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Environmental Agency of the Republic of Slovenia

ALADIN related activities in SLOVENIA - 2010

The computer system SGI Altix ICE 8200

Technical characteristics:

- 36 compute nodes in a single rack,
- 16 GB of memory and 2 Quad core Intel Xeon 5355 processors per node (288 cores),
- two Infiniband DDR networks, one for IO and the other for MPI communication,
- additional 7 service nodes for login, management, control and IO operations (308 cores all together),
- a dedicated NAS IO node with 30 TB FC disk array.

System software:

- SGI ProPack on top of SLES 10,
- OpenMPI, SGI MPI,
- Altair PBSPro queuing system,
- Intel 10.1. and 11 Fortran compiler.

Experiments with CANARI analysis for snow

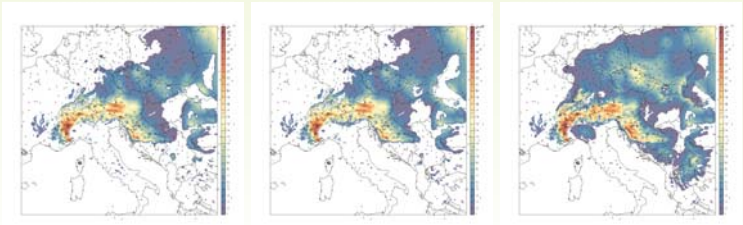
More info: ALADIN Newsletter 37

CANARI snow analysis (cy35t1) was tested at 4.4 km resolution. First tests were performed for a single date, and after some tuning an assimilation cycle was run over a period of 20 days (from January 11 until end of January 30, 2009).

Set up and important tunings are:

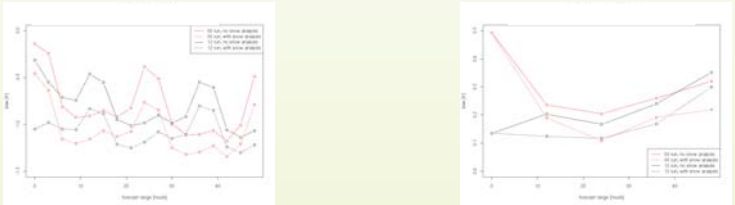
- the climatology relaxation (not used),
- the observation filter (difference between observation altitude and model altitude, maximum altitute of the observation),
- horizontal and vertical correlation function effective radius,
- errors of background and measurement,
- selected method for the vertical interpolation of snow height is important.

Production runs based on the assimilation cycle with snow analysis have a generally colder model state near the ground: deterioration of the scores for the screen level temperature and small improvement for the scores in the boundary layer (925 hPa).



Snow water reservoir [kg/m2] (shaded) for January 15th, 2009 at 6 UTC: downscaled from ARPEGE (left), 6 hour first guess based on ARPEGE downscaling (center) and tuned CANARI analysis (right). Numbers in the map show SYNOP snow height observations [cm].

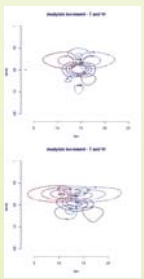
Time series of snow water reservoir for Torino/Caselle (left) and Ljubljana (right) for different experiments: black line is simple ARPEGE downscaling, blue line is first guess initialisation (only for snow) cycle and red line is CANARI snow analysis cycle. Black circles are observations [cm]. See how the red line catches up with the observations on the left once enough snow melts - so that the difference is small enough to pass through CANARI quality control. Note: magenta line is CANARI analysis with Urban formula - found not to be useful.



Scores for the production runs based on snow assimilation cycle: left is for temperature at 2m and right is for 925 hPa pressure level. Dashed lines are with snow analysis and full ones without. Different colours indicate different initialization time of the forecast. Cooling is present in both cases, since snow is mostly added in the assimilation procedure for the tested period.

Implementation of local 4DVAR prototype

- under SMS (based on pre-operational 3DVAR suite and HARMONIE 4DVAR prototype), with cy35t1
- three outer-loops are implemented in a multi-incremental manner,
- the inner-loops are performed at 3 times smaller resolution,
- very simplified dry MF physics were used in the TL/AD runs,
- technical validations of the 4d minimization were performed in single and full observation experiments,
- multi incremental results were compared with those done at full resolution in a very simplified framework (single outer-loop and single observation),
- the CPU and memory consumptions were measured.

