# REPORT FROM THE WORKING GROUP ON METHODS (WG I)

*Chairperson: Jaime Daniels*

This working group discussed a variety of topics related to the methods used to generate operational satellite winds and arrived at a number of recommendations based upon results presented at the workshop. The working group began by addressing CGMS XXIX action items 29.36-29.39. This was followed by discussions about the wind products that can be derived from some of the newer instrumentation. Finally, the group discussed a variety of issues including methods used to derive atmospheric motion, quality control, and the issue of reprocessing winds.

*The CGMS XXIX Action Items that were addressed by the group are presented below with pertinent discussion items and subsequent recommendations.*

Action 29.36) **Discuss the compatibility of spatial resolution and image repeat cycle for winds tracking and provide pertinent recommendations to CGMS operators;**

The WG recognized that: i) the highest quality winds come from the appropriate match of spatial and temporal resolutions; ii) the lower limit on wind errors is determined by the spatial resolution, sampling interval, and image-to-image registration; and iii) optimal tracking time interval is dependent on the spectral band and the feature (cloud, water vapor) being tracked.

WG1-R1: Continued improvements in image-to-image registration are required, particularly as the tracking time interval is reduced. As a goal, the WG recommends image-to-image registration accuracy to be ~ ¼ pixel size.

WG1-R2: Based upon experience gained by numerous satellite operators as a result of rapid scan work performed to date, a general guideline for the optimal match of spatial and temporal resolution are: 1 km VIS/5-minutes; 4km IR/10-15 minutes; 4km WV/30-minutes

Action 29.37) **Discuss the template size for tracking features and provide pertinent recommendations to CGMS operators;**

The WG recognized that: i) the size of templates dictates product density and plays a role in how well features can be tracked; ii) the appropriate template size is dictated by the desired feature to be tracked, the resolution of the spectral band to be used for tracking, and particular application (NWP, nowcasting) of the wind product. A number of satellite operators have performed experiments to determine the optimal template size using the satellite minus rawinsonde statistics, RMS and speed bias, as benchmarks.

WG1-R3: Satellite operators run experiments using different size templates for different bands and resolutions and compute and analyze statistics against ground truth data to determine the optimal size.

WG1-R4: Satellite operators keep in mind the *intended user of the wind product* and work with user on issues involving product density and quality. For example, a higher density winds product may not be necessary, or optimal, in a global scale NWP model where assimilation issues such as observation correlated error, data thinning, and observation quality must be considered.

WG1-R5: Publish template sizes currently used by operational centers and use these as a guideline.

Action 29.38) **Discuss the use of geometric (and other) height allocation methods for comparison with and validation of multi-spectral infrared height assignment methods of wind vectors that are used operationally;**

WG1-R6: There was strong concensus among the group that, *for now*, geometric height techniques should be used for verification of heights assigned by temperature methods. Satellite operators should take advantage of geometric height software tools available to validate their wind products. Comparisons should be done between MISR geometrically determined tracer heights and other (MODIS and other GEO) temperature determined tracer heights for the same tracers.

Action 29.39) **Revist the current concepts of height allocation techniques for assigning atmospheric motion vectors to a single level height and to provide relevant results to CGMS satellite operators;**

WG1-R7: Satellite operators need to do more work in quantifying and characterizing height assignment errors (relative to rawinsondes, geometric heights, level of best fit) for the various height assignment methods used (IR-Window EBBT, WV intercept, CO2 slicing, and WV EBBT) and passing this information onto NWP users. Furthermore, satellite operators should develop and assign confidence indicators to the tracer height assignments.

WG1-R8: Encourage NWP users to investigate the problem of assigning satellite-derived wind vectors to the level of best fit and communicate impact results to the satellite wind operators. In this regard, the satellite operators are encouraged to provide pertinent tracer information to NWP users. For other non-NWP users, satellite operators are encouraged to provide them with the best

possible wind product which includes their best estimate of the tracer height.

*A clear underlying theme emerged from the numerous presentations given at the workshop. Namely, that there is* ***still a critical need for much more information on wind (from the surface upwards) over the oceanic regions of the globe***. *The remaining recommendations are based upon the WG discussions that centered about new satellite wind products and wind tracking methods.*

WG1-R8: The WG strongly supports the generation, validation, and use of new satellite wind products. These include: i) polar cloud-drift and water vapor motion winds from MODIS, MISR, DMSP, and AVHRR; ii) geostationary water vapor motion winds from hyperspectral instruments (GIFTS); iii) surface winds derived from passive (SSM/I, TMI, MSWR) and active (QuikSCAT, SAR) microwave sensors; iv) wind profiles from Doppler Wind Lidar (DWL), and v) cloud-drift winds using 3.9um channel information and to use contrast stretching for this channel and other channels

WG1-R9: Given the positive forecast impacts (per model impact studies presented by ECMWF and NASA DAO) in the polar and extra-tropics as a result of assimilating the MODIS WV winds, the WG recommends the inclusion of a water vapor channel on the future VIIRS instrument.

WG1-R10: Further development of new feature tracking techniques, such as the optical flow technique. Compare performance of such techniques to the standard tracking techniques used today operationally.

WG1-R11: Satellite operators perform impact studies involving use of *different* first guess information and the use of *higher resolution* (horizontal and vertical) model data in wind processing schemes.

WG1-R12: Satellite operators continue to pursue opportunities, resources permitting, for acquiring rapid scan imagery for the generation of rapid scan winds in order to demonstrate benefits to nowcasting and NWP. A number of presentations were given this workshop that showed rapid scan imagery not only increased the vector yield, but also increased their quality and usefulness in tropical storm and mesoscale analyses.

WG1-12: Satellite operators are encouraged to reprocess satellite winds from imagery residing in their agency's data archive. The WG recognizes that such a reprocessing capability is resource intensive, but that such an effort could significantly contribute to re-analysis projects.

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