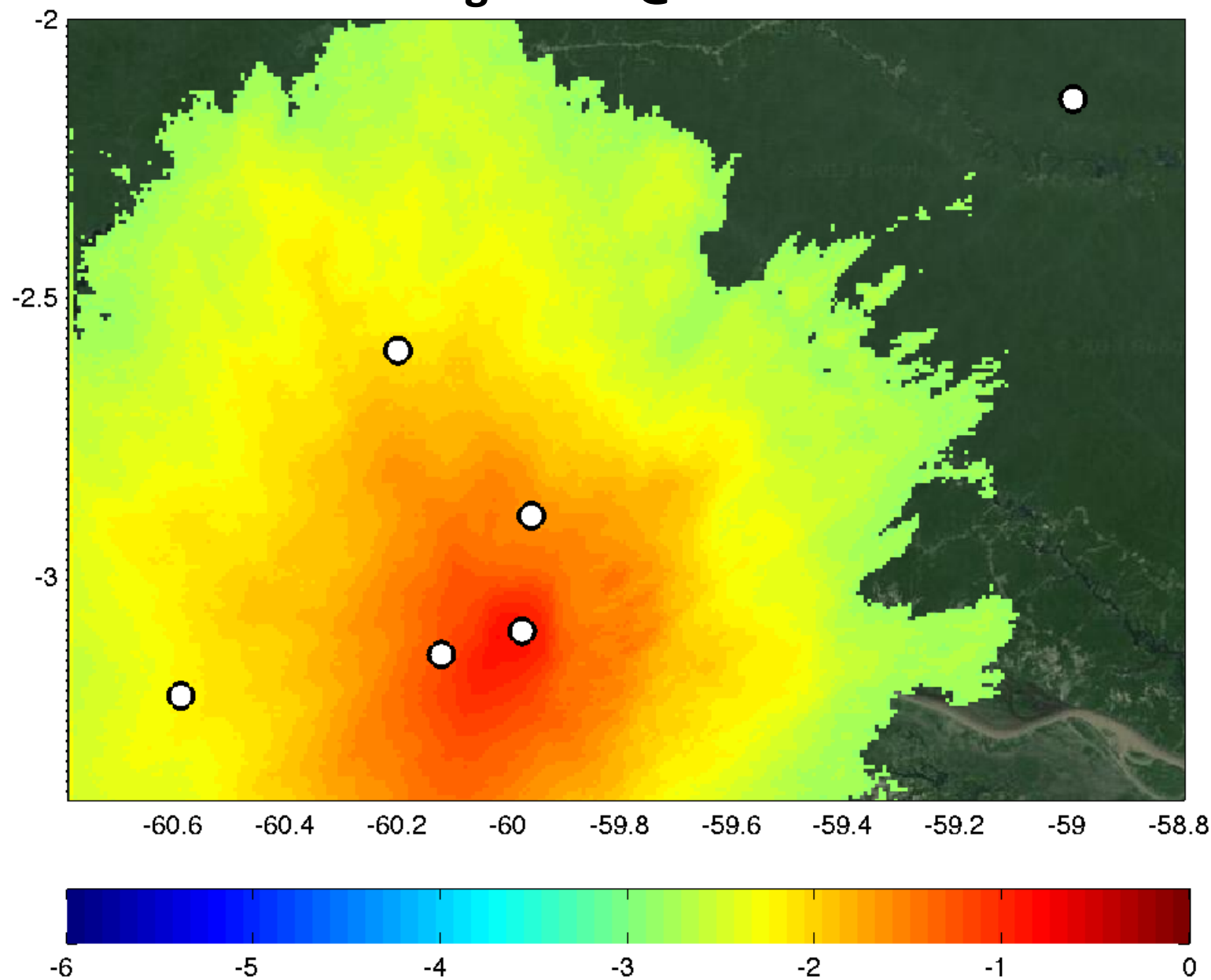


Log10 (Normalized Concentration)

