



Evaluation of NWP models with BLLAST data

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Coster

I/ Rapid overview of observations and models

II/ General behaviour of the models

III/ A focus on the representation of the transition

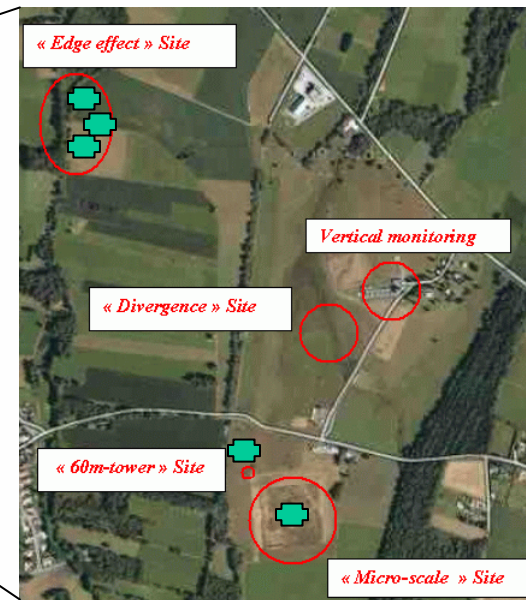
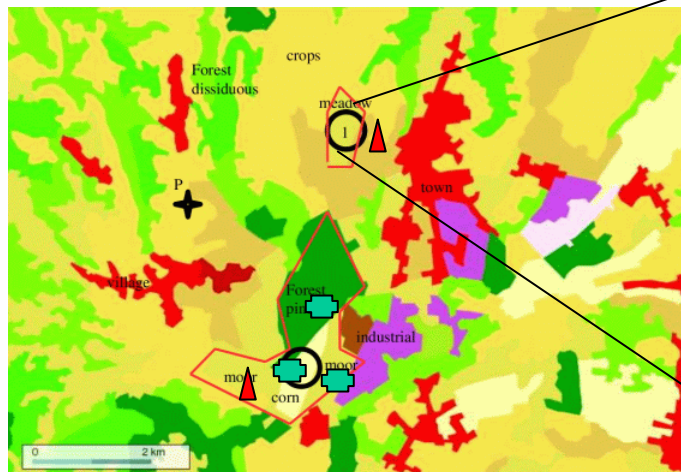
The different observations used for the evaluation :

Vertical profiles:

- radiosoundings : frequent launched at site 2 (about every 1.5 hour in POI) and standard at site 1 (every 6 hours) ▲
- SUMO profiles at site 1 or site 2
- information on clouds (ceilometers +sky imager)

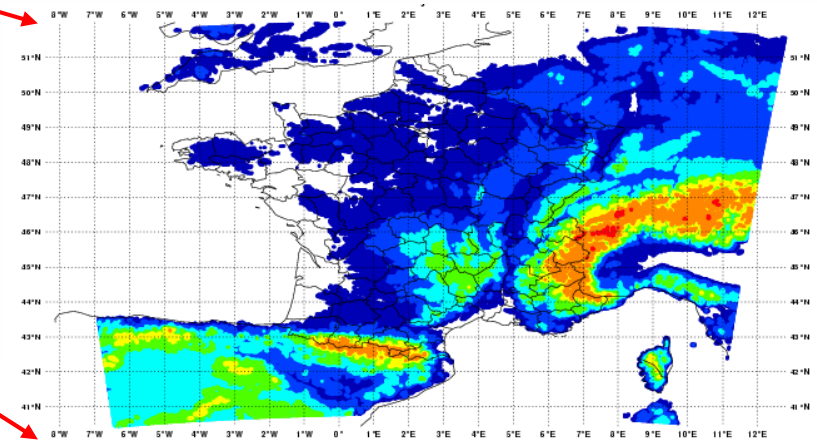
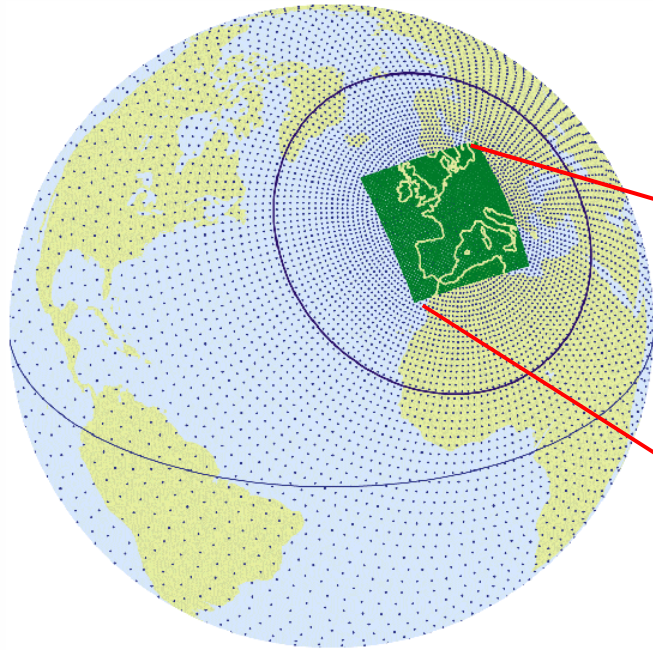
Energetic and close to surface observations:

- flux stations over different covers ■
- instrumented tower (65m): meteorological variables, turbulent fluxes measurements



Site 1

Operational Weather forecasting at Météo-France: ARPEGE and AROME



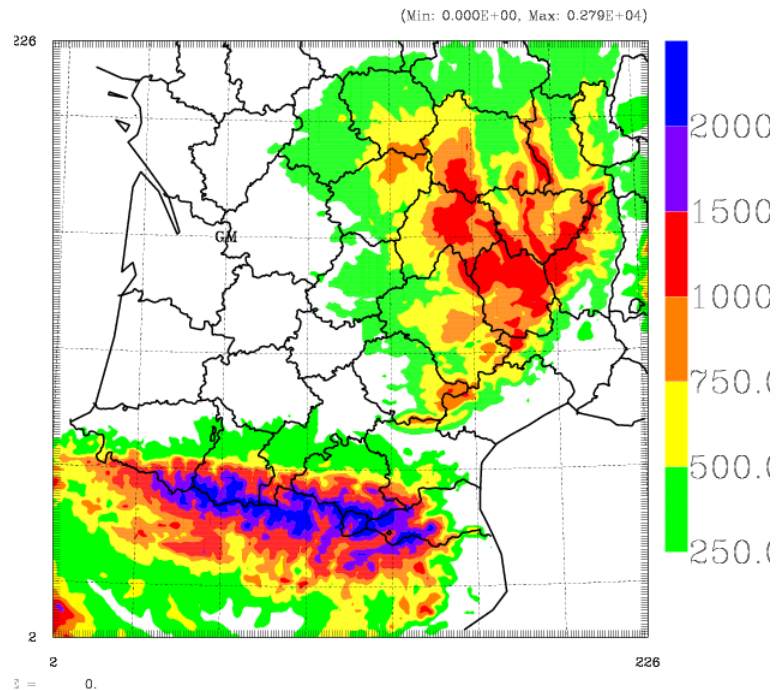
Global ARPEGE-IFS

4-day forecasts every 6 hours $dx=10$ km on France, 55 km on Australia $dt=10$ mn
Stretching factor $c=2.4$ and turning of the pole over the zone of interest
Stretched vertical grid with 70 levels
4DVar Inc Data Assimilation system
(T107 25iter and T323 30iter $dx=60$ km)

Cloud Resolving Model AROME

30 h forecasts every 6h
 $dx=2.5$ km, 60 Levels, *time-step=1mn* (SL)
3DVar Data Assimilation system (RUC3h)

AROME-2.5km Domain for Blast



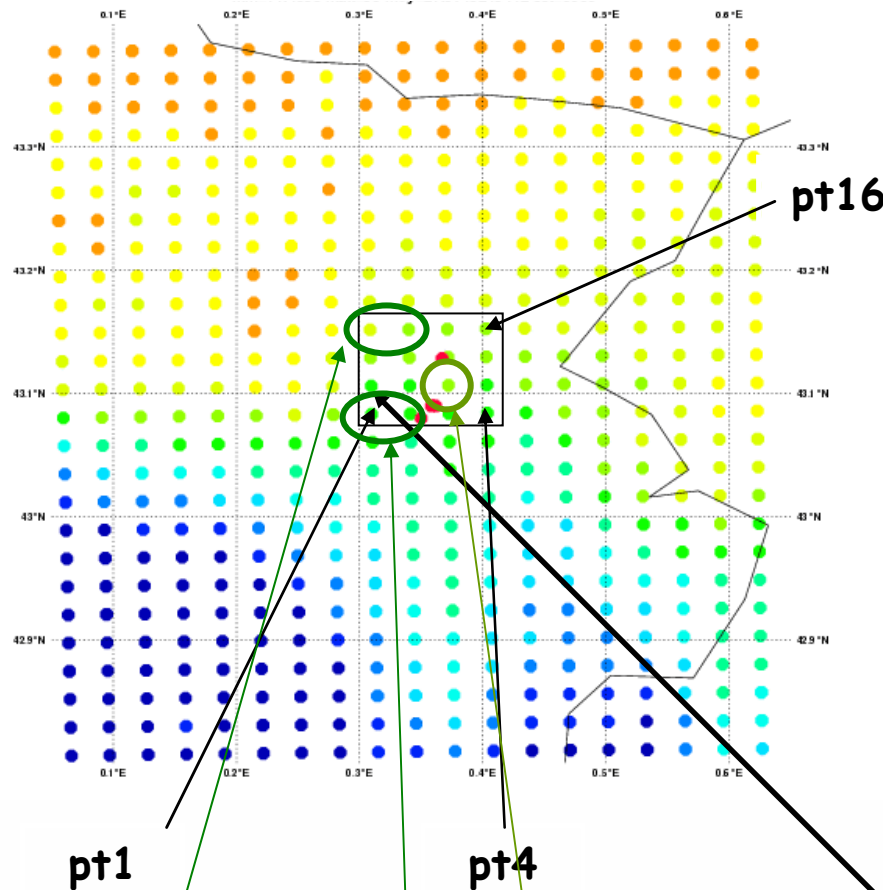
- Runs at 0 and 12 (FC+30h) initialized and coupled by AROME-2.5km operational.
- Diagnostics (DDH profiles) activated.

