

Recent data assimilation progress in Slovenia

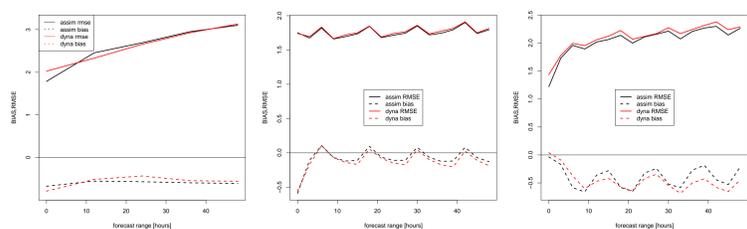
Benedikt Strajnar, Environmental Agency of the Republic of Slovenia

Operational suite

The characteristics of operational data assimilation suite at Slovenian meteorological service:

- 450 x 432 grid points, 4.4 km horizontal resolution, 43 vertical levels, timestep 180 s
- all types of OPLACE observations + locally received surface data
- 3DVAR atmospheric analysis after surface OI
- digital filter initialization
- ALARO physics package, cycling of prognostic 3MT fields

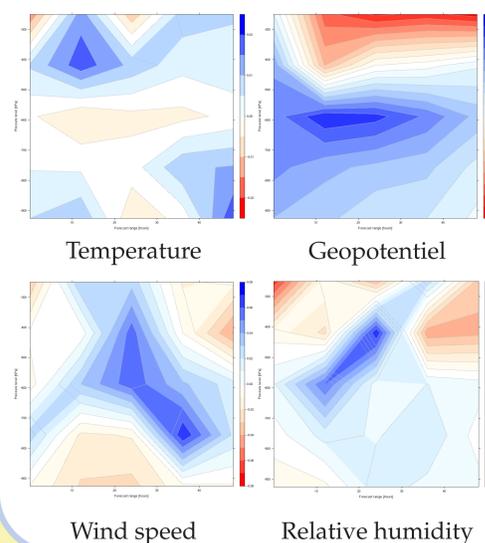
Recent verification (22th February-13th March 2011) shows that local assimilation improves surface wind and temperature forecasts, while humidity is slightly degraded. Upper-air verification indicates some improvements up to about 10 h of a forecast. Afterwards, the quality of forecasts with assimilation is similar or slightly worse (more biased) compared to dynamic adaptation.



850 hPa wind speed 10 wind speed 2m temperature

Impact of VARBC

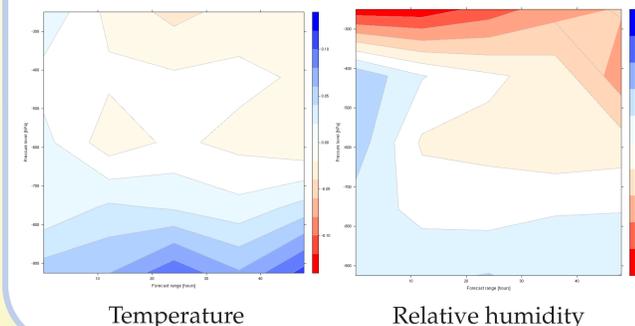
Impact of using VARBC to correct for radiance biases was examined on a period of June 2010, with "warm" predictors from ALADIN France operational suite. There are more improvements (blue) than degradations (red), especially for temperature, geopotential and relative humidity. The impact on wind is more mixed, with some degradations near the surface.



Temperature Geopotential
Wind speed Relative humidity

3DVAR after surface analysis

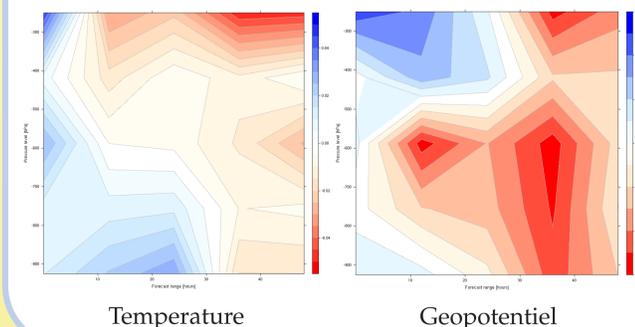
Performing atmospheric analysis after surface OI (CANARI) results in improved (blue) scores for near-surface temperature and relative humidity compared to parallel atmospheric/surface analysis.



Temperature Relative humidity

Impact of 2 m observations

In the first preoperational suite at EARS no 2m data were assimilated. This is compared to a suite with assimilation of 2 m temperature and relative humidity. The beneficial impact (blue) on surface temperature is evident, but a degradation of geopotential height can be observed at the same time.

