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TECHNICAL NOTE

The Effect of Drifting Buoy Data on NCEP Numerical Weather Forecasts

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1. Introduction

There are generally about 600 to 800 drifting buoy data operationally available for use in analyses during each NCEP global atmospheric data assimilation cycle, depending on the analysis time. Figure 1 shows the distribution of these drifters over the global oceans. One can see that the drifters are about equally distributed over the midlatitude oceans of the Northern and Southern Hemispheres. They represent less than one percentage of the total NCEP global observation data base, which includes conventional surface and upper air observations over land and sea as well as a vast amount of satellite measurements of ocean surface winds, and upper air temperature and humidity data. Table 1 shows typical conventional surface marine observation data counts within + and - 3 hours of an analysis time of the NCEP global data assimilation cycle. Unlike ships and moored buoys which contain sea level pressure, wind, and temperature reports, most of the drifters contain only sea level pressure, with only a very small number (less than 40) of the drifters containing wind vector information.

The effect of the drifting buoy data on the NCEP numerical weather forecasts was investigated by Kistler (1996, personal communication) using the NCEP reanalysis data assimilation system for two months, January and July during the FGGE year, 1979 (see the Appendix for a summary of Kistler's test results). The present study further investigates the effect of drifting buoy data on the NCEP numerical weather forecasts using the most current operational global data assimilation system. Similar to the Kistler's work, a parallel global data assimilation experiment (PRV) was run excluding surface drifting buoy data from the operational NCEP analyses during the global data assimilation cycles for two selected periods, one in the winter month of January 1996, the other in the summer month of July, 1996. The elimination of the drifter data constitutes the sole difference between the PRV parallel run and the operational PRZ run in which the drifter data are used routinely.

The NCEP T62 global data assimilation system, details of which were given in Kanamitsu (1989) and Kanamitsu et al (1992), was used to investigate the impact of the drifting buoy data on

analyses and forecasts. Basically, the assimilation system consists of a forecast model and an analysis scheme. The forecast model is a global spectral forecast model of triangular truncation with 62 waves for the horizontal spectral resolution. In the vertical it has 28 sigma layers. The forecast model includes identical parameterization of such physical processes as convection, precipitation, radiation, and boundary layer physics as those employed in the NCEP operational forecast T126 model. The assimilation experiment is preceded by a six hour forward integration of the forecast model, starting from the beginning of the data assimilation period, to produce first guess fields of winds (u,v), temperatures (T), and specific humidity (q). The observations within a +/- 3 hour window are then used to update the first guess fields and complete the analyses.

This process of a six hour model forecast followed by an analysis update is repeated four times a day, once every six hour interval, until the end of the total one month of the assimilation period. For each of the two parallel run experiments, five day forecasts were made at the 0000 UTC cycle of the daily data assimilation, so that there were a total of 31 cases of forecasts. In this study the forecasts valid at 24, 48, 72, 96, and 120 hours of the 31 forecast cases are used for comparison between the two parallel runs. Standard statistics of anomaly correlations and RMS forecast height errors are calculated for each of the two parallel forecasts. In addition, forecast errors of sea level pressures and 10 meter winds with reference to mid-latitude deep ocean buoys and tropical TOGA buoys for the two parallel experiments are compared. These results are discussed in Section 2. A summary concludes this report.