Average IOP1 @ 300m

WRF @ USP, Grid d04, Resol. 0.7 km

flexpart/continous/fwd/d04/

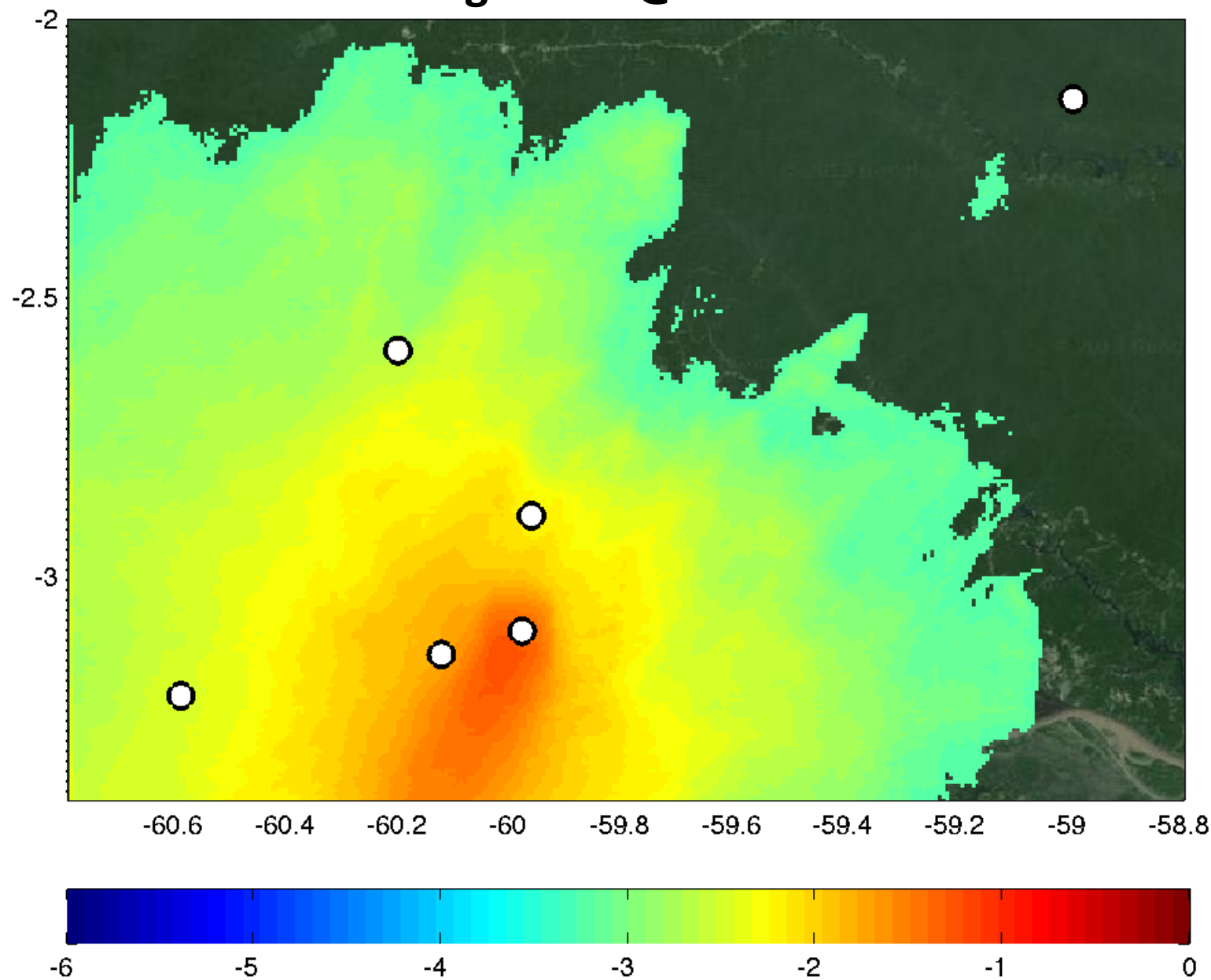


Log10 (Normalized Concentration)

Average IOP1 @ 600m

WRF @ USP, Grid d04, Resol. 0.7 km

flexpart/continous/fwd/d04/

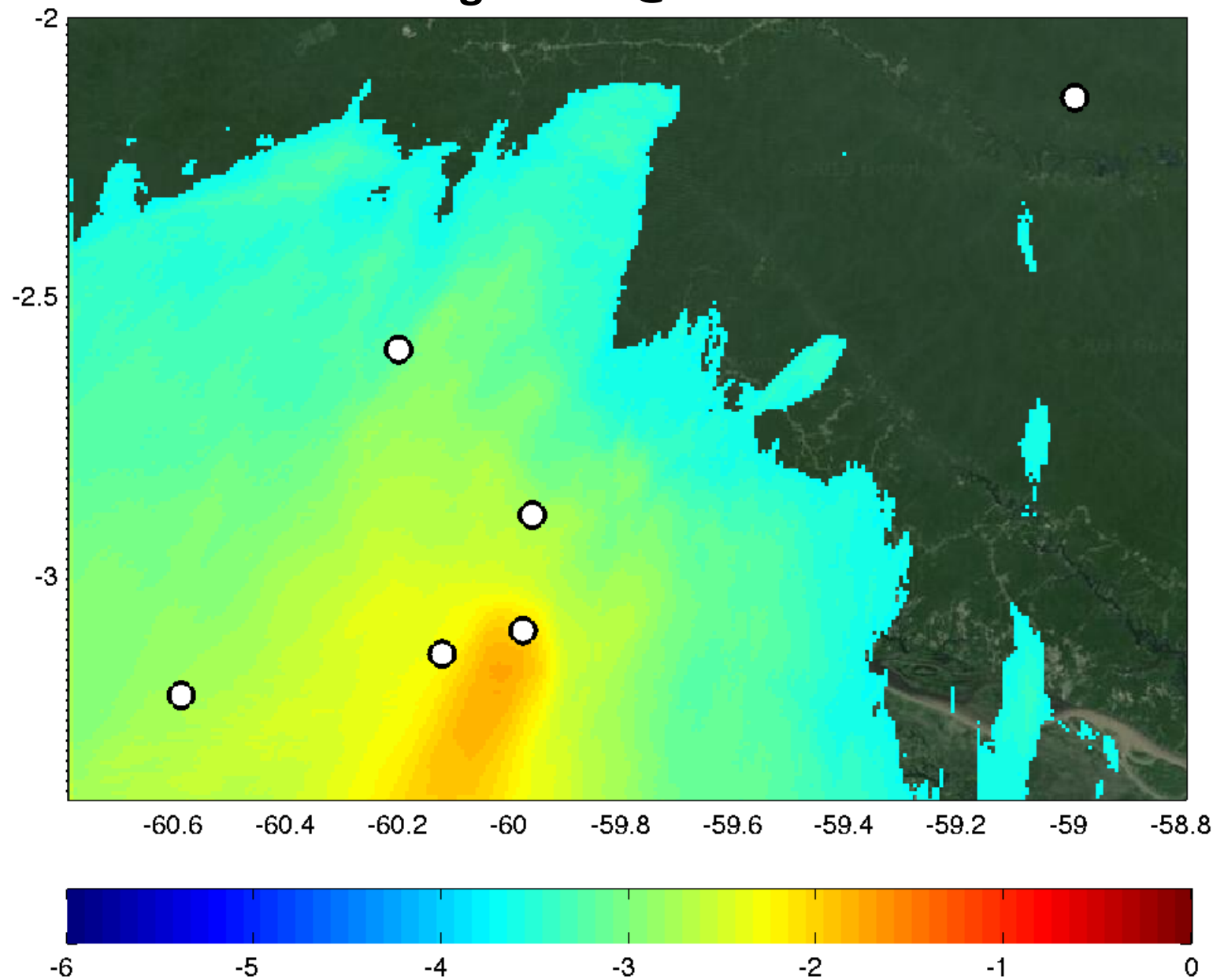


Log10 (Normalized Concentration)