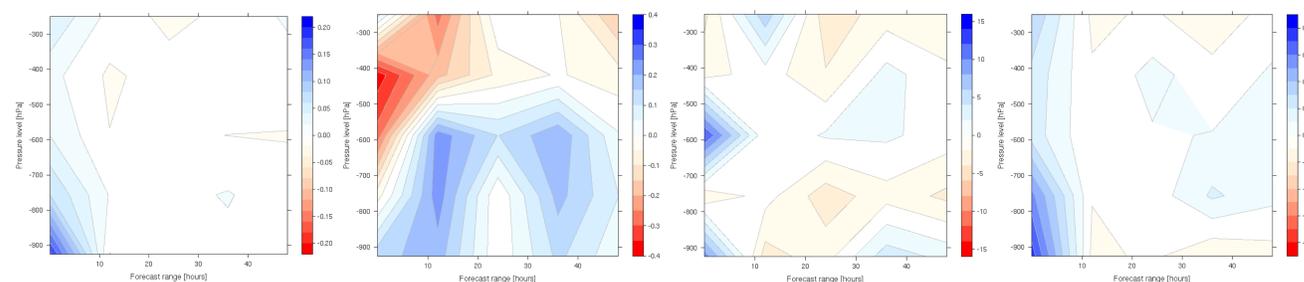


Temperature Geopotential

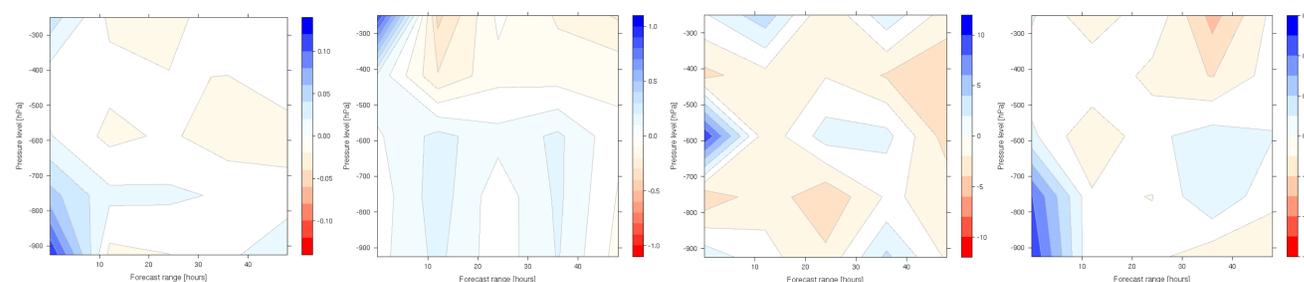
DFI tunnings

A check of performance of various implementations of digital filter initialization (DFI) has been carried out. The comparison included incremental and non-incremental filters with different τ_s (filter cut-off period).

RMSE Incremental DFI ($\tau_s=1.5$ h)

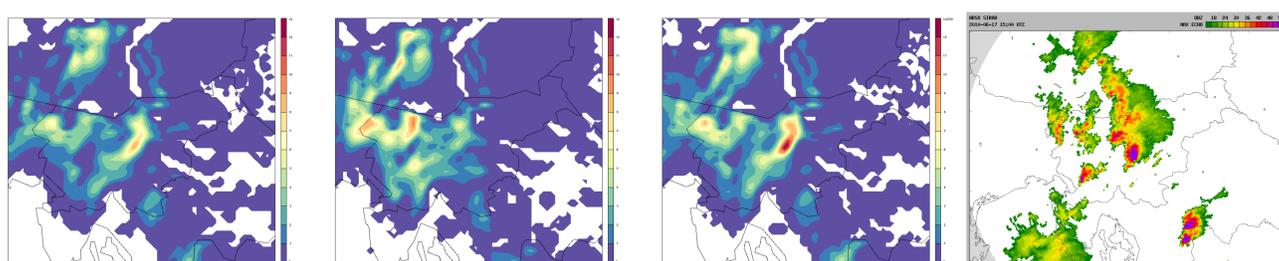


RMSE Non-Incremental DFI ($\tau_s=1$ h)



Temperature Geopotential Wind direction Wind speed

Bluish colors mean improvements with respect to operational non-incremental implementation ($\tau_s=3$ h). Scores indicate that reducing τ_s brings some improvements (temperature, low-level geopotential, wind speed) especially in the first hours of forecast. Difference is small between incremental and non-incremental formulation of a filter.



DFI ($\tau_s=3$ h) IDFI ($\tau_s=1.5$ h) DFI ($\tau_s=1$ h) radar zmax

Illustration of differences on a case with severe hail over Slovenia. Best precipitation forecast (mm/6 min) is observed for DFI with shorter τ_s (1 h) and rather poor performance of IDFI. Reduced τ_s will be considered in future operational implementations.

Satellite data selection

A study of assimilation of various radiance channels from NOAA and METOP-A included monitoring of all AMSU-A, AMSU-B (MHS) and SEVIRI channels in the assimilation suite. Based on observation-minus-guess and analysis-minus-guess departures, the following blacklisting strategy can be recommended for ALADIN-SI assimilation system:

satellite	sensor	0	6	12	18
NOAA-16	AMSU-A	-	8-12	-	5-12
NOAA-16	AMSU-B	-	B	-	3-5
NOAA-18	AMSU-A	5-12	B	B	-
NOAA-18	AMSU-B	B	B	B	3-5
NOAA-19	AMSU-A	5-12	B	5-12	-
NOAA-19	MHS	3-5	B	B	-
METOP-A	AMSU-A	-	8-12	B	-
MSG	SEVIRI	B	2,3,7	2,3,7	2,3,7

B stands for "blacklisted", "-" represents no data over domain. All data from NOAA-17 are blacklisted. The evaluation in terms of forecast quality is ongoing.

Future plans

The focus of future work will be on:

- applying improved satellite selection with new data from NOAA-19 and METOP-A
- improving vertical resolution of the model, update of B matrix
- assimilation of IASI radiances
- assimilation of high resolution aircraft data, collected at Ljubljana airport by Mode-S system.