

# ALADIN in Slovenia - 2015

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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:

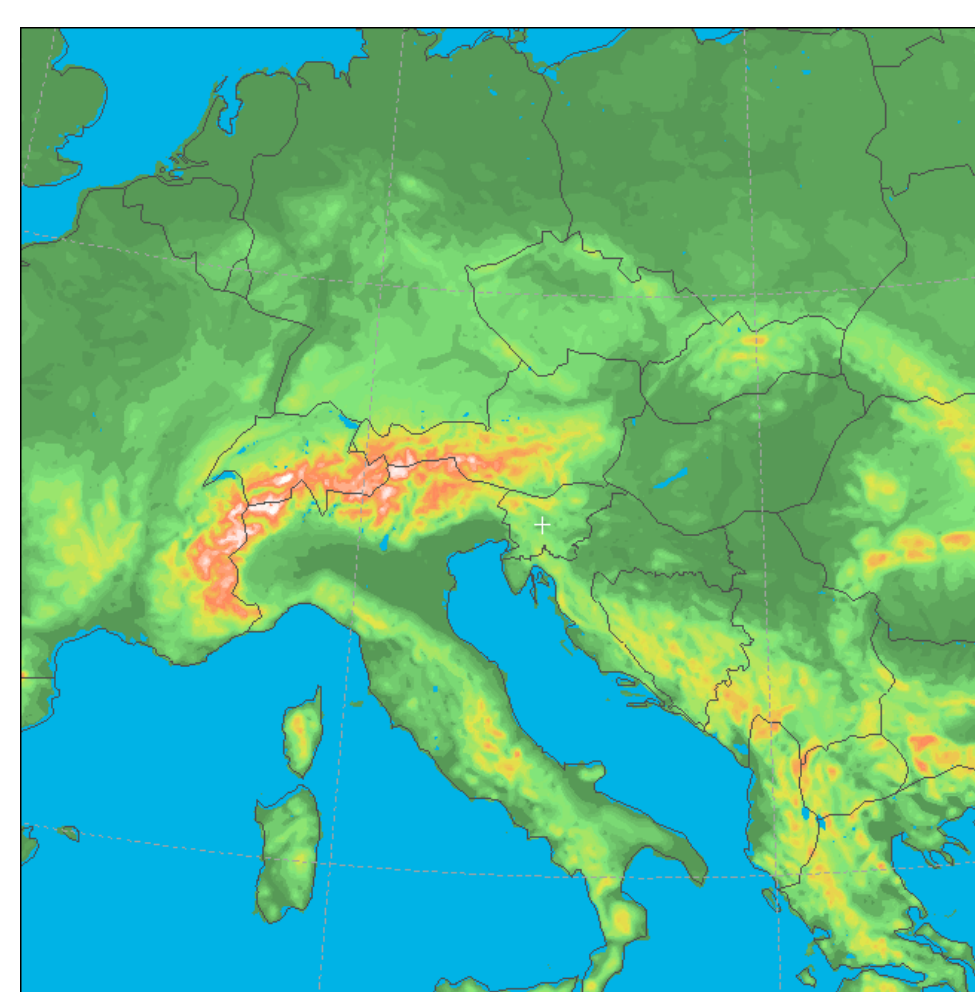
- OS: SGI ProPack on top of Suse Enterprise Server,
- Intel Fortran compiler, SGI mpt,
- Altair PBS job queueing system,
- TotalView debugger.



## 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).



ALADIN-Slovenia model domain.

