

## SESSION 4

### FUTURE STUDIES AND DEVELOPMENTS

*Chairperson: J. Schmetz*

The session on Future Studies and Development provided an overview of various topics that need to be considered for further improving our capability of inferring winds from satellite imagery.

The keynote by C. M. Hayden<sup>37</sup> presented research results that rooted to operational application and clearly showed the potential in existing methods for improvements in the near future. His results were complemented by K. Holmlund who investigated the usefulness of different quality flags for cloud motion winds. W. Shenk presented a comprehensive summary of concepts that have not yet been addressed in operational systems. He pointed out that some of the ideas are around for two decades, yet they still have not been exploited operationally.

J. Purdom demonstrated that sequences of satellite images unveil new information on storm dynamics when the animation subtracts the mean flow. W. Smith presented results from an aircraft campaign measuring high resolution radiance spectra over cirri and lidar cloud top heights simultaneously. Simulations of various channel combinations as used by the operational satellites are tested for estimating the altitude of semitransparent clouds and examined in comparison with the lidar.

R. Anderson drew the attention to existing data sets that are available for case studies, for instance on the usefulness of rapid scan images. The two final presentations addressed the future. F. Gérard described the concept of the imager planned for the second generation of METEOSAT satellites. M. Yeh illustrated the potential of neural network approaches for the processing of satellite images.

#### Conclusions

1. Satellite cloud motion winds for use in numerical weather prediction have made considerable progress over the last couple of years. However, the session demonstrated that there is a gap in quality between operational cloud motion winds and those produced in a research mode. Noteworthy is that good ideas for improvements are around for many years without ever being implemented in an operational system. Therefore a closer cooperation between scientific and operational work is needed, This workshop will serve as good start in order to reach that goal.
2. The most important issue is height assignment. The present methods for semi-transparent clouds need to be and can be improved. An interesting aspect,

concerning international collaboration, rest in the fact that GMS-5 and GOES-Next satellites will carry WV channels. Thus there could be a large degree of commonality in CMW retrievals. It is still not clear whether the height assignment obtained by an accurate radiometric method is the optimum altitude for a single-level wind vector.

3. Quality flags will enhance the information content and consequently the impact of CMWs in the analysis/forecast.
4. It may be useful that satellite winds from whatever source are processed in a way that leads to one satellite wind product. This product could be largely freed from a-priori first-guess information, which in turn could increase the 'true' information content of satellite winds for the analysis/forecast. As a way towards such a goal I see two steps:
  - i) various types of winds from image data (visible, infrared, water vapour) should be combined;
  - ii) secondly, it may be worth while considering the combination with wind fields from other sources (microwave).
5. It is important that we keep up the momentum in improving the quality of SATOBs since otherwise the quality of the product will be surpassed by the improved analysis/forecast methods. That requires a continuous future research.
6. Last but not least I would like to mention that the use of cloud winds in the NWP analysis needs to be ameliorated. The most recent impact studies at ECMWF indicate that the forecast experiment NOSAT + SATOB and NOSAT + SATEM produced better results than NOSAT + SATOB + SATEM. The fact that a single component (SATEM or SATOB) gives better results than the combination points at difficulties in the analysis/assimilation system, thus exacerbating the previously expressed opinion that the use of satellite data is less than optimal. This necessitates a close cooperation between user and producer community.

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