I/ Rapid overview of models and used observations

AROME

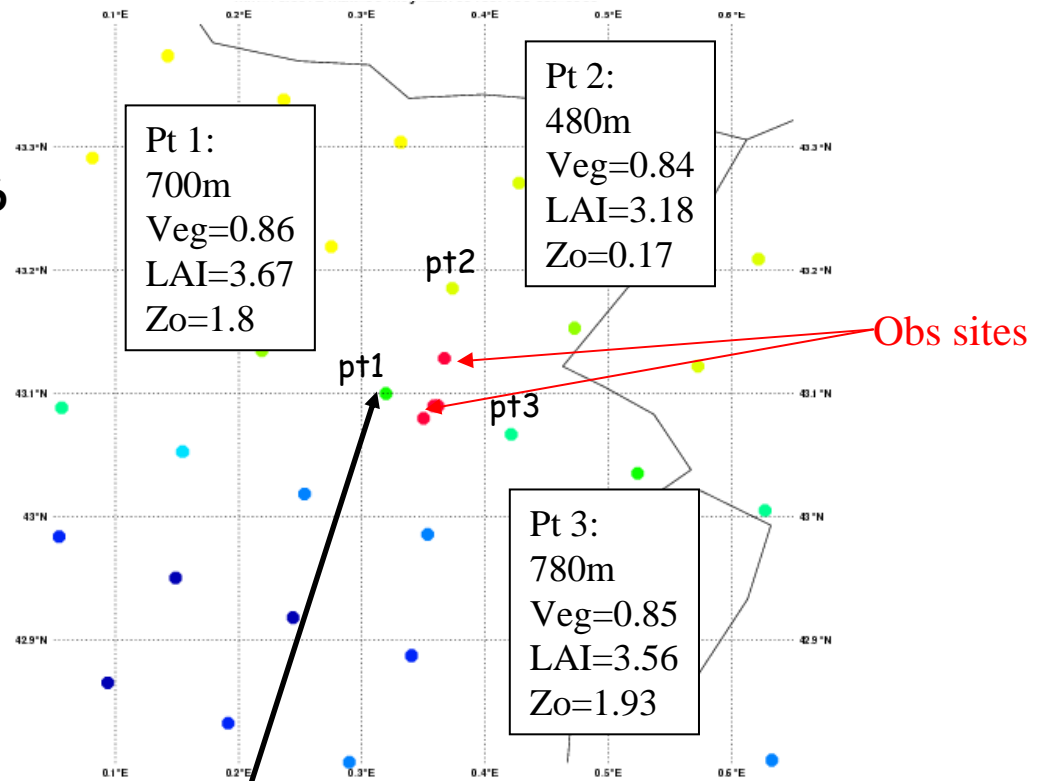
	Pt1:	Pt2:	Pt3:	Pt4:	Pt5:	Pt6:	Pt7:	Pt8:	Pt9:	Pt10:	Pt11:	Pt12:	Pt13:	Pt14:	Pt15:	Pt16:
Alt:	535	611	595	558	552	605	609	593	532	567	579	575	505	521	529	527
Veg:	0.95	0.93	0.92	0.92	0.92	0.93	0.85	0.94	0.93	0.91	0.91	0.91	0.93	0.92	0.88	0.90
LAI:	3.4	3.5	3.2	3.4	3.5	3.4	3.3	3.2	3.5	3.7	3.3	3.5	3.8	3.7	3.2	3.5
Zo:	0.78	0.53	0.26	0.16	0.24	0.38	0.45	0.39	0.49	0.37	0.18	0.47	0.83	0.64	0.23	0.38

ARPEGE

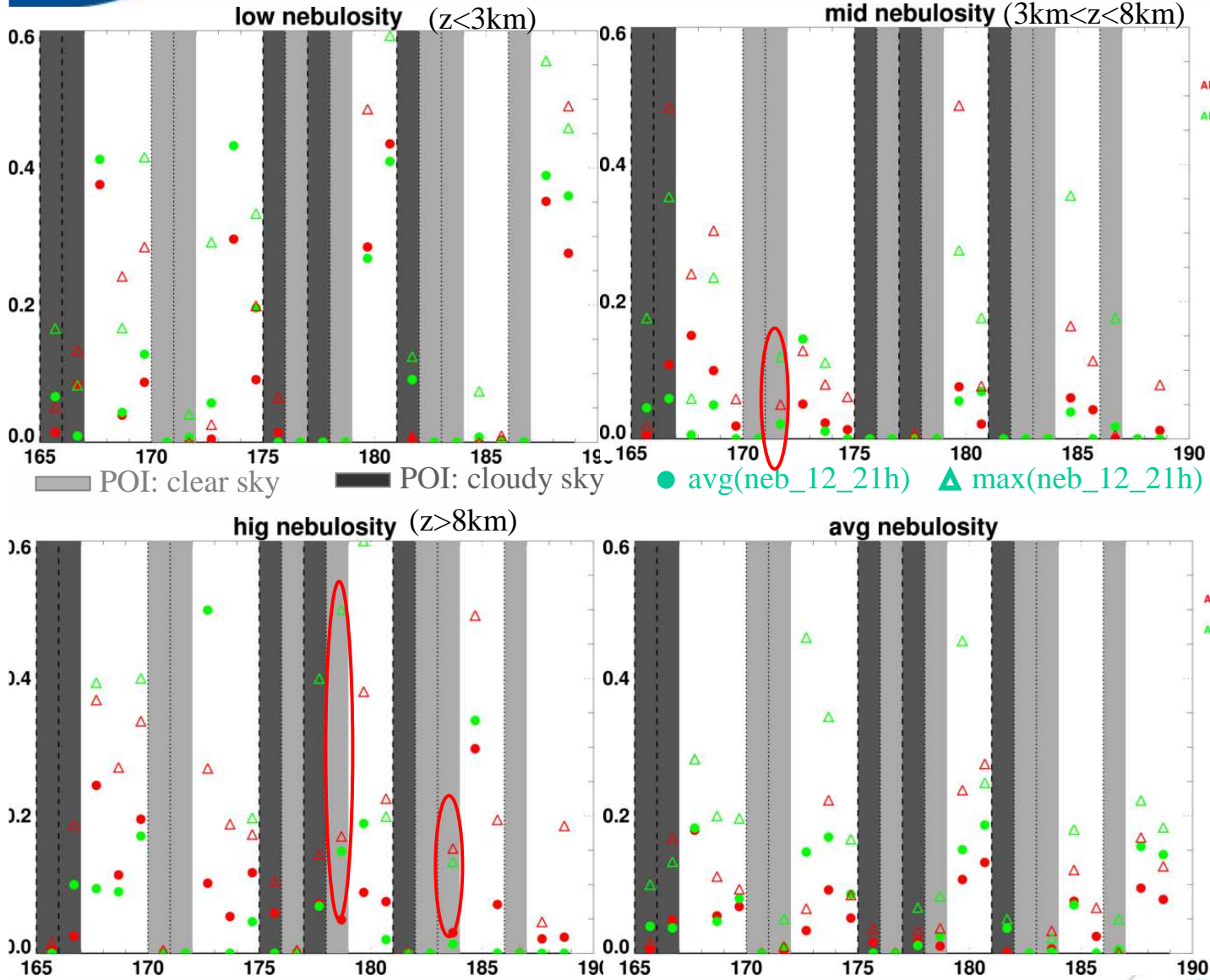


>40% of decid. forest
>40% of conif. forest

DDH point extracted



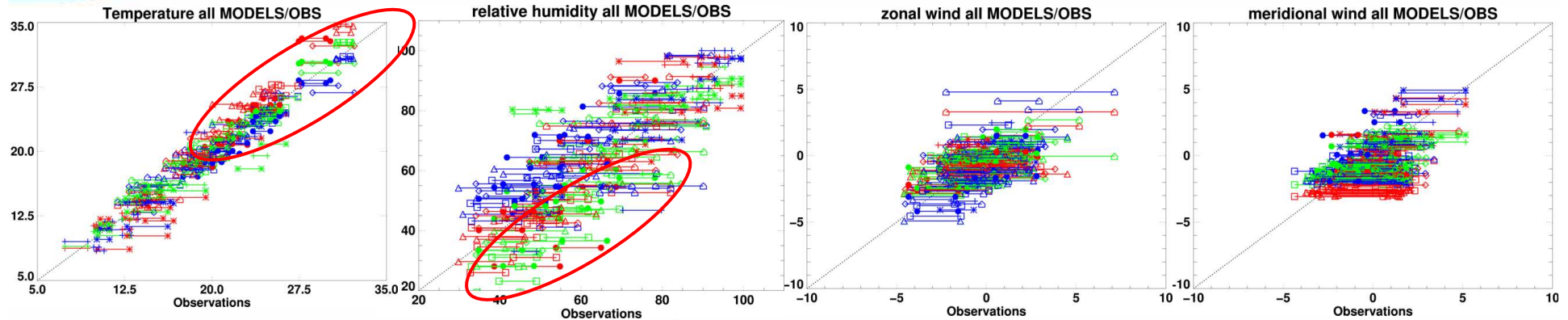
Representation of clouds



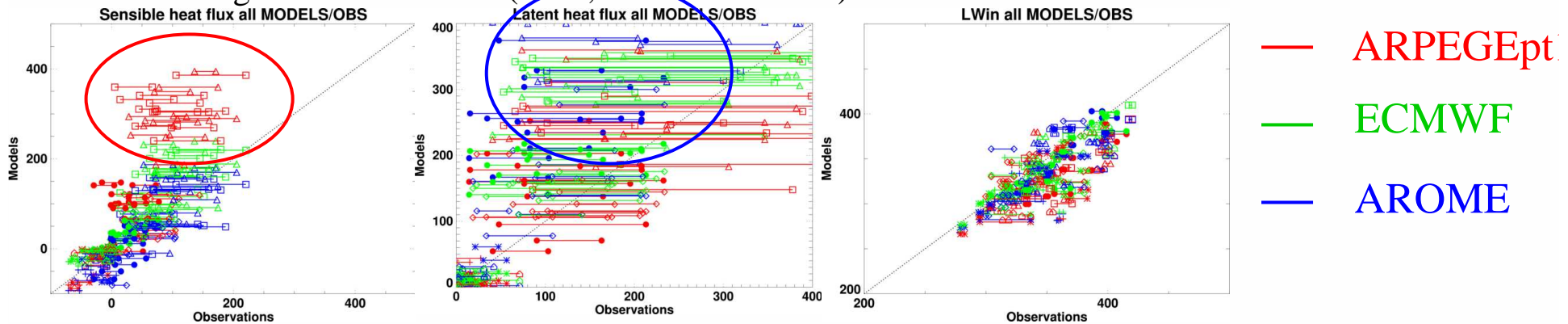
Gal behaviour:

- relatively good cloud cover representation
- some midclouds AROME/ARPE GE 20 June
- Some high clouds 27 June and 02 July