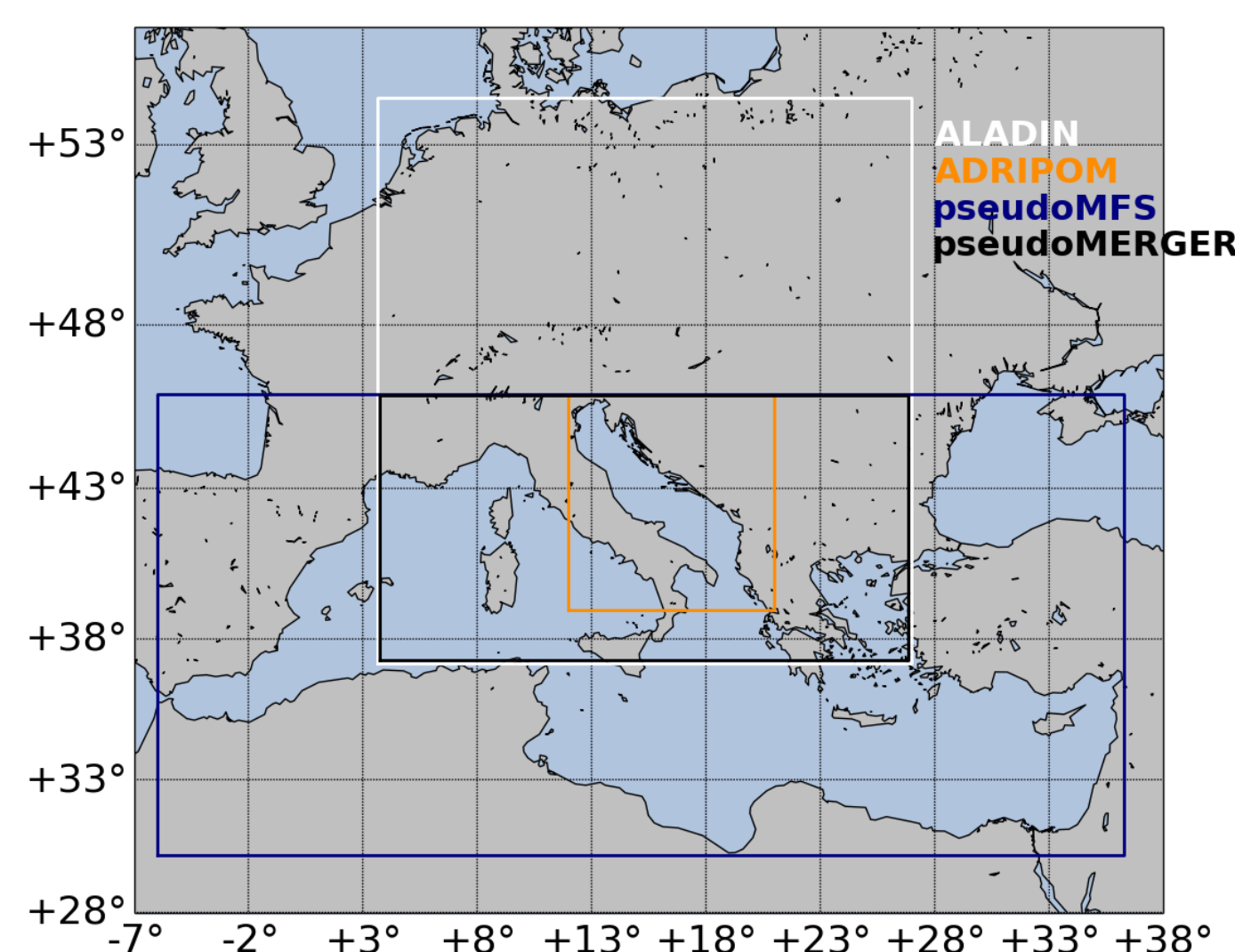
Assimilation cycle:

- 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).

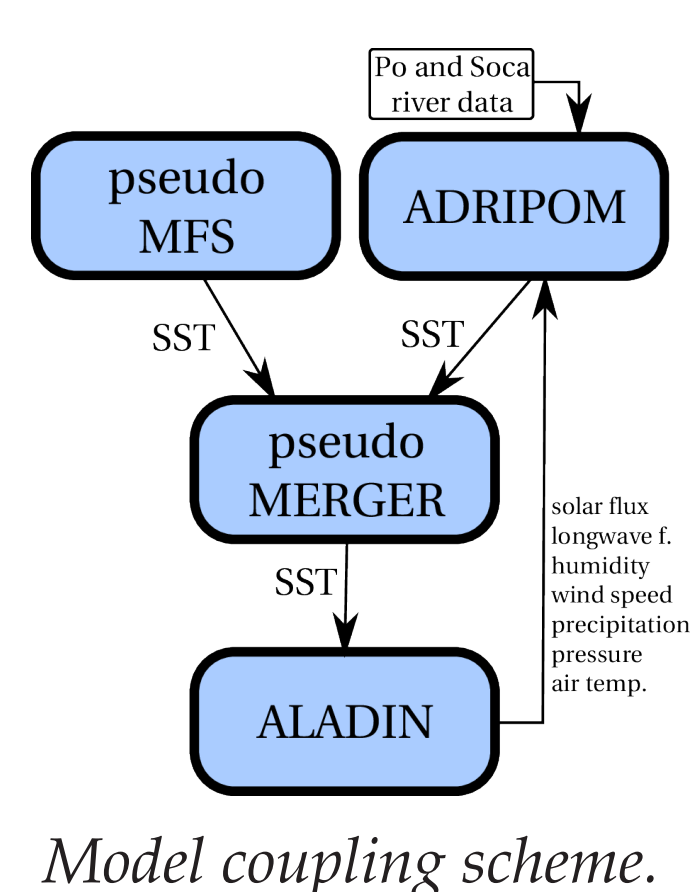
## Two-way atmosphere-ocean coupling

A prototype of a two-way coupled atmosphere-ocean modeling system:

