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Analysis and Forecast Experiments at NMC Using ERS-1 Scatterometer Wind Measurements

T. Yu, P. Woiceshyn[1], W. Gemmill, and C. Peters[2]

Development Division, National Meteorological Center
National Weather Service, NOAA, Washington, DC 20233

[1] NASA-JPL, Los Angles, CA
[2] General Sciences Corporation, Laurel, MD

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1. Introduction

The ERS-1 scatterometer can provide more than 50,000 radar backscattered measurements in a six hour window, separated by a spacing of 25km over the global oceans. These backscattered measurements are processed by the European Space Agency (ESA) to provide ocean surface wind vectors, using the CMOD4 model transfer function. The backscattered radiation measurements and the processed ESA winds are transmitted to the National Meteorological Center (NMC) in near real time. The backscattered radiation data and the ESA winds, among others, are currently being evaluated at NMC for use in numerical weather prediction. Section 2 discusses results on the evaluation of the ESA winds and those generated from other model transfer functions, and describes a procedure to reprocess the scatterometer winds from backscattered data at NMC. Preliminary results of using the reprocessed winds in the analysis and assimilation experiments are presented in Section 3.

2. Reprocessing of the ERS-1 scatterometer winds

The ESA winds received at NMC are processed using the CMOD4 transfer function. For comparison, we also processed winds using CMOD4 and a number of other transfer functions from the backscattered measurements. The ESA winds and those produced using different transfer functions are compared with collocated buoy reports. The results of comparison over a six months period have been presented in Table 1 of Peters et al (1994) at the same conference. Although ESA winds have a small RMS wind speed error (about 1.9 m/sec), their RMS direction error is large (about 58 degrees). The RMS wind speed errors of the CMOD4 winds processed at NMC are also 1.9 m/sec, but the RMS wind direction errors reduce to 35 degrees. Note that the statistics for the NMC processed IFREMER transfer function winds is the same as the NMC processed CMOD4 winds. On the other hand, statistics for other transfer functions show that although the RMS wind direction errors are also smaller than those of the ESA winds, their RMS wind speed errors are larger (about 2.3 m/sec).

The CMOD4 transfer function was selected as the wind algorithm at NMC. The reprocessing procedure makes use of the NMC's global operational sea surface temperature analysis for eliminating bad backscattered data over ice, and makes use of the NMC's global ocean surface wind analysis as a background field for removing directional ambiguities. The wind retrieval and directional ambiguity removal algorithms originally developed at the UK Met Office (Offiler, 1992) were modified so that a more stringent quality control procedure was applied to the backscattered measurements data, and all duplicate block data were removed and sequentially time blocked. As a result, the NMC's reprocessed winds have a much smaller directional RMS error than the ESA winds. A detailed description on the reprocessing procedure can be found in Woiceshyn et al (1994).

3. Analysis and Assimilation Experiments

The ESA winds and the NMC reprocessed winds according to the procedure described above were used in the NMC's global spectral statistical analyses for a synoptic time. During the six hour window centered on 0600 UTC April 27, 1993, there

were 3073 ERS-1 scatterometer winds (taken only from every other point out of the 19 cells of observations on each row of the data swath). The results of the two analyses generated from including the ESA winds (Exp.A), and the NMC reprocessed winds (Exp.B), are compared with wind observations of different data types to compute vector wind RMS errors. Table 1 shows that including the NMC reprocessed scatterometer winds in the analyses leads to a smaller RMS vector wind error than that with the use of ESA winds in the analyses.

To examine the usefulness of the ERS-1 wind data on atmospheric analyses, a benchmark analysis experiment (Exp.C) was also performed in which the ERS-1 data were not used in the analysis. The RMS vector wind errors from the with ESA winds experiment and those from the with NMC reprocessed winds experiment are compared with those of the benchmark experiment. The results show that the use of NMC reprocessed winds has a positive effect by improving the fit of analyses to all data types which include all the marine and upper air radiosondes and satellite-derived cloud drift winds, whereas the use of ESA winds in the analysis shows otherwise. It should be noted that the results shown in Table 1 are based only on a single synoptic analysis, and more analyses and assimilation experiments are required to address the impact question of the two data sets.

The impact of the NMC reprocessed ERS-1 wind data on analyses and forecasts is being investigated by running several days of data assimilation experiments. The assimilation and forecast results will be reported at the conference.

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References

Offiler, D., (1992): ERS-1 wind retrieval algorithm and ambiguity removal, EDIPVS Project Note 9, UK Met Office, Bracknell, UK.

Peters, C., W. Gemmill, P. Woiceshyn, and V. Gerald, (1994): Evaluation of empirical transfer functions for ERS-1 scatterometer data at NMC, preprint paper to be presented at the Seventh Conference on Satellite Meteorology and Oceanography of the American Meteorological Society, June 6-10, 1994, Monterey, California.

Woiceshyn, P. et al (1994): Evaluation and calibration of ERS-1 AMI scatterometer data, NMC Office Note (in preparation).

Table 1. Fit of Analyses to Wind Observations for 0600 UTC April 27, 1993

Observation Types	ESA winds (Exp.A)	NMC Processed winds (Exp.B)	Benchmark (Exp.C)
Ships and Buoys (N = 714)	3.59	3.60	3.64
SSM/I wind speed (N = 7418)	2.22	2.04	2.07
ERS-1 winds (N = 3073)	3.13	2.36	---
All wind data (N = 18418)	3.19	3.03	3.12 (N = 15345)