Representation of 2m-variables and fluxes



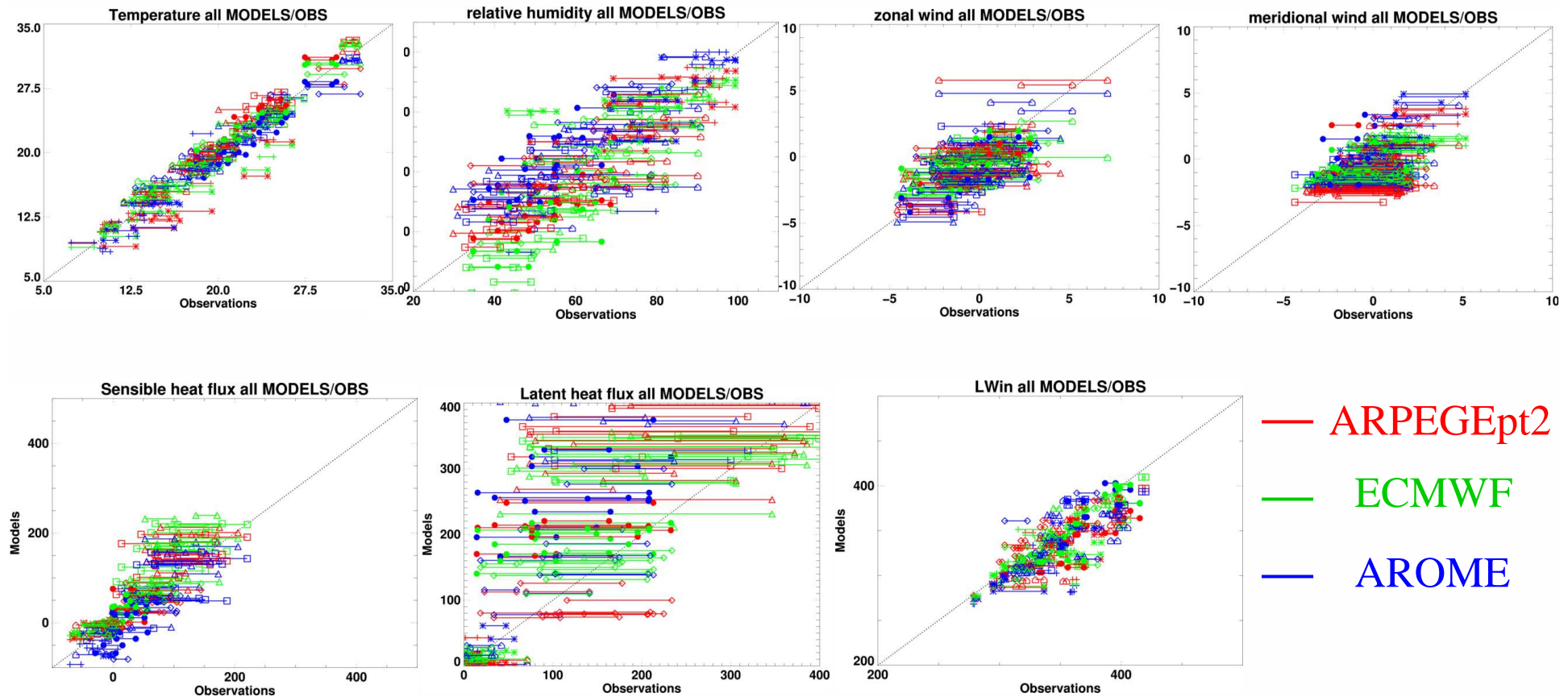
03, 06, 09, 12, 15, 18, 21 : 1 point for model
range for observations (Corn, Moor and Tower) in the hour



-ARPEGE tends to overestimate sensible heat flux and T2m, to underestimate rh2m (as ECMWF)

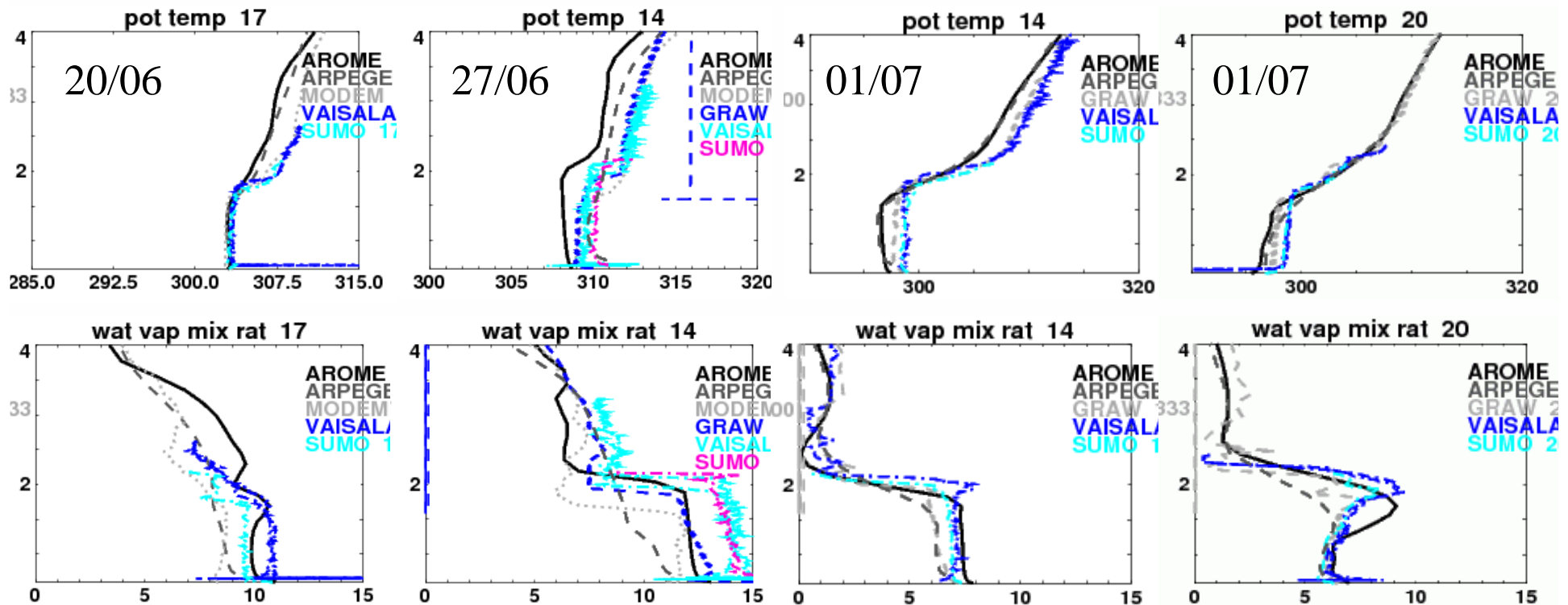
-AROME tends to overestimate latent heat flux

Impact of the chosen points for ARPEGE



- ARPEGE tends to overestimate sensible heat flux and T2m, to underestimate rh2m (as ECMWF) → not when using pt2 (not forest) : strong links to LU
- AROME tends to overestimate latent heat flux

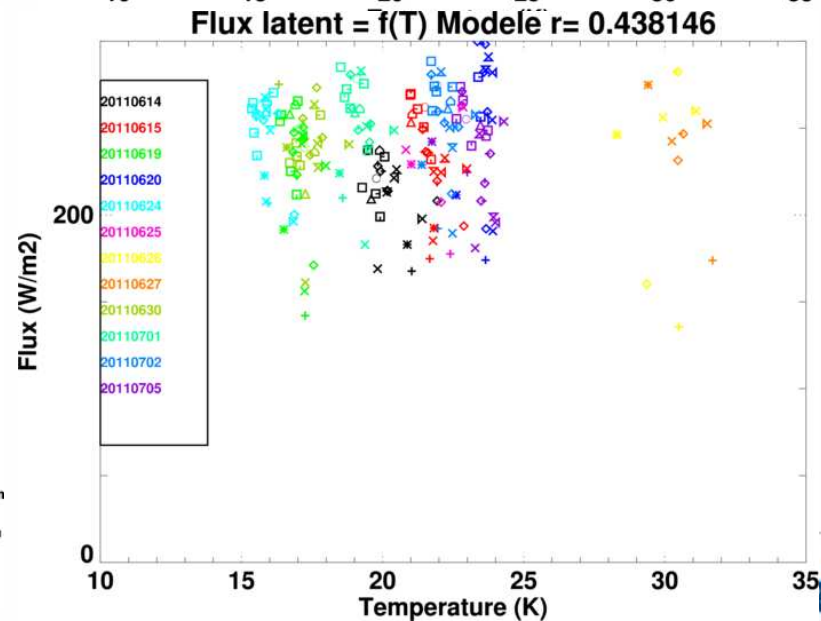
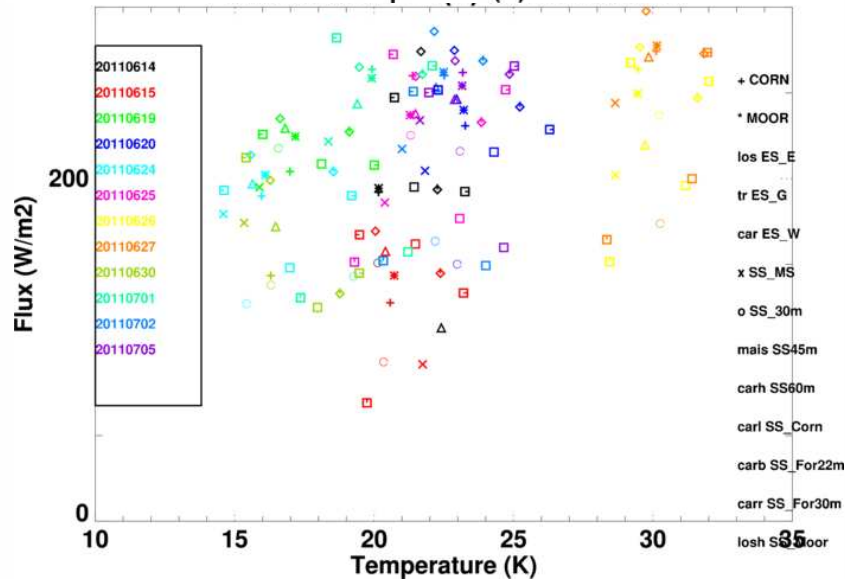
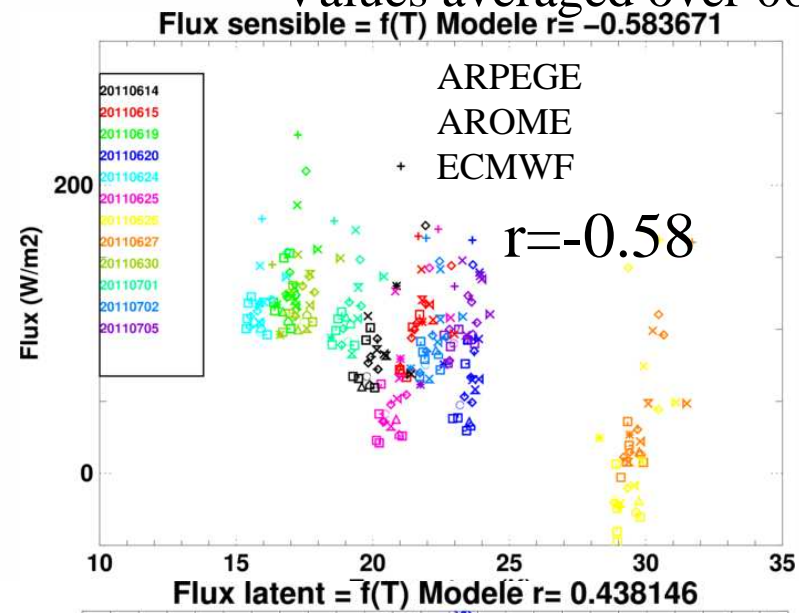
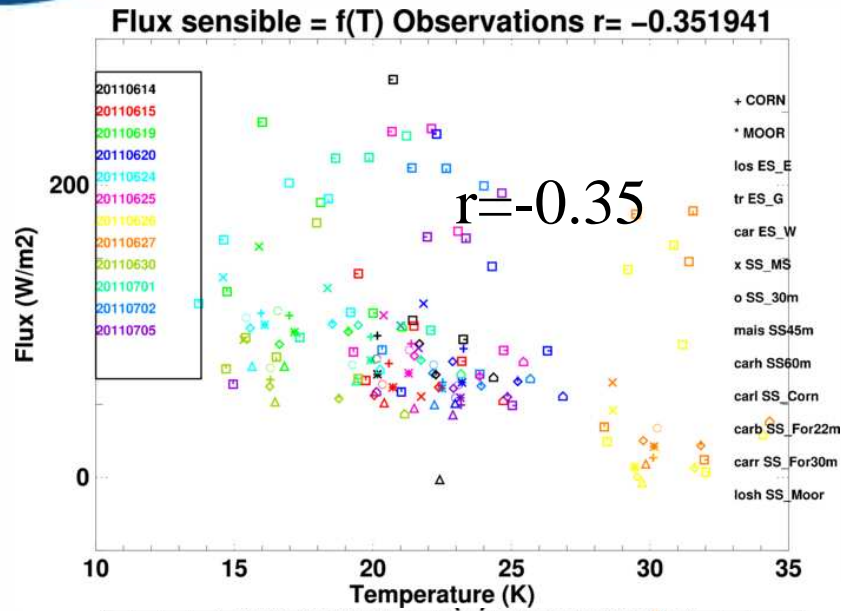
Representation of the vertical structure