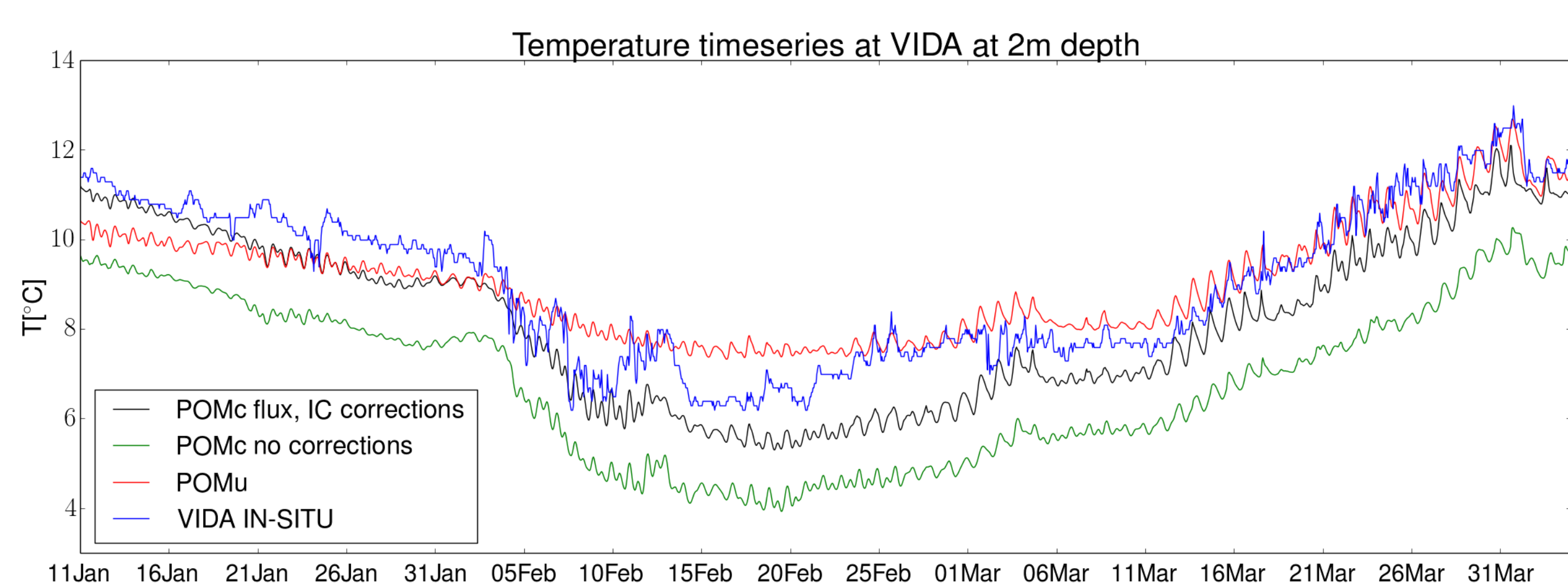
- ALADIN - receives SST field from the MERGER model and sends the computed mean sea-level pressure, air temperature, precipitation, wind speed (u and v directions), humidity, solar and longwave downward radiation fields to the ADRIPOM model,
- ADRIPOM (Princeton Ocean Model for Adriatic Sea) - receives mean sea-level pressure, air temperature, precipitation, wind, humidity, solar and longwave downward radiation fields from ALADIN and sends the computed SST field to the MERGER.
- MFS - a pseudo model, which reads the daily SST from the MyOcean MFS model and sends it to the MERGER model,
- MERGER - a pseudo model, which receives the SST fields from ADRIPOM and MFS models, merges them on a common mask and sends the merged SST field to the ALADIN model.



Domains of coupled models.



Model coupling scheme.



