

Report from Working Group 2 (WG2): Data Assimilation

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1. Processing and satellite changes

A very significant upcoming change for the current GOES AMVs is the plan to update the processing to use the algorithm developed for the future GOES-R satellite. The processing is currently run routinely, but the resulting AMVs are not yet made available to users. To allow users to start preparations for the switch-over, the group made the following recommendation:

Recommendation to NESDIS: To make the GOES AMVs processed with the GOES-R algorithm available to the community in the current BUFR format as soon as practical through parallel dissemination.

The group discussed experiences with satellite or processing changeovers in general. Across NWP centres there are differing levels of resources available to deal with significant changes, namely transitioning to a new generation of satellite, a major change to the derivation, or a change in format.

NWP centres very much appreciated the 9 month overlap period of parallel dissemination for Himawari-8 and MTSAT-2 AMVs provided by JMA. This allowed thorough testing and impact evaluation. Many centres required the full 9 month period to finalise the change-over from MTSAT-2 to Himawari-8 in their operational systems. Long overlap periods are also considered necessary for major derivation changes, such as the introduction of the GOES-R algorithm for existing GOES satellites.

Recommendation to AMV producers: To provide a 9-month overlap period when transitioning to a new generation of satellites and for major derivation changes.

It was also noted that in the case of like-for-like satellite changes (i.e. new satellite, but with the same instrument as the predecessor), the previously recommended 3 month overlap period is still considered sufficient, provided no significant differences are found during the evaluation.

2. Notification of changes

The group noted the on-going need for improved advanced notification in case of changes in the processing. While most data providers have user notification services of some form, the notifications are not always sufficiently targeted and do not necessarily reach the relevant experts. To improve the situation, the group expressed the following:

Recommendation to wind producers: To provide notification of significant upcoming changes in the data provision or content via the IWWG email list with sufficient notice according to the nature of the change.

It was noted that a “flooding” of the email list with notifications regarding minor aspects should be avoided (such as minor outages or routine manoeuvres with little impact). Instead, the use of the email list should serve as a backup or safety net to ensure that important changes are seen by users.

The group noted that while EUMETSAT does provide reliable and comprehensive user notification through the UNS service, notifications about AMV products are only available under much wider categories. Given the wide scope of these categories, AMV-related messages can easily be missed. The group hence made the following recommendation:

Recommendation to EUMETSAT: to introduce an AMV-specific UNS category.

It was also noted that having access to past notifications would be very useful. While several agencies provide web-based notification portals with archives of past notifications, users are not always aware of how to find these. The group decided that a web-page under the IWWG Wiki-pages with links to these portals would be a useful addition.

Action on Steve Wanzong (as IWWG web-master), in collaboration with NWP working group co-chairs: to provide links to existing user notification pages from space agencies on the IWWG wiki pages

3. Introduction of new BUFR template

The group strongly supports the development and finalisation of the new BUFR template. A proposal, being reviewed during the work-shop, will be circulated to the IWWG group by mid-September 2016 for final comments. The new BUFR template will allow for a number of new entries, providing information from the tracking as well as information on the tracked clouds and uncertainties from advanced cloud height assignment algorithms. Not all new entries may be filled initially by every producer, as evaluations on their use and derivation are on-going,

The transition to the new BUFR template will be a significant task for the community, as it will require significant technical alterations in the NWP systems and these can take a long time to propagate into operational systems. To aid this, the following recommendation was made:

Recommendation to NESDIS: to make offline test data available for the new BUFR template as soon as possible once it has been approved by WMO (e.g., 1 time slot would be sufficient) for technical testing/implementation.

All AMV producers are expected to move their data dissemination to the new BUFR template in due time once the new template has been approved. Parallel dissemination of the same data in the old and the new format will then be required for this transition. Provided the above-mentioned test data is made available well in advance of the transition (say, 9 months before), this overlap period could be kept relatively short (e.g., 3 months). This is summarised in the following recommendation:

Recommendation: All AMV producers to adopt the new AMV BUFR format once it has been finalised. A 3 month overlap period of providing the same data in the new and old format should be provided, assuming the above-mentioned test data has been provided 9 months earlier.

4. Evaluation of new information provided in the new BUFR template from new AMV algorithms

The new AMV tracking or height assignment algorithms that have been developed at NESDIS, JMA and EUMETSAT provide additional information on the tracking, on height assignment uncertainties, as

well as on properties of the tracked clouds. Investigations reported at this and previous workshops indicate that this can be useful for refined quality control or uncertainty characterisation. Further evaluations are only possible once sufficient datasets with the additional information have been disseminated. In particular, it will be important to understand the different implementations of each algorithm, especially for the cloud parameters where there are known to be differences in the cloud products. NWP centres are encouraged to continue evaluating the new information provided with new AMV algorithms (from both tracking and cloud height assignment) and to share their results.

