



IWW16
Working Group 1 Discussion

Moderators: Javier García-Pereda (AEMET)
Marie Doutriaux-Boucher (EUMETSAT)

Thursday, May 11, 2023

Participants



Live participants

- Jason Apke
- Steve Wanzong
- Svetla Hristova-Veleva
- Renato Galante Negri
- Kazuki Shimoji
- Kevin Maschhoff
- Dong Wu

- Sara Tucker
- Amir Ouyed Hernández
- Andrew Bailey
- Stéphane Laroche
- Marie Doutriaux-Boucher
- Javier Garcia-Pereda

Remote participants:

- Kevin Barbieux
- Graeme Kelly
- Jose María Garcia
- Olivier Hautecoeur
- Rich Dworak
- Youva Aoun
- Dave Santek



HLPP 4.2.1 and related actions

- HLPP 4.2.1
Establish commonality in the derivation of AMV for global users where appropriate (e.g., through sharing of prototype algorithms) and consider backwards compatibility when designing AMV algorithms for the 16-channel imagers, so that present state-of-the-art algorithms can be applied to old imagery.



A46.03 - BUFR Table

A46.03: AMV producers to adopt the latest AMV BUFR template

Center	Status
CMA	Not implemented but planned for Dec 2021 – Apr 2022 for FY2H, FY4A.
CPTEC/INPE	Not implemented as they do not supply to GTS.
EUMETSAT	Applied since February 2021 for MPEF release 2.9.
ISRO	Not implemented, no work scheduled at this time.
JMA	Not implemented, no work scheduled at this time.
KMA	Implemented a compressed version on 21 December 2021.
NOAA	Applied since 23 April 2019.
NWCSAF	Applied since v2018.1, available since January 2020.

Centres requested to provide a status update
but few AMV production centres were actually present in the Working Group Discussion!

Action IWW16-WG1-01: WG1 Moderators to check through an online survey the status of implementation of the new BUFR format by the different AMV production centres.



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Some elements in the AMV BUFR template might still be empty or have different implementations in different AMV algorithms.

Action IWW16-WG1-02: Eumetsat to organize a meeting with AMV production centres towards a common interpretation of doubtful BUFR parameters (action coming from previous IWW15)



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Suggestions also for a common NetCDF for AMVs:

Several AMV netCDFs exist already (NOAA, NWCSAF, EUM/MTG,...)

Action IWW16-WG1-03: Marie Doutriaux Boucher to collect examples of all existing AMV netCDFs and characteristics, and coordinate corresponding discussion for the common NetCDF

- Should it replicate the current common BUFR?
- Definition as “CF compliant” for easy use by applications?

A46.02 – Common QI



A46.02: All AMV producers to implement the “Common QI module” in their algorithms.

Center	Status
CMA	In time before the 4 th AMV Intercomparison.
CPTEC/INPE	In time before the 4 th AMV Intercomparison.
EUMETSAT	Applied since November 2018 for MPEF release 2.7.
ISRO	Not implemented, no work scheduled at this time.
JMA	Applied since 17 March 2019.
KMA	Applied since 28 October 2019.
NOAA	Not implemented but planned for June 2021.
NWCSAF	Applied since v2018, available since February 2019.

For the same reason, the [survey in Action IWWG-WG1-01](#) will also check the status of implementation of the Common QI module by the different AMV production centres.

How many NWP centres are actually using CQI?

→ Recommendation IWW16-WG1-01: NWP centres encouraged to use the common QI for homogeneity in the use of different AMV products.



HLPP 4.2.2 and related actions

- HLPP 4.2.2:

Investigate the best configurations to be used by the AMV producers for use in global and regional NWP models respectively, and clearly define the appropriate requirements for each of them.

A46.04: NWP community to define the best configuration to be used by the AMV producers, for use in global and regional NWP models.

A46.06: IWWG to look at improving quality indicators for high resolution wind derivation for mesoscale and regional applications. (Ref. CGMS-46-IWWG-WP-01).

