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UNIVERSITY AT ALBANY
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Final Report for Partners and Cooperative Project (S03-38672)

Partners or Cooperative Project: NEXRAD Precipitation Algorithm Verification Study

University: University at Albany, State University of New York

University Researcher:
Dr. David R. Fitzjarrald, Atmospheric Sciences Research Center (ASRC)

Sub-contractor: Atmospheric Information Services (AIS), Albany, NY.
Dr. Jeffrey M. Freedman

NWS Office: Albany, NY WFO

Name of NWS Researcher: John S. Quinlan

Date: 31 March 2005

Section 1: Summary of Project Objectives

The main objective of this project is to develop more accurate Z-R and Z-S relationships for use in operational real-time precipitation and hydrological forecasting for the

mountainous terrain of the Catskills through the use of data from the New York City Department of Environmental Protection (NYCDEP) surface meteorological observation stations and the NWS Cooperative Observer (COOP) Network. Twelve case studies were chosen for analysis (see Table 1 below). They represent events that presented a particular challenge for precipitation and hydrological forecasting and analysis.

Section 2: Project Accomplishments/Findings

Analysis of the data is complete. Unforeseen delays were encountered, mainly due to the need to update software codes used to analyze the NEXRAD Archive II data, and in the acquisition of recent NYCDEP meteorological network data. An additional 6 months unfunded time was requested to complete the work.

Twelve cases selected for this study underwent ground truth verification of NEXRAD precipitation estimates. Modifications to the Z-R and Z-S algorithms were validated over the Catskills; additional testing was done over similar terrain to the east of Albany, namely the Taconics, Berkshires (MA), and the Green Mountains (VT). New Z-R and Z-S relationships were developed for the case types listed in Table 1 below.

Difficulty was encountered in data quality used for ground truth verification. For example, the NYCDEP station snowfall data is, at times questionable. The more recent NYCDEP data (from 2002) had not undergone quality control/assessment at the start of this project. This issue was subsequently resolved.

We noted that snow/liquid equivalent relationships can vary greatly over the study domain for some events. Since the operational NEXRAD Z-S relationships cannot be varied by geography or topography, this makes accurate precipitation (snowfall) estimates problematic under certain circumstances.

Section 3: Benefits and Lessons Learned: Operational Partner Perspective

Coordination and information exchange among the three participants was facilitated by the fact that ASRC, the NWS Albany WFO, and AIS are co-located within the same building complex. During the upcoming summer season NWS Albany WFO will use the new ZR calibrations during opportunistic tropical storm events; the Z-S calibrations will be applied during the winter of 2005-2006. Working with the relatively new NYCDEP surface network has also fostered cooperation between the NWS Albany WFO and NYCDEP personnel, and NYCDEP data will be helpful in verifying local hydrological products.

Section 4: Benefits and Lessons Learned: University Partner Perspective

Student interns have been heavily involved in analyzing the NEXRAD Level II data; they have continuing exposure to the multitude of NEXRAD products available through analysis software such as WATADS. Exposure to NEXRAD products has also opened up research avenues in other projects, such as using archived Level II data to analyze wind

fields over the Hudson Valley for the purposes of studying the evolution of local circulations.

Section 5: Publications and Presentations

The work will be presented at the upcoming 7th Annual Northeast Regional Operational Workshop in Albany, NY on 1-3 November 2005. Another paper may be presented at the 20th Conference on Hydrology, 29 January–2 February 2006, in Atlanta, Georgia. A paper will be submitted to the Journal of Hydrometeorology within the next few months.

Section 6: Summary of University/Operational Partner Interactions and Roles

Albany NWS WFO: John Quinlan was the main contact between the Albany NWS WFO and the COMET partners. His duties included educating student interns regarding running the WATADS software, frequent meetings with Drs. Fitzjarrald and Freedman, identifying particularly problematic cases for inclusion in the study, and the final analysis and refinement of the modified Z-R and Z-S relationships.

Dr. David R. Fitzjarrald, ASRC: Dr. Fitzjarrald was the co-principal investigator for ASRC. He provided workstations for student interns performing data analysis and provided the connection between this study and data obtained during the Hudson Valley Ambient Meteorology Study.

Dr. Jeffrey M. Freedman, AIS: Dr. Freedman was co-principal investigator for AIS. He acquired all NYCDEP data used in this study, performed data analysis and verification on all surface data used in this study, and with Mr. Quinlan, produced the final analysis and modification of Z-R and Z-S relationships.

Table 1. Case Studies

Case Type	Dates	Times
Elevation Snow	21-23 March 2001	12Z (21st) – 06Z (23rd)*
Elevation Snow	18 May 2002	21Z (17th) – 00Z (19th)
Widespread Snow	30-31 December 2000	06Z (30th) – 19Z (1st)
Widespread Snow	5-6 February 2001	00Z (5th) – 00Z (8th)**
Widespread Snow	5-6 March 2001	12Z (4th) – 12Z (7th)
Widespread Snow	6-7 January 2002	12Z (6th) – 06Z (8th)
Systems of Tropical Origin	16-17 September 1999	21Z (15th) – 21Z (17th)
Systems of Tropical Origin	6-7 June 2000	15Z (4th) – 12Z (7th)
Systems of Tropical Origin	21-22 September 2002	15Z (21st) – 09Z (23rd)
Stratiform-convective	14-16 July 2000	15Z (14th) – 09Z (17th)
Stratiform-convective	17 December 2000	15Z (16th) – 21Z (18th)
Stratiform-convective	15-16 September 2002	06Z (15th) – 21Z (16th)

*More precipitation on the 24th
**Lake effect followed on 7th – 8th.