

# ALADIN in Slovenia - 2017

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## HPC system

Technical characteristics (SGI ICE X):

- 62 compute nodes installed in two racks, every compute node has 32 GB of memory and 2 eight core Sandy Bridge processors(E5-2670 @ 2.6 GHz) (992 cores),
- two Infiniband FDR networks,
- 150 TB of disk space (HA NFS).

Software:

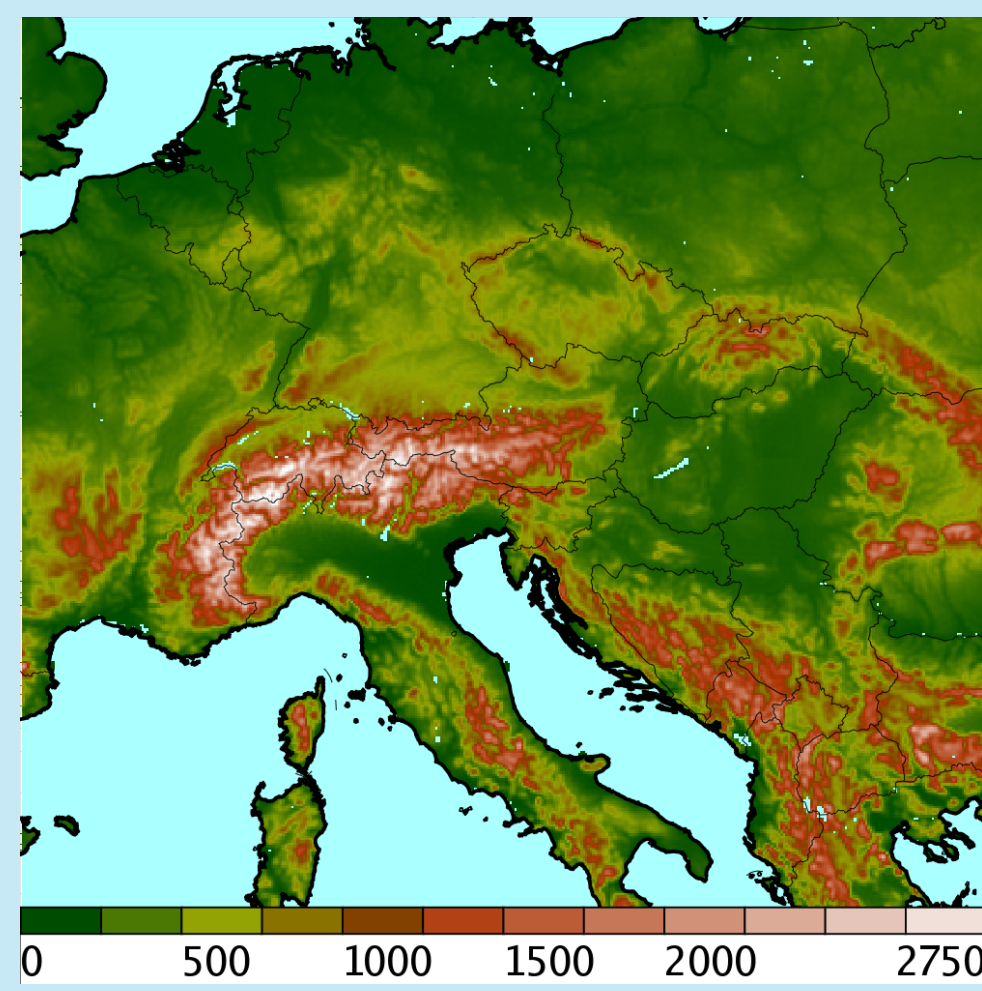
- OS: SGI ProPack on top of Suse Enterprise Server,
- Intel Fortran compiler, SGI mpt,
- Altair PBS job queueing system,
- TotalView debugger.



## Operational suite

Model characteristics:

- CY38T1, ALARO-0 baseline,
- 4.4 km horizontal grid spacing, 87 model levels,
- linear spectral elliptic truncation,
- Lambert projection,
- 421x421 points, (with extension zone 432x432), E215x215,
- 180 s time-step,
- four production runs per day: 00, 06, 12, 18, forecast up to 72 hours, additionally four runs 03, 09, 15, 21 up to 36 hours,
- coupling at every 3 hours, LBC from ECMWF Boundary Conditions Optional project (time lagged coupling).
- cy40t2\_bf7 with ALARO-1vB is in e-suite



ALADIN-Slovenia model domain.

