SESSION III

ASSIMILATION AND IMPACT OF ATMOSPHERIC MOTION VECTORS IN NUMERICAL WEATHER PREDICTION

Chairperson: John Le Marshall

The Third Session of the Workshop provided eight papers addressing the assimilation of atmospheric motion vectors (AMVs) and their impact in numerical weather prediction (NWP). As in previous Workshops, it gave considerable insight into the large range of activities associated with the use of AMVs and solid evidence of their utility in NWP.

Paul Menzel discussed in detail the seasonal impact of five satellite data types on the ETA Data Assimilation/Forecast System (EDAS). The data types were two precipitable water data types, temperature data for a cloudy environment and two cloud motion data types. Examining geopotential height, temperature, u-component of the wind and relative humidity showed a modest positive impact on the forecast for all data types with cloud drift wind data having maximum impact in Winter while precipitable water has the largest positive impact during the Summer and transition seasons.

Brian Soden discussed the use of GOES AMVs for numerical hurricane prediction and climate studies at NOAA/GFDL. Cloudy and clear sky multispectral water vapour observations were used in a series of parallel forecasts to determine the impact of the GOES winds on tropical cyclone track forecasts. Over 100 cases from 10 different storms in 3 seasons were examined. On average, the assimilation of satellite winds reduced track errors at all forecast periods. Relative reductions of track error were 5% and 12% at 12 and 36 hours respectively. Also discussed were the application of hourly GOES 6.7 micron water vapour observations to an examination of the processes regulating the distribution of upper tropospheric water vapour. Use was made of an objective pattern-tracking algorithm to trace upper tropospheric water vapour features from sequential images.

A case study describing the use of METEOSAT-5 winds in an analysis of a tropical cyclone in May 1999 was presented by Ramesh Bhatia and his colleagues. This study indicated the utility of the winds in the analysis and subsequent prediction of motion of a tropical cyclone affecting the Gujarat coast in May 1999.

Jenni Evans from Pennsylvania State University described the development of the Community HUrricane Modelling System (CHUMS), based on the Penn. State/NCAR non-hydrostatic mesoscale model (MM5). The detailed physics of the MM5, down to the resolution of non-hydrostatic effects and cloud scale, and the availability of a 4-dimensional data assimilation cycle based on nudging were the reasons for the choice of this numerical system for tropical cyclone studies. An initial case study of Tropical Cyclone Floyd in 1999 was presented at the meeting, demonstrating the potential of this system for further studies.

Bruce Ingleby from the UK Met. Office described recent developments in the use of satellite winds by the UK Met. Office. Changes to the operational NWP model as a result of impact tests with METEOSAT-5, GMS and GOES high-density infrared and METEOSAT high resolution visible winds were noted as was the introduction of 3D-Var. in place of the previous optimal interpolation method of assimilation. Some initial work, looking at the impact of METEOSAT winds over the Indian Ocean and Australian Region was also recorded.

Assimilation of conventional and satellite wind observations in the global data assimilation system at NCMRWF was reported by S. R. H. Rizvi and his colleagues. The paper addressed research efforts at NCMRWF in assimilating various types of wind observations, conventional and satellite, in an operational global data assimilation system (GDAS). It was reported that conventional winds from INSAT, GMS, GOES and METEOSAT at low resolution have been used and, recently, high resolution METEOSAT-5 and ERS-2 winds have been incorporated into the operational GDAS. The procedures adopted to overcome problems in assimilating these later data and their impact at NCMRWF were recorded. A technique for assimilating surface wind speeds from recently launched Indian IRSP4 OceanSat was also noted.

XiuJuan Su and her associates reported on work toward improved use of GOES satellite-derived winds at the National Environmental Modelling Center, Washington. This work is directed towards improved assimilation of the wind data, paying particular attention to the use of Quality Indicators.

The final paper of the Session reported on a preliminary impact study using QuikScat/ SeaWinds ocean surface winds in the JMA spectral model. Yoshihiko Tahara and his colleagues reported that JMA has developed an improved assimilation system. This contains a wind retrieval system of higher accuracy, a new quality control scheme to reject erroneous wind data, a retrieval scheme for ocean surface pressure based on surface wind observations and a system to assimilate the pressure data into the NWP model. Using this assimilation system, JMA successfully showed positive impact from the use of the scatterometer data in the global model. JMA began the operational use of ERS scatterometer data in 1998. In addition to the ERS scatterometer study, a preliminary impact study demonstrating the capability to assimilate QuikScat/SeaWinds in the JMA spectral model was also presented.

Overall, the session recorded recent advances in the assimilation of high-resolution winds from satellite observations and provided evidence of gains still to be made at many NWP centres.

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