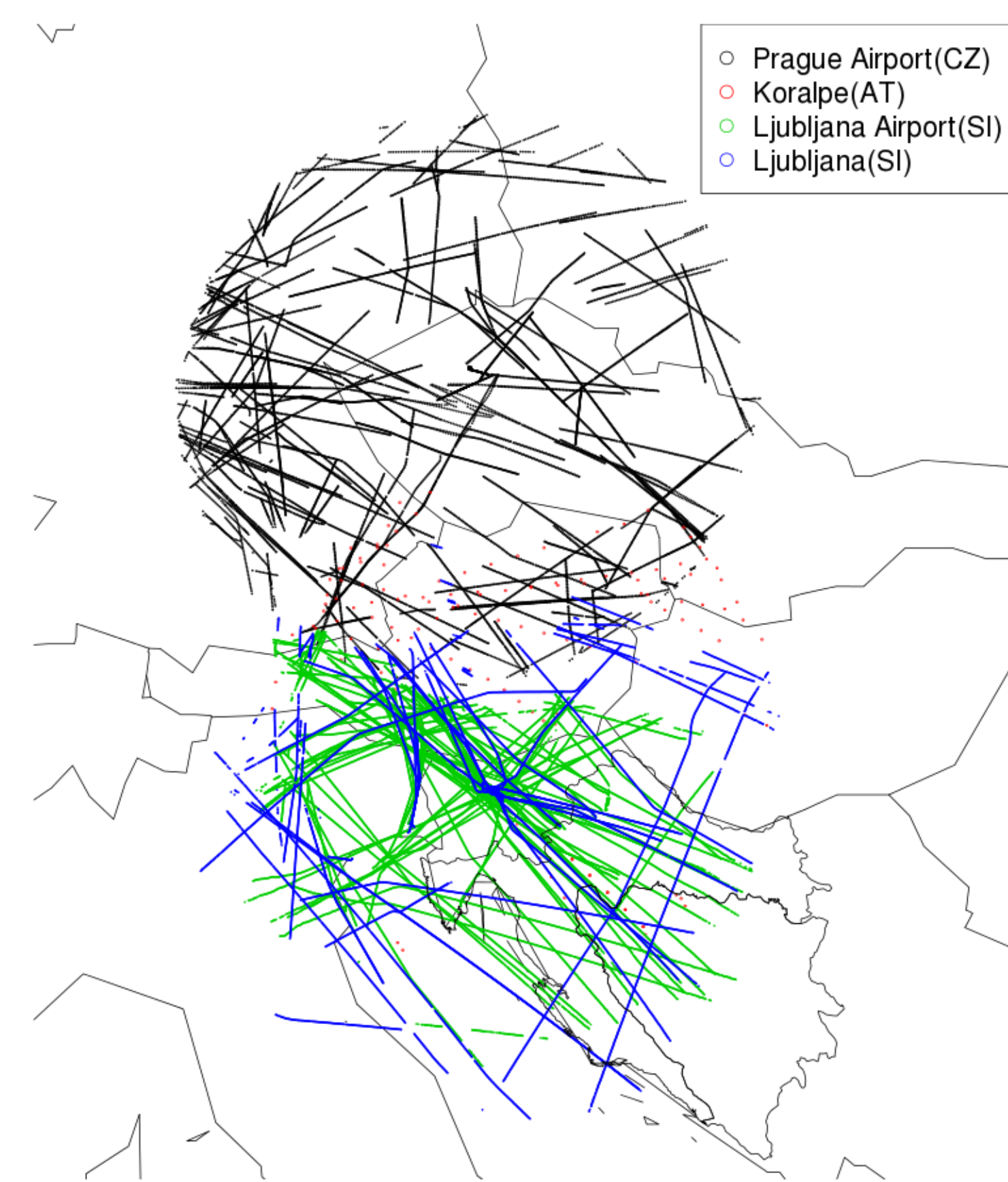
Comparison of observed sea temperature at 2 m depth at buoy in Gulf of Trieste (blue curve) with coupled ADRIPOM with flux and initial condition corrections (POMc, black curve), without any corrections (POMc, green curve) and uncoupled POM (POMu, red curve). Coupled system captures the transient features well but overestimates the net upward fluxes, leading to over cooling in ADRIPOM as well as ALADIN. Time period is January-April 2012.\*

\*Geophysical Research Abstracts, Vol. 17, EGU2015-1924-3, 2015, EGU General Assembly 2015.

## Towards extending Mode-S coverage over central Europe

Mode-S MRAR are new aircraft-derived observations.