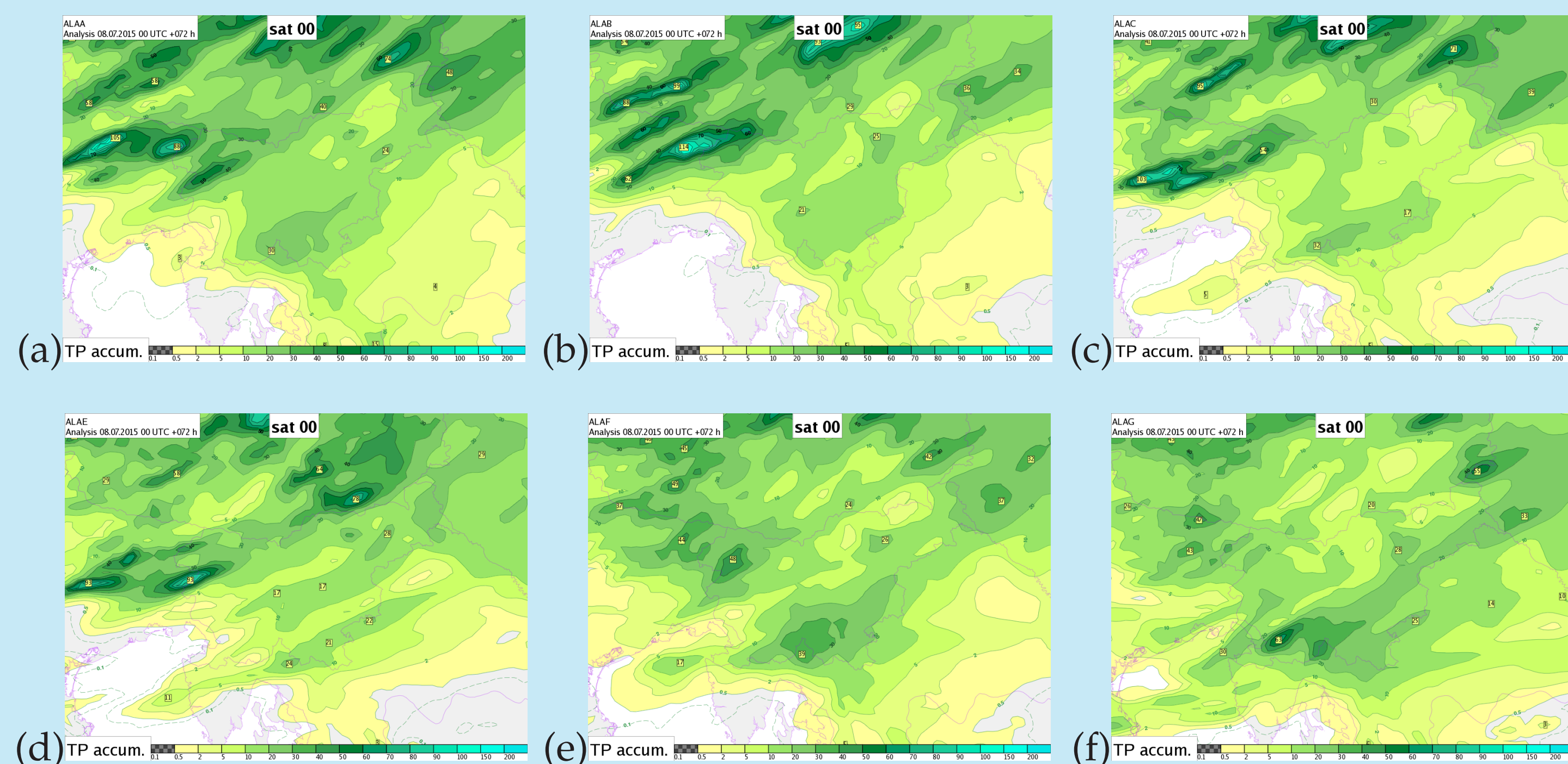
Assimilation cycle:

- 3-hourly 3D-Var assimilation cycle (RUC),
- B-matrix sampled from downscaled ECMWF ensemble members,
- CANARI surface analysis using surface observations (T and RH at 2 m),
- coupling frequency 1 hour,
- space consistent coupling, no digital filter initialization,
- observations: OPLACE data and local observations (SYNOP, Mode-S MRAR).

