P1.38 PRACTICAL APPLICATIONS OF ROADWAY WEATHER INFORMATION SYSTEMS IN PENNSYLVANIA

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1. INTRODUCTION

Through a cooperative agreement sponsored by COMET (Cooperative Program for Operational Meteorology, Education and Training) and FHWA (Federal Highway Administration), the State Climate Office at Penn State University along with the National Weather Service Office in State College (CTP) have collected data from the Pennsylvania Department of Transportation's (PennDOT) Roadway Weather Information Sensor (RWIS) Network since May 2001. In all, over 80 sites have reported with a frequency as often as every 30 minutes. The RWIS are strategically located to assist PennDOT in their Total Storm Management Program. Each of PennDOT's 11 districts uses the data to assess their response to hazardous winter weather.

The agreement focused on several aspects of developing a working partnership between the three groups. Initially, the climate office developed a storage and retrieval system for all RWIS data as well as a quality control routine. During this time, the NWS tested the incorporation of RWIS data into their Advanced Weather Interactive Processing System (AWIPS) for enhancement of winter weather warnings. PennDOT was given feedback on the quality and frequency of the atmospheric portion of RWIS data to insure the best reports. Together the partners conducted an intensive winter weather training session in October 2002 with virtually all DOT districts participating to raise their awareness of data and forecast information availability to the DOT road crew managers. The final phase involves the completion of the data interface, the determination of microclimate regimes and their effects on local forecasts, and assistance in placement and upgrades to the current RWIS network.

2. QUALITY CONTROL

The initial issue of quality control involved establishing a reliable means of receiving the observations from the RWIS stations. Cooperation between PennDOT, Penn State University and the National Weather Service resulted in a designated location to obtain a single file containing data from each of three vendors who installed stations across the state. Alternate methods of data retrieval were established in the event of a breakdown in the primary retrieval. After completion of a reliable data transfer process, the next task in assuring the quality of the data was standardizing the parameters that were reported in a unique format by each of the three vendors. It was vital that the specific time of observations was known and that the atmospheric parameters reported were converted to the standards established by the World Meteorological Organization (WMO) before applying other quality control procedures. After this phase, the homogenized observations were entered in real-time into a MYSQL database on an hourly and even half-hourly basis.

The quality control procedure implemented on the RWIS data is a two-step method. The first step verifies the integrity of the data on a spatial basis while the second examines recent observations of each station. Each RWIS site was matched with the nearest FAA ASOS station and their temperature, dewpoint and wind sensor values were compared to assess the veracity of the RWIS data on a spatial basis. The FAA ASOS network was selected for this phase of the quality control due to the high level of instrument maintenance by NWS/FAA and the reliability of their reporting infrastructure.

This second check confirms that the values of the parameters do not remain stationary over a prolonged time or do not change radically over a short-term. Specific 'trigger' values were determined for each parameter for its length of stagnation and degree of sudden change.

The siting of the RWIS stations does not allow for direct comparison between the readings of the ASOS & RWIS sensors. RWIS's are located in both rural and metropolitan areas creating a wide range of distances between an RWIS and the nearest FAA station. To accommodate this, algorithms based on this distance and differences in elevations of the

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stations were developed to identify when the output of an RWIS was askew of the nearest ASOS. In addition, visits to each RWIS determined distinct features of the surroundings (valley, ridge and water bodies) that might explain any reoccurring differences at a particular station.

Observations that did not pass either of these two tests were flagged and adjusted based on the nearest neighbor's value. These amended values, along with values that passed both quality control tests were plotted with data from the ASOS, AWOS, and Pennsylvania Department of Environmental Protection (DEP) networks (Figure 1) to provide a real-time visual monitor for the quality of the corrected observations. The original observations that were found to be erroneous were placed in another database, which allowed for assessing the need for re-calibration or maintenance of the sensors as well as the potential of a microclimate in the vicinity of the RWIS.