A46.04 – Global AMV Configuration



Timeliness	Important as data later in window has the most impact.
Target Size and Image Interval	Best to generate AMVs with target size and interval which is optimal for best AMV product. NWP centres can superob data, if necessary, to the resolution which is optimal for NWP. Based on recent studies this might be ~ 16x16 pixels with ~10 min interval (where available).
Grid Size	Should avoid overlapping targets (to reduce correlated error). There is an open question as to whether NWP centres might benefit from maximising density after allowing for this constraint as it gives flexibility to use data at higher density in regions of interest and the potential to reduce random error through superobbing. However, there is a <i>cost/benefit trade-off</i> : the cost of production/storage/processing of increased volumes versus the currently unknown benefit to NWP.
Temporal Frequency	Many centres assimilate data hourly in NWP so this seems like a sensible target, however, increased frequency can help to fill the spatial gaps. <i>It may be useful to have the data every half hour</i> , perhaps even more often. However, note caveat cost/benefit trade-off above. May benefit from enhanced spatial/temporal products for critical events such as storms.
Derivation Settings	Are there any other changes that could help to improve the spatial coverage without impacting too much the quality of the winds? Novel optical flow retrieval is potentially one option.
Derivation Information	Access to information from the derivation that might have skill for NWP quality control. This might include information on the correlation surface (for confidence in tracking) as well as information from the cloud analysis and height assignment steps. Request made for standardised cloud type to be made available.

NWP proposal
for Global models

A46.04 – MESO AMV Configuration



Timeliness	Critical. Some regional models cannot use data older than 50 min.
Target Size and Image Interval	Likely want a higher resolution product than for global, but not clear what will be optimal. Might be worth trying 16x16 and smaller targets with both 10 min and 5 min intervals (where available). May need approaches to reduce noise (averaging correlation surfaces, clustering, filtering). Produce AMVs from high resolution channels (0.5 km, 1 km).
Grid Size	Ideally set grid size to avoid overlapping targets, but otherwise the more the better. TBC if density is sufficient without overlapping targets – NWCSAF/HRW could be used to explore. May want to relax this criterion.
Temporal Frequency	Probably want winds produced every 10/15 min – should help to improve the spatial coverage even if we thin or superob to one per hour due to correlated error. May benefit from enhanced spatial/temporal products for critical events such as storms. May be useful for NWP and forecasters.
Derivation Settings	Are there any other changes that could help to improve the spatial coverage without impacting too much on the quality of the winds?
Derivation Information	Access to information from the derivation that might have some skill for NWP quality control. This might include information on the correlation surface (for confidence in tracking) as well as information from the cloud analysis and height assignment steps. Request made for standardised cloud type to be made available. Improving the errors is likely to be particularly important for initialising the smaller scale flow.
NWP Usage	A particular challenge is how to benefit from the high-resolution information without hitting the system too hard due to correlated errors. We may want to consider back-and-forth nudging as well as variational approaches in NWP.

NWP proposal
for Regional models
(slightly updated in IWW16)

In both cases, the survey in Action IWWG-WG1-01 will also check the options in the different AMV Algorithms to implement these global and regional configurations, and when they could be implemented.



Additional options

Some additional options from this workshop:

- Is it possible to define a “tracking error” related to the shape/size of the AMV correlation surface, and populate the new BUFR with it?
 - The new AMV BUFR includes parameters for this “tracking error”!
 - AMV centres should use it!

Graeme Kelly’s IWW15 slides on his approach to the correlation surface:

- Find position and strength of primary maxima
- Remove an 8x8 pixel square centred on this location
- Find the next maxima (second)
- Calculate the normalised difference between the first and second maxima
 - The bigger this value, the more unique this maximum, suggesting better tracking constraint and some skill in O-B comparisons.

The survey in Action IWWG-WG1-01 will also check the options in the different AMV Algorithms to implement this “tracking error”, and when it could be implemented.