- these observations are very promising source of upper-air temperature and wind information, quality is similar to AMDAR,
- data from two air-traffic control radars in Slovenia are already assimilated in ALADIN-Slovenia,
- positive impact on short-range forecasts shown for periods and cases\*,
- recently, Mode-S MRAR data samples are available from radars in Czech Republic (here Mode-S EHS included) and Austria.



Coverage of 4 Mode-S radars configured to collect Mode-S observations in central Europe.

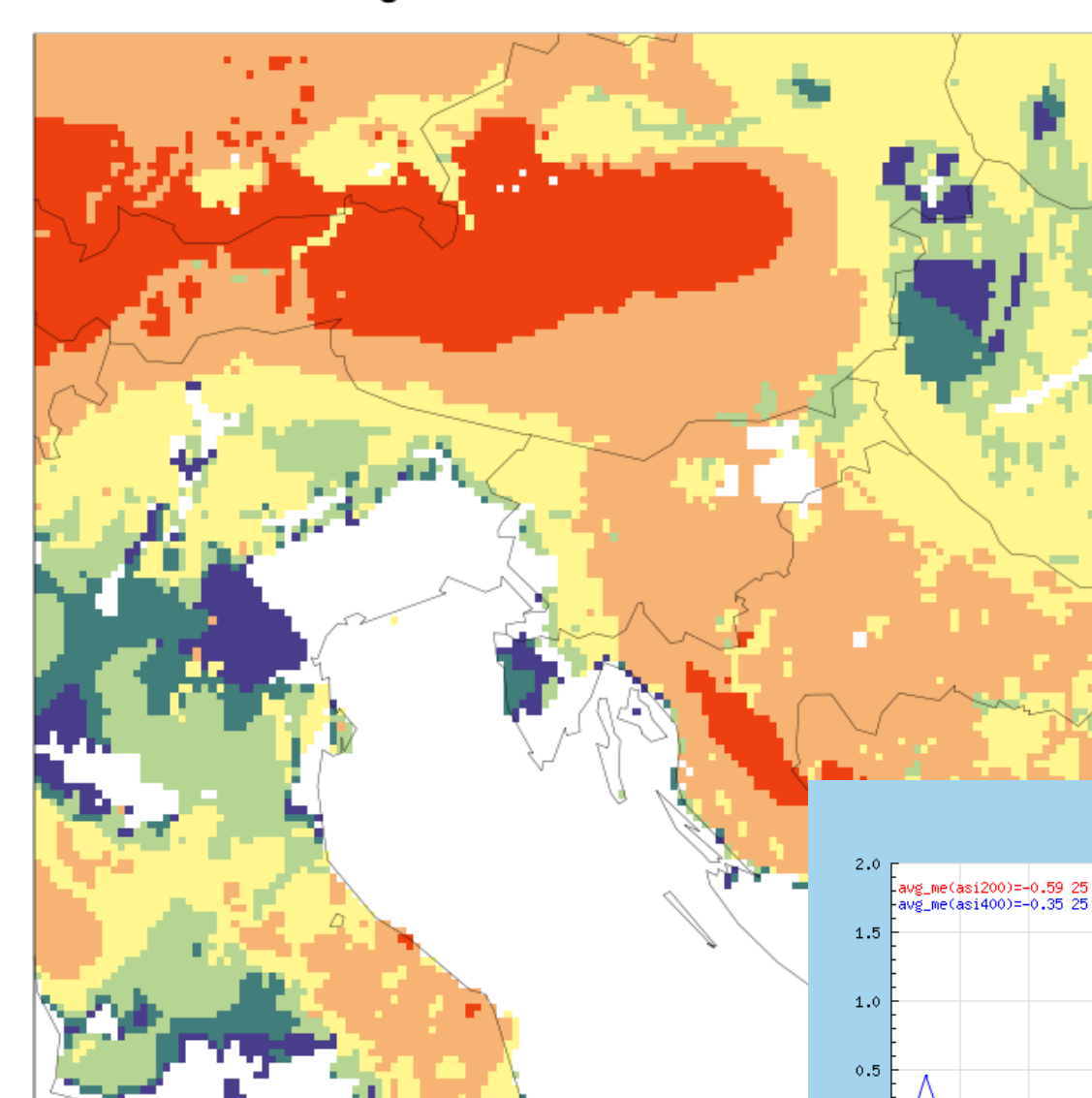
\* Strajnar et al. 2015, JGR-Atmospheres, in press.

