ALADIN in Slovenia - 2012

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AGENCIJA RS ZA OKOLJE

Computer system SGI ALTIX ICE 8200

Technical characteristics:

- 45 compute nodes installed in a single rack, every compute node has a 16 GB of memory and 2 Quad core Intel Xeon 5355 processors (360 cores)
- additional 7 service nodes are used for login, management, control and IO operations
- 52 nodes, 388 cores all together
- two Infiniband DDR networks, one for IO and the other for MPI communication
- a dedicated NAS IO node is installed with 48 TB FC disk array
- 2.2 TB lustre scratch file system

Programs:

- OS: SGI ProPack on top of SLES 10 SP3
- MPI: OpenMPI
- queuing system: Altair PBS Pro 9.2
- Tempo 1.10 cluster management system
- Intel 10.1. & 12.0 Fortran compiler
- TotalView 8.9 with License for 4 process tokens

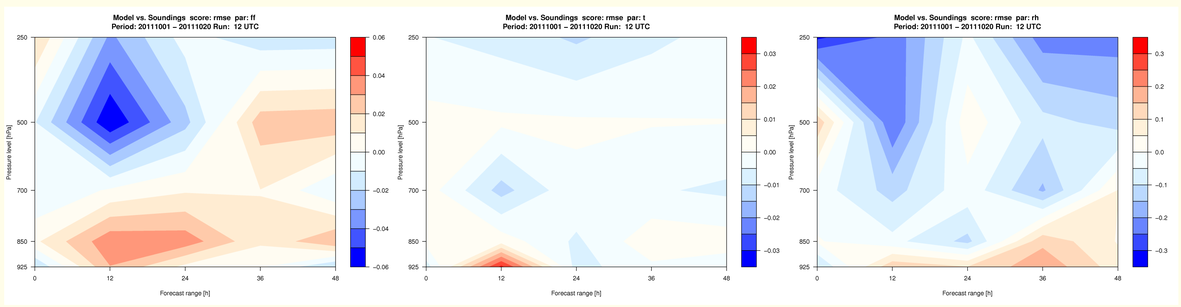
Data assimilation with IASI

Two experimental assimilation cycles have been prepared under ALADIN cy36t1 for a period of three weeks with the following characteristics:

- basic ALADIN settings: 4.4 km horizontal resolution, 43 vertical layers, 6h analysis, variational bias correction
- assimilated data types: SYNOP, vertical sounding, AMSU-A, AMSU-B, NOAA 16, NOAA 18, NOAA 19, SEVIRI, AIREP and AMV
- assimilation cycle with assimilated IASI data (about 100 channels all from 8.26-15.50 micron band) was compared against assimilation cycle without IASI data
- based on 00 UTC and 12 UTC analyses 48h forecast were prepared for both IASI as well as non-IASI experiments and compared against vertical sounding data

Evaluating IASI experiment against non-IASI experiment one can conclude:

- 00 UTC forecasts display mostly neutral and even slightly degrading impact on the forecasts. This is a predictable outcome, as IASI data are generally not available at 00 UTC over our domain.
- 12 UTC forecasts are more promising displaying a slightly positive impact particularly in the mid- and high-troposphere. Scores indicate:
  - a mostly neutral impact on temperature and a minor degradation near the surface in the first hours of the forecast
  - a positive impact on relative humidity in the mid- and high-troposphere for the entire forecast range and a slightly worsening impact near the surface
  - a small improvement in the mid- and high-troposphere and a slight degradation in the low troposphere in case of wind speed for the first 24 hours of forecast

