

## **REPORT FROM THE 10TH INTERNATIONAL WINDS WORKSHOP**

This paper summarises the outcomes of the 10<sup>th</sup> International Winds Workshop (IWW10). The workshop was hosted by JMA and took place in Tokyo from 22-26 February 2010. There was a good cross-spectrum of attendance (46 participants) from a wide range of producers, NWP centres and a few research centres.

This paper:

- i) recalls recommendations from CGMS-37 to IWW10
- ii) highlights the outcomes and recommendations from IWW10

CGMS-38 is invited to discuss the outcomes and recommendations from IWW10.

## Report from the 10th International Winds Workshop

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### 1 INTRODUCTION

This paper summarises the outcomes of the 10<sup>th</sup> International Winds Workshop (IWW10) hosted by JMA in Tokyo from 22-26, February 2010.

#### **Local Organising Committee**

Mr Akihiro Shimizu, JMA

Mr Kazuki Shimoji, MSC/JMA

#### **Scientific Program Committee**

Mr Ryo Oyama (JMA)

Mr Koji Yamashita (JMA)

Mr Arthur de Smet (EUMETSAT)

Mr Jaime Daniels (NOAA/NESDIS, Co-Chair)

Dr Mary Forsythe (Met Office, Co-Chair)

The workshop was very successful and provided a good opportunity to share results and discuss future work and collaborative opportunities. We experimented with an altered meeting format to allow more time for discussion of key topics. This was well received and will be continued with future workshops.

The workshop included 8 sessions of talks (20 min time-slots, no posters):

1. Operational Status
2. AMV derivation development
3. AMVs in NWP
4. Characterising AMVs
5. Polar AMVs
6. Mesoscale
7. MISR and ADM
8. Surface winds

2 parallel working groups on Thursday pm:

WG1: Methods

WG2: Data Assimilation

and 4 plenary discussions (PD) on key topics:

PD1: Plans to develop a portable AMV processing software package (see CGMS-38 EUM-WP-42)

PD2: Collaborative activities

PD3: Winds for high resolution NWP

PD4: Process for testing and implementing operational changes

## 2 RECALLING RECOMMENDATIONS FROM CGMS-37 TO IWW10

The recommendations from CGMS-37 were introduced in the opening session of IWW10. Some specific items were discussed in the new dedicated plenary discussions. The remainder were addressed in the Thursday afternoon working groups.

**Recommendation 37.18:** WMO encourages CGMS members to repeat the very informative international operational AMV algorithm intercomparisons at regular time intervals of about 3-4 years.

**Recommendation 37.19:** CGMS members should provide support to the next IWW10 meeting by approving participation of scientists and operational staff working on the utilisation and derivation of satellite winds and, if possible, by providing some support to travel of relevant people from the research community.

**Recommendation 37.20:** Efforts to enhance the use of AMVs in NWP should continue to address both the quality of the AMVs as well as the way the product is utilised in NWP assimilation systems.

**Recommendation 37.21:** In view of the success of the polar winds all efforts should be undertaken to continue such products as long as possible from imaging instruments in polar orbits.

*The potential deployment of an imager in a highly elliptical orbit raised interest and CGMS Working Group II expressed strong support.*

**Recommendation 37.22:** IWW10 is requested to address the development of a stand-alone software package for the derivation of AMVs from imaging satellite instruments.

**Recommendation 37.23:** CGMS endorsed and recommended all topics listed in EUM-WP-31 section 6 for a detailed discussion at IWW10.

- i) What is the best process to be followed when making updates to operational AMV processors?
- ii) Re-evaluate approach for height assignment of low-level winds.
- iii) Height assignment validation in general for all levels of AMVs, especially using the A-train data.
- iv) Further studies using AMVs derived from simulated imagery based on NWP model output.
- v) Representing AMVs as layer observations
- vi) Use of additional information on cloud characteristics (e.g. microphysics) within the AMV derivation schemes
- vii) Development of error estimates
- viii) Development of high resolution wind products
- ix) Investigations into use of hyperspectral sounder data on future geostationary sounding missions

**Recommendation 37.24:** JMA is invited to report at IWW10 on the derivation and quality of AMVs derived from the MTSAT imaging at time intervals as short as 7 and 4 minutes, respectively.