Average IOP1 @ 1.1km

WRF @ USP, Grid d04, Resol. 0.7 km

flexpart/continous/fwd/d04/

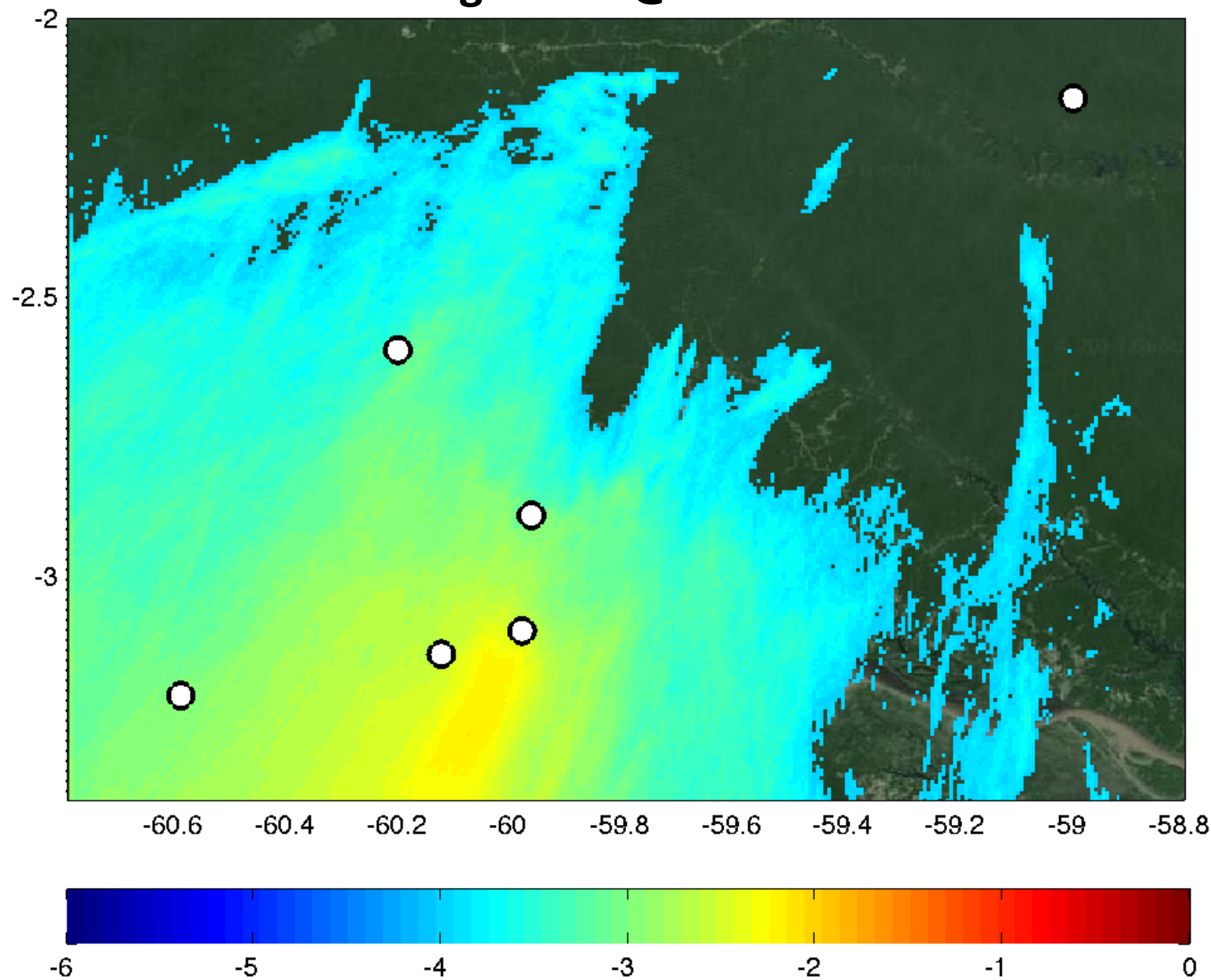


Log10 (Normalized Concentration)

Average IOP1 @ 1.2km

WRF @ USP, Grid d04, Resol. 0.7 km

flexpart/continous/fwd/d04/

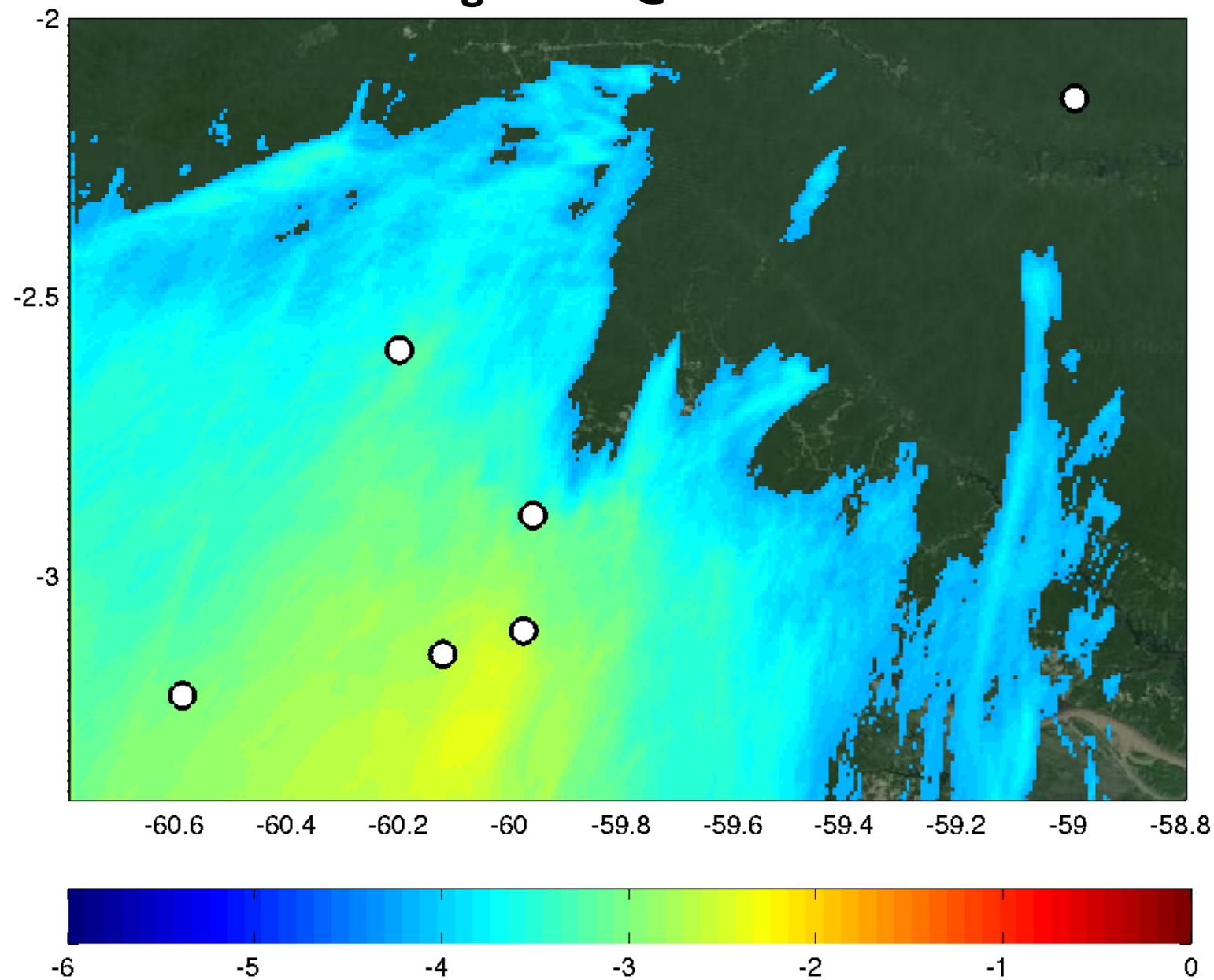


Log10 (Normalized Concentration)