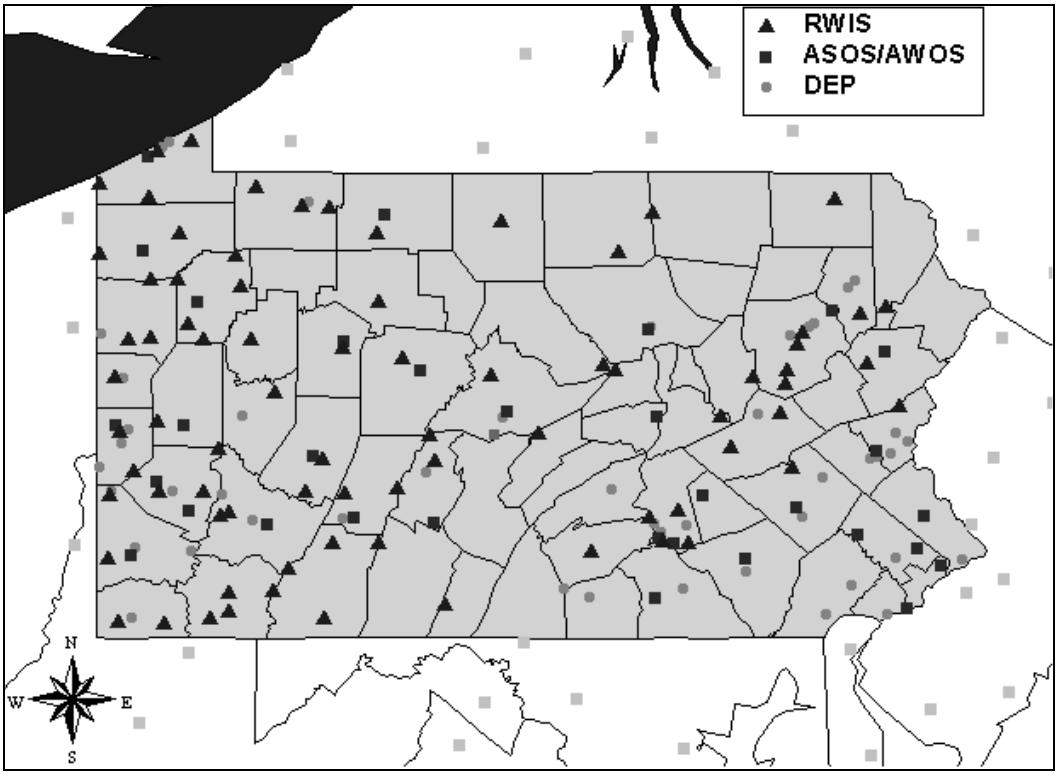

Figure 1: Hourly Reporting Stations in Pennsylvania

3. APPLICATIONS

These RWIS data readily lend themselves to a broad range of applications ranging from long-term climatology to short range forecast and warnings. From a climatological perspective, these data may eventually be as important as the FAA ASOS data. The focus here is to demonstrate some short-range forecast potential of these data.

Figure 2 shows a weak line of showers moving across northern Pennsylvania at 1300 UTC 20 September 2002. At this time, only three observing sites were available in the region, two of which were RWIS sites. The relatively cool moist air produced by the shower is only sampled by the single RWIS station to the east. This area, as shown in Figure 1, from KBFD eastward has no FAA reporting station and is normally a data void area. Figure 3 shows the same

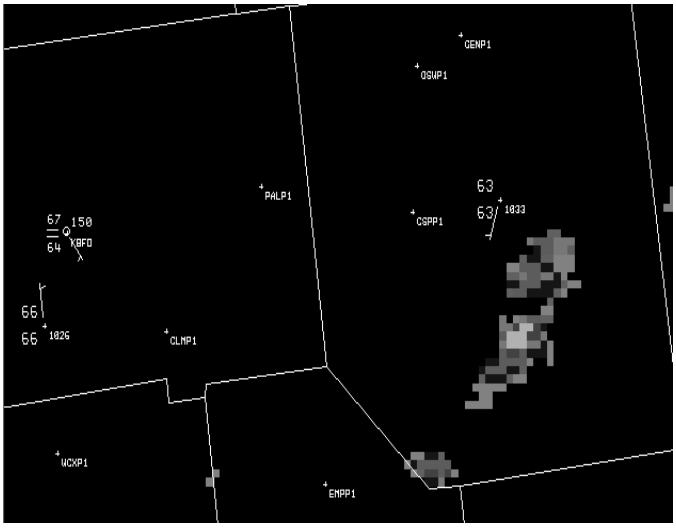

Figure 2: RWIS and FAA plots overlaid with radar at 1300 UTC 20 September 2002

weak line of showers 15 minutes later, at 1315 UTC. The line of showers is just approaching the FAA station KUNV. To the north and west, on the other side of the line, an RWIS stations provides data on the passage of the line. Clearly, these data could be of great value during winter storms and convective weather situations filling data voids at strategic locations at critical times. They have great potential in severe weather events to show the strength of thunderstorm cold pools and gust fronts. Furthermore, these data could provide better insights, when integrated with radar and satellite data, as to the location of significant meteorological boundaries.

