Royal Netherlands Meteorological Institute
Ministry of Infrastructure and the Environment

Quasi-real-time L2 processing for ADM-Aeolus

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The NWP user community requires Quasi-Real Time (QRT) and Near-Real-Time (NRT) centralised global L2 processing and dissemination of ADM-Aeolus L2 wind profile data to take full benefit of the Aeolus atmospheric dynamics mission. Such Aeolus service is proposed by KNMI and would extend its satellite wind processing services on behalf of EUMETSAT for the NWP community. Aeolus would nicely complement these wind processing services, which are based on diverse operational and research wind sensing instruments.

1. Introduction

As requested by the 20th ADM-Aeolus Mission Advisory Group (MAG) and after consultation with the HiRLAM project, KNMI outlined and recommended a procedure for on-the-fly quasi-real-time (QRT) and near-real-time (NRT) ADM-Aeolus wind-profile processing at KNMI for effective regional NWP application of the Aeolus winds.

Such a on-the-fly processing capability is motivated by the regional NWP community, who are moving to the nowcasting regime with their operational Data Assimilation Systems (DASs), and thus more and more require QRT timeliness. The experience on wind services (at KNMI) and on the L2 Aeolus processing will be effectively used to provide quality assurance, monitoring, corrective maintenance and other user services needed for on-the-fly application of ADM-Aeolus winds in regional NWP. Such capacity would also complement the global efforts at ECMWF on these topics, since unexpected calibration and processing challenges may emerge for this first mission of its kind. KNMI and ECMWF closely collaborate on the development of the L2 wind processor and plan to collectively maintain the series of subsequent processor versions in the future. The KNMI plan contributes to an experienced Aeolus scientific ground staff and helps a swift exploitation of the Aeolus winds. Last, but not least, this KNMI proposal would provide EUMETSAT the opportunity to be actively involved in the ADM-Aeolus programme to serve its member states with QRT winds.

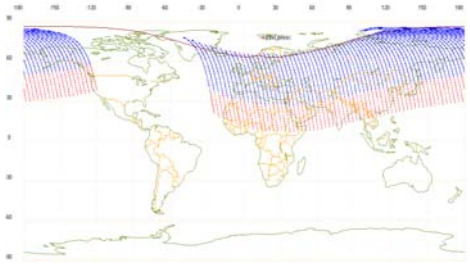

Figure 1 *QRT dumps from Svalbard ground station.*

2. Quasi real time (QRT)

ESA has explicitly included QRT requirements in the performance specifications for the L1B code (5 min L0 -> L1B processing time/full orbit) and the ground segment (PDS internal data circulation concept & performance requirements). The 30-min data delivery after observation time for L1B will be demonstrated for ascending orbits only over northern Europe for the last 10 minutes of sensing prior to the start of the 10-minute downlink, corresponding to ~8000 km (see figure 1). However, extension of this service to additional ground stations is on offer by the US (by Wallops Island and McMurdo stations).

3. Regional NWP timeliness

NWP data assimilation is cycled over analysis windows (see figure 2). A cut-off time is used to limit the delay of the analysis (green), measured from analysis verification time (e.g., window centre). However, untimely observations may be lost (red) due to the cut-off time.

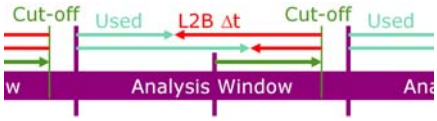

Figure 2 *Data assimilation cycling*

Regional NWP data assimilation focuses on rapid weather changes and therefore cut-off times are taken relatively short. This means for example that 70-100% of Aeolus QRT L2B winds would be used in current HiRLAM implementations in the participating countries, while only < 50% of Aeolus NRT L2B winds would be used in HiRLAM DASs. We moreover note a general tendency to faster 3-h or 1-h cycling and corresponding fast cut-off in the coming years. So, to better exploit observations there is an increasing need for QRT delivery in regional NWP.

4. L2 Processing

Some complications exist in the operational implementation of the L2 processing due to the presence of dynamic auxiliary files (figure 3).

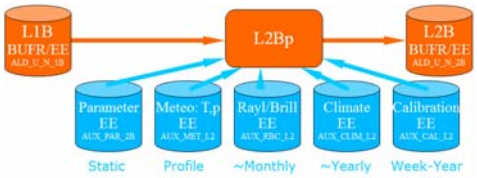

Figure 3 *L2B processing with dynamic auxiliary files.*

A background temperature (T) and pressure (p) are needed for wind profile processing, but todays background T and p errors cause only small errors in the Aeolus wind profiles: at 40 m/s wind, for example, 0.1 m/s per K error in T (0.25% of the true wind) and ~ 0.003 m/s per hPa error in p (0.008% of the true wind), which sensitivities may be further corrected in the DAS by a straightforward observation operator.

As in normal NWP practise, the replacement of the more static auxiliary files follows verification of data quality improvement. This may be done by parallel processing with the old and new files and the development of product quality assurance metrics.

5. Global QRT/NRT processing

KNMI is part of the L2Bp development team and will run versions compatible with the ECMWF repository. A global QRT/NRT implementation is foreseen to facilitate adequate monitoring. On-the-fly automatic monitoring would be developed for quality assurance to allow automatic ingestion in NWP (L2B product monitoring flags). This includes the control and testing of all dynamic L2Bp auxiliary inputs in parallel suites and guided by Aeolus experts to allow a fast (weekly if need be) operational implementation cycle in communication with the users.

The wind processing service would be similar to the EUMETSAT scatterometer processing and ASCAT EARS at KNMI in terms of implementation. More information on these similar wind services can be found on KNMI's scatterometer web pages www.knmi.nl/ scatterometer as well as on the EUMETSAT NWP SAF web pages www.nwpsaf.org and the OSI SAF web pages www.osi-saf.org.

Also for Aeolus, limited resources would be needed in Aeolus-DAS interface development by regional DAS when QRT L2B were available. It facilitates EUMETSAT member states to experiment with the first space-borne DWL profiles in an operational context and thus actively involves EUMETSAT in the ADM-Aeolus demonstration mission.

The L2A cloud and aerosol processing has not been part of the proposal to EUMETSAT, but KNMI is open to requirements for QRT/NRT global processing of the L2A product as well.

6. Conclusion

This poster stresses the need of the NWP community for a on-the-fly QRT/NRT delivery of Aeolus L2B wind profiles for regional NWP forecasting by a central global service. While the 29th EUMETSAT Science Working Group (SWG) recognises the advantages of centralised QRT/NRT processing and dissemination of ADM-Aeolus L2B data by an Aeolus expert centre, the EUMETSAT Council decided in 2010 to consider support of such an investment in ADM-Aeolus in preparation of future operational DWL missions, once the launch date has been firmed up. KNMI offers to host a central and global QRT/NRT L2 production to be supported by EUMETSAT, very similar to its current successful scatterometer EARS processing.

If you have any questions regarding KNMI's wind products, do not hesitate to contact the KNMI authors.

Figure 4 *Artist impression of Aeolus in space © ESA*