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REPORT ON EXPERIMENTS ON TARGETED OBSERVATIONS

The paper provides a short report to CGMS on experiments on targeted observations. It responds to Action 28.32 of CGMS XXXVIII where discussions within the Working Group III on 'Cloud Motion Winds/Satellite-Derived Winds' acknowledged the success of recent experiments and recognised the usefulness of further work using satellite derived winds.

The paper provides a short summary of issues relevant to WG III and should serve as a starting point for discussions in WG III.

In particular it is noted that satellite winds themselves should not be considered as targeted observations. Since recent studies show the significant potential of satellite-tracked winds to reduce analysis and forecast errors, efforts should be made to enhance coverage and frequency of satellite wind products, thereby increasing the probability to cover sensitive areas by the product.

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1 INTRODUCTION

Targeted observations serve the purpose to provide better and/or more measurements of an area in the atmosphere that has a very high probability to benefit the forecast at a downstream location. Extra observations in those areas will result in a relatively large decrease in the forecast error in a given downstream area at given point in time.

Targeted observations need to be adaptive; i.e. the position of the 'sensitive' areas needs to be determined in near-real time on the basis of a numerical forecast model. Then in-situ measurements within this area could be improved through dedicated observations, for instance dropsondes from aircraft. An alternative, or better a complementary effort, is to better utilise satellite observations in the sensitive area. This can be achieved through more frequent observations, a better spatial coverage or better retrieval techniques in general.

This paper briefly recalls the salient results of recent experiments (FASTEX and NORPEX) with regard to the utility of Atmospheric Motion Vectors (AMVs) as a means for targeted observations.

2 AMVS IN TARGETED OBSERVATION EXPERIMENTS

The investigations into targeting special observations to improve numerical weather prediction (NWP) model forecasts has developed significantly over the last years. Results from two experiments i) FASTEX (Fronts and Atlantic Storm-Track Experiment) in January and February 1997 and ii) NORPEX (North Pacific Experiment) in January and February 1998 can be used to state the impact of special observations of AMVs on the forecast skill.

Langland et al. (1999a) show that the winds from GOES-8 have a positive impact on the forecast during NORPEX. The influence can be mixed, in some cases being positive at altitudes below 700 hPa, a negative impact between 700 and 400 hPa and neutral above 400 hPa in one case. Case studies also show a positive impact of a mix of in-situ (dropsonde) and remotely-sensed AMVs.

During NORPEX (Langland et al., 1999b) satellite wind data, specially produced with the method of Velden et al. (1997) from GOES-9 and GMS-5, were assimilated every 6 hours. During the six weeks of the experiment the forecast error (1000 and 500 hPa height) of a 2-day forecast for the area 30°-60°N and 100°-130°W was reduced by almost 10%. In particular cases the error decreased by as much as 50%. For comparison, the assimilation of dropsonde data reduced the error on average by 10% with maxima in individual cases of 30%. In an experiment with the combined assimilation of dropsondes and AMVs the impact of the dropsondes is reduced, which confirms that the two types of data are complementary. In some situations the amount and impact of satellite winds is so substantial that the additional expense of in situ observations is hardly justified (Langland et al., 1999b). From the Figures of Langland et al. (specifically Fig. 9) it is also noted that the variability of the impact of the satellite data is higher. Probably this has to do with data quality and quality control, and also with the assimilation of the data.

Gelaro et al. (2000) report substantial improvements in 48-h forecast skill over the northwest Pacific

and the western North America when using geostationary satellite winds (Velden et al. 1997) in the assimilation into the Navy Operational Global Atmospheric Prediction System (NOGAPS) during NORPEX. Results indicate that the most important analysis errors in the forecast system are not necessarily the largest analysis errors. Interesting is also that the impact of the analysis increments is most important below 400 hPa. They point out that the effectiveness of additional observations in reducing forecast errors may depend as much on how often they are utilised as where they are utilised. This calls for efforts to increase the frequency of operational satellite derived wind products and corresponding impact studies.

3 DISCUSSION

Results from previous experiments show the positive impact of special data sets of AMVs on forecasts with NWP models. While the data sets have been prepared specifically for those experiments with research algorithms, it is conceivable that the research methods are run operationally. This will provide continuously data with the quality and coverage of the research data set. Then the concept of targeted observations from space is not valid anymore. Instead the best data set is delivered permanently. In fact this may be the most practical and most economic way. Therefore one could suggest that the concept of targeted observations from space gets replaced by the more generic paradigm that space observations should always be utilised operationally to their full extent, i.e. quality, coverage and frequency of observation should be maximised which is a continuous activity.

The targeting experiments also note the highly variable coverage with AMVs as drawback. Efforts should be made to better compensate for the lack of AMVs in cloud free areas with AMVs from tracking WV features. In parallel the way of assimilating the satellite data needs to be improved; here a distinction between the tracking of cloud targets and water vapour targets might be beneficial.

WG III is invited to discuss the notion that satellite-tracked winds are not targeted observations as such. If the satellite-tracked winds have an optimal coverage and frequency (and of course quality), the targeted area is always part of the operational data set (provided the retrieval in the relevant area is possible at all).

Future research (e.g. during THORPEX: The Hemispheric Observing System Research and Predictability Experiment) should address the issue whether the satellite data are always consistent with and complementary to other data. An issue not addressed so far is the higher frequency of observation and product retrieval (hourly) that is possible and being pursued with today's and future geostationary satellite systems. As Gelaro et al. (2000) point, the effectiveness of additional observations in reducing forecast errors may depend as much on how often they are utilised as where they are utilised.

4 REFERENCES

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