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FY 1999 - FY 2001

This research project continues the development and enhancement of the AWARDS (Agricultural WAter Resources Decision Support) system. The original development of the AWARDS system was accomplished during the FY 1996 - FY 1998 period under Project ID: WR.12. System enhancements were added during FY 1998 - FY 1999 (extension granted September 1998) under Project ID: WR.13. This RTT project addresses the following problems:

- The accuracy of Quantitative Precipitation Estimates (QPE) based on standard NEXRAD (NEXt generation weather RADar) data over the mountainous terrain of the western states is not sufficient for Reclamation's operationa needs.
- More rain gage measurements are needed for the National Weather Service (NWS) West Gulf River Forecast Center (RFC) to produce good Stage III rainfall estimates over the Rio Grande Basin in New Mexico.
- The present AWARDS method for estimating the effective rainfall is not suitable for land with varied soil types and sloping terrain.
- The present AWARDS riparian/agricultural evapotranspiration (ET) forecasts for “today” actually use the previous 72-hr weather station data.
- The current Quantitative Precipitation Forecasts (QPFs) produced by the NWS are for only 24 hours and are generally not available in digital format.

The overall goal of this project is to improve and extend the capabilities of the AWARDS system.

Objective 1. Where NEXRAD radars are located at higher elevations in rough terrain, provide better rainfall estimates over valleys where the irrigated land and river riparian areas are located and over project reservoir/river systems. These rainfall estimates are displayed on the Hydrologic Rainfall Analysis Project (HRAP) grid (about 4 km x 4 km cells).

Objective 2. Develop the methodology to automatically derive Early Eta Model-based 36-hr QPFs and ET forecasts for riparian/crop vegetation once a day and then post these QPFs and ET forecasts on AWARDS images and/or pop-up charts.

Project work on the objectives during FY1999 was as follows:

Objective 1: Reclamation established data-sharing partnerships with the West Gulf RFC and the NWS Weather Forecast Office (WFO) in Albuquerque. Reclamation procured 10 automatic weather stations to support project operations in the Middle Rio Grande area. These weather stations and a radio communications system for data

transmission were installed by the Middle Rio Grande Conservancy District (MRGCD). The MRGCD is also doing the O&M for this network, which is just becoming operational. Reclamation will use environmental data from this network for daily ET calculations for the AWARDS system. Precipitation data will be sent to the NWS in real time for use in the adjustment of NEXRAD data (i.e., the production of Stage III). Hourly Digital Precipitation Array (Stage III) data are received automatically via FTP from the West Gulf RFC. Also, procedures were developed to automatically obtain QPFs in digital format from the West Gulf RFC for use in the Rio Grande AWARDS system.

An AWARDS system was also implemented for the Rogue River Basin in southwestern Oregon. This work is in partnership with Reclamation's Bend Field Office. The accuracy of the NEXRAD Stage III products over southwestern Oregon is not sufficient for project needs. This is because of the mountainous terrain, the location of the Medford NEXRAD at a high elevation location from which it views ice particles during winter months, and other factors. Therefore, the Reclamation-developed Snow Accumulation Algorithm (SAA) was adapted to use NEXRAD Information Dissemination System (NIDS) reflectivity data. A study was made of 32 days with significant precipitation over the Rogue River Basin during the November 1998-April 1999 period. This study showed that the SAA of $Z_e = 100R^{2.0}$, using a 4 dBZ minimum value to calculate precipitation, significantly improved the precipitation estimates over the standard NEXRAD $Z_e = 300R^{1.4}$ relationship with a 22 dBZ minimum value. The correlation between daily radar and gage estimates was 0.75, and the radar/gage ratios for the 32 storm day totals for both Medford gages were 103 percent. Adding a range correction factor beyond 50 km to compensate for precipitation returns below the radar beam provided improved precipitation estimates at far range.

Objective 2: NWS eta model 40-km gridded parameters from the 0000 UTC model run are automatically collected from the National Centers for Environmental Prediction (NCEP). Daily ET forecasts are made by averaging the past 3 days use, and eta model forecast parameters are used for adjustment.

The primary partners on this project during FY 1999 were: NWS West Gulf RFC, Albuquerque WFO, and Arkansas-Red Basin RFC; Reclamation's Upper Colorado Region, Albuquerque Area Office, and El Paso Field Division; Pacific Northwest Region, and Bend Field Office; Middle Rio Grande Conservancy District, New Mexico; Lugert-Altus Irrigation District; Oklahoma; and three irrigation districts in the Rogue River Basin, OR.

Other RTT projects that enhance this project are:

- Riparian & Agriculture ET Demand Study (WR.99.43), Brower
- Quantitative Precipitation Forecasts (WR.99.07), Stodt
- NEXRAD Precipitation Algorithm (WR.99.06), Super

AWARDS system products and papers resulting from this study are displayed on Reclamation's NEXRAD World Wide Web page on the Internet (http://www.usbr.gov/rsmg/nexrad).

Publications prepared during FY1999 include:

SCIENCE And Technology Program

Hartzell, C.L., L.A. Brower, R.W. Stodt, and S.P. Meyer. 2000. Agricultural Water Resources Decision Support System. Preprints, 2nd Conference on Environmental Applications, Amer. Meteor. Soc., Long Beach, California, paper 5.7, 8 pp.

Hartzell, C.L., and A.B. Super. 2000. Development of a WSR-88D based Snow Accumulation Algorithm for quantitative precipitation estimates over southwestern Oregon. Preprints, 16th Int. Conf. on Interactive Information and Processing Systems (IIPS) for Meteorology, Oceanography, and Hydrology, Amer. Meteor. Soc., Long Beach, CA, paper 11.1, 4 pp.

HTTP://WWW.USBR.GOV/RESEARCH