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APPLICATION OF ENVIRONMENTAL SENSOR STATIONS IN THE WESTERN UNITED STATES

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1. INTRODUCTION

Environmental Sensing Stations (ESS) are deployed in all western states. ESS has been used for many years as a highway winter maintenance tool (also referred to as road weather information systems - RWIS) to improve snow removal and ice prevention efficiency, and as a means to improve communication of weather and road conditions to travellers. The ESS community is now focusing on improved weather information by developing *decision support systems* that furnish information that can be used by transportation users and operators to make informed decisions based on weather and road conditions.

2. MESOWEST

As a means to provide real-time access to ESS observations for NWS offices, National Centers, and the research community, the NOAA Cooperative Institute for Regional Prediction (CIRP) has developed software to link together weather observations in the western United States from over 2800 stations, including ESS stations (Fig. 1). We refer to this collection of regional and local networks as MesoWest. Information regarding MesoWest can be obtained through the Internet at *http://www.met.utah.edu/mesowest.*

As shown in Fig. 1, ESS weather observations are available in the following states: Idaho, Montana, Nevada, Utah, Washington, and Wyoming. These data are made available as a result of cooperative agreements between local NWS offices and the respective Department of Transportation offices. ESS observations are transmitted to CIRP electronically via NWS Forecast Offices, universities, and directly from several DOT offices. We will continue to facilitate access to ESS data as additional stations become available via the internet.

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MesoWest operates on a 15 minute data collection and processing cycle. At the end of each cycle, the data are integrated into a mySQL database and accessible to users via the Internet. Increasingly, data are being processed asynchronously (i.e., as soon as they arrive) in order to minimize latencies. MesoWest data are used extensively for operational forecasts by meteorologists at local NWS offices in the western United States as well as national meteorological centers such as the National Centers for Environmental Prediction (NCEP) and the Storm Prediction Center (SPC). Mesowest data have also been used for prototype development of the Maintenance Decision Support System (MDSS) sponsored by the Federal Highway Administration (FHWA) Office of Transportation Operations (HOTO).

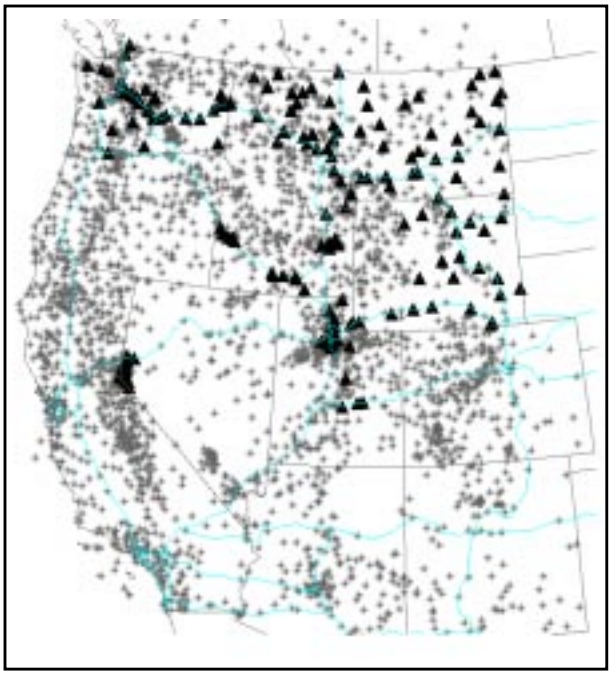

Figure 1. Locations of roughly 2800 weather observing stations (asterisks) in the western United States that are accessible via MesoWest. Triangles denote ESS stations.

In addition to providing data at individual stations for operational use, CIRP creates objective analyses of meteorological data fields from the array of stations available in real-time. Surface analyses of such fields as the temperature, dew point, and pressure are generated in near real-time. Other types of analyses are generated by combining the MesoWest data streams with a background field provided by the NCEP RUC2 analysis. These analyses rely upon the University of Oklahoma Advanced Regional Prediction System Data Analysis System (ADAS).

3. Applications

Automated weather and road conditions at ESS stations are a component of Utah DOT's integrated approach to road weather decision making that also relies upon: additional current weather observations at other MesoWest stations and from satellite and radar; site-specific and task-specific short range weather and pavement temperature forecasts provided commercially; and associated communication, processing, and display capabilities. Utah DOT personnel (including Traffic Operations Center staff, area supervisors, operations engineers, and maintenance personnel) access the ESS data either from a DOT ESS server or via a prototype ESS web page that has been maintained by CIRP during the past 4 years. Fig 2 demonstrates the utility of non-ESS weather stations in helping define weather conditions near many secondary roads and highways where ESS has not been deployed.

Besides providing tailored access to MesoWest weather observations, such as with UDOT, CIRP provides specialized estimates of along highway weather conditions based on the ADAS real-time analyses. Air temperature variations along roadways can be dramatic in the complex terrain of the Intermountain West as shown in Fig. 3 which transects Interstate 80 through the state of Utah. The use of the ADAS analyses leverages the weather data collected from non-ESS networks available from MesoWest and other meteorological data sources in order to provide a higher degree of resolution to weather conditions along roadways than could be determined from ESS sites alone.

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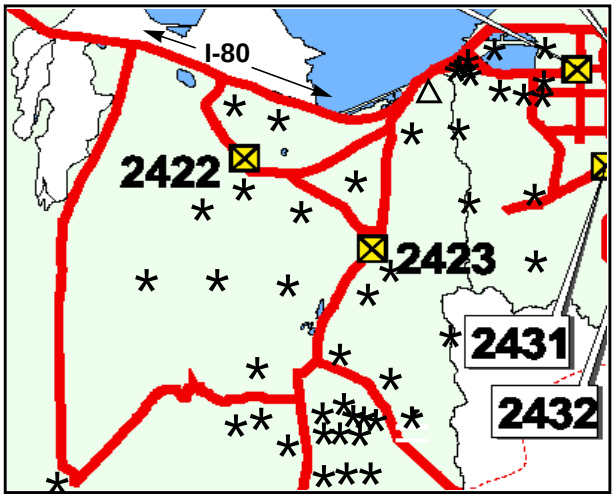

Figure 2. MesoWest stations in relation to roads serviced by the Utah Department of Transportation (UDOT) south of the Great Salt Lake. Boxes represent UDOT maintenance stations, asterisks are non-ESS MesoWest stations, triangles represent MesoWest ESS stations.

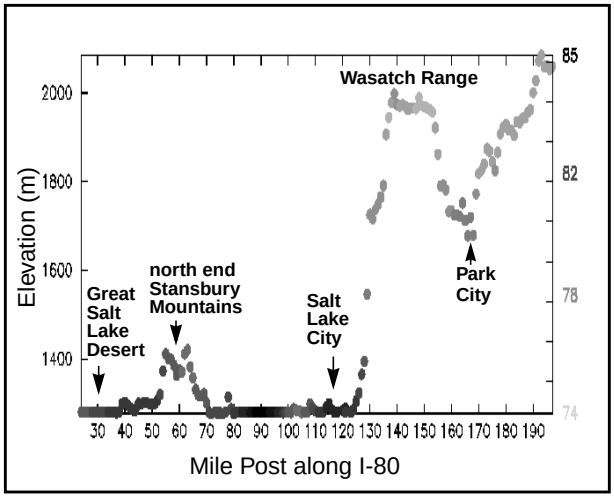

Figure 3. Analysis at 1800 UTC SEP 26 2001 of surface air temperature (in ^{o}F according to shading at right) along Interstate 80 in Utah from the ADAS analysis. Temperature is largely a function of elevation, though other mesoscale variations are visible.