**Recommendation 37.25:** On the basis of existing scientific prototype software for product retrievals, NOAA and EUMETSAT offer to other satellite operators existing prototype algorithm software for testing and further development.

### 3 HIGHLIGHTS FROM IWW10

#### Some highlights from the talks

1. NESDIS GOES-R nested tracking algorithm – an interesting new approach to tracking, where early results suggest a benefit in reducing the jet slow bias.
2. Environment Canada's plans for 2 satellites in highly-elliptical orbit – would provide enhanced wind information over the higher latitude NH region.
3. Potential for provision of height error estimates, cloud layer and microphysical information with new cloud and AMV schemes at EUMETSAT and NESDIS.
4. Potential to improve coverage and reduce image interval using images from orbital satellite pairs e.g. Metop-A/B, NOAA-18/19 etc.
5. Techniques to improve production of mesoscale wind fields including an interesting proposal from JMA for AMVs.
6. Results of adjoint sensitivity studies performed by ECMWF, NRL, GMAO and Environment Canada show significant impact from AMVs, particularly per ob. Should we be assimilating more AMV data?
7. Preliminary results from ECMWF on their work allowing for correlated error in the assimilation – may enable assimilation of data at higher density.
8. Comparisons of MISR and Meteosat AMVs and potential for future MISR-like missions.
9. Similarities in scatterometer O-B speed bias map plots from several centres. Further investigations planned.
10. Plans for the launch of the first Korean geostationary weather satellite, COMS, in Spring 2010.
11. Potential of WindSat surface wind assimilation to offset impact of QuikScat failure.

#### Plenary Discussion 1: Portable software

This topic generated a lot of debate and addressed the following two objectives:

1. Greater involvement of research groups to help develop and test new approaches for deriving satellite-based AMVs.
2. Increased collaboration between operational AMV producers to speed up improvements to AMV derivation and move towards more consistent approaches.

This topic is discussed further in CGMS-38 EUM-WP-42.

#### Plenary Discussion 2: Collaborative activities

The discussion focussed on two main projects: the AMV inter-comparison project and the investigation of AMV characteristics using simulated imagery. These projects have served as an outstanding mechanism for international collaboration between groups working on the problem of satellite wind derivation. It was agreed that the AMV inter-comparison project is very useful for learning more about the differences in AMVs produced at different centres and ultimately for improving the quality and consistency of the products.

EUMETSAT, CIMSS/NESDIS, JMA and the NWC SAF agreed to participate in a further study using the latest derivation software, a new study period and more in-depth analysis. Other centres including CMA and BoM expressed more tentative interest in participating. It was agreed that this would be useful as a routine check, possibly every 2 years to coincide

with the IWWs. However, we may need to review the frequency at which this could be done as it will depend on the availability of resources. Some other considerations:

The test case could be reused as part of routine testing of a derivation upgrade

We could provide the test case more widely and encourage research participation in algorithm development

We could additionally use a simulated imagery case for an inter-comparison study

It was agreed that deriving AMVs from imagery simulated from high resolution NWP model output provides a powerful technique for assessing AMV characteristics. CIMSS and ECMWF have done some work in this area. It was agreed that further studies would be beneficial.

### **Plenary Discussion 3: High resolution winds**

There were several talks on this topic which reflects its increasing importance for NWP centres. However, there are still no stand-out solutions for either the derivation or assimilation of high resolution winds. We would benefit from greater community-wide discussion to guide developments. Some points noted include:

Warned against overlapping targets, recommended more work on approach to QIs, and suggested looking at new AMV approaches like NESDIS' nested tracking algorithm developed for the future GOES-R satellite or JMA's method that uses more than 3 images. Need for NWP to be clearer on their requirements (spatial, temporal resolution).

May need to be more accurate with AMV time stamps.

Discussed how best to take forward e.g. encourage greater discussion between various producers and NWP centres who are looking at this. *[The co-chairs are aiming to address this by setting up a new wiki section on the IWWG web pages]*

Suggestion to take advantage of THORPEX / TPARC campaigns for validation. Also proposed use of full resolution sondes, profilers and MISR.

Desire to assimilate at higher resolution. Options include allowing for correlated error in the assimilation and use of a variable thinning box (use at higher density in areas of interest). Should also consider changes to quality control.

### **Plenary Discussion 4: Process for testing and implementing changes**

Arthur de Smet (EUMETSAT) and Iliana Genkova (ECMWF) presented a nice review of the change process in the current European system and highlighted the roles of the producer and the lead NWP centre in that process. This generated a lot of discussion among the IWW10 participants.

A key part of the discussion was the advantages and disadvantages of different evaluation approaches and where they are best carried out.

1. Visual inspection (Producer)
2. Collocation with other observations (Producer, but limited coverage)
3. Comparison to NWP background (Producers should use more)
4. Impact trials (NWP, but need long period, can be hard to interpret)
5. Advanced observation diagnostics (NWP, still relatively new approach)

The responsibilities of the producer and lead NWP centre were discussed. Some suggestions included:

Grouping a set of changes for final testing and implementation, as the testing and implementation process can be lengthy.

Only recommend passing changes to NWP when show neutral or positive results for steps 1-3. May accept some degradation to enable future improvements i.e. common sense approach.

It was agreed that a paper summarising the recommended process of testing and implementing algorithm changes will be put together and circulated within the IWWG community for final agreement. This will then be attached to the IWWG web pages.

### **Working Groups**

These addressed several topics initiated by the co-chairs and from CGMS-37. Some of the discussion is already captured elsewhere within this document. The key additional points are noted here.

- Recognised importance of reprocessing wind observation in support of reanalysis projects.  
Collated details of reprocessing and reanalysis plans.
- Discussed concerns of feasibility of tracking over 100 minutes following research at EUMETSAT (important for single-satellite polar AMVs).
- Encouraged wider efforts to look at generating polar AMVs from image pairs as can help close gap between geostationary and polar AMVs.
- Discussed possibility of generating and comparing the forward and backward displacement of a tracer as a quality control approach.
- Encouraged efforts to inter-compare and work towards unifying QI approaches (differences seen in AMV inter-comparison project).
- Support for the NWP SAF work on AMVs and scatterometer. Suggestion that adding AMV best-fit pressure statistics would be useful.
- Recognition that it would be good for NWP centres to support further evaluation of the MISR winds in preparation for possible future satellite missions.
- Discussion of options for improving the AMV assimilation including using a layer observation operator, allowing for correlated error in the assimilation, better representation of the errors and changes to the thinning strategy.

### **IWW10 recommendations**

The list provided below summarises the main IWW10 recommendations. CGMS-38 is invited to consider these recommendations, with particular focus on those highlighted in bold relating to higher priority tasks.

- IWW10.1. NWP centres to coordinate a joint AMV and scatterometer denial study (possibly two 6 week periods), also looking at adjoint sensitivity statistics where available. Aim to summarise in a report to the WMO GOS impact workshop and IWW11, both due to be held in the first half of 2012.**
- IWW10.2. AMV producers to undertake a new AMV derivation inter-comparison using the latest software and a new study period. Plan to repeat at intervals and report results at the IWWs. [The co-chairs plan to set up a wiki page for this project. For the next phase we will need volunteers to coordinate (i) the study period and requirements (ii) the distribution and collection of data and (iii) the analysis of results. Unless volunteers are identified we may need to postpone the next phase until after IWW11 – priority should go to IWW10.4]**

- IWW10.3. ECMWF, EUMETSAT, CIMSS and the Met Office to discuss options for a new simulation study. A key area to address is the association of errors with cloud type and evolution (testing the passive tracer assumption), although several other items could be investigated with this technique.
- IWW10.4.** **Co-chairs to summarise the proposed approach to address the points raised in the plenary discussion on developing portable software (see CGMS-38 EUM-WP-42). The NWC SAF, producers and co-chairs to undertake work to address the key actions.**
- IWW10.5.** **Co-chairs to set up a wiki page and initiate discussion on improving the derivation and assimilation of high resolution winds.**
- IWW10.6. Co-chairs to put together a summary of the recommended process for testing and implementing derivation changes to be attached to the IWWG web pages. Producers and NWP centres to consider amending their strategy in-line with the agreed process.
- IWW10.7. Encourage NESDIS to take part in AMV reprocessing efforts in support of reanalyses.
- IWW10.8.** **Encourage all scatterometer data producers to consider providing global data in near-real-time to support NWP.**
- IWW10.9. Encourage reprocessing of scatterometer data in support of reanalyses.
- IWW10.10. Height assignment is recognised as a major error source for conventional AMVs. IWW10 presentations highlighted the potential of the stereo-based height approach used for MISR winds. We strongly encourage renewed efforts to evaluate MISR winds in NWP and support proposed initiatives to develop MISR follow-on (e.g. MISR-lite) which consider the timeliness and coverage requirements of NWP.
- IWW10.11. Support and encourage efforts to develop hyperspectral wind products.
- IWW10.12. Support the Canadian proposal for satellites in highly-elliptical orbit.
- IWW10.13.** **Encourage increased efforts to validate AMV height assignment using the A-train, model, sonde, and profiler data.**
- IWW10.14.** **Encourage continued efforts to generate physically-based AMV vector and height error estimates to be sent with each wind.**
- IWW10.15. Encourage further development of the IWWG web pages, particularly to help with IWW10.4 and other collaborative projects. Increase profile of pages by encouraging links to the site from elsewhere.

## 4 CONCLUSIONS

The 10<sup>th</sup> International Winds Workshop hosted by JMA in Tokyo continued the series of successful meetings. All recommendations from CGMS-37 were discussed, together with other key scientific issues, during the working group and plenary discussion sessions. A number of recommendations were made as highlighted in Section 3. A notable element is the number of collaborative projects ongoing within the community. These are a very useful way to address a number of issues and we invite CGMS-38 to support continued collaboration by enabling specific studies and by providing funding for travel of scientists.

Concerning recommendations for work in the immediate future, the CGMS-38 is invited to emphasise the following aspects and, where relevant, request papers for CGMS-39.

NWP centres to coordinate a joint AMV and scatterometer denial study, also looking at adjoint sensitivity statistics where available. Aim to summarise in a report to the WMO GOS impact workshop and IWW11, both due to be held in the first half of 2012.

AMV producers to undertake a new AMV derivation inter-comparison using their latest software and a new study period. Plan to repeat at intervals and report results at future IWWs.

The NWC SAF, producers and IWWG co-chairs to undertake the work outlined in CGMS-38 EUM-WP-42.

The IWWG co-chairs to set up a wiki page and initiate discussion on improving the derivation and assimilation of high resolution winds.

Encourage all scatterometer data producers to consider providing global data in near-real-time to support NWP.

Encourage increased efforts to validate AMV height assignment using the A-train, model, sonde, and profiler data.

Encourage continued efforts to generate physically-based AMV vector and height error estimates to be sent with each wind.

The IWW10 proceedings will be available soon on the EUMETSAT web site under [www.eumetsat.int](http://www.eumetsat.int).

As a final point to note, Dr Mary Forsythe will be on maternity leave during 2011. We are arranging a stand-in co-chair to help with preparation of IWW11 due to be held in New Zealand in early 2012.