## LandSAF snow cover assimilation

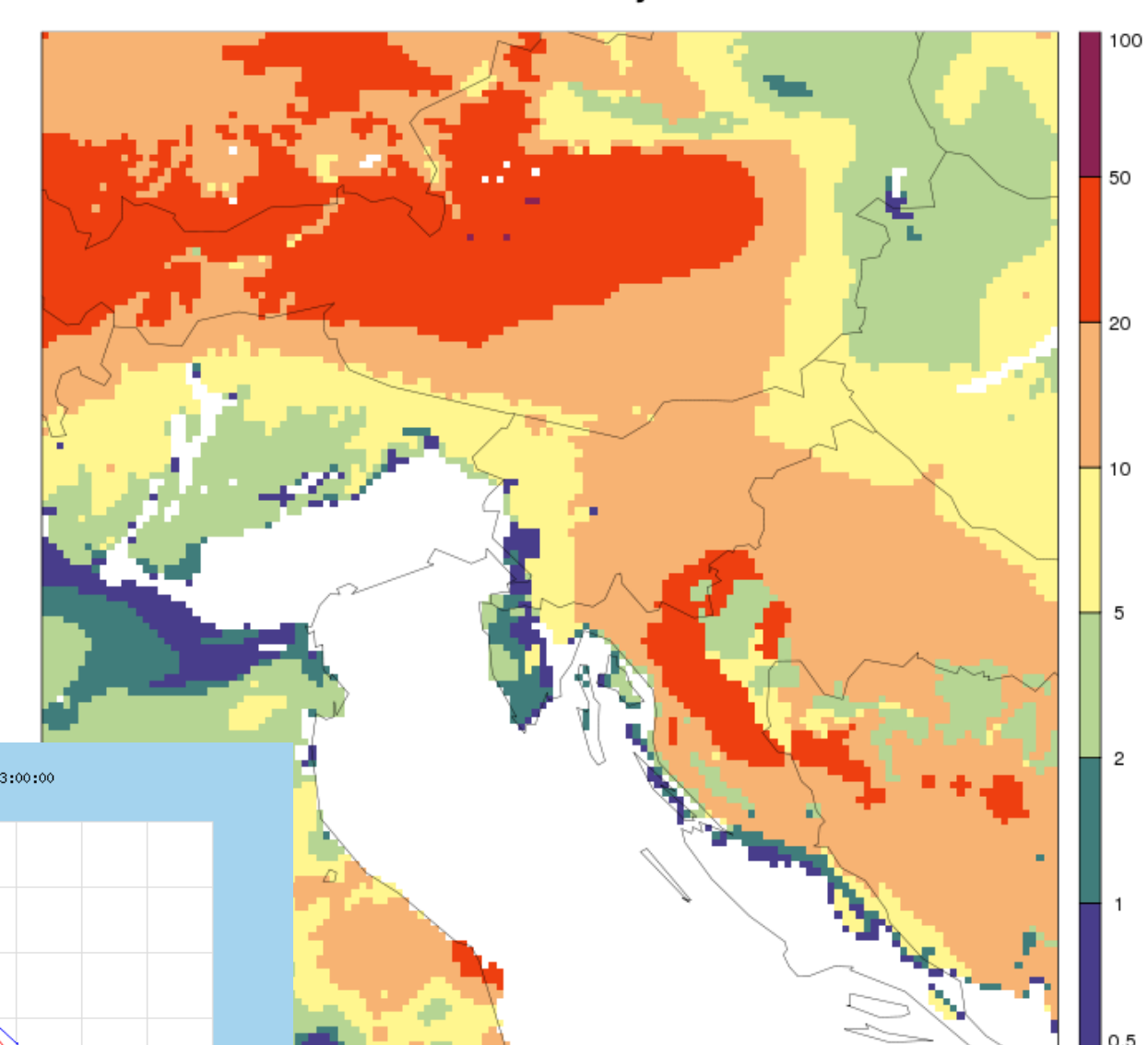
An experimental assimilation of LandSAF snow cover has the following characteristics:

- a simple snow cover assimilation is used to modify snow extent in the last stage of RUC 3D-Var,
- snow is either removed or added (10 kg/m<sup>2</sup>) depending on satellite product,
- input data is 15 minute LSAF snow cover - not the standard daily product,
- daily product is not suitable due to very long data collection window (e.g. entire day),
- results show large differences in snow accumulations and extent compared to simple cycling of snow,
- on the average, little impact on objective scores, but in some locations it can be quite significant.

