Assimilation and Forecast of Hurricane Floyd with the DAO Finite Volume Data Assimilation System

Jiun-Dar Chern* and Shian-Jiann Lin
NASA/GSFC, Greenbelt, MD 20771
E-mail: jchern@dao.gsfc.nasa.gov (6)

1. Introduction

The last decade has seen a growing interest among the major operational weather prediction centers in the application of global models for tropical cyclone track and intensity predictions. Current generation of global models with resolution in the range of 50 to 100 km is generally sufficient for resolving the synoptic scale steering flow. But it is still too coarse to resolve the inner core of tropic cyclone for reliable intensity predictions. The primary goal of present study is to examine the analysis quality and forecast skill of Hurricane Floyd with the new DAO global Data Assimilation System.

2. The fvDAS/model based forecast system

In recent years, a major effort has been undertaken at Data Assimilation Office (DAO), NASA Goddard Space Flight Center to develop the next-generation data assimilation system — the Finite Volume Data Assimilation System (fvDAS). The system consists of the joint NASA/NCAR general circulation model (fvGCM, Lin and Rood 2002) and the physical-space Statistical Analysis System (PSAS, Cohn et. al 1998). Preliminary results from forecast experiments using the fvGCM with initial conditions produced by fvDAS have shown that in general there is significant improvement in the forecast skill over DAO's operational Goddard Earth Observing System Data Assimilation System (GEOS-3 DAS). There are still many aspects of the new system need to be tested and evaluated. In this study, we have carried out a series of assimilation and forecast experiments of Hurricane Floyd with the fvDAS to evaluate the analysis quality and forecast capability.

3. Experimental design and results

Hurricane Floyd passed fairly close to the entire U.S. east coast from September 14 to September 17, 1999 and resulted in one of the largest evacuation in U.S. history: an estimated two million people were evacuated. It was blamed for 56 deaths and about $3-6 billion in total damage. In this study, a series of assimilation and 5-day forecast have been carried out from September 9 to September 15 using a pre-release version of fvDAS. By default, the fvDAS has 1° x 1.25° horizontal resolution with 55 vertical levels from surface to 1 Pascal. Tropical cyclones develop over the tropical oceans, and these are the data-sparse areas of convectional surface-based observations. Remote sensing provides the most reliable and often the only data source about the structure and position of tropical cyclone. It is very important to use satellite data to improve the initial analysis of the hurricane. In addition to the convectional data, we have utilized the SSM/I total precipitable water, TIROS Operational Vertical Sounder (DAOTOVS), cloud tracking

wind, and QuickSCAT SeaWinds Scatterometer surface wind in the data assimilation system.

Figure 1 shows Hurricane Floyd tracks form National Hurricane Center observed best track, fvDAS analysis, and fvGCM 5-day forecast starting at 0000 UTC 12 September 1999. In spite of the fact that the 1° x 1.25° resolution can only represent the broad features of tropical cyclones and its environment, the hurricane track from fvDAS analysis is in excellent agreement with the best track. The 5-day forecast with initial condition from fvDAS analysis also shows good skill in forecasting the track of Floyd, especially the first 48 –hour forecast.

4. References

Cohn, S. E., A. da Silva, J. Guo, M. Sienkiewicz, D. Lamich. 1998: Assessing the effects of data selection with the DAO physical-space statistical analysis system. *Mon. Wea. Rev.*, **126**, 2913-26.

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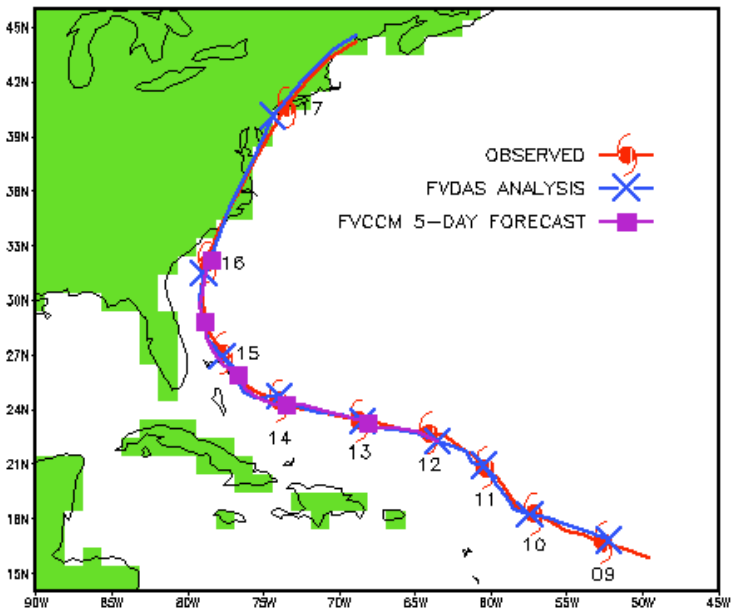

Figure 1. Hurricane Floyd tracks form National Hurricane Center observed best track, NASA DAO Finite Volume Data Assimilation System (fvDAS) 1º x 1.25º analysis, and fvGCM model 5-day forecast starting at 0000 UTC 12 September 1999.