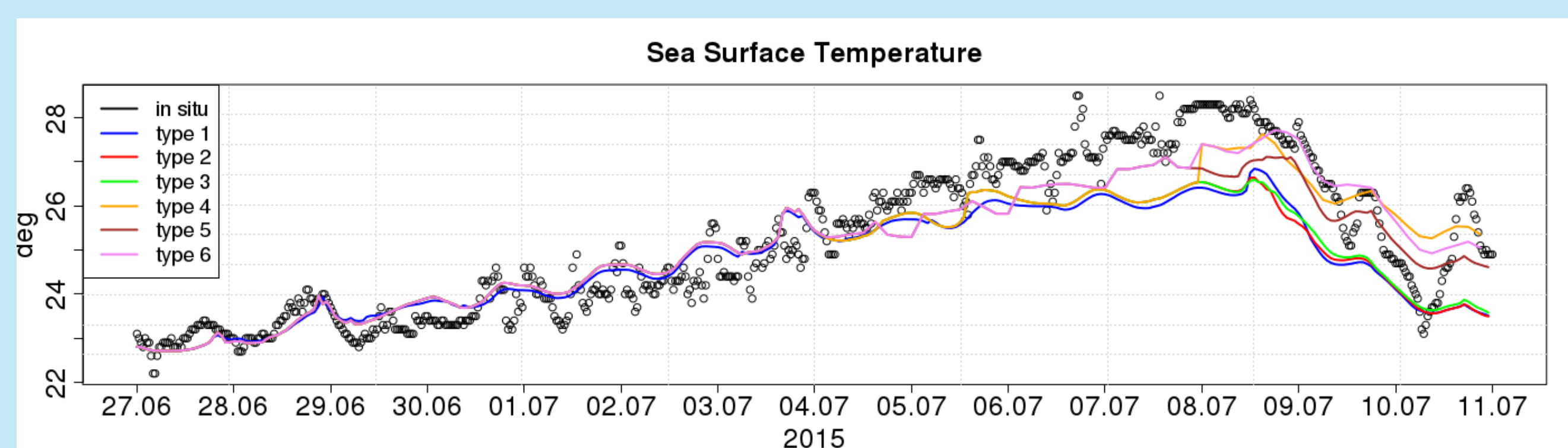
## Precipitation in two-way atmosphere-ocean coupling

Positive impact of two-way coupled system using Princeton Ocean Model (POM) over the Adriatic sea and Mediterranean Forecasting System (MFS) with respect to one-way coupling was previously demonstrated mainly for sea surface variables. The follow-up work focuses on precipitation along Adriatic coast:

- several heavy precipitation cases simulated by a short warm-up period (data assimilation cycle) and 72 h forecast,
- several approaches to applying the one- or two-way coupling and using SST information in ALADIN were compared,
- preliminary results suggest that it is important that two-way coupling is applied during the long term (e.g. 72 h) forecast and also during the warm-up period,
- the precipitation forecast is more sensitive to two-way coupling in the Adriatic sea for smaller synoptic systems (e.g., cut-off lows, fronts).



The 72 h precipitation accumulation using various SST implementations: (a) ECMWF/OSTIA, (b) MFS, (c) MFS + Adriatic POM, (d) MFS + Adriatic POM + two-way cycled forecast, (e) two-way coupled warm-up + uncoupled forecast, (f) two-way cycled warm-up and forecast.