Average IOP1 @ 1.5km

WRF @ USP, Grid d04, Resol. 0.7 km

flexpart/continous/fwd/d04/

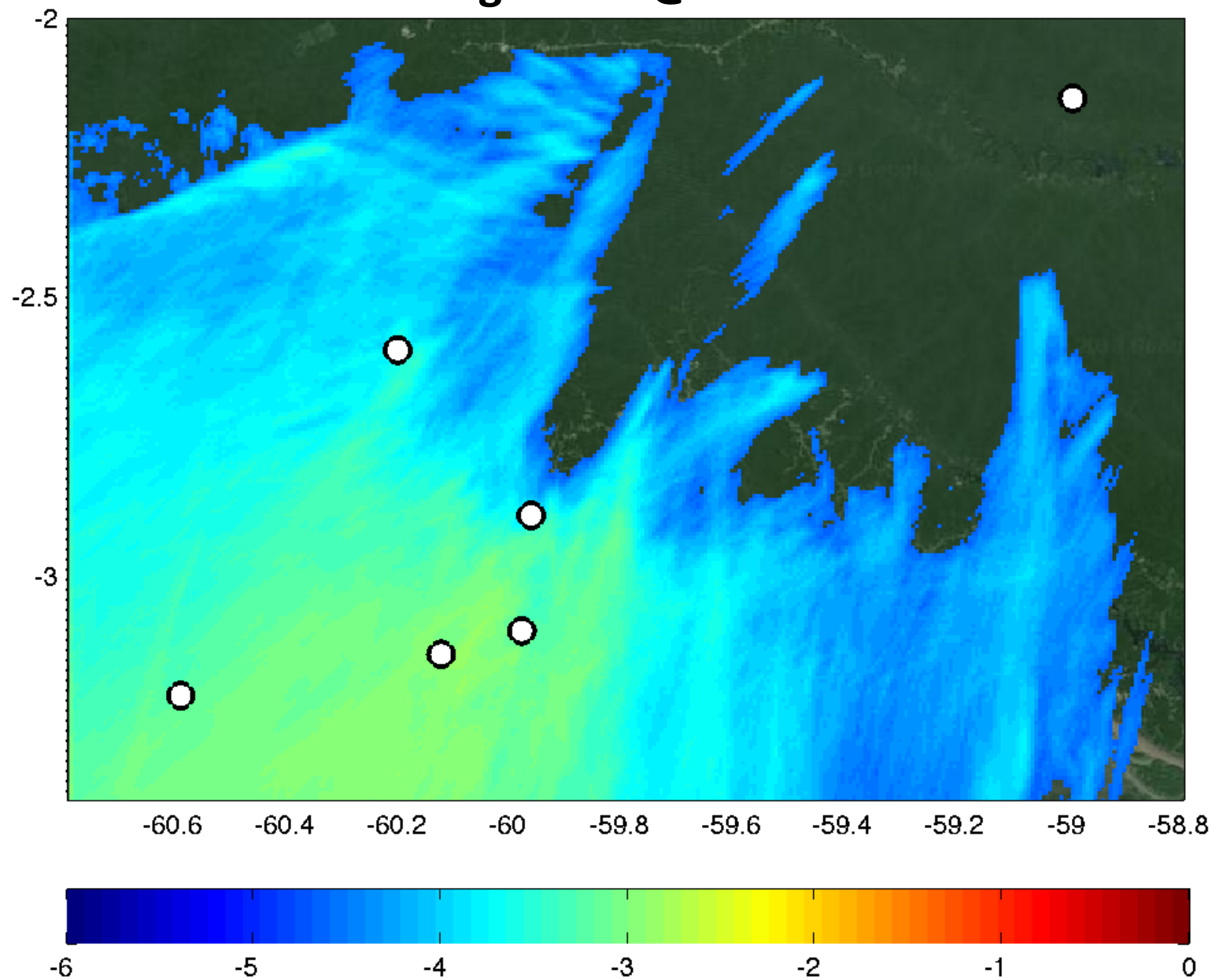


Log10 (Normalized Concentration)

Average IOP1 @ 2km

WRF @ USP, Grid d04, Resol. 0.7 km

flexpart/continous/fwd/d04/

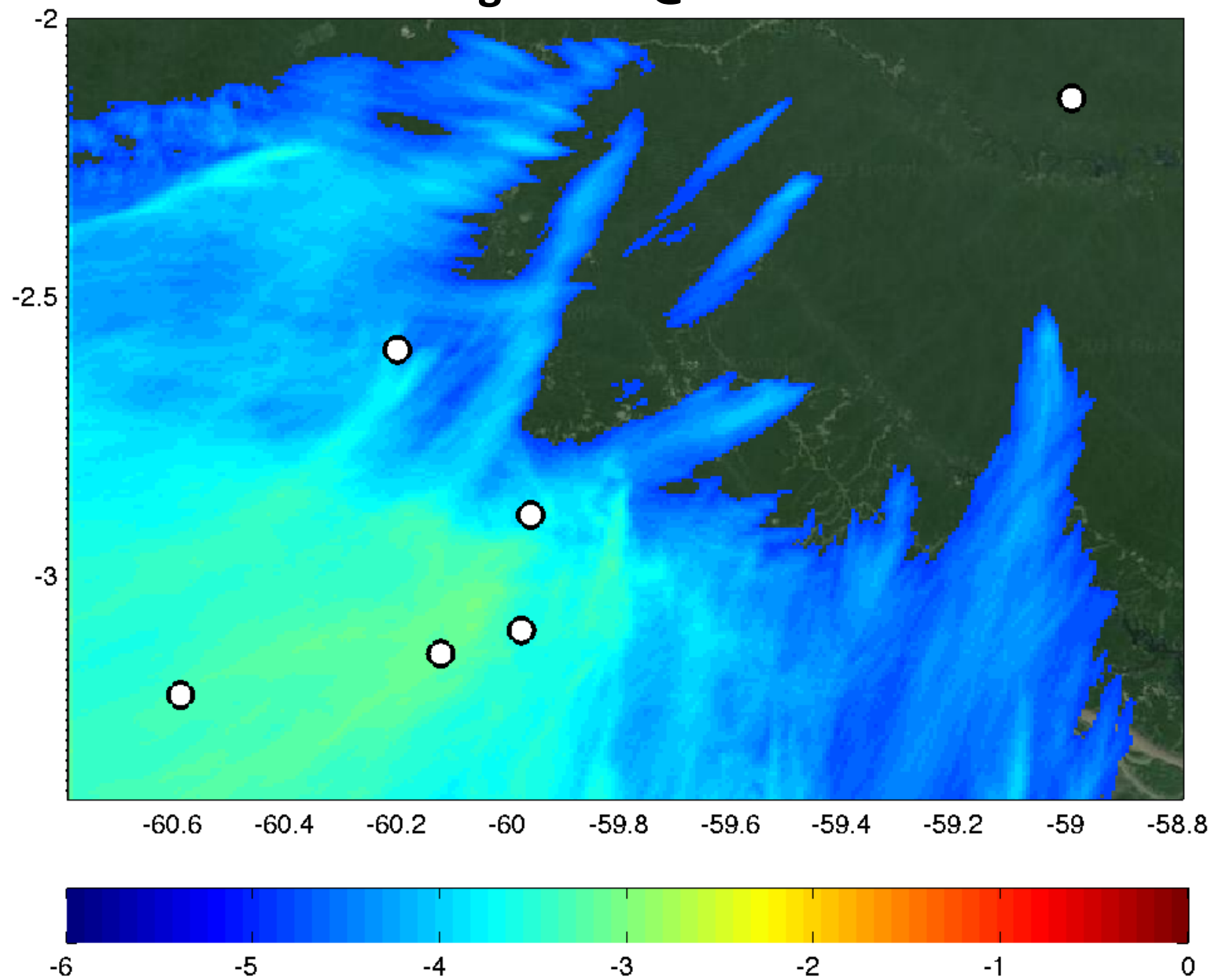


Log10 (Normalized Concentration)