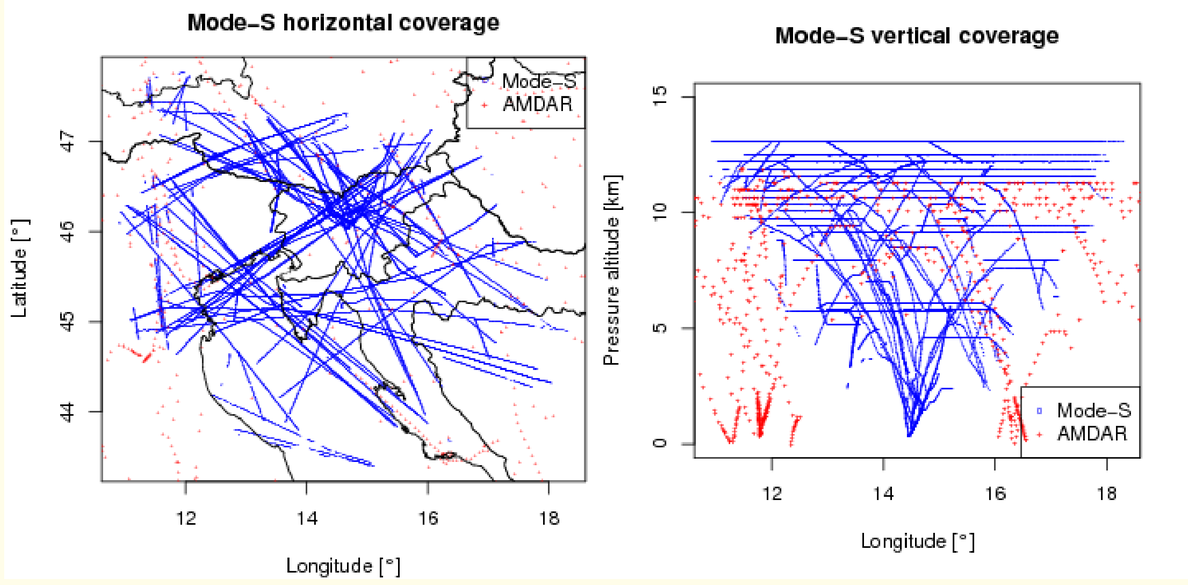


Figures display RMSE evaluation of the IASI and the non-IASI experiments. RMSE scores for the non-IASI experiment are subtracted from RMSE scores for the IASI experiment. Hence, negative values (shown in blue) imply a beneficial impact on the forecasts when IASI is assimilated; the opposite is true for positive values shown in red.

Assimilation of IASI data demonstrates promising results particularly in the direction of improving relative humidity in mid- and high-troposphere. IASI assimilation is planned to become operational as soon as the issue we are currently experiencing with VARBC cycling is resolved.

Validation of Mode S aircraft observations

High-resolution wind and temperature observations from Ljubljana Airport obtained through Mode S data link have been collected since May 2011. First evaluations show that the quality of data is similar to that of AMDAR. Compared to AMDAR, observation coverage is much increased over Slovenia.

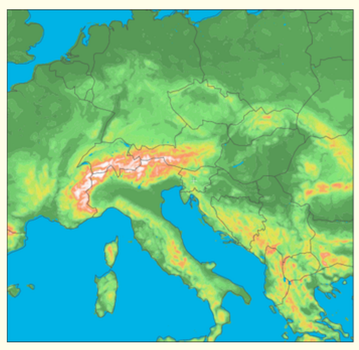


Horizontal and vertical coverage of Mode S.

Operational suites

si04da: 4.4 km data assimilation suite

- 4.4 km horizontal grid spacing
- 43 vertical model levels
- linear spectral elliptic truncation
- Lambert projection
- 439*421 points, (with extension zone 450*432), E224x215
- 180 s time-step
- four runs per day: 00 UTC (54 h), 06 UTC (54 h), 12 UTC (54 h), 18 UTC (54 h)
- coupling at every 3 hours, lateral boundary conditions from ARPEGE
- data assimilation
- digital filter initialization