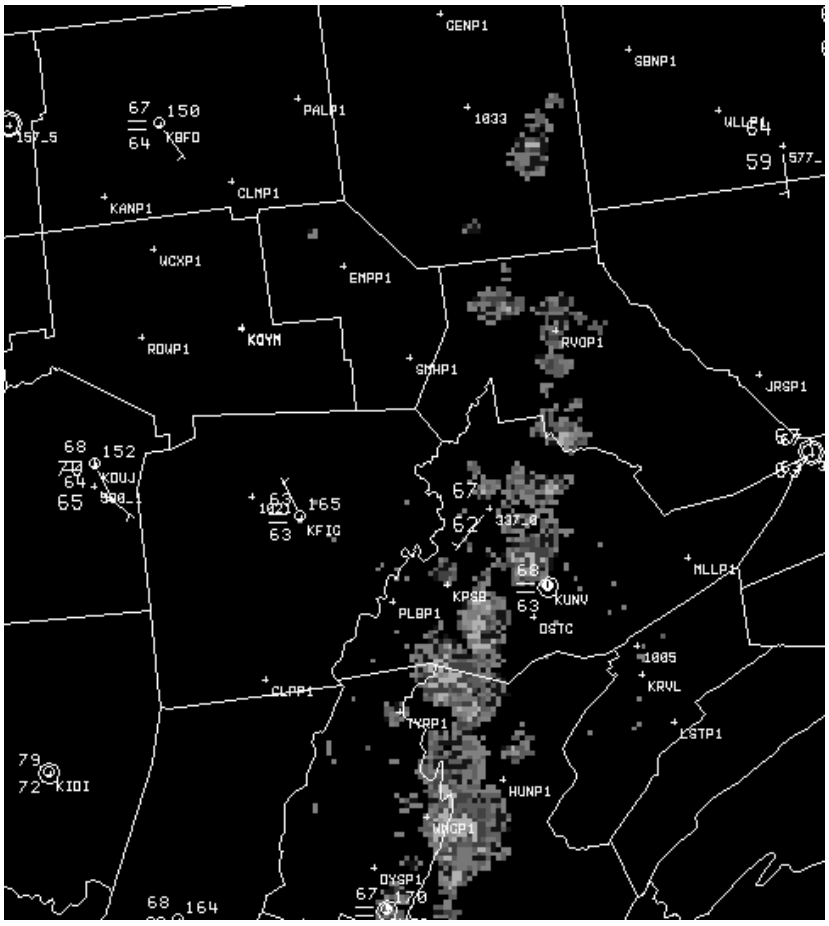

Figure 3: RWIS and FAA plots overlaid with radar at 1315 UTC 20 September 2002

4. DOT TRAINING

The web-based data display continues to evolve, allowing users to see evidence of microclimates in the state. In addition to the real-time displays, as the database expands, it will provide valuable information about local winds, radiational cooling and other climate effects due to the complex terrain across Pennsylvania.

Design of the interactive web page is proceeding. Page improvements were discussed in recent meetings with local Pennsylvania Department of Transportation County Maintenance Managers. The normal operations and data needs for the managers staff were discussed in light of the life cycle of a winter storm. Pre-storm information and planning plus information needs 2 hours prior to the onset of precipitation and post storm data requirements were explored.

A new web page was outlined that would consist of Watch Warning and Advisory products issued by the National Weather Service as well as forecasts. Additionally, RWIS, DEP and ASOS displays of current observations on a regional basis will be shown in spatial and temporal modes. When this information is combined with NWS radar data, it will bring significant improvement to determining the onset of precipitation. The web page will bring into one site radar displays that cover all of Pennsylvania as well as adjacent areas surrounding the state. Additionally,

this more detailed radar information will allow maintenance managers to make more informed decisions in resource allocation.

The web page will link to climatological information, weather safety facts and other weather resources such as presentation material from the joint PSU/NWS weather-training course for PennDOT Roadway Managers. The design of the web page will likely be completed by spring of 2003.