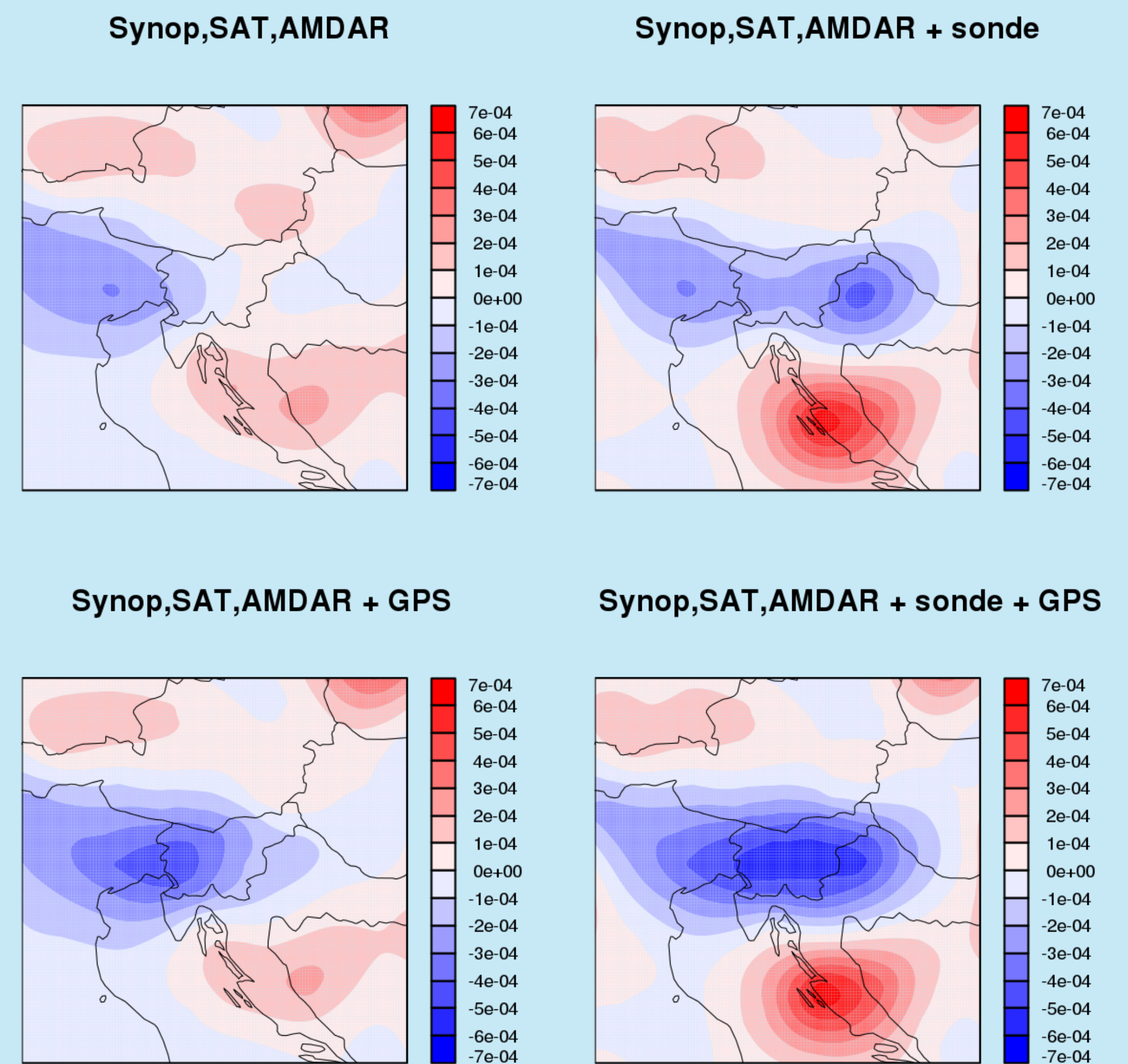


Verification of SST at a buoy located in Gulf of Trieste for the same event and same coupling types (1-6). Fully coupled run (type 6) clearly overperforms the other experiments.

