# SESSION VI

## New Techniques and Instruments

*Chairpersons: Niels Bormann and Chris Velden*

The sixth and last session of the workshop provided an overview of a number of interesting and promising new developments in the field of satellite winds. The topics ranged from the introduction of exciting new products and their impact on numerical weather prediction to the investigation and enhancement of existing techniques.

Dave Santek (CIMSS) introduced a new AMV dataset providing unprecedented coverage of wind observations in the polar regions. The winds are derived by feature tracking from subsequent swaths from the MODIS instrument flown on the Terra polar orbiting satellite. MODIS allows the generation of IR and WV winds, using the automated procedure originally developed at UW-CIMSS for data from geostationary satellite data. Initial assimilation experiments undertaken at ECMWF for a 30 day trial period indicate a substantial positive forecast impact, particularly over the polar regions and the Northern Hemisphere.

In a follow-on talk about the MODIS winds, Jeffrey Key (NOAA/NESDIS/ORA) discussed some of the challenges to be addressed when retrieving AMVs in polar regions. He highlighted how height assignment for low, thin clouds over ice and snow is extremely difficult, and how the frequent presence of temperature inversion regimes further complicates matters. Furthermore, the high and steep orography creates temperature and reflectance gradients that make cloud detection very difficult.

Lars Peter Riishøjgaard (NASA/DAO) presented results from further initial assimilation studies with a 30 day test dataset of MODIS winds within the DAO data assimilation system. These confirmed the ECMWF results of significant positive forecast impact from the MODIS winds, particularly over the Northern Hemisphere. It was noted that First Guess departures in the assimilation can be considerably reduced by performing a height reassignment of the winds within the NASA/DAO system, using methods similar to that already used in the NOAA/NESDIS/CIMSS processing.

Ákos Horváth (University of Arizona) gave an overview of the status of cloud-motion wind products from the Multi-angle Imaging SpectroRadiometer (MISR). Based on stereo-methods, the automated procedure can produce cloud tracked winds from 70.4 x 70.4 $km^2$ domains, with derivation from smaller domains possible. Sample retrievals show characteristics consistent with pre-launch error estimates of ±3 m/s for wind and ±400 m/s for height. The need for the development of automated quality control procedures was stressed.

Donald Frank (NASA/DAO) presented results of a first evaluation of the MISR winds within the NASA/DAO assimilation system. Maps of biases between the MISR winds and the First Guess were shown, together with further statistics characterising the quality of this new product.

Lars Peter Riishøjgaard (NASA/DAO) discussed the issue of utilising high-density observations for numerical weather prediction, with particular emphasis on the trade-off between computational cost in the assimilation system and sufficient coverage. The discussion was based around thinning techniques for AMVs, promoting the use of targeted thinning.

Jason Dunion reported on new developments to provide improved coverage of the low level night-time wind field through AMVs derived from the GOES 3.9 μm channel. By enhancing the brightness temperatures in the 3.9 μm images, flat gradients that are characteristic of this channel can be sharpened, leading to a substantially improved low-level cloud detection and subsequently improved

winds derivation. These new wind observations are expected to be available through NOAA/NESDIS operations later this year.

Françoise Désalmand (LMD) reported on improvements in the tracking of low-level clouds over land. Improvements are observed with a shorter time interval between images and a better spatial resolution. A method based on optical flow was used to calculate dense vector fields. The LMD cloud classification was used to check the level of cloud motion winds extracted with an IR brightness temperature threshold and identified as low-level.

Jianmin Xu (NSMC) presented an automatic image navigation algorithm for FY-2 geostationary satellites. The method is based on an analysis of time series of the sub-satellite line count and the image deformation from the central column. The solution to the navigation model does not depend on any landmark matching. The greatly improved navigation makes enhanced product generation possible.

Garrett Campbell (CSU) reported on the verification of automatic winds and heights using asynchroneous stereo analysis. An automatic, portable asynchronous stereo analysis scheme has been developed, which can be initialised with winds from the CIMSS satellite winds processing. The analysis scheme demonstrates that the geometric and temperature cloud height assignment methods are similar. It is possible to identify some clouds which have incorrect heights derived from the temperature, but the stereo scheme has considerable random error.

Paul Menzel (NOAA/NESIDS) gave an overview of recent comparisons of cloud motion vector height assignment techniques using the GOES-12 imager. The results suggest that the $H_2O$/IRW intercept technique and the $CO_2$ slicing technique for inferring the heights of semi-transparent cloud elements produce somewhat similar results, agreeing to within 80 hPa. Differences in the performance for certain atmospheric conditions were discussed. The talk pointed out the need for a better characterisation of height assignment uncertainties and their effects on AMV quality.

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