Snow reservoir [kg/m<sup>2</sup>] on 17. dec. 2010 at 12 UTC (analysis) using LSAF 15 minute snow cover



Snow reservoir [kg/m<sup>2</sup>] on 17. dec. 2010 at 12 UTC (analysis) no snow analysis



EXP

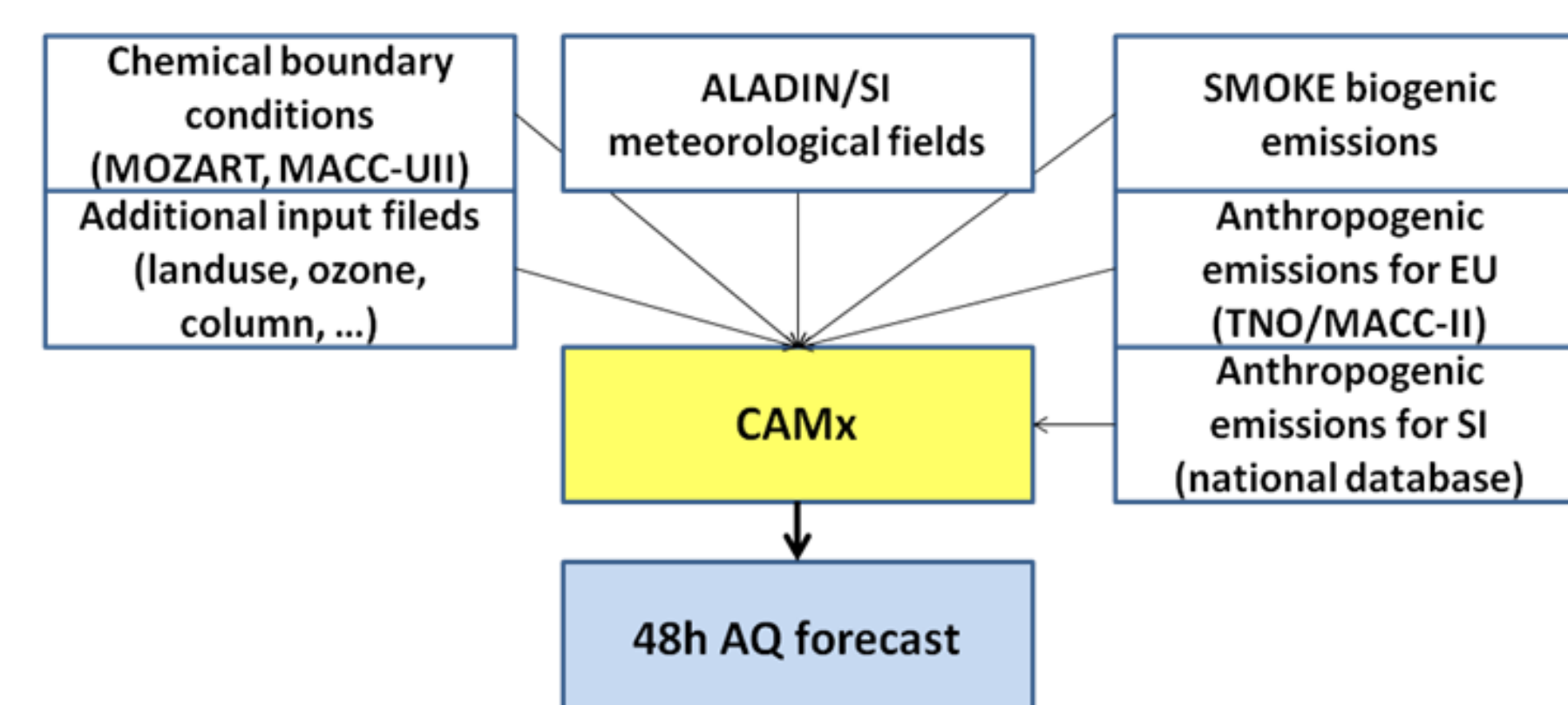
REF

Improvement of temperature bias at 2 m for station in Maribor (EXP in blue, REF in red).