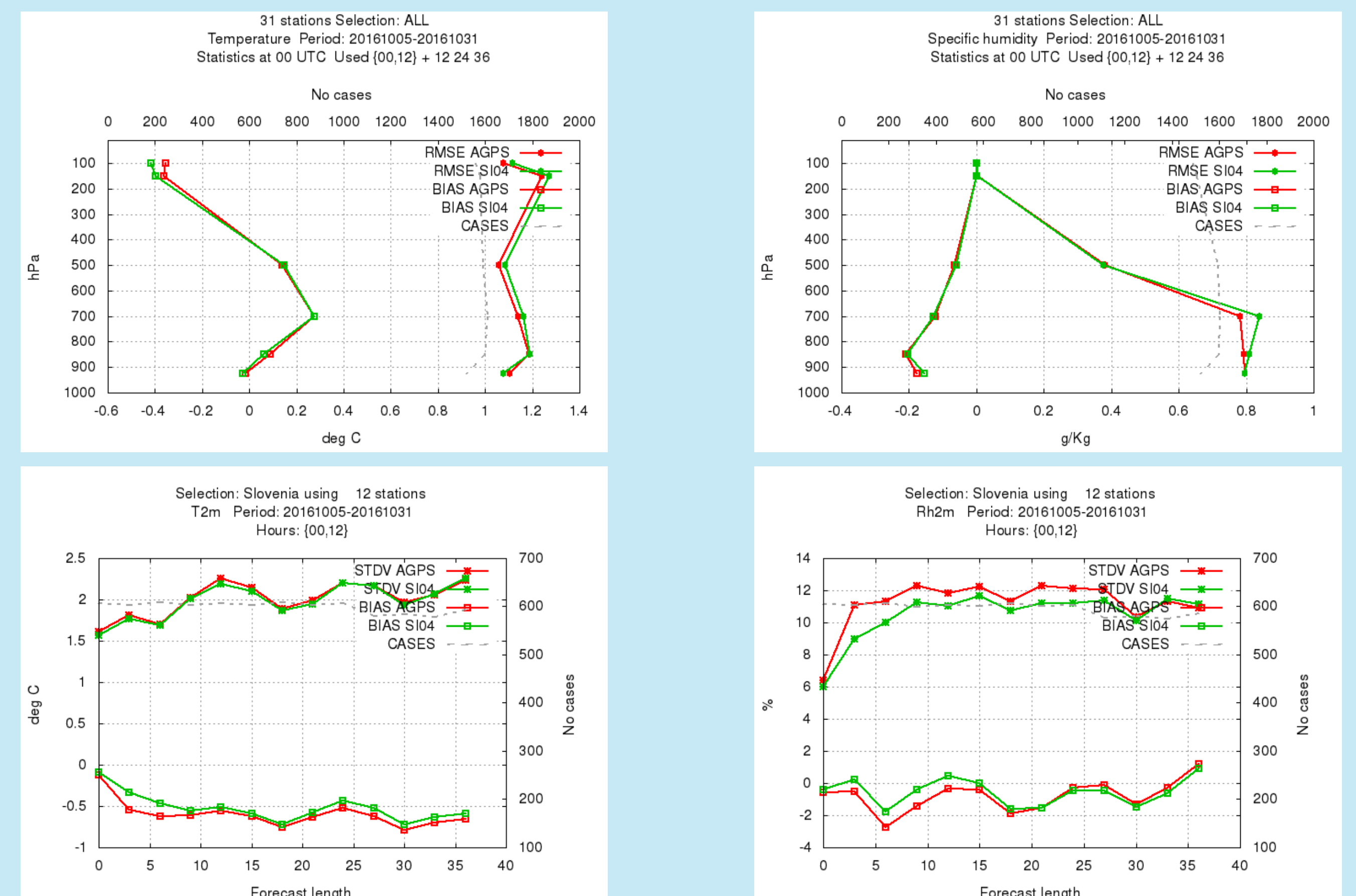
## Data assimilation of GPS ZTD observations

Evaluation of GPS Zenith Total Delay (ZTD) observations from Slovenian Geodetic Institute (SIGNAL network) is ongoing:

- impact is generally positive on the upper-air scores,
- the surface variables over Slovenia are degraded (e.g., cold and dry bias in October),
- due to mixed impact the data are not yet used operationally.



An illustrative case of GPS-ZTD impact on specific humidity analysis on level 50 over Slovenia. Shown are analysis increments with respect to the same first guess when GPS are added on top of Synop, aircraft and satellite (SAT) observations (bottom left) and additionally radiosonde observations (bottom right). Upper plots are references with and without radiosondes. GPS-related humidity increments are comparable and coherent with other observations.