At the same time, it was recognised that there is a renewed need to document the derivation algorithms put into use, especially given the substantial changes to the processing algorithms in some cases. While some information is available through IWWG proceedings, these are not always considered sufficiently detailed. In particular, users require a precise description on what exactly is provided in the new BUFR entries, as input to the investigations regarding their use and to avoid misconceptions. This is considered a very important aspect, and hence resulted in the following:

Recommendation to AMV producers: to provide comprehensive scientific documentation on the derivation algorithms, including a clear description of what will be provided in the new BUFR format

Action on Met Office and Steve Wanzong (as IWWG web-master): to consider how to collate this information so it can be made available to users (for instance, on the IWWG or the NWP SAF website)

5. Identification of sources of uncertainty

The group recognised that there is an on-going need to characterise the various sources of uncertainty inherent in the derivation and use of wind observations, and in particular of AMVs. The following activities are planned or on-going:

- Height assignment evaluations through longer-term comparisons to lidar data, together with evaluation of best-fit pressure statistics (DWD, University of Munich & ECMWF)
- Comparison of AMVs to aircraft data (NCEP)
- Use of simulated imagery with AMV derivation algorithms (KMA)

The following activity was also suggested:

- Comparison of AMVs to high-resolution MODE-S aircraft data

6. New satellite mission proposals

There continues to be an unmet requirement of wind profile observations with sufficient global and temporal coverage. The group is looking forward to Aeolus data which will give profiles of line-of-sight winds, but notes that currently there is no secure follow-on mission. Some proposed missions with potential have been presented at the workshop.

Recommendation to space agencies: to implement satellite missions that allow the provision of wind profile information with global coverage (e.g., DWL, hyperspectral IR with high temporal frequency and spatial resolution).

7. Motion information from geostationary hyperspectral IR sounder data

The group discussed how best to obtain wind profile information from hyperspectral IR instruments in an NWP context, with a view to MTG-IRS and similar missions. Two different options are being considered:

1. Direct assimilation of (clear) radiances in 4d-Var (or equivalent). 4d-Var's ability to extract wind information from humidity or ozone-sensitive observations has been demonstrated in the past with data from geostationary or polar satellites (e.g., Peubey and McNally 2009, QJRMS; Riishøjgaard 1996, QJRMS; Geer et al. 2014, ECMWF Tech Memo 741)

or

2. Tracking structures in sequences of humidity (or other) retrievals and subsequent assimilation of the derived wind profiles. Activities in this direction were shown at this and previous workshops.

No clear consensus was reached which of the two options is most promising. Aspects to consider are:

- The retrieval and subsequent tracking step is likely to lead to complex error characteristics from the derived wind profiles, and these error characteristics may be difficult to handle in subsequent assimilation.
- Fine-scale information may be accessible through the tracking step which could be more difficult to obtain in 4d-Var, particularly if data are heavily spatially thinned.
- Offline tracking offers clear benefits when using 3d-Var rather than 4d-Var as assimilation algorithm. There was some debate whether the tracing effect demonstrated with 4d-Var will work as well for some newer assimilation algorithms, such as 4d-EnVar.

Work is expected to continue in both directions, bearing in mind the aspects considered above.

8. Reprocessing activities

The group continues to support reprocessing activities to derive consistent wind datasets with state-of-the-art algorithms, especially for early data. These are being produced particularly in support of reanalysis activities. To ensure such reprocessing activities continue to benefit from algorithm developments, the group expressed the following:

Recommendation to wind producers: to consider backwards compatibility when designing current processing algorithms, so that present state-of-the-art algorithms can be applied to old data.

It was noted that reprocessing can be useful also for long-term datasets that are not used in reanalyses, as they can be used for evaluation of reanalyses.

9. Use of NWC-SAF AMV software

The group noted that a number of NWP centres are using the NWC-SAF AMVs software to derive higher density AMVs for their mesoscale assimilation systems:

- Met Office (operationally)
- AEMet (experimentally)
- Norway Met. Service (experimentally)
- Hungary Met. Service (experimentally)
- Korea Met. Administration - KMA (experimental use adapted to COMS).

Several other centres have expressed an interest in using NWC-SAF derived AMVs in their NWP models.

Further developments of this software are supported (e.g., production of o-b statistics, nested tracking algorithm). At the same time, the group noted that the use of the NWC-SAF software is a response to an unmet requirement for mesoscale AMV datasets, and causes multiplication of undesirable overheads.

Recommendation to AMV producers: to provide higher-density AMV products that capture small-scale detail for mesoscale applications. Rapid-scan configurations are particularly suitable for this.

10. NWP-SAF and OSI-SAF monitoring activities

The group acknowledged the usefulness of the NWP-SAF AMV monitoring report which was compiled and circulated, as usual, ahead of the meeting. The group supports the continuation of this activity.

Members of IWWG are encouraged to study the monitoring report and provide feedback, including identification of new issues or further investigation of issues already identified.

11. Feedback on Workshop organisation

The general feedback from the group was that it had again been a very successful workshop. It was noted that there was more interaction due to the type of conference venue, and this was seen as very positive. The mix of presentations/posters/discussions/working groups was again well received.

Some suggestions were made for the incoming co-chairs to consider:

- It was noted that many NWP centres provide status/overview reports which often cover many aspects, and given the range of topics covered in these presentations there is often no time to provide details on particularly interesting topics. To improve this, it was suggested to encourage NWP centres to provide status updates/overviews in posters, in order to allow time for more in-depth presentations on selected most relevant topics.
- How do we best report to WMO/CGMS on wind aspects for scatterometer and Aeolus, but also retain some focus on AMVs? We expect more focus on other observation types for some meetings, for instance, given the expected availability of Aeolus data in the next two years, but we also expect dedicated Aeolus workshops separate from IWWG that feed into IWWG.