Additional options

Some additional options from this workshop:

- Is it possible to define a common “gross error check” by all AMV producers, which does not use any NWP wind guess?

There is no consensus on this;
several centres are using it while others don't.

Recommendation IWW16-WG1-02: AMV algorithms should not use any comparison with the “NWP wind” for AMV rejection in any “gross error check”.

In the survey in Action IWWG-WG1-01, AMV producers will describe in detail the “gross error check” process implemented in their algorithms.



Additional options

Some additional options from this workshop:

- Implementation of “stereo heights” by other AMV centres?
 - ➔ Options have increased a lot with the different combinations shown (GEO+GEO, LEO+LEO, GEO+LEO)
 - ➔ They could be applicable in the whole globe!

In the survey in Action IWWG-WG1-01, AMV producers will describe any current and future options for use of “stereo heights” in their algorithms.

Recommendation IWW16-WG1-03: Agencies should consider benefits of satellite location in order to maximize the production of “stereo AMVs”.



Additional options

Some additional options from this workshop:

- Testing/implementation of Feature matching and consensus - FMC (Kevin Barbieux' new tracking method) without wind guess by other AMV centres
 - ➔ For information, Kevin Barbieux is going to publish in a paper the whole description of the method.
- Testing of Optical flow by other AMV centres (e.g., option for use of Jason Apke's OCTANE, available in github)

Recommendation IWW16-WG1-04: AMV centres encouraged to evaluate both items. ("Feature matching and consensus – FMC" and additional "optical flow" procedures).

HLPP 4.2.3



- HLPP 4.2.3: Assess the value of winds from GEO Hyperspectral IR
 - CMA presented GIIRS GEO hyperspectral data available on CMA website, for use.
 - IASI 3D winds provided as demonstrational in 2024.
 - EUM has 3D wind algorithm ready for MTG/IRS, based on current IASI 3D winds, which should provide data less than a year after satellite commissioning (2025).
 - JMA will also incorporate a GEO sounder in their following GEO series (2029).



A46.07 – AMV Climate Projects

A46.07: IWWG to consider developing climate projects from Atmospheric Motion Vectors (AMVs) and to report to the CEOS/CGMS WGClimate with a potential pilot project. (Ref. CGMS-46-IWWGW-01).

Recommendation IWW16-WG1-05: IWWG to inform WG-Climate about:

- 1) Considering the production of a global AMV product using the new harmonised GEO ring level 1 (2027)

- 2) Considering exploring potential climate applications using AMV CDR.
For example:
 - Exploring jet stream location trends/changes
 - Exploring the African and Indian monsoon trends/location
 - Suggestion for AMVs derived using dust (or other atmospheric trace gases)



Other Items

- Can NWP test new wind datasets? Stereo winds, Optical Flow, Sounder.
 - ➔ It is a fact that there has been a strong push for these new elements in this IWW, and specially for “stereo winds”.
- Discuss the state of AI/ML in AMV/NWP
 - ➔ New research has been emerged in this IWW related to these items.
- Encourage more participation within the AMV Intercomparisons.
- Explore potential synergies between AMV observations.

Recommendation IWW16-WG1-06: “optical flow” products to evaluate methods which incorporate traditional AMV techniques for quality control in novel dense optical flow techniques.



Administrative Items

A new host for the email groups and webpages should be secured prior to IWW17.

Recommendation IWW16-WG1-07: EUM to contact CGMS secretariat to setup a long term IWWG website and email exchange



Feedback on IWW16

- The Workshop was very well organized by the hosts.
- The Workshop is important for community discussions.

- About the hybrid format:
 - ➔ It allows a more diverse group of people to attend, although it reduces a bit the interactions.
 - ➔ The format should be kept, although people are encouraged to attend in person.

Recommendation IWW16-WG1-08: IWW organizers to include Slack/Slido in next workshop to facilitate interation between attendants during and after the workshop