Observation Preprocessing System for RC LACE (**OPLACE**)

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Abstract

A common observation preprocessing system (OPLACE) has been built up within the framework of RC LACE consortium. The system delivers processed and quality checked meteorological observations in an appropriate format for data assimilation in numerical weather prediction models. Furthermore, RC LACE NMSs exchange their dense national surface synoptic measurements and high-resolution aircraft data in real-time. OPLACE ensures stable and reliable bases for operational NMS purposes.

Introduction

The preprocessing of observations to be used in data assimilation is demanding task. It requires handling of raw data, including receiving in real time, storage, simple quality control and format conversions but also more advanced data processing. Small national meteorological services (NMS) seldom have means to develop such systems on their own. Within RC LACE consortium (consisting of NMSs of Austria, Croatia, the Czech Republic, Hungary, Romania, Slovakia and Slovenia), a common system to preprocess meteorological observation (OPLACE) has been developed to reduce costs and to use staff resources efficiently.

OPLACE system

The OPLACE system is hosted by Hungarian Meteorological Institute (OMSZ) since 2009. It was based on already existing infrastructure of OMSZ, e.g. data acquisition, databases of conventional observations from GTS and satellite data processing from EUMETCAST. It uses programs and tools to decode, process and convert data, furthermore external libraries and packages, such as BUFRDC, ecCodes and EUMETSAT NWC SAF.

Observations are splitted in hourly time-slots (defined as +/- 30min interval of the given hour) and separated by observation type. The separation gives flexibility to the users to download data according their needs. The OPLACE system updates observation every half-an-hour as most of data arrive with a non-negligible telecommunication delay.

OPLACE currently provides European surface synoptic data, upper-air sounding, wind profiler, and aircraft observations as well as various remote sensing observations from operational near-polar-orbiting satellites (see table below for an overview). In the near future, OPLACE will use observation from new satellite sensors, such as CrIS and ATMS, as well as GNSS, and radar data.