- temperature : often inversion not strong enough, some cold bias
- Moisture : AROME is moister than ARPEGE (often in agreement with observations)

Temperature/Flux relationship:

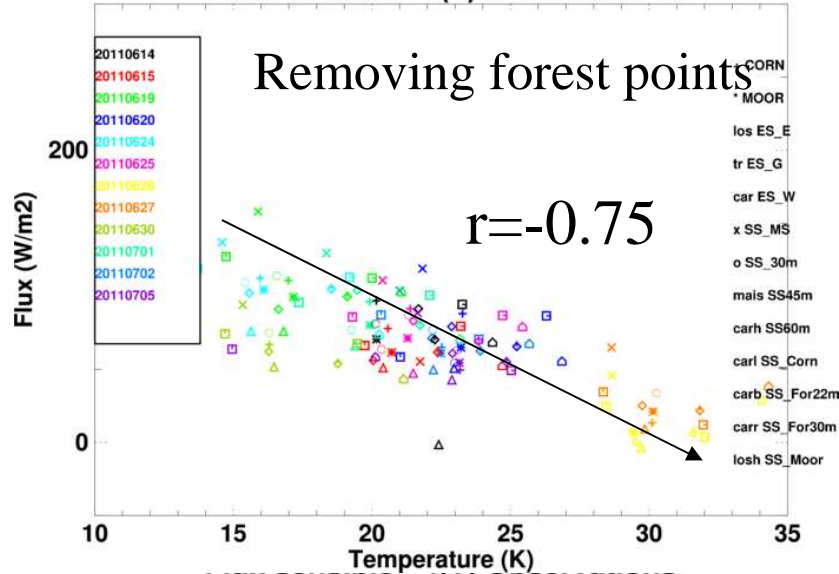
Values averaged over 06-> 18TU



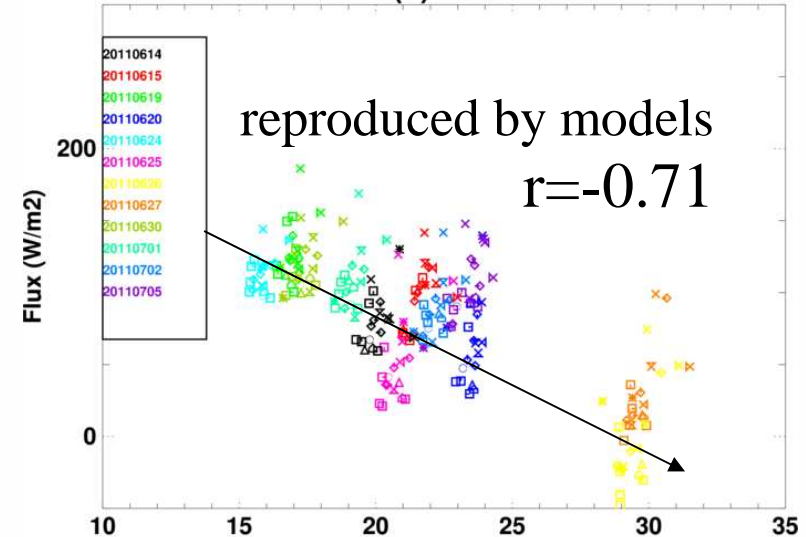
Temperature/Flux relationship:

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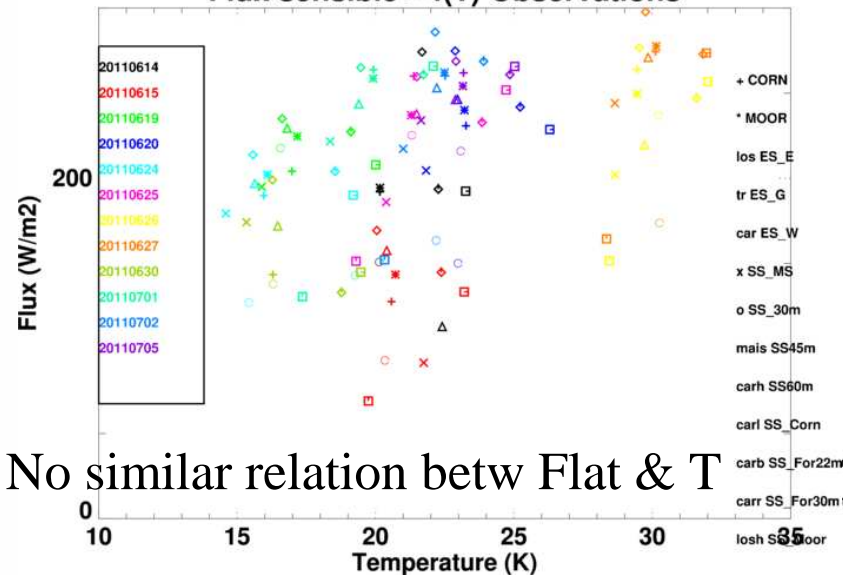
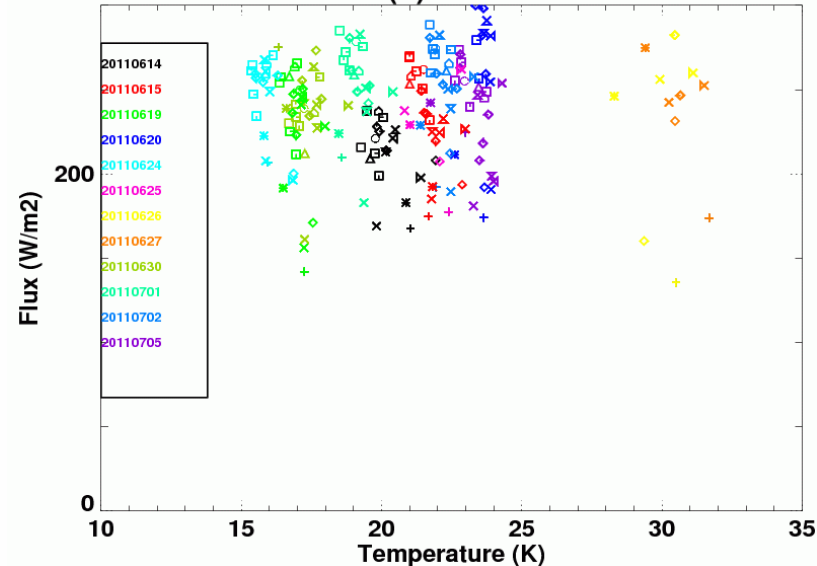
Flux sensible = f(T) Observations