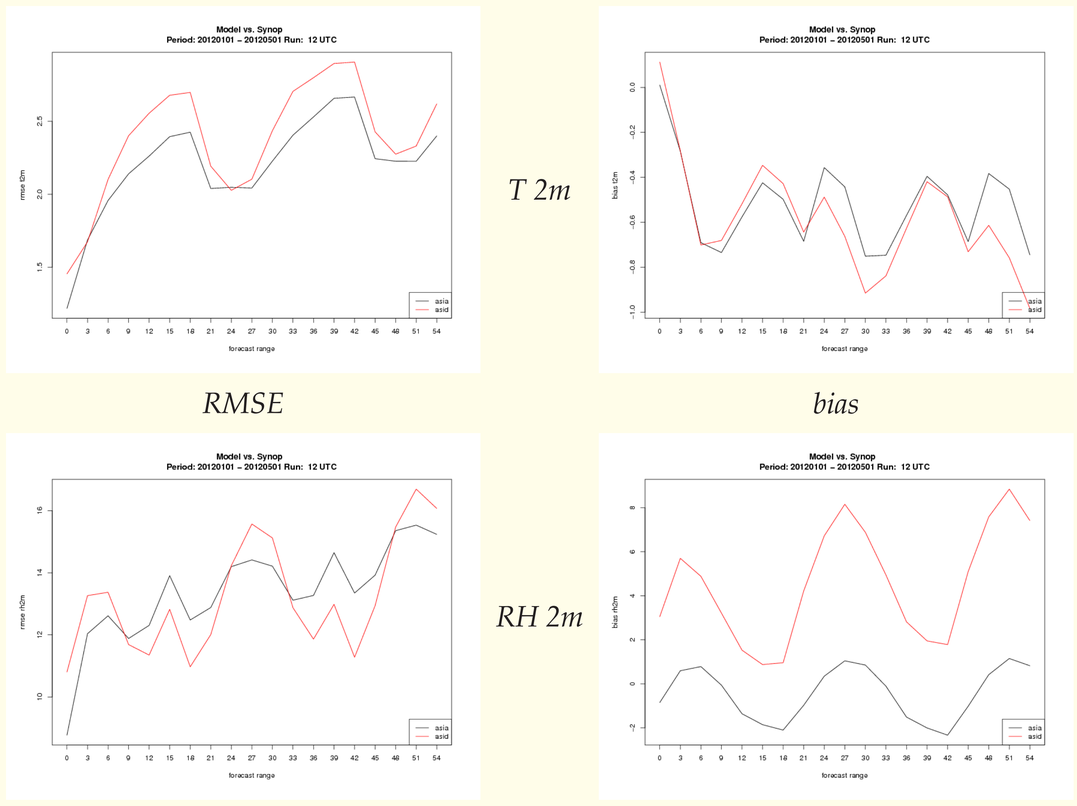
si09 and si09ec: 9.5 km dynamical adaptation suites

- 9.5 km horizontal grid spacing
- 258*244 points, (with extension zone 270*256), E134x127
- 400 s time-step
- initial and lateral boundary conditions from ARPEGE or ECMWF
- four runs per day till 72 h (60 h)

Data assimilation

4.4 km Data assimilation

- B matrix (downscaled ARPEGE)
- CANARI surface analysis using surface observations (T and RH at 2 m),
- 3DVAR upper air assimilation
- surface blending step, which merges CANARI surface analysis over land, ARPEGE sea-surface analysis and 3DVAR analysis
- 6-h forecasts as first guess (long cut-off LBC's from ARPEGE)
- digital filter initialization
- observations: OPLACE data and local observations (SYNOP)



Scores for 12 UTC runs from January till April 2012. Above: scores from 2 m fields for data assimilation suite (black line) and dynamic adaptation (red). Below: Profile of RMSE differences between data assimilation and dynamic adaptation. Bluish colors represents beneficial impact of data assimilation, reddish degradations.

Summary of recent scores:

- 2 m temperature is substantially improved by data assimilation (bias,RMSE)
- 2 m relative humidity improved (bias, RMSE neutral)
- neutral impact on wind
- upper air scores mostly neutral, positive in the first few hours of forecast

Applications using ALADIN fields

ALADIN results serve as meteorological input to:

- INCA analysis and nowcasting system
- BOBER hydrological forecast for Sava, Soča and Mura river catchments
- NAPOM (North Adriatic POM) 3D sigma-coordinate ocean model set up in Northern Adriatic
- CAMx photochemical dispersion model