Average IOP1 @ 3km

WRF @ USP, Grid d04, Resol. 0.7 km

flexpart/continous/fwd/d04/

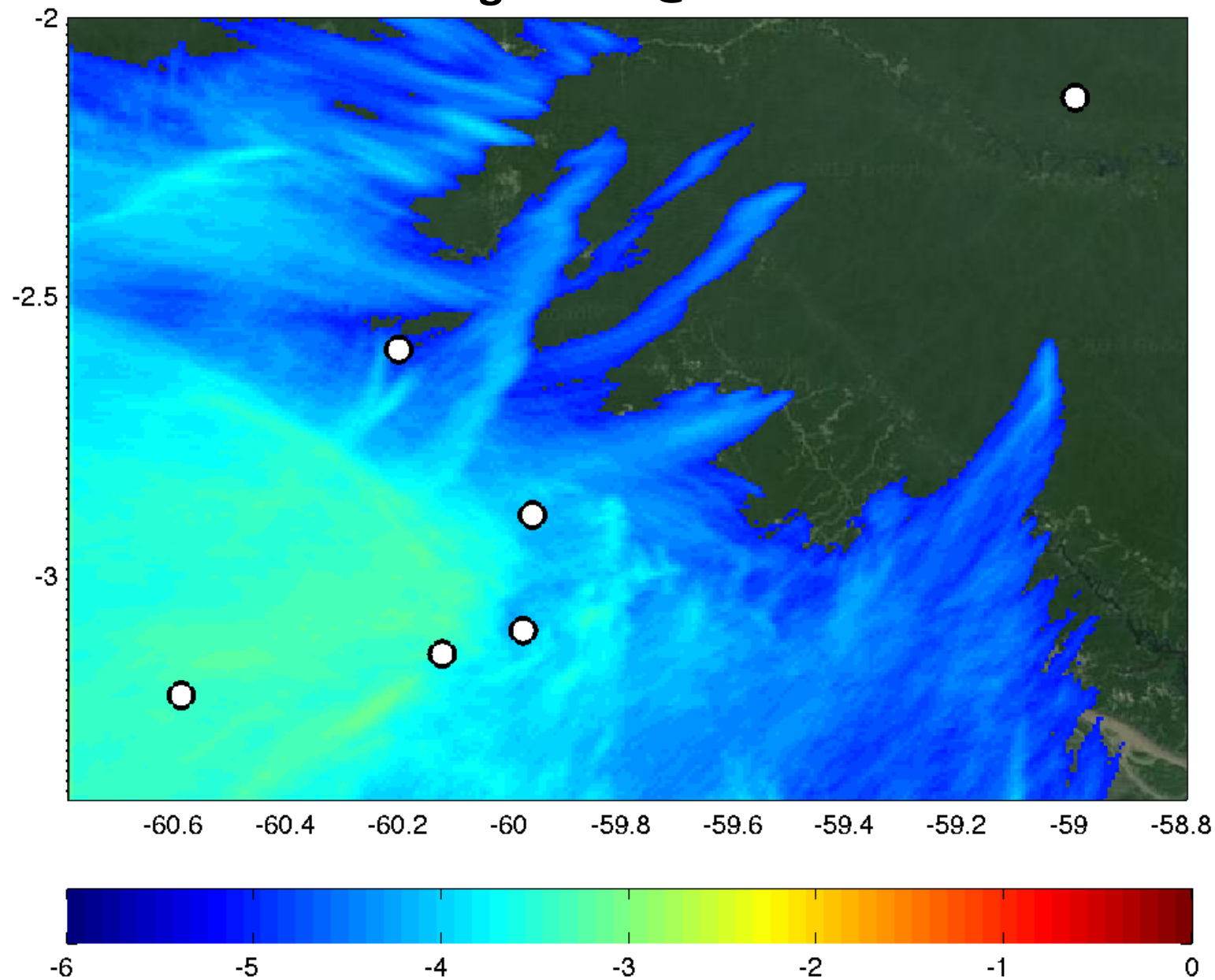


Log10 (Normalized Concentration)