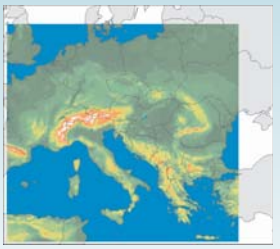


Vertical cross-section of single observation analysis increment (temperature observation at 500 hPa with innovation of 1 K), produced using 3DVAR (top) and 4DVAR (bottom). Temperature (K, black isolines) and radial wind (m/s, blue and red isolines) are shown.

OPERATIONAL STATUS

Characteristics of the operational ALADIN/SI model configuration:

- model version: AL35T1 using ALARO with 3MT physics
- integration four times per day: 00 UTC (72 h), 06 UTC (72 h), 12 UTC (72 h), 18 UTC (48 h),
- 9.5 km horizontal grid spacing,
- 43 vertical model levels,
- linear spectral elliptic truncation (E134x127, 258*244 points, with extension zone 270*256),
- Lambert projection,
- 400 s time-step,
- initial and lateral boundary conditions from ARPEGE,
- LBC coupling every 3 hours,
- digital filter initialization.



Operational ALADIN/SI domain9.5km

Additionally:

- integration four times per day: 00 UTC (72 h), 06 UTC (72 h), 12 UTC (72 h), 18 UTC (72 h),
- initial and lateral boundary conditions fromECMWF

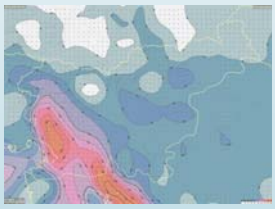
ALADIN 4.4 km domain 439*421 points

Characteristics of the parallel ALADIN/SI model configuration, same as operational except for:

- integration two times per day: 00 UTC (54 h), 12 UTC (54 h),
- 4.4 km horizontal grid spacing,
- linear spectral elliptic truncation (E224x215, 439*421 points, with extension zone 450*432),
- 180 s time-step.

INCA analysis and nowcasting system:

- running in pre-operational mode under SMS,
- resolution 1x1 km, 401x301 points,
- NWP input: ALADIN fields,
- observations: temperature, humidity, wind and precipitation from AMS, SYNOP and radar measurements,
- nowcasting initiated from the analysis and converging to NWP model after 12 hours,
- temperature, humidity, wind and several convective indices are updated hourly,
- precipitation type, rain and snow rate products are updated every half an hour.



Extreme bora case.

Data assimilation

Experimental assimilation cycle has been setup in the SMS environment with the following characteristics:

- 4.4 km horizontal resolution, 43 vertical levels, 6 h analysis frequency, ensemble B matrix (downscaled ARPEGE),
- 3DVAR upper air assimilation using all available data,
- CANARI surface analysis using 2 m temperature and 2 m relative humidity observations,
- surface blending step, which merges CANARI surface analysis over land, ARPEGE sea-surface analysis and 3DVAR analysis,
- cycling of microphysical and 3MT prognostic fields (initialization from first guess),
- first guess step using long cut-off ARPEGE lateral boundary conditions, digital filter initialization (DFI).

Observations usage:

- OPLACE pre-processed data: SYNOP (ps,T,q), AMDAR/AIREP aircraft data (T,u), METEOSAT SATOB cloud drifts (u), TEMP (T,u,q), WINDPROFILER (u), NOAA AMSU-A,AMSU-B (Tb), METEOSAT SEVIRI (Tb),
- local non-GTS data on surface level,
- web-based observation monitoring system developed by LACE.

Validation of the cycle:

Objective verification against radiosonde (TEMP) and SYNOP observations shows:

- neutral impact of assimilation on geopotential,
- slightly positive impact on low to midlevel temperature for the first 12 h,
- positive impact on wind fields, especially for the first 12 h,
- slight but systematic negative impact on relative humidity,
- substantial improvement on 2 m temperature RMS and bias.: