

A Coordinated Study of Atmospheric Motion Vector (AMV) Impact on NWP and Other Satellite Wind Highlights

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Outline

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- **IWWG Achievements**
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 - Collaborative Projects
- **IWW11 Top Recommendations & Future Work Plans**
- **Summary**

International Winds Working Group (IWWG)

- Established in 1991 and became a formal working group of the Coordination Group for Meteorological Satellites (CGMS) in 1994.
 - Currently 50-60 active members.
- Provides a forum to discuss and coordinate operational and research developments in satellite-derived wind data production, verification/validation procedures, and assimilation techniques.
 - Geostationary and polar imagery (clouds and water vapor)
 - Radar backscatter & conical microwave radiometers (ocean surface winds)
 - Research instruments (ie., MISR)
 - Future instruments (advanced imagers, space-borne LIDAR, Geo-Hyperspectral)

How the IWWG Operates

- **Biennial Workshops**
 - The most recent (IWW11) workshop: February 20-24, 2012 in Auckland, New Zealand
 - The first workshop (IWW1): September 17-19, 1991 in Washington, DC
 - Participants (~50) from operational satellite centers, NWP centers, industry, and academia
- **Internal Interactions**
 - IWWG web site/wiki
 - Collaborative projects
 - Email lists

IWWG Web Page *A Collaborative Tool...*

- **Wiki Sections**

- Product information / training
- Collaborative Activities

- **Why Wiki?**

- wiki is a website where registered users can edit a web page using a web browser.
- Supports collaborative projects

- **IWWG Workshops**

- Workshop proceedings
- Now [available online](#) for all IWWs (thanks to EUMETSAT)

International Winds Working Group (IWWG) - Mozilla Firefox

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http://cimss.ssec.wisc.edu/iwwg/iwwg.html

INTERNATIONAL WINDS WORKING GROUP

HOME ABOUT US INFORMATION (wiki) ACTIVITIES (wiki) WORKSHOPS LINKS CONTACT US

Welcome to the **International Winds Working Group** website

The International Winds Working Group (IWWG) was established in 1991 and became a formal working group of the Coordination Group for Meteorological Satellites (CGMS) in 1994.

IWWG was initially established to focus on cloud track winds from geostationary data. As the satellite observing system has developed, the IWWG has broadened its interest to cover the range of wind datasets derived from current and future satellite missions. The main focus remains the atmospheric motion vectors produced by tracking features (clouds and water vapour) in geostationary and polar imagery sequences. Other winds datasets addressed by the group include: (i) ocean surface winds derived from radar backscatter and conical-scanning microwave radiometers (ii) data from research missions (e.g. MISR winds) and (iii) future datasets including wind probe information from space-borne lidar and 3-D wind fields derived from tracking features in clear sky moisture fields produced from future geostationary hyperspectral infrared sounders.

IWWG provides a forum to discuss and coordinate research and developments in data production, verification/validation procedures and assimilation techniques.

General Announcements	Latest News
<p>11th INTERNATIONAL WINDS WORKSHOP 20-24 Feb 2012, University of Auckland, New Zealand</p>  <p>Courtesy of IrNZ/Flickr.com</p>	<p>For older news items see the news archive</p> <p>Feb 12: Release of the 5th analysis report of the NWP SAF AMV monitoring - see the NWP SAF AMV analysis reports web page for further information.</p> <p>Feb 12: Update to IWWG web pages including introduction of new wiki pages.</p> <p>Jan 11: Proceedings of IWW3 available online - follow the workshops link.</p> <p>Dec 10: Régis Borde standing in as co-chair for IWWG while Mary Forsythe is on maternity leave during 2011 (Régis will also co-chair IWW11 in Feb 2012).</p>

Web page: <http://cimss.ssec.wisc.edu/iwwg/iwwg.html>

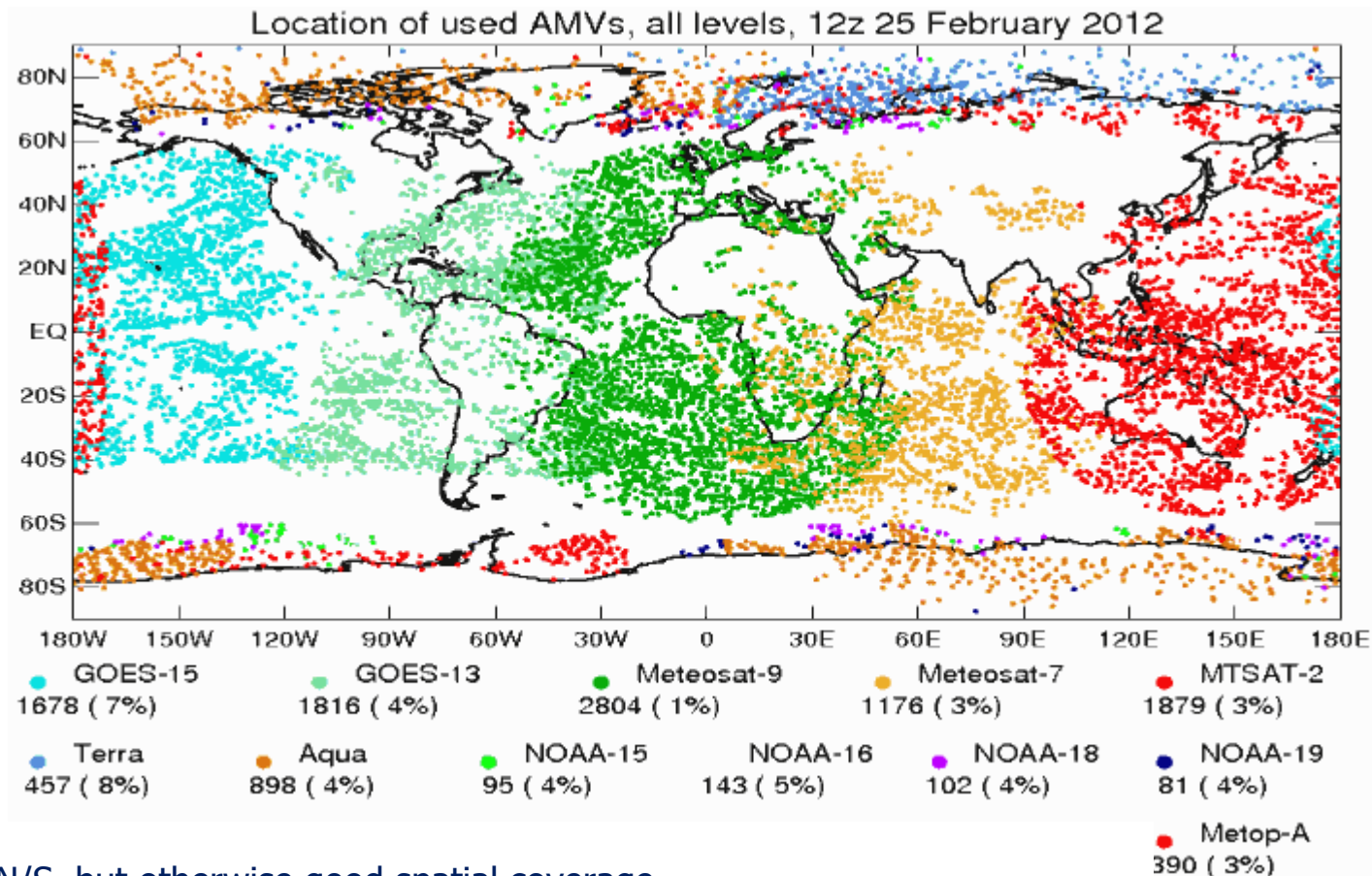
Highlights from IWW11 (Feb 2012)

- Hosted by the University of Auckland, New Zealand (**Local Host: Roger Davies**)
- Co-chaired by Jaime Daniels , Régis Borde
- Attended by 56 scientists
- NWP representation the best ever
- **Covered:**
 - Updates on operational products
 - Latest developments in AMV derivation, characterisation, NWP applications
 - One session focussed on MISR winds
 - One session focussed on Doppler Wind Lidar
- **In addition to usual WGs, held focused group discussions on:**
 - NWP winds impact study and high resolution winds
 - AMV intercomparison plan and simulated data studies
 - AMV open source software



Today's Satellite Wind Observations

Where we are now... AMVs



Met Office using data from 5 geostationary and 7 polar platforms

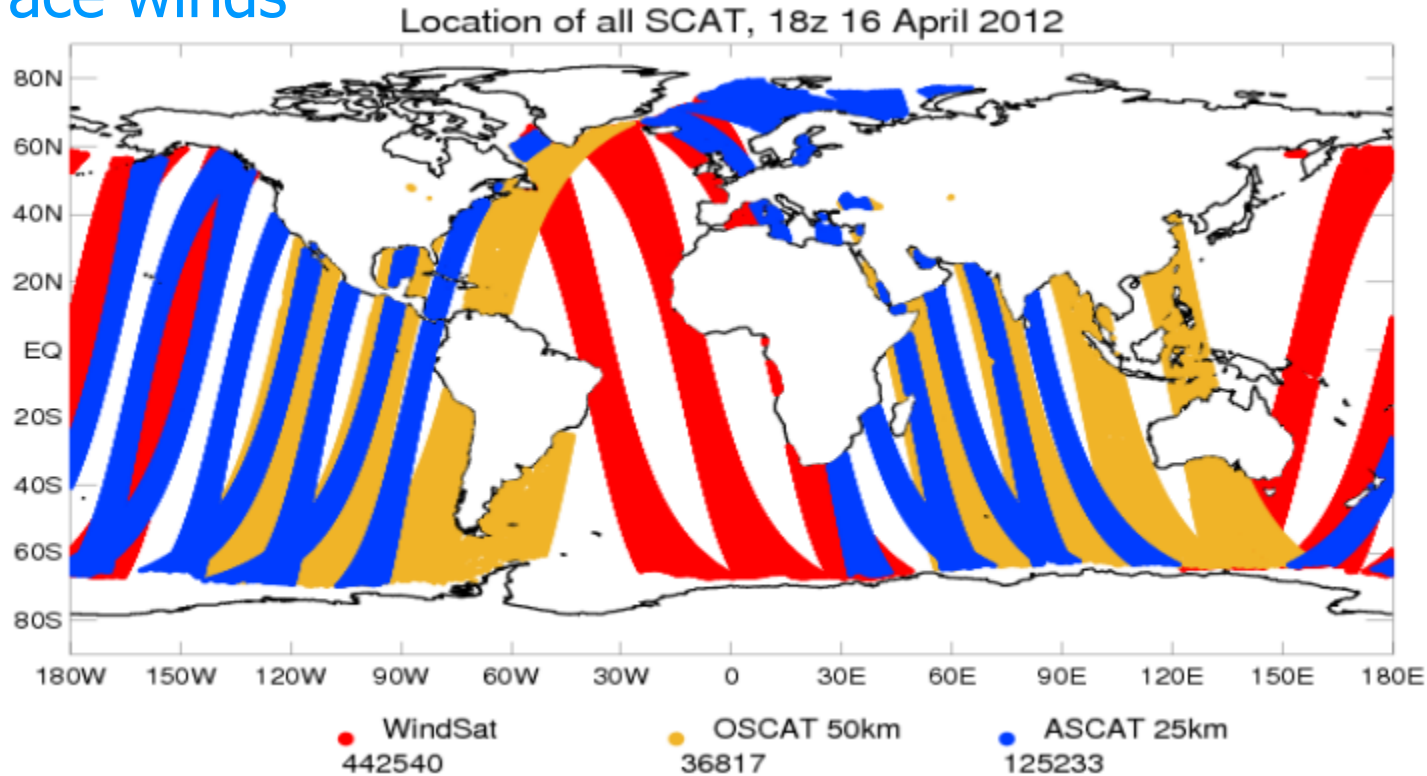
- Data gaps around 60N/S, but otherwise good spatial coverage.
- Improving temporal coverage - most geostationary AMVs available hourly.
- Working toward commonality in the derivation of AMV products for global users



Today's Satellite Wind Observations

Where we are now...SCAT winds

Surface winds



The first winds from China's HY-2A satellite have been produced. These will provide complementary coverage to ASCAT and OSCAT observations

Recent IWWG Achievements

- Completion of a 2nd NWP winds impact study (undertaken in 2011-12)
- Number of new or improved satellite wind derivation schemes
- Inter-comparison Study of Atmospheric Motion Vectors (AMVs) (first study in 2006, second phase 2012-13)
- AMV simulated data studies (ECMWF:2011-12, University of Reading – ongoing)
- Portable AMV derivation software (via NWC SAF) to support research efforts (ongoing)
- AMV reprocessing capabilities achieved by numerous satellite operators (EUMETSAT, JMA,) – supports SCOPE-CM effort

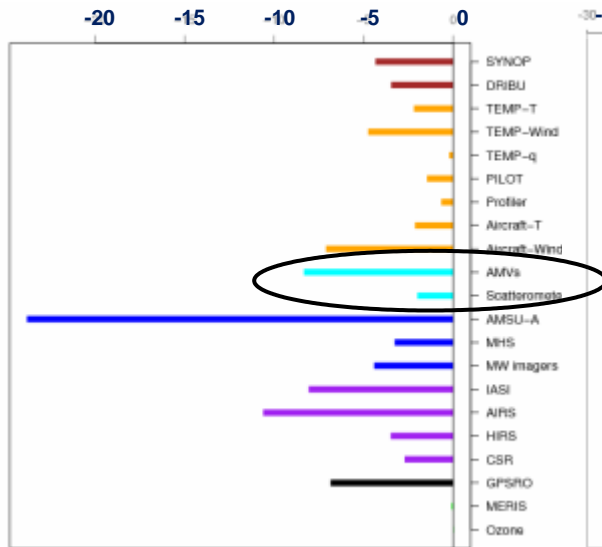
Coordinated Study of Winds Impact *Highlights...*

- **Second NWP Impact Study Undertaken (Two seasons)**

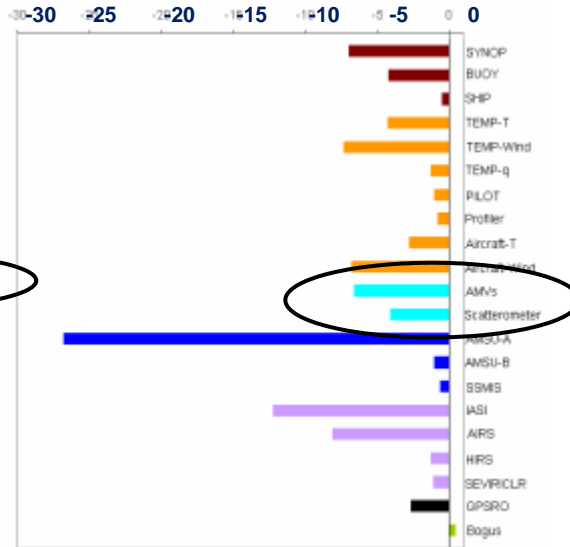
- Participating Centers: DWD, ECMWF, JMA, KMA, Meteo-France, NRL, UKMO

- **Forecast Sensitivity to Observations (FSO) – Adjoint Tools**

- Adjoint-based FSO method gives estimate of the contribution of each observation towards reducing the 24-hour forecast error
- Impact results among centers agree fairly well : **AMV FSO of 7-11%; Scatterometer FSO 3-5%**



ECMWF



Met Office



NRL

Coordinated Study of AMV Impact

Conclusions...

- **Positive forecast impact is seen from AMVs across all NWP centers** especially in upper troposphere;
- AMVs generally turn out to be in the top five most important contributors for the NWP centers (*WMO 5th Workshop on the Impact of Observing Systems on NWP*)
- Nearly all centers see a strong impact on the tropical mean wind analysis
- Larger impact often seen for centers who use 3DVAR or use fewer other observations, and for NRL whose FSO statistics suggest quite a different impact from the various components of the observing system
- No geographical regions where the AMVs are performing consistently poorly among several centers.
- In addition to the classic denial study, **the FSO statistics further indicate significant relative importance of the AMVs in the global observing system context**

Improving Satellite Winds

Where the current efforts are focused...

- **Improving coverage**

- Multi-satellite winds (*LEO/GEO, LEO/LEO*)
- Higher resolution products (*spatial, temporal*)
- Higher product refresh rates (*hourly GEO*)
- Reduced latency

- **New/emerging wind derivation schemes**

- Future advanced imagers (*GOES-R ABI, MTG, AHI, Geo-KOMPSAT-2, FY4*)
- Future GEO hyperspectral sounders (*MTG, FY4*)
- Multi-satellite LEO Winds: (*Metop-A/B, Terra/Aqua, NOAA/AVHRR, VIIRS*)
- Multi-satellite GEO/LEO Winds
- ADM-Aeolus: Global vertical wind profiles
- Synergistic use of LEO hyperspectral instruments for GEO AMV height assignment
- MISR cloud motion winds: higher resolution, reduced latency
- Higher resolution scatterometer winds

Top Recommendations from IWW11

- **IWW11.1.** All AMV producing centres are encouraged to investigate how to provide enhanced ***situation-dependent error estimates of wind and pressure with new AMV derivation techniques***. NWP centers encouraged to work with producers on the evaluation
- **IWW11.2.** A second ***AMV derivation inter-comparison project*** should be carried out and the results presented at IWW12 in 2014
- **IWW11.3.** IWWG co-chairs to kick-off an activity to pull together the latest research on ***high resolution wind production and usage*** and to encourage increased focus on this theme at IWW12. This will involve input from NWP centers (to investigate need for this data in high resolution models and how best to assimilate) and data producers (how best to adapt the derivation).
- **IWW11.4.** Satellite providers should investigate the potential of ***global AMVs from tandem satellites***: dual Metop, MODIS/VIIRS, and the future Sentinel 3A/B.

Future Work Plans

- **Coordinated Study of AMV Impact on NWP**
 - Complete and distribute final report
- **Execute 2nd AMV Intercomparison Study**
 - Test datasets generated and made available to IWWG members (Oct 2012)
 - Producers will generate AMV datasets (Dec 2012)
 - Analysis and comparisons done via support obtained from the NWC SAF Visiting Scientist Program (by IWW12)
- **Error Characterization Studies**
 - Generate and utilize enhanced situation-dependent error estimates of AMVs (wind and height); especially new approaches
 - Conduct collaborative AMV Simulation Studies
- **AMV Reprocessing Capability**
 - Satellite operators to work toward achieving this capability

Future Work Plans (*cont'd*)

- **High Resolution Wind Datasets**

- Recognized by IWWG as one of the key new areas to focus on
- **Goal: Improve forecasts of high impact weather events**
- Capture/utilize smaller scale motion observed in high resolution geostationary imagery (e.g., ***clearly evident in rapid-scan animations***)
- NWP/data assimilation improvements for high impact weather
- Supporting AMV Simulation Studies
- Future satellites, new instruments, new approaches for deriving atmospheric winds
- **IWWG co-chairs kicking off a focused and coordinated effort (wiki activity page) to address this; involve NWP centers and data producers.**

- **Portable AMV Derivation Software**

- **Continue efforts to achieve a community-based AMV software package**
- Enables greater involvement of research groups
- Enables increased collaboration between operational AMV producers

Summary

- **International Winds Working Group**
 - Well focused, committed, and poised to address issues related to satellite winds; achieved through collaborative projects
 - Striving for commonality in products for the benefit of NWP users
- **IWWG has elevated the utility of AMV for NWP in recent years**
 - IWWG coordinated study of AMV impact on NWP demonstrated the significant relative importance of the AMVs within the Global Observing System (GOS)
- **A number of new or improved satellite wind derivation schemes have or are being developed**
- **IWWG is actively pursuing a more focused effort on high resolution (e.g., mesoscale) winds**
 - to help improve forecasts of high impact weather events

Further Information

Visit IWWG Web page:

<http://cimss.ssec.wisc.edu/iwwg/iwwg.html>