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**Year 1 Progress Report and Year 2 Budget
Submitted to
Office of Global Programs
National Oceanic and Atmospheric Administration
1100 Wayne Avenue, Suite 1210
Silver Spring, MD 20910-5603**

**DEVELOPMENT OF HYDROLOGIC NOWCAST AND FORECAST PRODUCTS
USING LAND DATA ASSIMILATION SYSTEM OUTPUT**

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May 26, 2003.

Introduction

The Global Energy and Water Cycle Experiment (GEWEX) is designed in part to improve the ability to predict the hydrological cycle and energy fluxes at the land surface. Early in the evolution of GEWEX, water resources applications were identified as a priority area. With the initiation of GAPP, further emphasis has been placed on linkages between GEWEX modeling and prediction, and water resources users. The GCIP/GAPP investment in LDAS facilitates the development of hydrologic nowcast and forecast products over the continental U.S. This project is motivated by the challenges posed in the GAPP Science Plan related to linkages between hydrological forecasting and water resources systems, and the opportunities provided by LDAS. It will extend the PIs' previous LDAS work to make available such nowcast and forecast products to the water resources community, through the NWS River Forecast Centers.

The project is developed around the following science questions:

1. Can the real-time LDAS outputs be used to generate hydrologic products of sufficient accuracy and timeliness to be useful for water resources management? What are the implications of the LDAS approach for water management at different river basin scales and over different time horizons?
2. Where is the greatest potential, at short, intermediate, and long lead times, for improving hydrologic predictions and forecasts? Can improved modeling strategies, like real-time LDAS, be used to improved hydrologic predictions?
3. How can the scientific contributions of the GAPP/LDAS approach best be transferred to the water resources community? What are the implications of approaches such as land data assimilation, ensemble forecasting, forecast uncertainty, forecast space-time resolution to the operational community?

One of the primary objectives of GAPP is to facilitate the transfer of hydrologic predictions to users for improved management of water resources. For short-term (up to 72 hours) hydrologic predictions, the real-time LDAS offers a sound basis for hydrologic prediction, but remains to be implemented. Adaptations of the retrospective LDAS data sets, linked to ongoing work in ensemble predictions at intermediate (15 day) and long-range forecasting, offer the potential to develop companion hydrologic forecasts at these longer lead times.

Project objectives

The specific objectives of the project will facilitate the development of experimental, real-time LDAS-based hydrologic products, and to evaluate their usefulness for water management. We intend for this evaluation will be carried out in cooperation with selected NWS River Forecast Centers, and the NWS Advanced Hydrologic Prediction Services (AHPS) project.

The specific objectives of the project are:

1. To continue participation of the Princeton-UW team with NCEP and NASA/GSFC in GAPP/LDAS to produce real-time VIC-based LDAS output over the continental U.S. LDAS domain;

2. To produce in near real-time, for selected river basins across the continental U.S., experimental streamflow forecast products based on the VIC model suitable for use in water resources management, and to make available to other LDAS team members associated data products required for other LDAS models to produce similar hydrologic forecast products;
3. To produce, over the LDAS domain, nowcast hydrologic products (soil moisture and snow) that can be used for water resources and related management activities
4. In cooperation with NOAA/NWS AHPS and selected River Forecast Centers, begin to evaluate these LDAS-based hydrologic products for water resources management.

Activities during the first funding period.

Because of administrative difficulties at NOAA/OGP, the project was not started until March 2003; thus the project at Princeton is only in its third month. Nonetheless, objective 1 is being met, with Princeton participating in the real-time LDAS activities. On May 25, 2003 there was a real-time LDAS investigator meeting at NOAA/HDL in Silver Springs.

As a second effort, we are identifying target areas for LDAS-derived nowcast and forecast products. Nowcast products for state variables like soil moisture and snow water equivalent will be produced over the continental U.S. portion of the LDAS domain, with a subset of specific sites identified for purposes of point evaluations using NRCS SCAN soil moisture stations, and SNOTEL snow water equivalent observations (the latter mostly over the western U.S.). A real-time soil moisture/drought analysis is being completed that will provide the basis for the first nowcast product.

Planned activities in year 2.

During year 2 we plan on finalizing the target areas for the LDAS-derived nowcast and forecast products. In addition, we will start to develop and test methods for production of hydrologic forecast products (primarily streamflow). The experimental forecast products will have a range of lead times including 72 hours, 15 days, and 6 months. Current thinking is that we'll select about 100 forecast points with drainage areas greater than about 1500 km² (equivalent to about 10 LDAS grid cells). Both synthetic ensemble forcings (based on real-time Eta model output) and QPF-based ensembles will be created for the 72 hours forecasts, with a 6-hour update cycle. The 15-day forecasts will be based on ensembles produced operationally by NCEP from the MRF model, and the 6-month forecasts will be based on Global Spectral Model ensembles, also produced by NCEP. Unbiasing of the coupled model forcings will be accomplished through use and/or adaptation of methods previously developed by the PIs for experimental long-range streamflow forecasting (6 month lead) in the Eastern U.S. and the Columbia River basin.