Flux sensible = f(T) Model



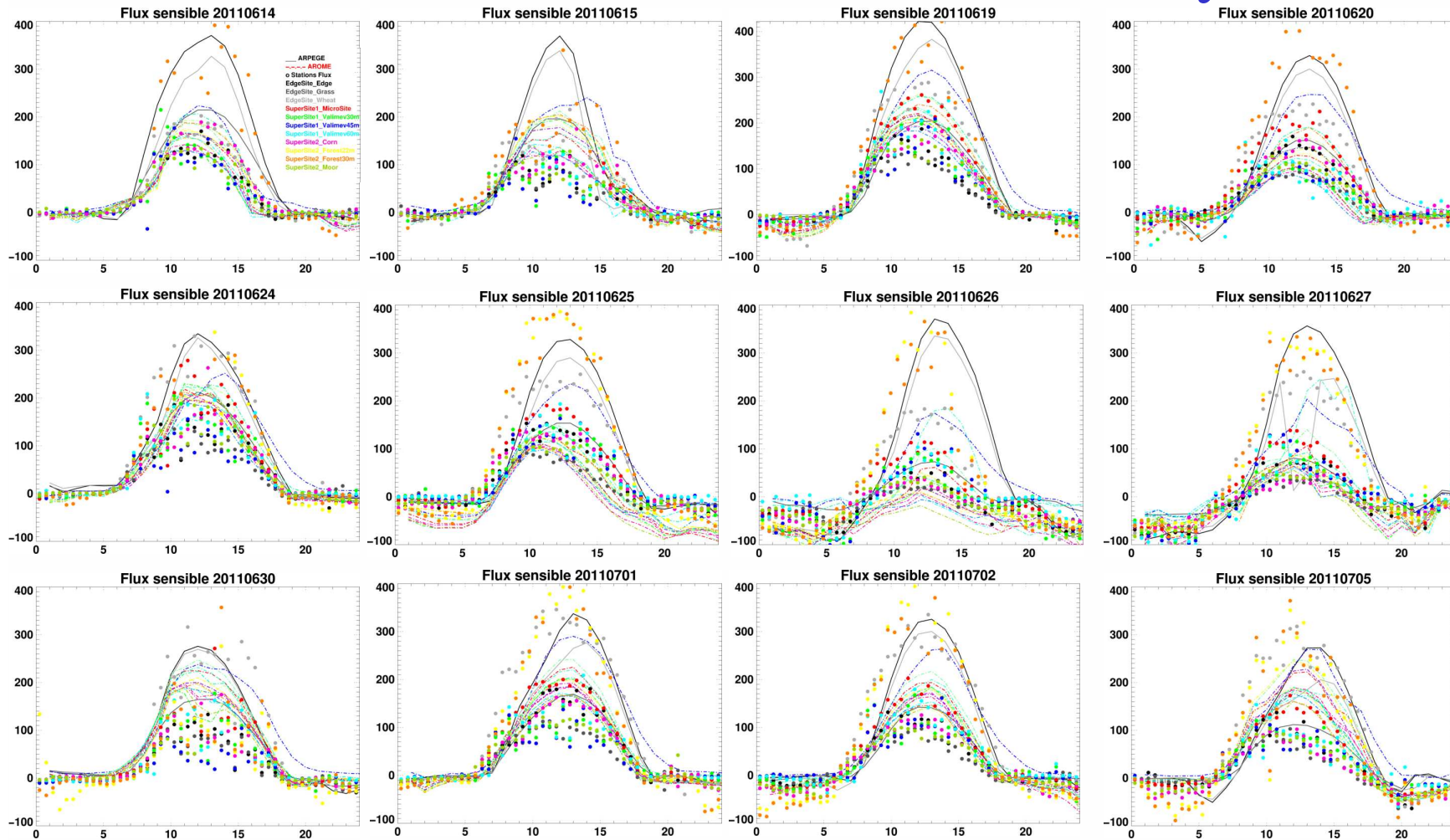
Flux latent = f(T) Model $r = 0.438146$



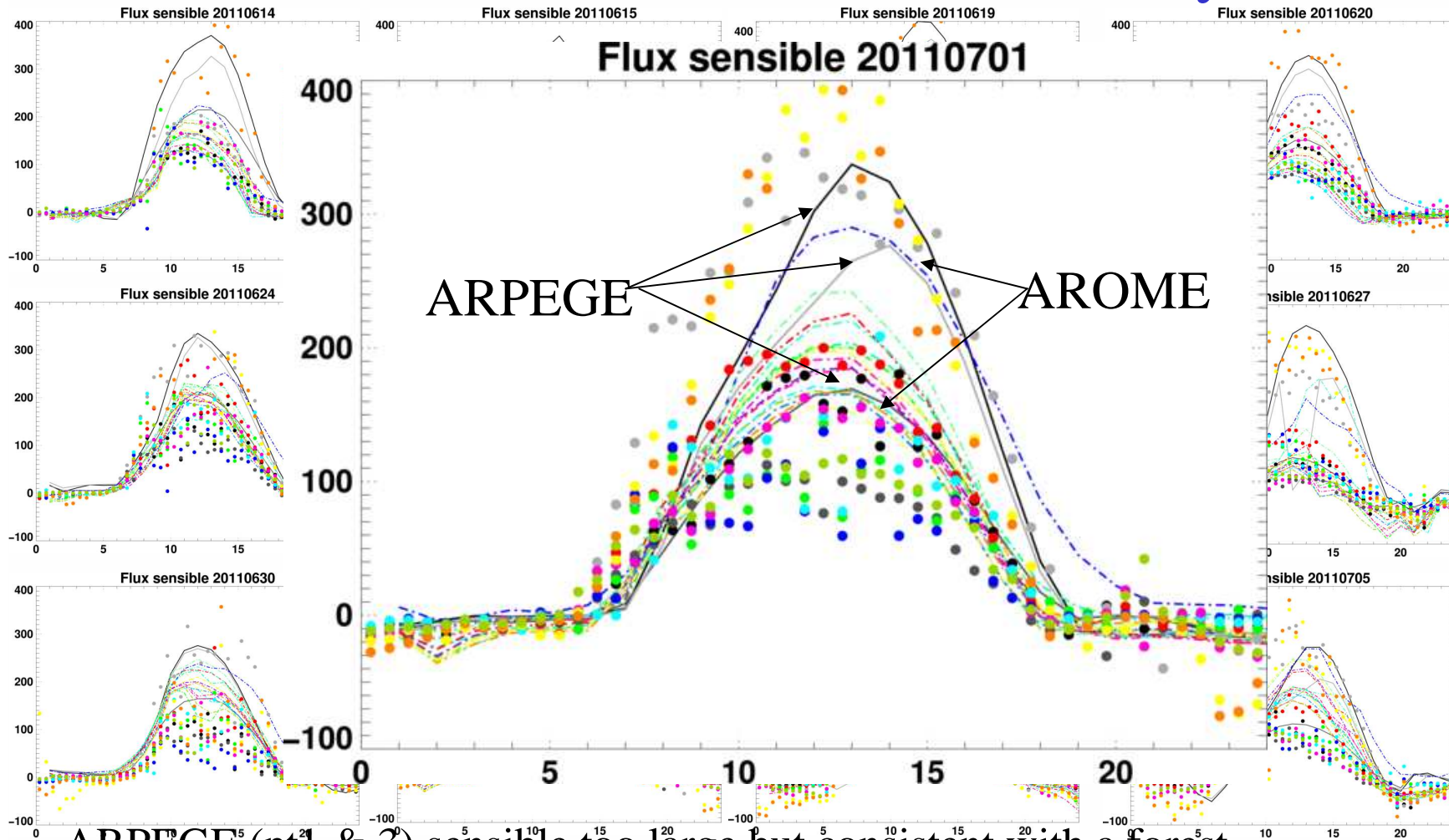
No similar relation betw Flat & T

No clear relation with the BL growing

A look at the horizontal variability in models



A look at the horizontal variability in models

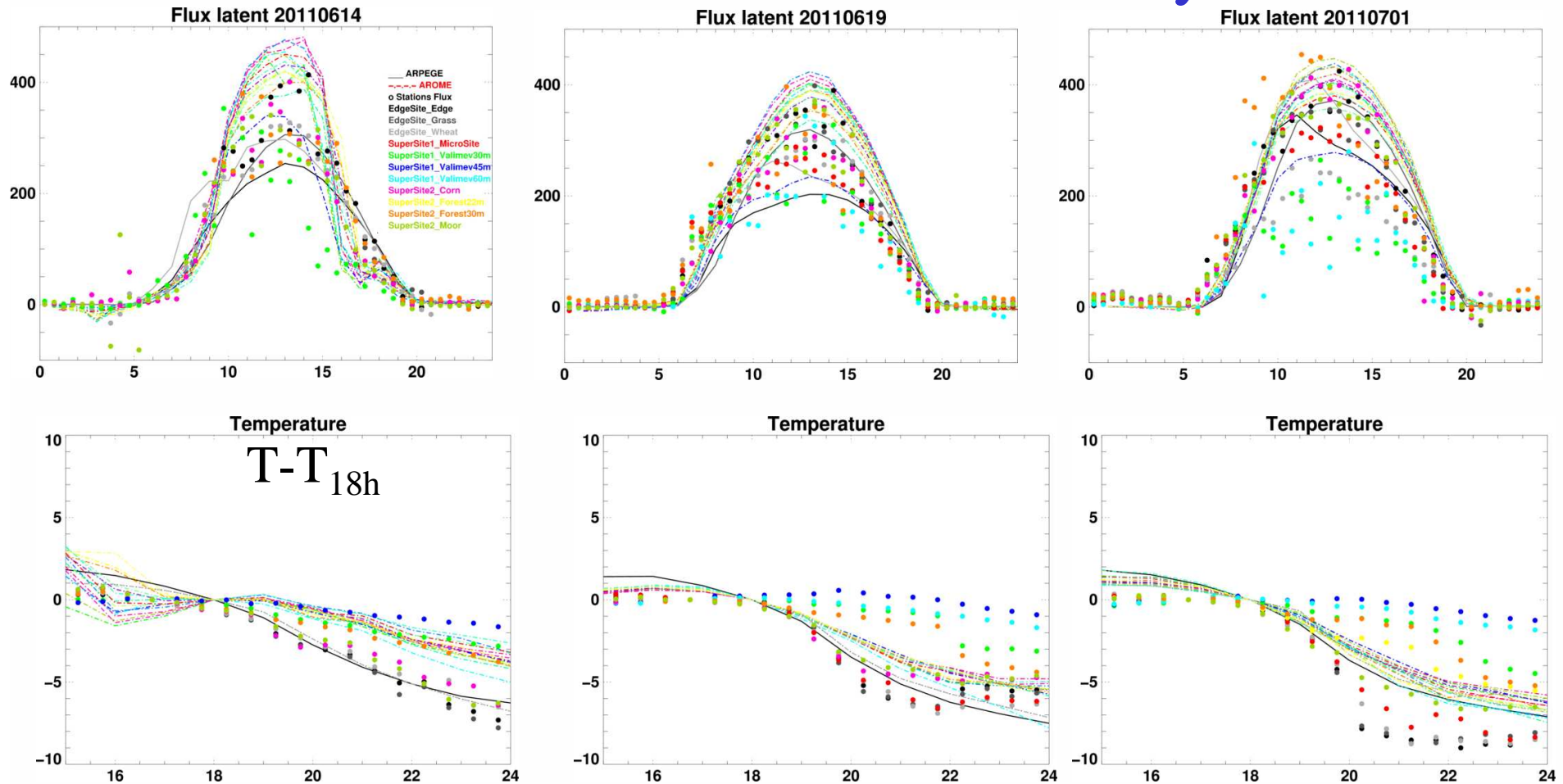


-ARPEGE⁵ (pt1 & 3) sensible too large but consistent with a forest

- AROME: blue and light green: has systematically larger SHF (-> points with larger grassland contribution). Variability similar than in observations