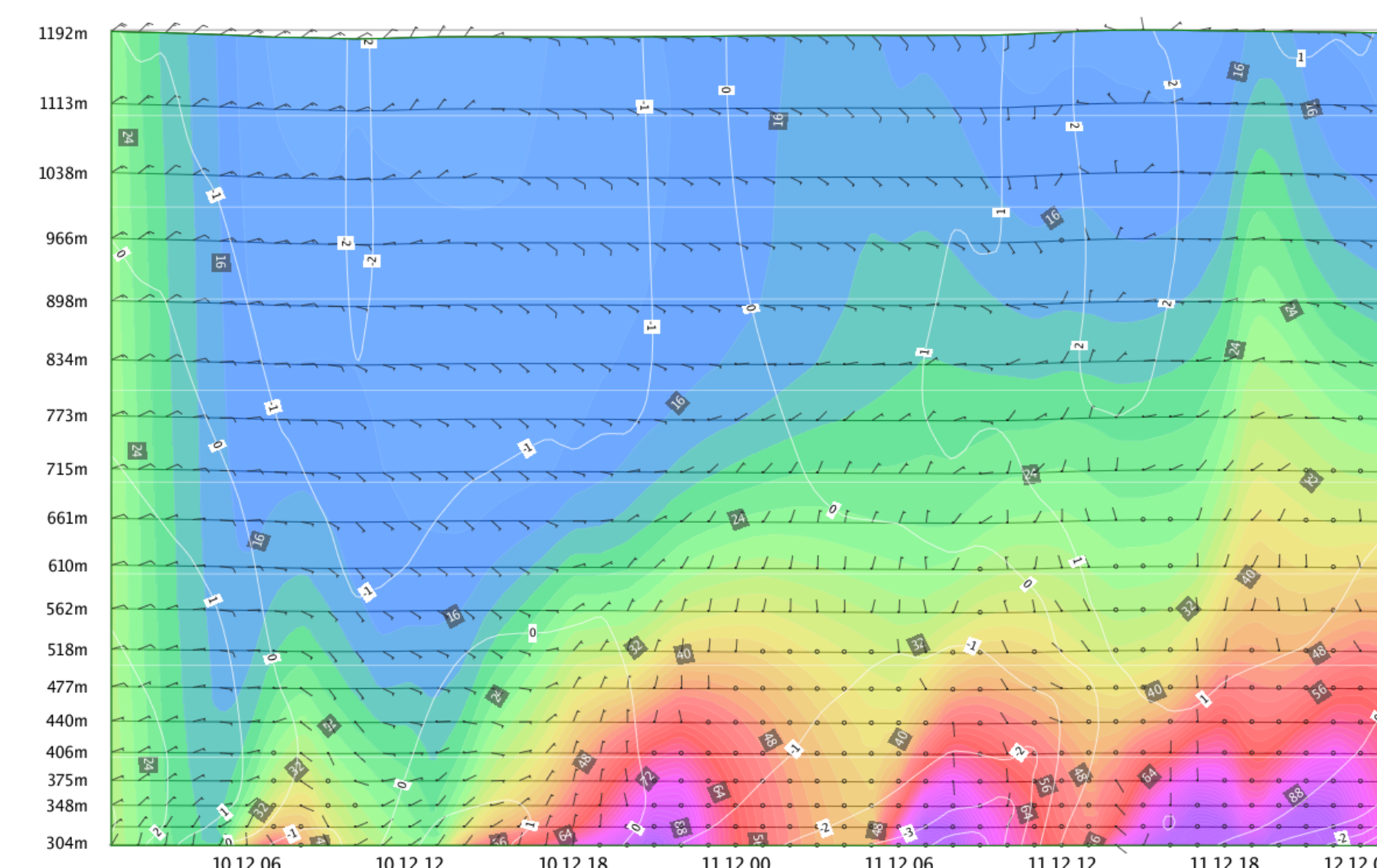
## Modeling system ALADIN-CAMx

Photochemical dispersion model CAMx (version 6.00) coupled off-line with ALADIN is used for air pollution simulations:

- Lambert projection,
- coarse grid: 135x135 points, 13.2 km horizontal grid spacing,
- fine grid: 185x167 points, 4.4 km horizontal grid spacing,
- 67 vertical levels up to 14 km in the troposphere,
- initial chemical conditions from the previous model run,
- chemical boundary conditions from global 3 h MOZART forecast (MACC-II project),
- emissions: highly resolved emission database for Slovenia region, emission database (MACC-II project) for the areas outside of Slovenia, biogenic emission using emission model SMOKE.



ALADIN-CAMx modeling system and data flow.



Time-vertical cross section of PM<sub>10</sub> [μg/m<sup>3</sup>] hourly concentration forecasts for Ljubljana for 11 December 2014. Two peaks per day (morning and afternoon) are clearly visible.