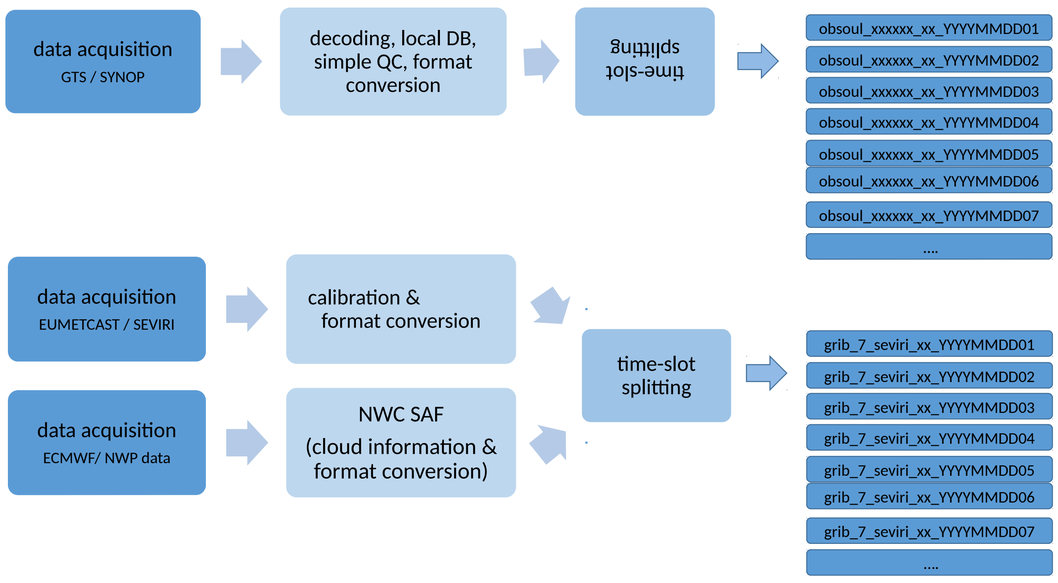


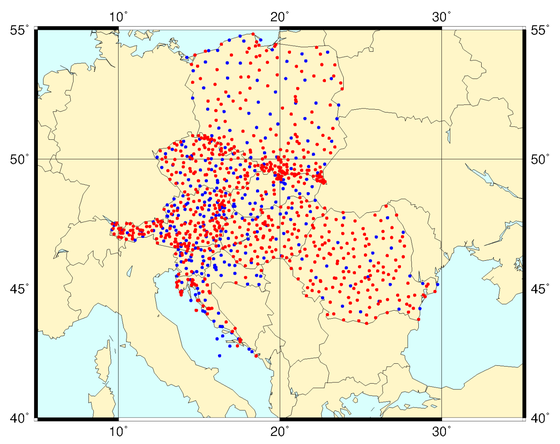
Illustration of observation preprocessing steps for synoptic data and SEVIRI radiances.

Observations	Type/Sensor	Platform	Format
Surface synoptic	SYNOP, SHIP, BUOY		ASCII, BUFR
Aircraft	AMDAR, ACARS		BUFR
Upper-air sounding	TEMP, TEMP MOBIL		ASCII, BUFR
Wind profiler	EUROPROFILE		BUFR
Atmospheric motion vectors	GEOWIND, HRWIND	Meteosat 10/11	BUFR
Satellite radiances	SEVIRI AMSU-A/B, MHS, HIRS, IASI	Meteosat 10/11 NOAA 15/18/19 Metop-A/B,	GRIB BUFR
Ocean/sea winds	ASCAT	Metop-A/B	BUFR

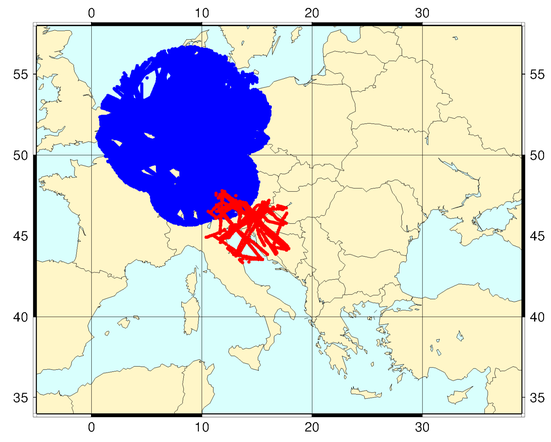
Overview of observations types, sensors and data formats available in OPLACE.

Regional data exchange

The substantial number of local observations is available in RC LACE countries. The main objective is to ensure an exchange of data which has potential for data assimilation and verifications. OPLACE provides a real-time exchange of these observations between RC LACE NMSs. Dense national surface synoptic measurements are exchanged since 2014, recently the national synoptic data from Poland were added. Modern air traffic surveillance systems (Mode-S radars) have received substantial attention in recent years due to its capability to provide not only an accurate knowledge of the position of the aircraft, but also meteorological information (de Haan, 2011; Strajnar, 2012). The exchange of high-resolution aircraft Mode-S MRAR (Meteorological Routine Air Report) data from Slovenia became operational in 2015 and it was extended by Mode-S EHS (Enhanced Surveillance) from KNMI in 2016.



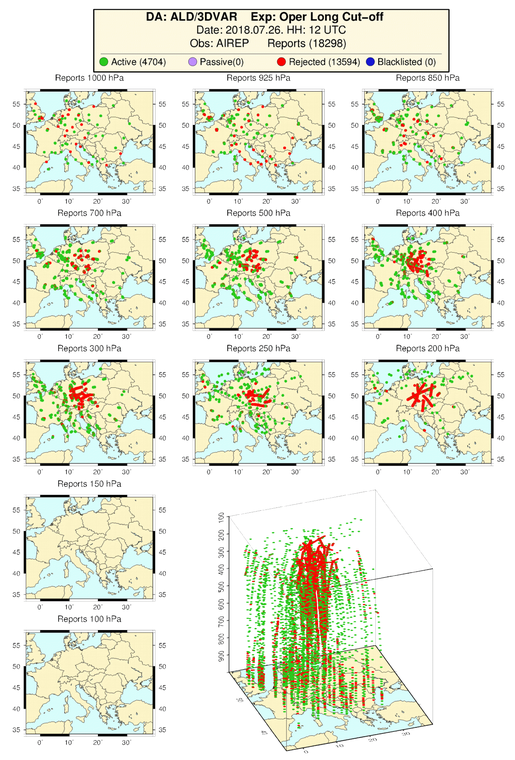
The coverage of surface observation available in the GTS (blue) and of denser national observations (red).