-Observations: some days wheat has SHF as large as the forest

A look at the horizontal variability in models

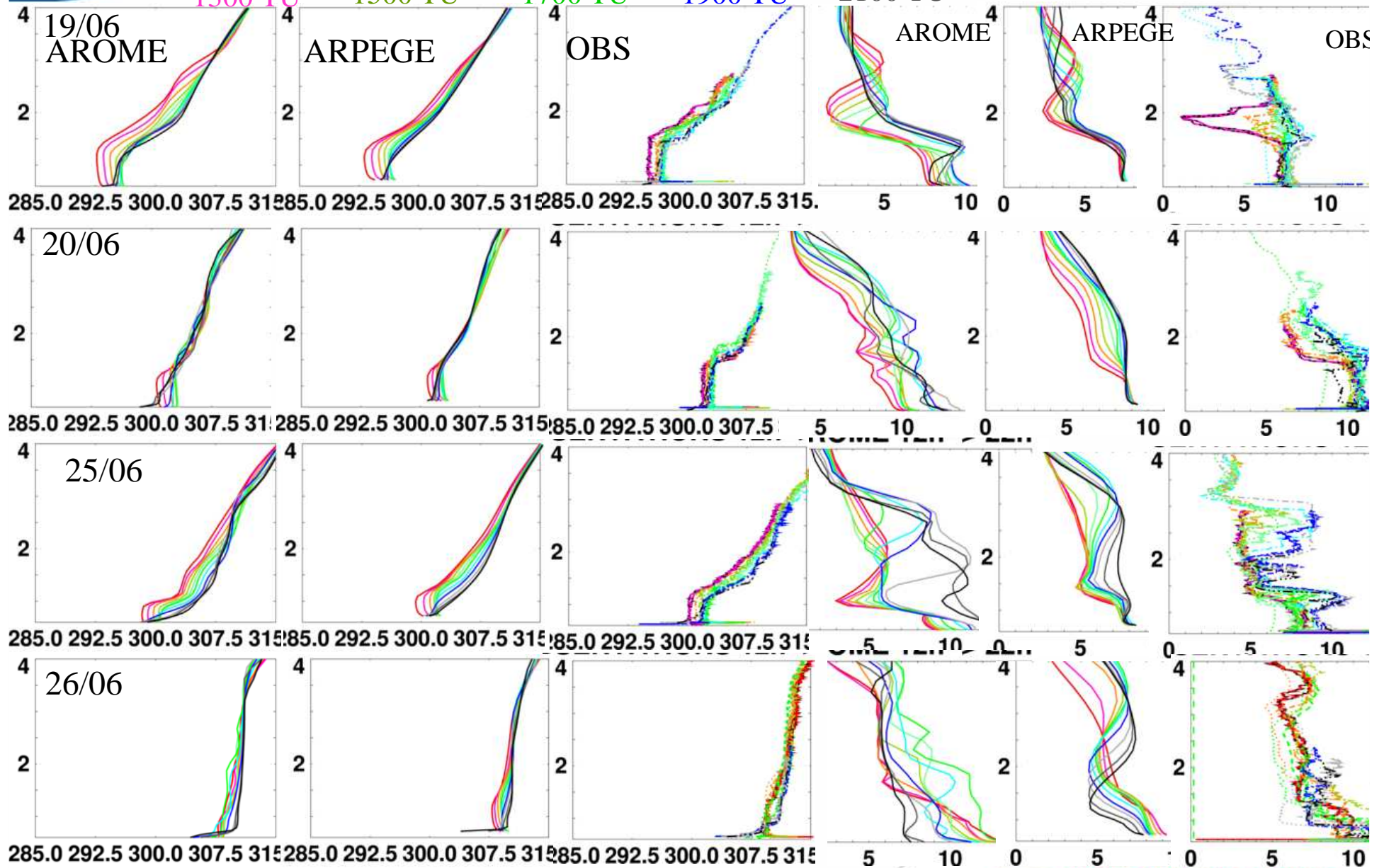


- LHF: AROME tends to overestimate LHF, smaller variability than observed
- Temp: ARPEGE larger & quicker decrease in the afternoon than AROME; in observations, different behaviours among the stations

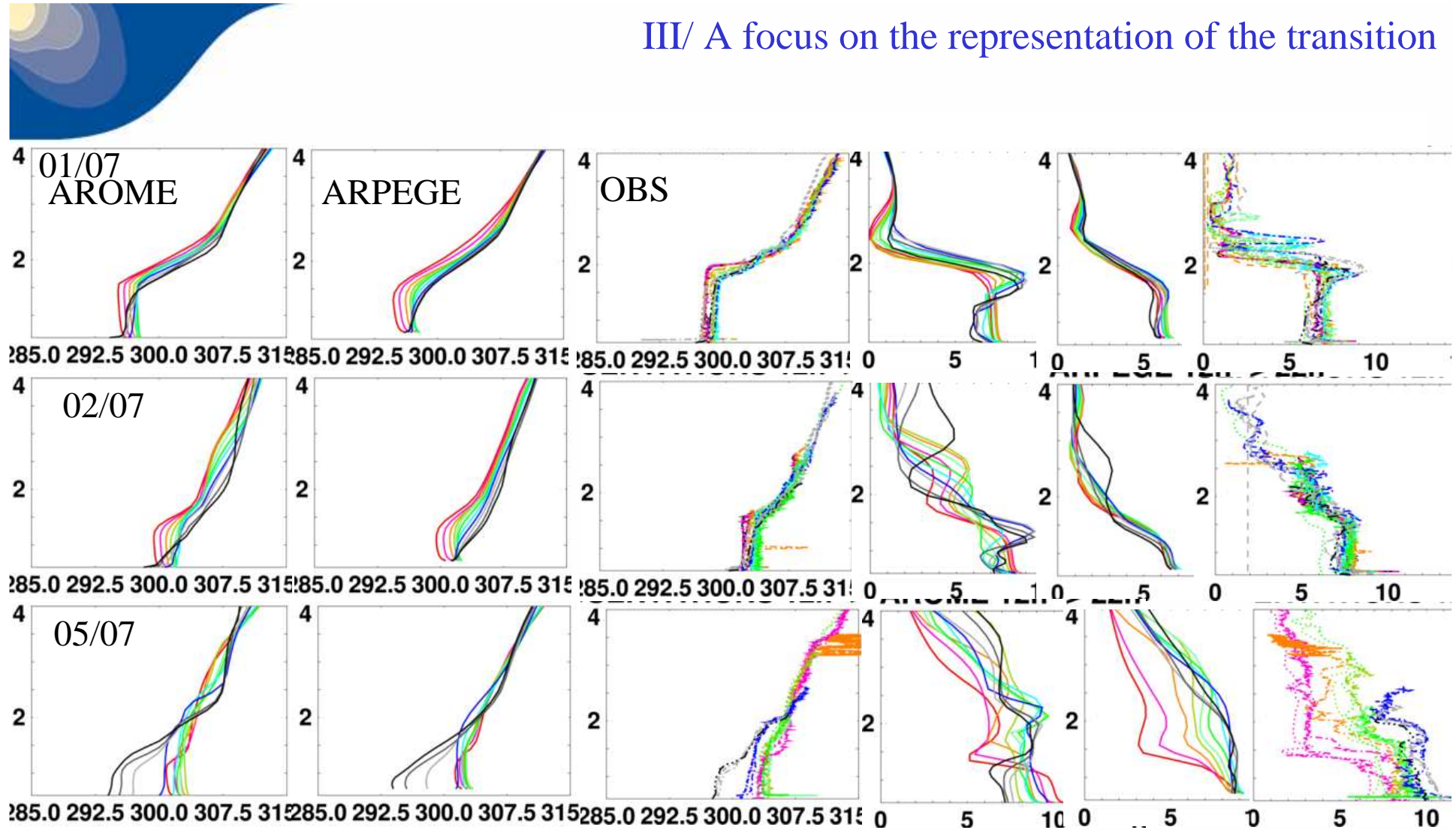
III/ A focus on the representation of the transition

Evolution from 12 to 22TU

— 1200 TU — 1400 TU — 1600 TU — 1800 TU — 2000 TU — 2200 TU
 — 1300 TU — 1500 TU — 1700 TU — 1900 TU — 2100 TU



III/ A focus on the representation of the transition

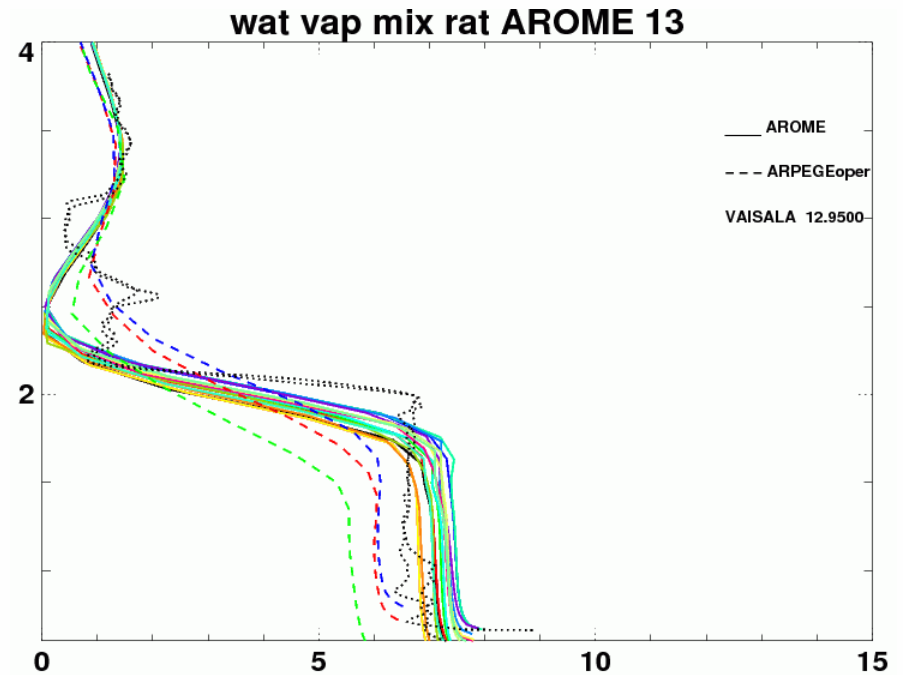
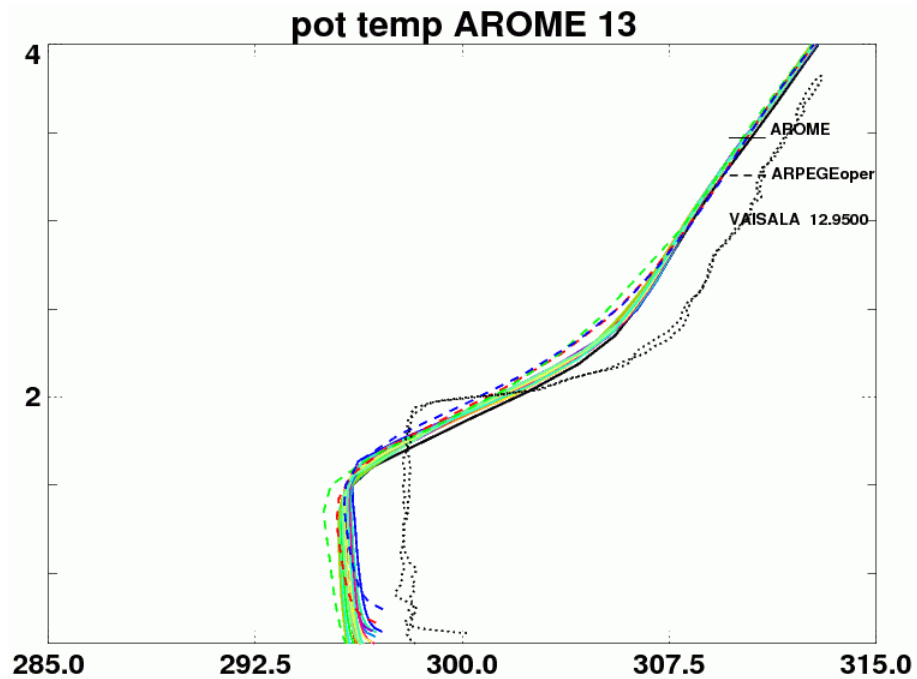