Average IOP1 @ 4km

WRF @ USP, Grid d04, Resol. 0.7 km

flexpart/continous/fwd/d04/

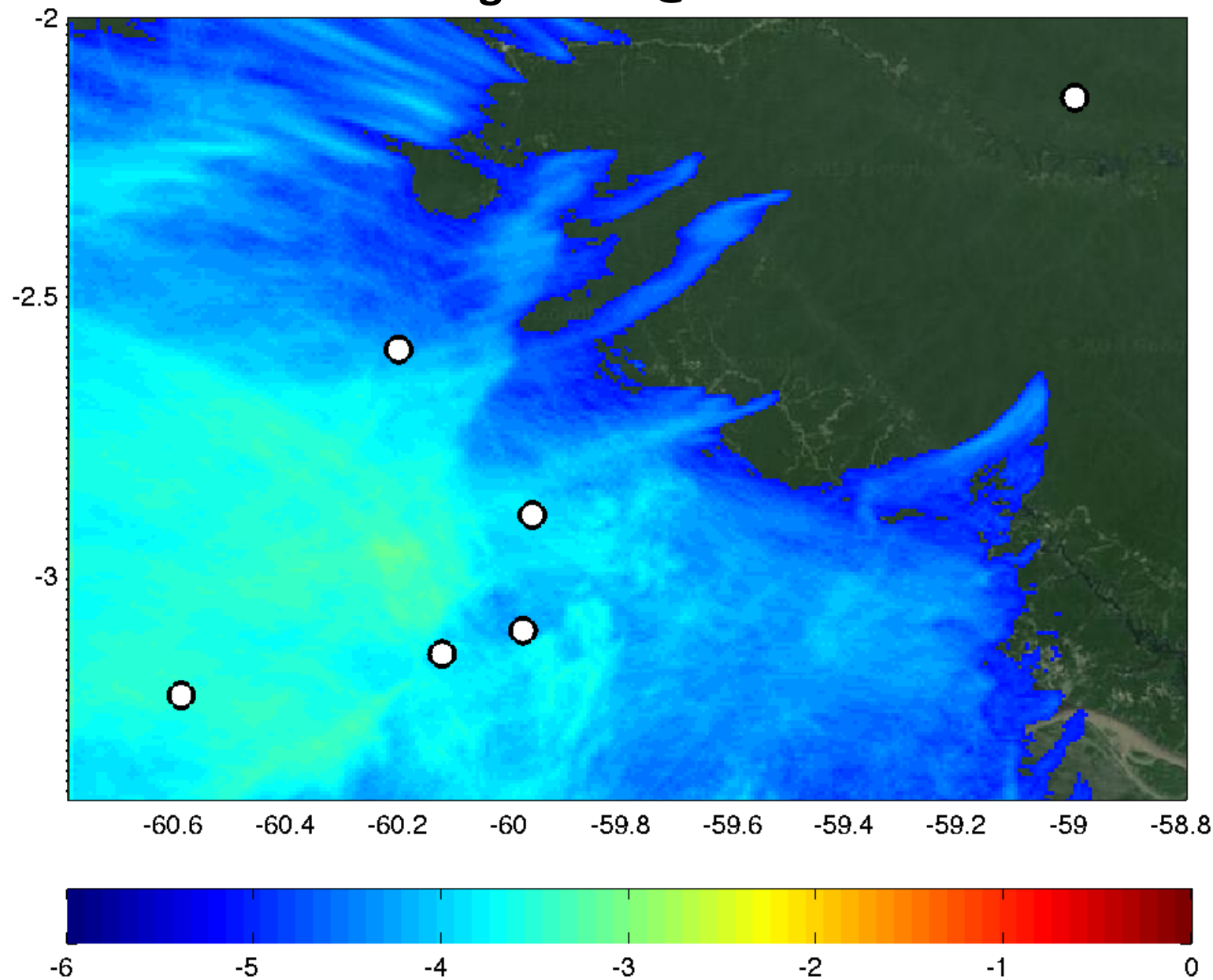


Log10 (Normalized Concentration)

Average IOP1 @ 5km

WRF @ USP, Grid d04, Resol. 0.7 km

flexpart/continous/fwd/d04/

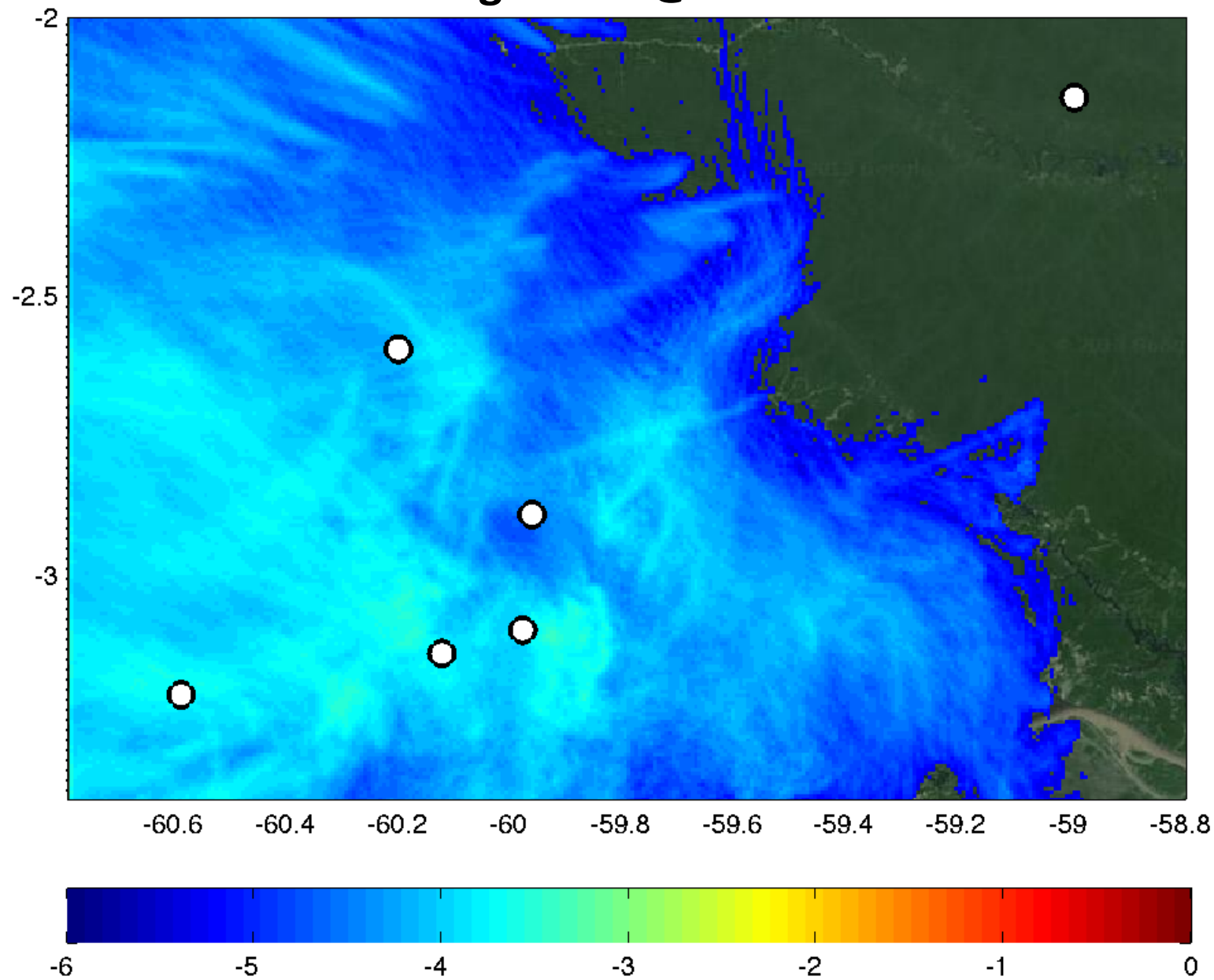


Log10 (Normalized Concentration)