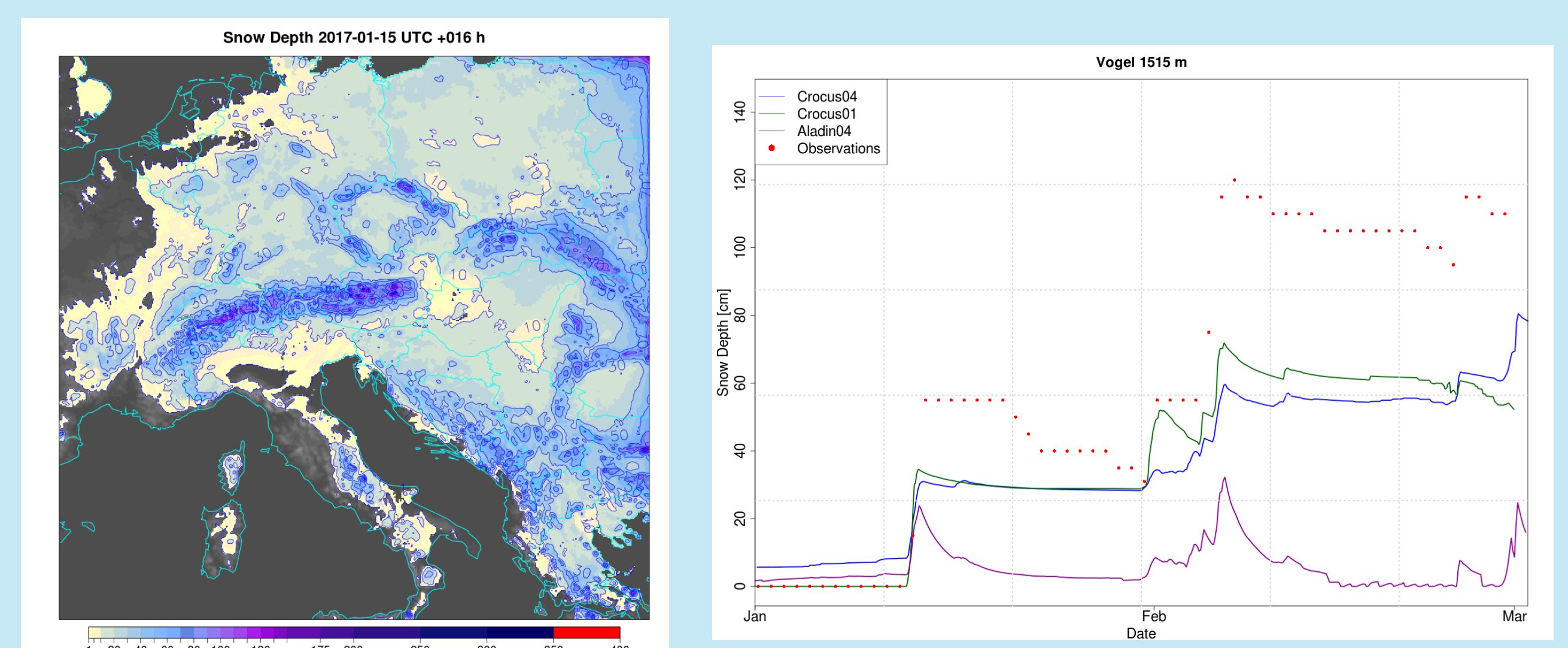
Verification of experiments using SIGNAL GPS (AGPS) and operational suite (SIS4). Shown are temperature and relative humidity against radiosondes and Slovenian Synop stations.

## CROCUS snow model

Performance of snow model Crocus (offline SURFEX) was evaluated over the winter 2017:

- the model is either coupled to INCA analysis or ALADIN forecast,
- snow analysis and forecast is produced for each grid point of the model,
- results are generally encouraging.

The model will be used primarily as a snow product for hydrology and as a tool in snow avalanche risk diagnosis and forecasting, but could later also be used as snow analysis for ALADIN.



An example of snow depth forecast on ALADIN domain on 2017-01-15 (left) and performance of Crocus analysis for January-February 2017 on Slovenian mountain station Vogel. Crocus is coupled with ALADIN (Crocus04) or INCA analysis (Crocus01). Estimated snow depth from ALADIN is also shown (Aladin04). Points are snow depth observations.