Globally a better representation of the vertical structure in the transition for AROME

III/ A focus on the representation of the transition

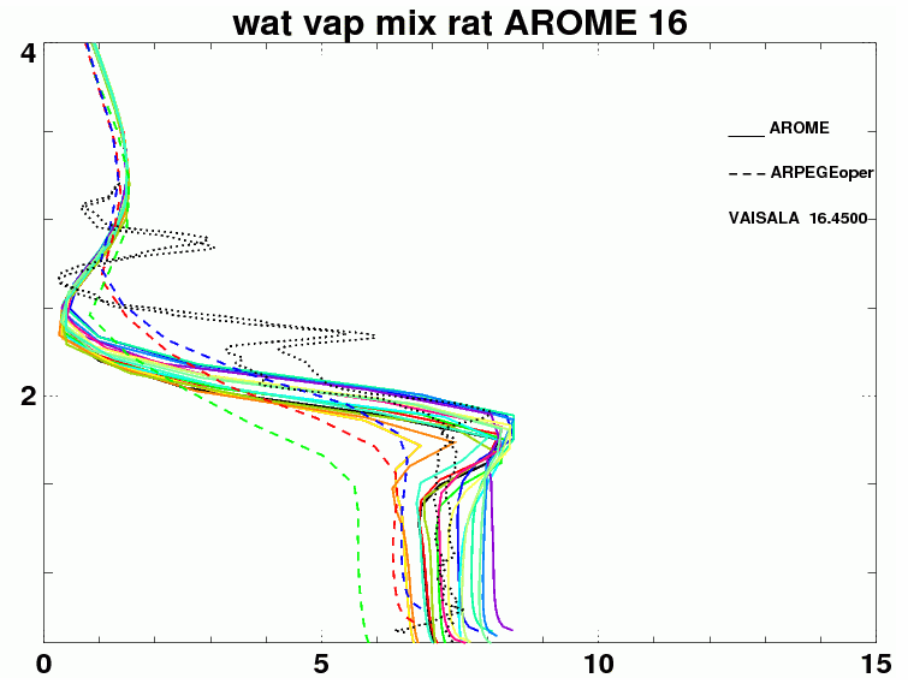
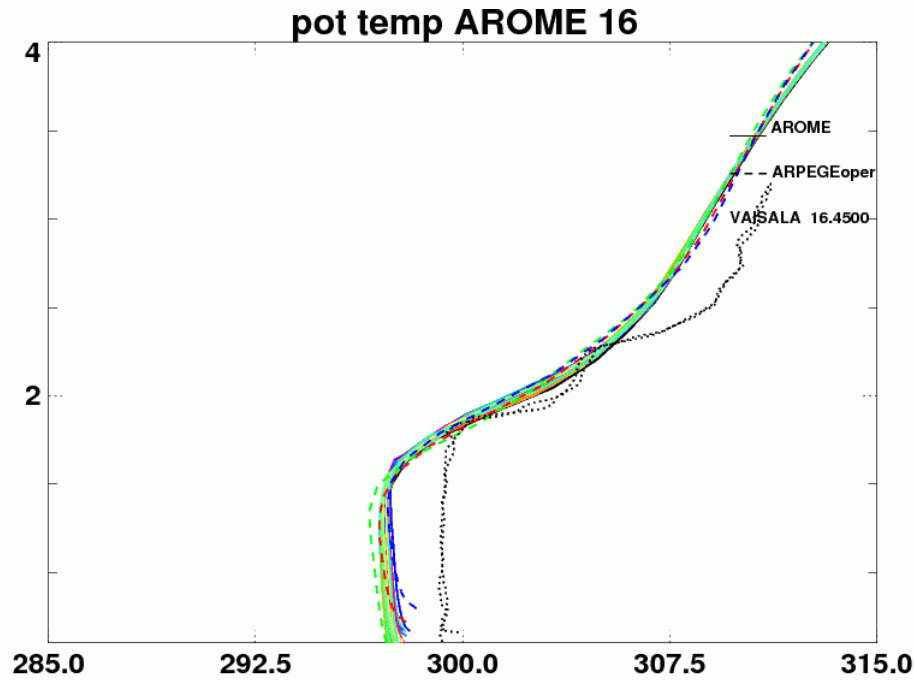
Vertical structure during transition

2011-07-01 13 UTC



Vertical structure during transition

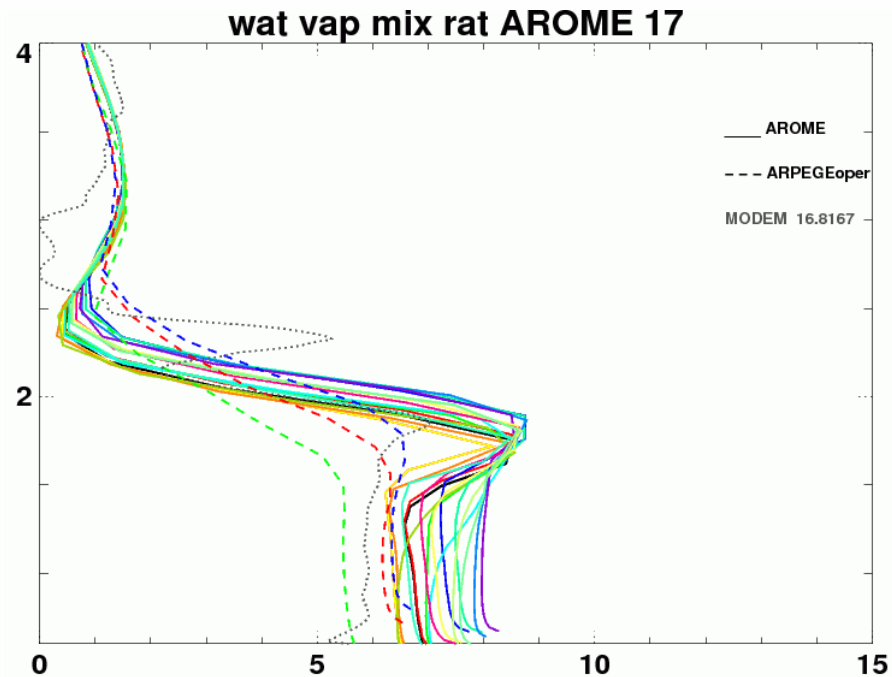
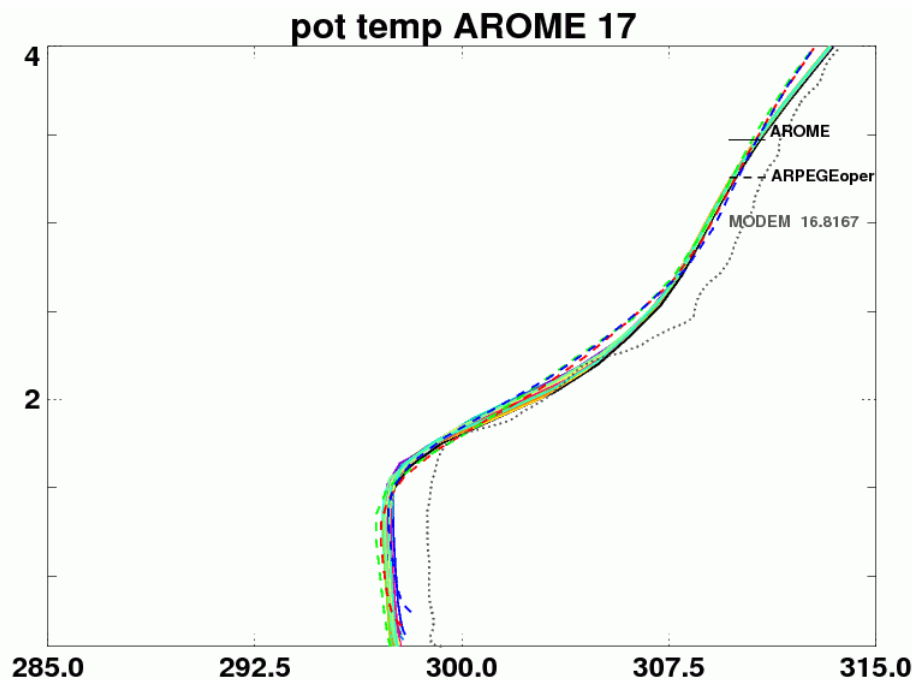
2011-07-01 16 UTC