Average IOP1 @ 6km

WRF @ USP, Grid d04, Resol. 0.7 km

flexpart/continous/fwd/d04/

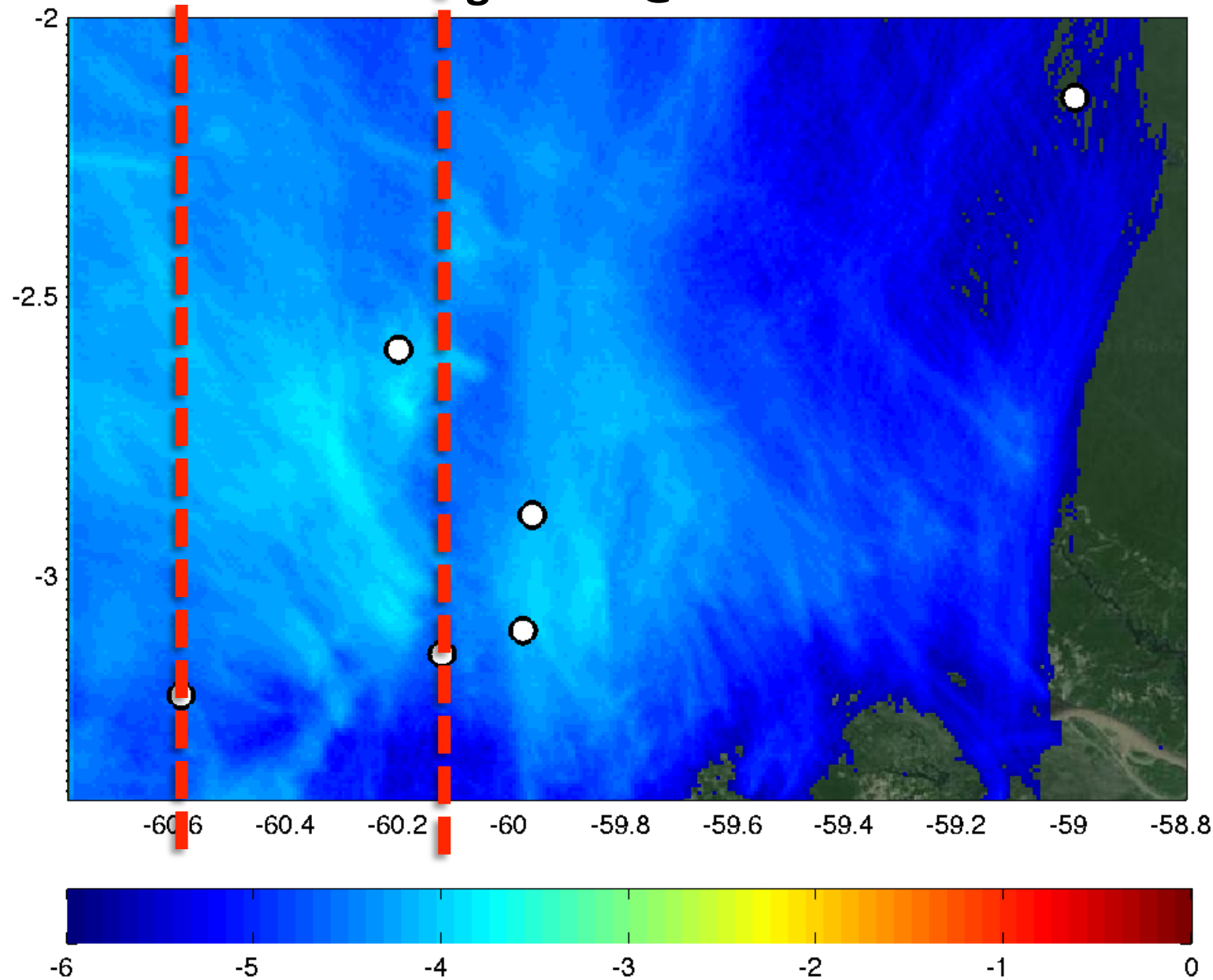


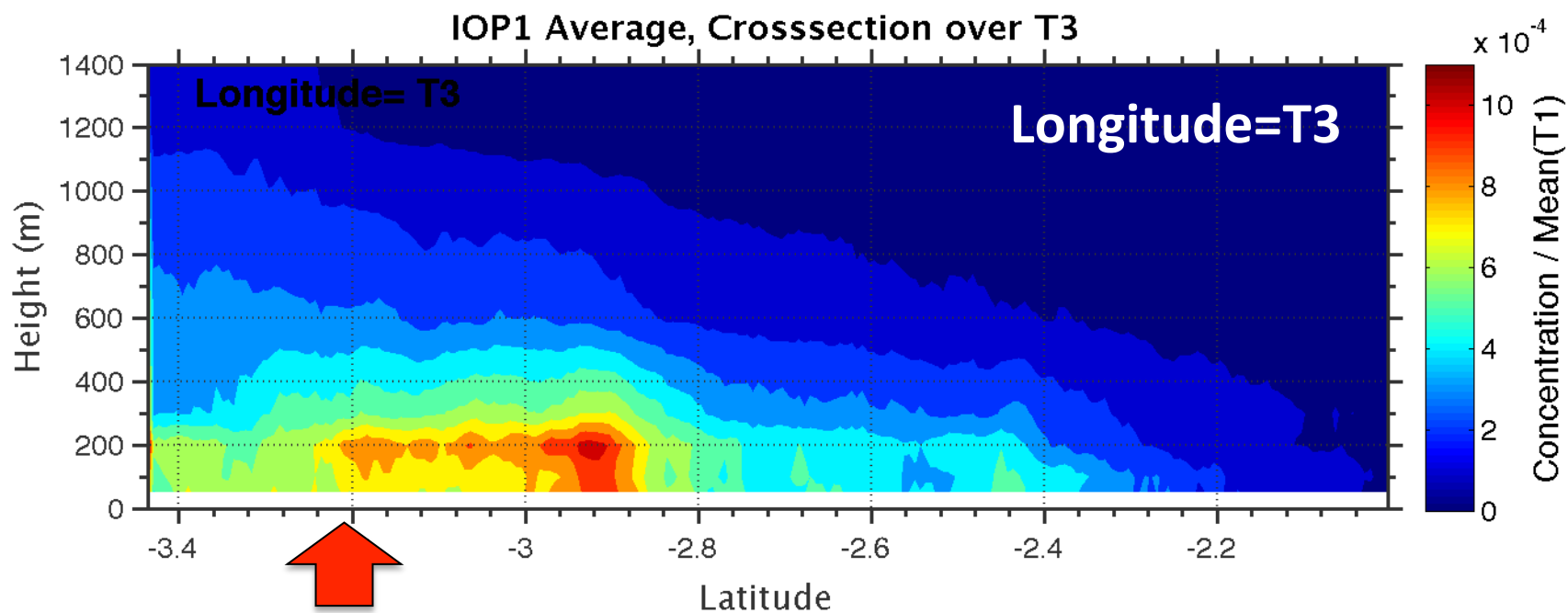
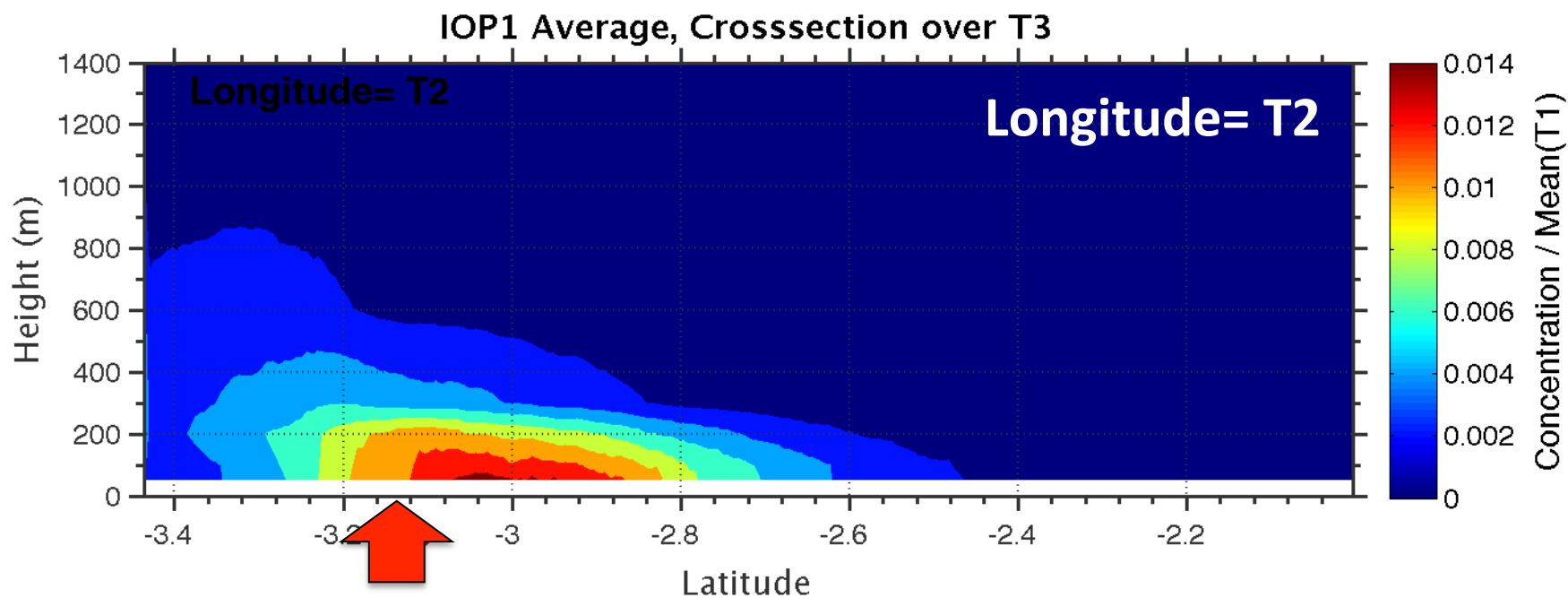
Log10 (Normalized Concentration)

