Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE **2012**	2. REPORT TYPE **N/A**	3. DATES COVERED **-**

4. TITLE AND SUBTITLE **Coupled Global-Regional Data Assimilation Using Joint States**	5a. CONTRACT NUMBER
	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **Texas A&M University, Department of Atmospheric Sciences, 3150 TAMU, College Station, TX, 77843-3150**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release, distribution unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT **unclassified**	b. ABSTRACT **unclassified**	c. THIS PAGE **unclassified**	**SAR**	**2**	

Standard Form 298 (Rev. 8-98)
Prescribed by ANSI Std Z39-18

Coupled Global-Regional Data Assimilation Using Joint States

Istvan Szunyogh
Texas A&M University, Department of Atmospheric Sciences, 3150 TAMU, College Station, TX, 77843-3150
phone: (979) 458-0553 fax: (979) 862-4466 email: szunyogh@tamu.edu

Award Number: N00014-12-1-0785
http://atmo.tamu.edu/profile/ISzunyogh

LONG-TERM GOALS

The main goal of this research project is to develop a data assimilation system to obtain a global atmospheric analysis for the U. S. Navy's Operational Global Atmospheric Prediction System (NOGAPS) model, as well as a set of limited area atmospheric analyses for multiple local domains for the Coupled Ocean/Atmosphere Mesoscale Prediction System (COAMPS) model by a single data assimilation process. We will achieve this goal by developing a novel data assimilation system based on analyzing the joint states of the global and the limited area models.

OBJECTIVES

Similar to other major numerical prediction centers of the world, the Fleet Numerical Meteorology and Oceanography Center (FNMOC) prepares both global and limited area weather analyses and forecasts. In fact, FNMOC prepares limited area model products for more regions (more than 60) than any other center in the world. In the current implementation of the model suite, the global model is started from analyses prepared by the Naval Research Laboratory Atmospheric Variational Data Assimilation--Accelerated Presenter (NAVDAS-AR) data assimilation system, which is based on a 4D-VAR data assimilation scheme, while the regional model is started from analyses provided by the Naval Research Laboratory Atmospheric Variational Data Assimilation (NAVDAS) system for the atmosphere and the Navy Coupled Ocean Data Assimilation (NCODA) for the ocean. Both NAVDAS and NCODA are 3D-VAR schemes. In this configuration, deterministic model information is propagated from the global model to the regional analysis through the lateral boundary conditions. Building on the results of our earlier research, we are developing a data assimilation algorithm, in which information flows in both directions between the global and the limited area data assimilation systems. We expect both the global and the limited area analyses to benefit from the coupled approach. In particular, we expect that in the coupled data assimilation system, the global analyses will benefit from the availability of the high-resolution limited area model information in regions where the presence of small scale atmospheric flow features (e.g., in a tropical cyclone or over complex terrain) severely restrict the representativeness of the observations at the scales resolved by the global model.

In addition, we hope that in the process of developing and testing the data assimilation system, we will gain new knowledge about the mechanisms by which mesoscale processes influence synoptic and global scale predictability. Such new knowledge will help make strategic decisions about the development of the analysis and forecast systems of the future.

APPROACH

Our approach takes advantage of the results of our earlier theoretical and modeling efforts on coupling the global and the limited area data assimilation processes (Merkova et al. 2011; Holt 2011; Holt et al. 2012; Yoon et al. 2012) and the advances made by Dr. Craig Bishop and his NRL Monterey-based research group by incorporating ensemble-based flow-dependent information into NAVDAS. Dr. Bishop and his group have developed an ensemble-based, highly portable version of NAVDAS for NOGAPS and COAMPS. We work in close collaboration with Dr. Bishop's group. The relevance of our research is expected to highly benefit from using a state-of-the-art operational system that includes capabilities to assimilate satellite radiance observations and to perform normal mode initialization. In addition, using the NRL system is expected to greatly accelerate the transfer of the research results to NRL, Monterey, and eventually to FNMOC.

WORK COMPLETED

The project has just begun. We are currently in the process of transferring the model and data assimilation codes from the Naval Research Laboratory, Monterey to Texas A&M University, where the code development will be carried out.

REFERENCES

Holt, C. R., I. Szunyogh, and G. Gyarmati, 2012: Can a moderate resolution limited-area data assimilation system add value to the global analysis of tropical cyclones? *Mon. Wea. Rev.* (under review).

Holt, C. R., 2011: *Testing a coupled global-limited area data assimilation system using observations from the 2004 Pacific typhoon season.* Master of Science Thesis, Texas A&M University, 60 pp.

Merkova, D., I. Szunyogh, and E. Ott, 2011: Strategies for coupling global and limited-area ensemble Kalman filter assimilation. *Nonlin. Processes Geophys.,* **18,** 415-430.

Yoon, Y.-N., B. R. Hunt, E. Ott, and I. Szunyogh, 2012: Ensemble regional data assimilation using joint states. *Tellus* (in press).