Vertical structure during transition

2011-07-01 17 UTC

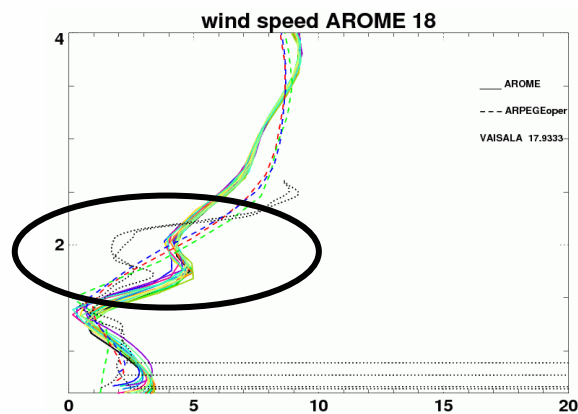
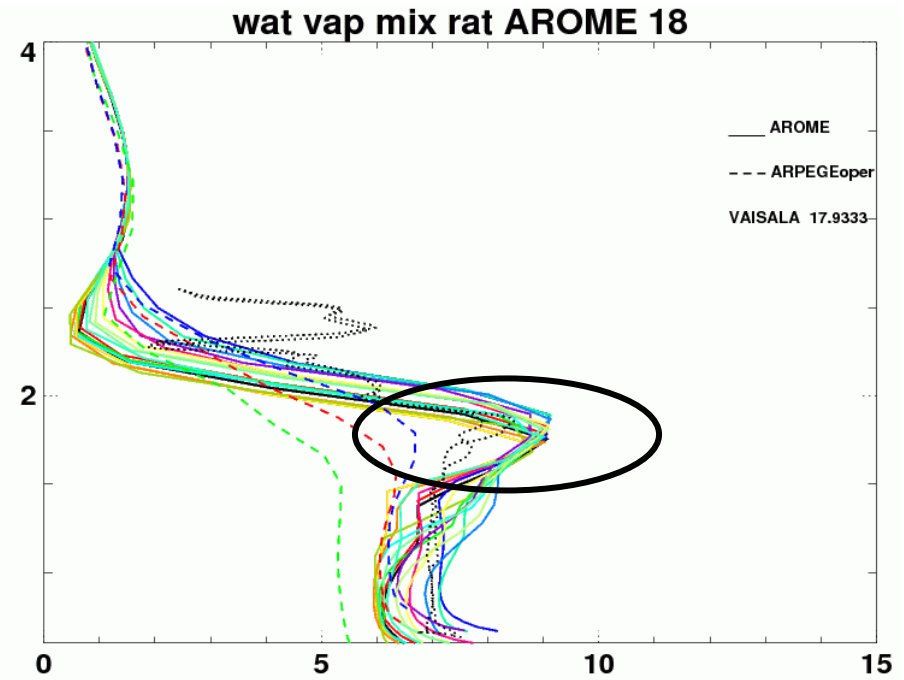
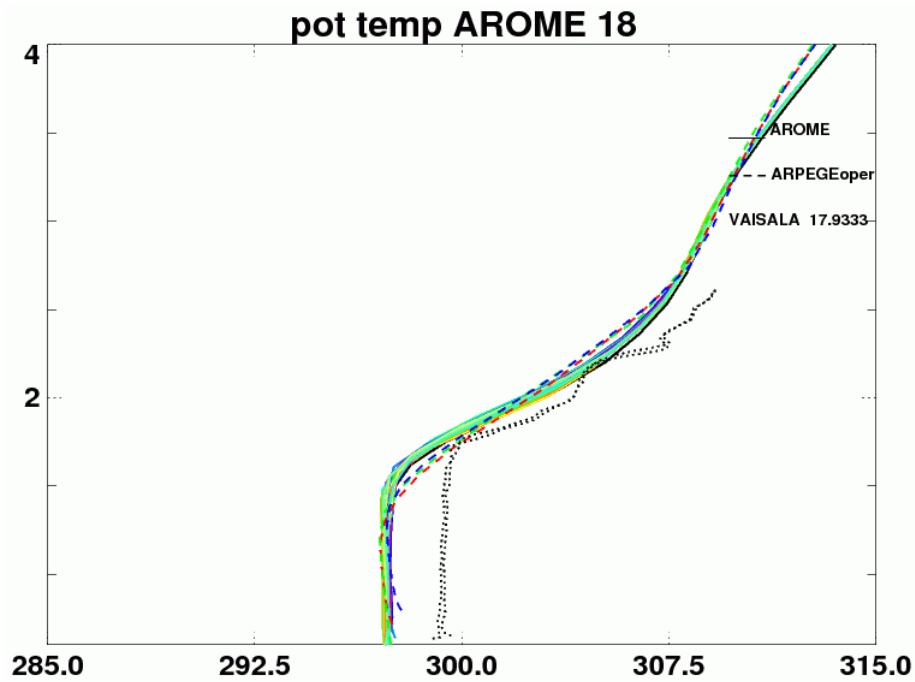
III/ A focus on the representation of the transition



Vertical structure during transition

2011-07-01 18 UTC

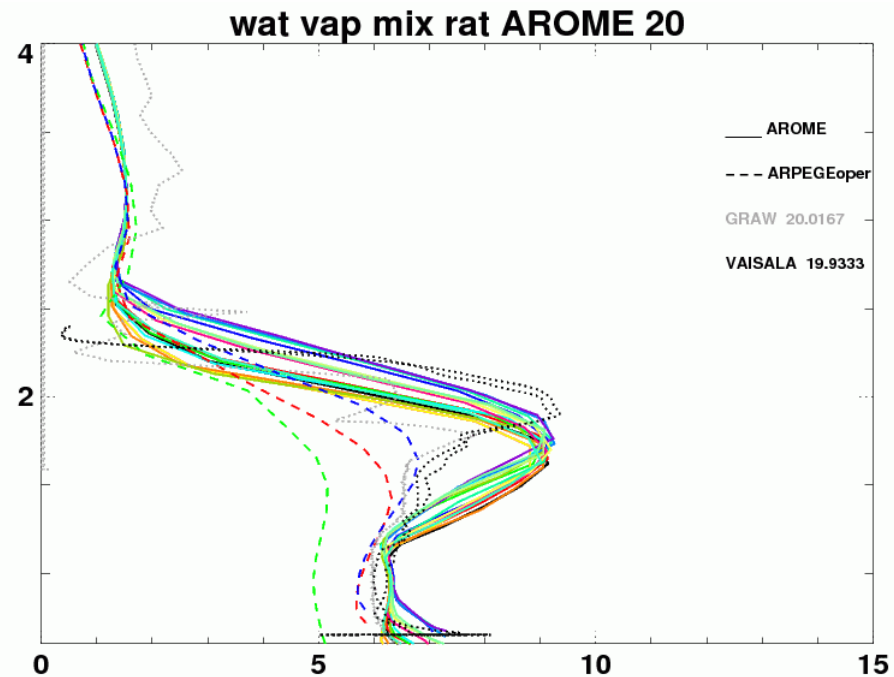
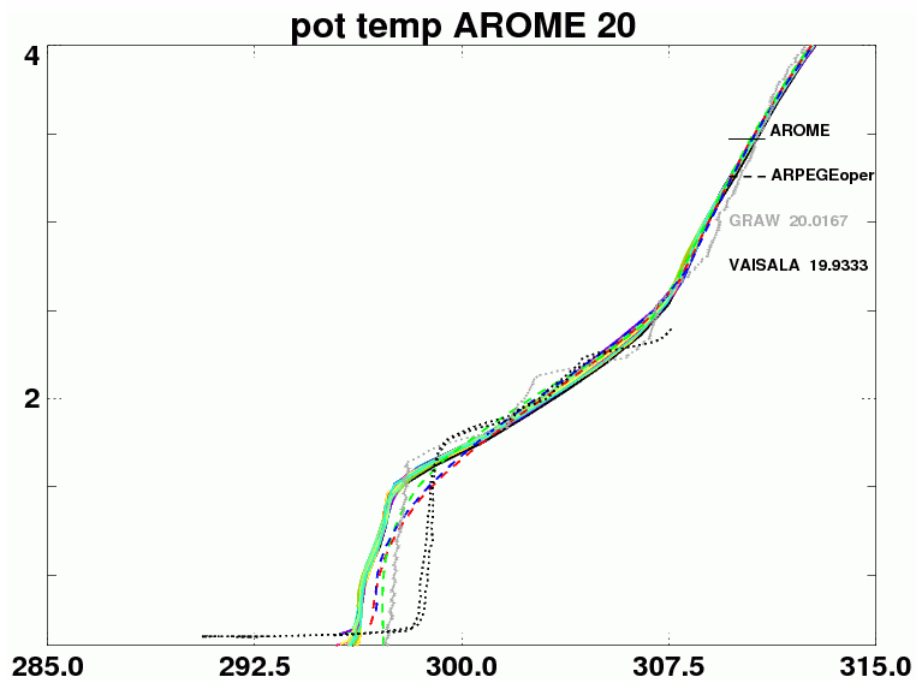
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Vertical structure during transition

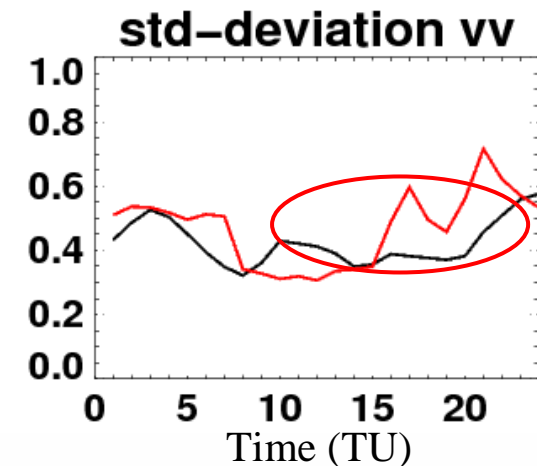
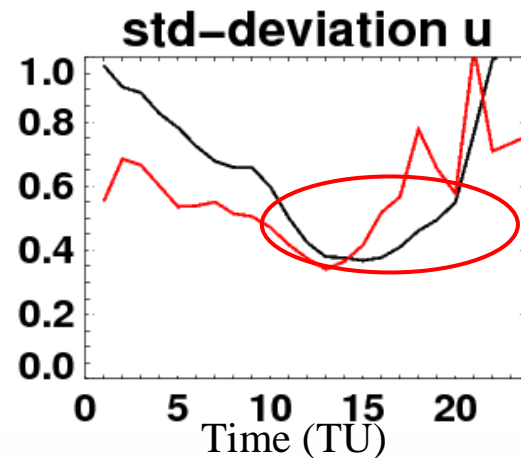
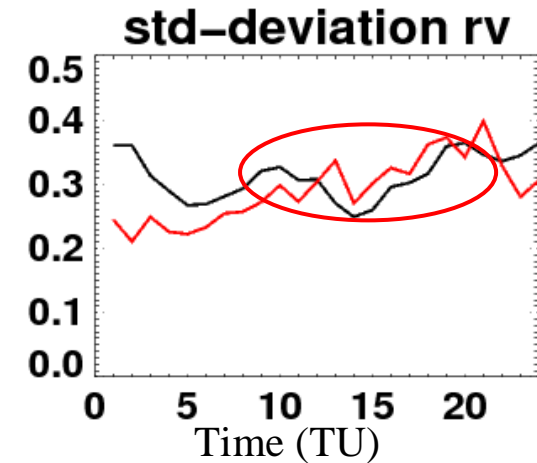
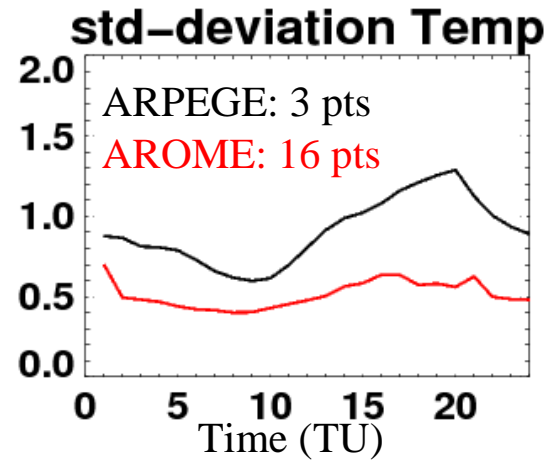
2011-07-01 20 UTC

III/ A focus on the representation of the transition



III/ A focus on the representation of the transition

Even though on a smaller domain, a larger rv variability in AROME due to complex advection (also larger uu and vv variability)



Standard deviation is computed for each day with the different points (3 for ARPEGE, 16 for AROME) and averaged over heights below 1.5km and then averaged for all IOP days



Conclusions

- An extensive evaluation thanks to the set of observations
- Globally the models represent the cloud characteristics
- Part of the errors in ARPEGE are linked to a different Land-Use (by the way large impact of forest on the surface fields), also not shown but a large impact of the call of the radiative scheme
- AROME better resolves the vertical structure and its evolution (in particular structures linked to advection)
- An interesting relationship between temperature and averaged sensible heat flux => no large SSHF during hot days