Operational Assimilation of Direct Broadcast MODIS Winds at FNMOC

Eight numerical weather prediction (NWP) centers worldwide are assimilating the Moderate Resolution Imaging Spectroradiometer (MODIS) polar winds in their operational forecast systems. However, typical delays in acquiring the MODIS data are such that much of the wind information is not available in time to be used in operational production runs of NWP models. To provide the MODIS winds in a more timely manner, the use of direct broadcast (DB) MODIS data is being explored.

The National Science Foundation (NSF) dual-band satellite antenna at McMurdo, Antarctica, provides the capability needed to test a direct broadcast MODIS winds system. Since March 2005 polar wind data covering much of Antarctica have been generated in real-time. All the processing is done in McMurdo, and only the wind data and plots are transferred back to the U.S. An example of the product is shown in Figure 1. It appears that the DB winds can be generated at least one hour faster than with our current data source, making more winds available for weather forecast models.

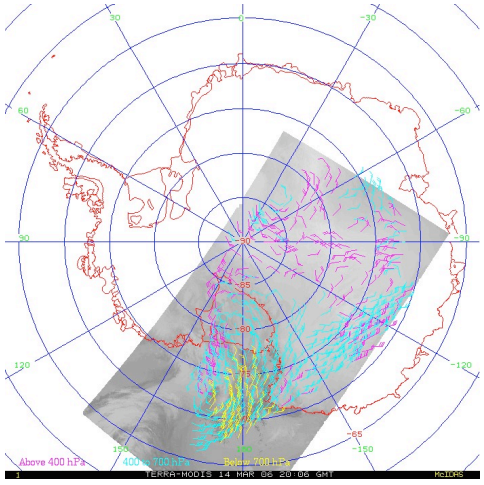

Fig. 1. Example of MODIS winds generated at McMurdo.

After nearly a year of testing and validation, the McMurdo winds are being made available to the NWP community. In addition to being posted on a public FTP site, the wind data are "pushed" to the Fleet Numerical Meteorology and Oceangraphy Center (FNMOC) for use in NOGAPS (Navy Operational Global Atmospheric Prediction System). Operational assimilation of McMurdo DB winds into NOGAPS began on 15 March 2006. NAVDAS (NRL Atmospheric Variational Data Assimilation System), the analysis component of NOGAPS, employs superobbing of MODIS winds. The McMurdo direct broadcast winds are superobbed together with the previously operational "bent-pipe" MODIS winds. Observation versus model background statistics for the DB winds in NAVDAS appear comparable to the bent-pipe winds. Figure 2 illustrates the data availability for preliminary ("early") and main NOGAPS model runs. The early run has a data cutoff of 1 hour and 10 minutes. The main run has a cutoff of 3 hours and 10 minutes. Both MODIS wind data sources are shown. Most of the wind data available for the early run is from McMurdo, with some bent-pipe winds available for northern Siberia. For the main run, both data sources are important.

The MODIS direct broadcast processing system was also designed to provide information to local forecasters. Wind, cloud and surface products are useful for local forecasts that affect flight operations and field experiments. In addition to winds, the McMurdo system generates a cloud mask, cloud thermodynamic phase and height, low-level temperature inversion strength and depth, and ice surface temperature and albedo. Other snow and ice products will be added in the near future.

With the early success of the McMurdo system, additional sites in the Arctic and Antarctic are being explored. A system is currently being installed in Tromsø, Norway that is tentatively planned to utilize an Integrated Program Office antenna on Svalbard. Another system is being configured for Sodankylä, Finland. Discussions are underway for similar systems in Fairbanks, Alaska, and Troll, Antarctica (Norway).

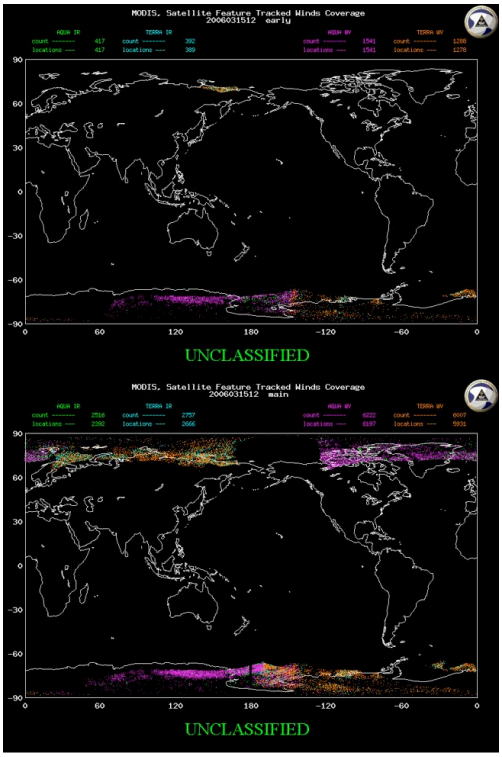

Fig. 2. MODIS winds available for the preliminary ("early") NOGAPS model run (top) and for the main run (bottom). Both the McMurdo direct broadcast and bent-pipe wind data sources are included in both cases.