WRF @ USP, Grid d04, Resol. 0.7 km

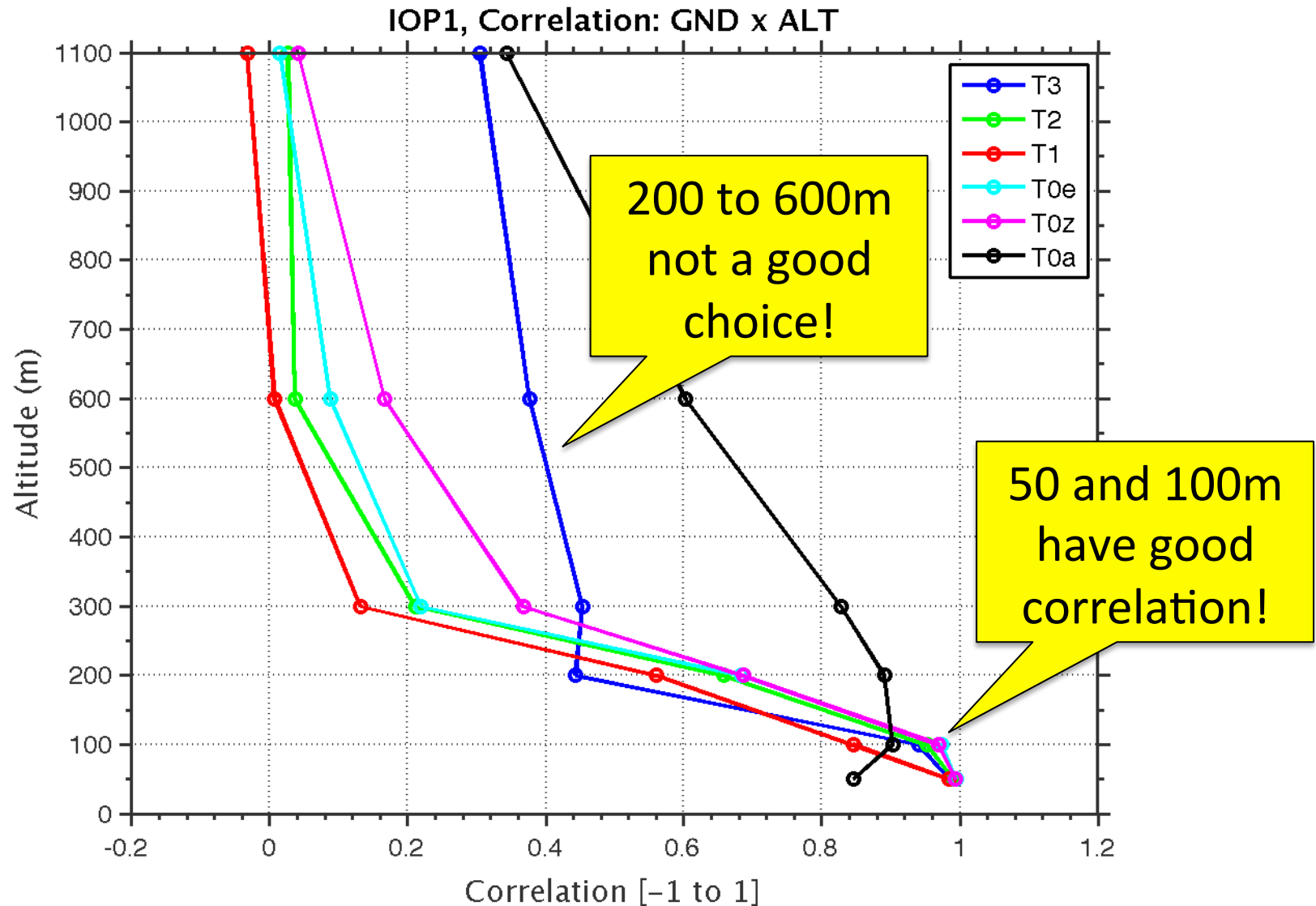
flexpart/continous/fwd/d04/

Average IOP1 @ 10km





Time Correlation: GND x Altitudes



Conclusions + Next Steps

- Conclusion (**careful**)
 - Plume not steady at all! $\Delta t \sim 0-5\text{hs}$ at T3
 - N-NE propagation is more loaded
 - Particles reach 10km, but high correlation $< 150\text{m}$
- Next (**important**)
 - How to validate the model? Compare with G1 flight also? Should we setup a working group??
 - Should we allow particles to dry or wet deposit? What altitudes are interesting?
 - What output is needed? Traj-files? Plume-times?

Thank you!