The geographical distribution of high-resolution aircraft Mode-S MRAR data from Slovenia (red) and of Mode-S EHS data from KNMI (blue).

Observation monitoring

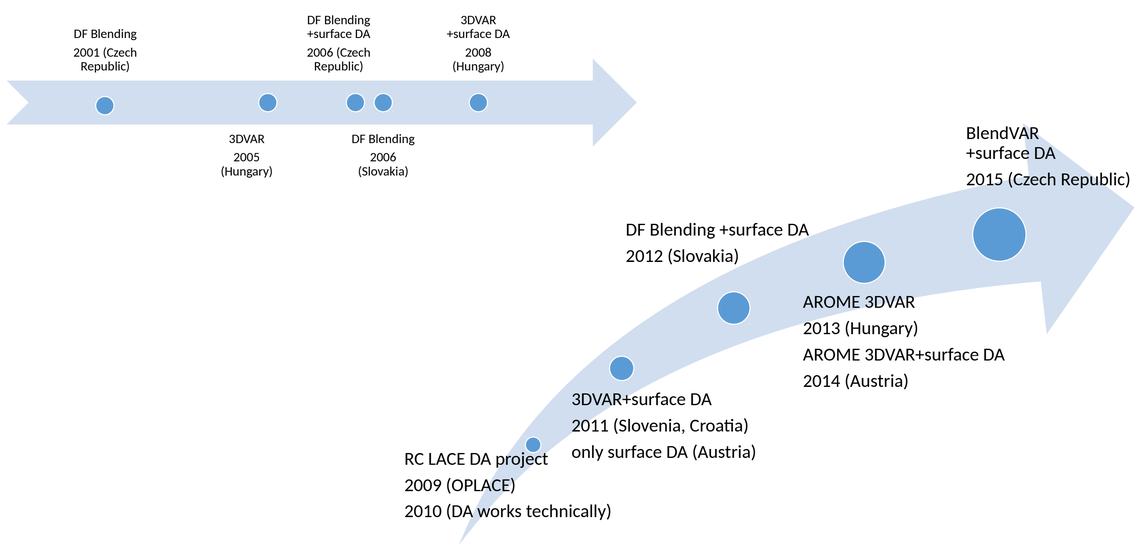
Another important component of an operational data assimilation system is observation monitoring. An interactive web-based observation monitoring system for the ALADIN variational data assimilation systems (3D-VAR, 3D-FGAT) was developed. The system allows visualization of the location, status and departure statistics of the different observation types for a given analysis date or for a selected set of analysis dates. Statistics are computed for report and data status, and for observation-guess and observation-analysis departures. As for the graphical products, various types are available: maps (2D, 3D), profiles, time-series, time-height cross sections, and observation usage charts.



Overview of active (in green) and passive (in red) aircraft based observations in ALADIN 3DVAR for 26 July 2018.

Conclusions

Data assimilation can significantly improve NWP forecast, but it is technically and manpower demanding. The observation preprocessing is essential component of data assimilation. The OPLACE system has been a key ingredient in the successful implementation of the data assimilation in local NWP suites of RC LACE Members. It is a good example how to work together in an effective way and save manpower. A common system allows an easier handling of local and/or international observation network upgrades. Furthermore, OPLACE provides a platform for exchange of high-resolution surface synoptic and aircraft measurements among RC LACE NMSs.



Milestones of operational data assimilation implementation in RC LACE countries.

Publications

Wang, Y., M. Bellus, A. Ehrlich, M. Mile, N. Pristov, P. Smolikova, O. Spaniel, A. Trojakova, R. Brozkova, J. Cedilnik, D. Klaric, T. Kovacic, J. Masek, F. Meier, B. Szintai, S. Tascu, J. Vivoda, C. Wastl, Ch. Wittmann, 2017: 27 years of Regional Co-operation for Limited Area Modelling in Central Europe (RC LACE). Bulletin of the Am. Met. Soc., Vol. 99 Issue 7, 1415-1432.