6.10 The Iowa Environmental Mesonet – Combining observing systems into a single network

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1. INTRODUCTION

In response to needs for more frequent and spatially detailed weather observations, Iowa State University has begun the process of collecting and archiving weather data from six different observing systems across Iowa into the Iowa Environmental Mesonet (IEM) (http://mesonet.agron.iastate.edu). Data will be checked for comparability among networks, quality controlled, and combined into a single database.

2. EXISTING NETWORKS

Iowa has a wide variety of detailed data from various sources. Existing systems currently include over 300 stations (Table 1) and over 1100 instruments within the state. The individual networks were autonomous with no coordination in siting or data format.

The initial goal of the IEM, already nearly achieved, has been to integrate existing data into a single collection point and data archive. The next goal is data compatibility and quality control. The IEM is taking an approach in network development that differs from the Oklahoma Mesonet (Brock et al. 1994) and the proposed Texas Mesonet, by building on data from existing networks (Fig. 1). By capitalizing on existing resources, the state demonstrates efficiency through cooperation among agencies.

Table 1.1 Existing stations by agency

Observing System	Number of Stations
National Weather Service ASOS	15
Iowa DOT AWOS	30
Iowa DOT RWIS	50
Iowa State University Ag-Climate	12
USGS/USACOE	115
National Weather Service COOP	169
National Weather Service Fischer Porter	62

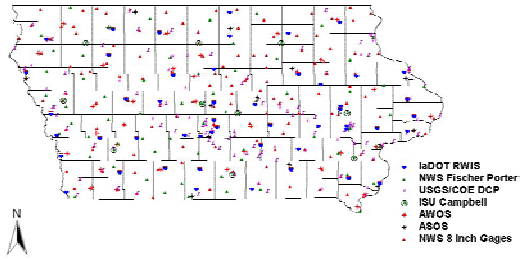

Fig. 1 State coverage of existing networks.

3. NETWORK EXPANSION

Gaps in certain areas, especially lightly populated areas in the western parts of the state, present data voids that may preclude qualification for government drought assistance. Many counties have only one official recording station. Data gaps especially in the 110 automated stations of the network (Fig. 2) will need to be filled by installing new stations under the auspices of the IEM, since most networks are not planning expansion.

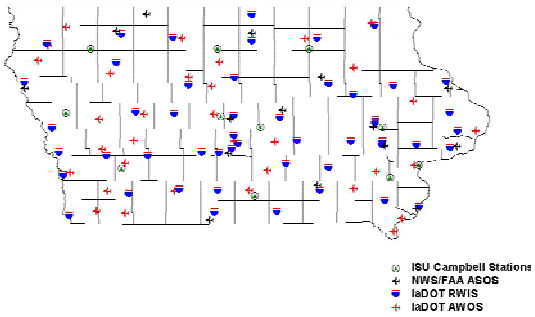

Fig. 2 Iowa automated weather stations

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At least 15 new stations will be added to fill existing holes in the network depending on the meteorological variable of interest. The state is well covered for reporting certain data such as maximum temperatures, according to station spacing criteria of Hubbard (1994). However, relative humidity and wind (Fig. 3) are poorly resolved. Many more rain gauges are needed to ensure good spatial coverage. Additional instrumentation will be deployed to monitor other currently unmeasured data, such as soil moisture.

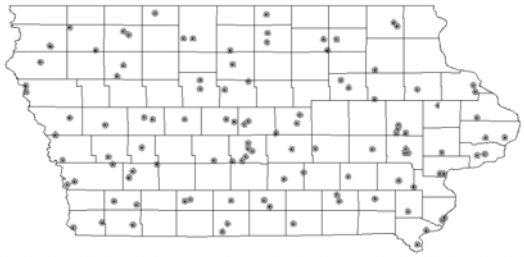

Fig. 3 State coverage of wind according to Hubbard (1994).

4. DATA COMPARISON

The main observing systems being used are the National Weather Service's Automated Surface Observing System (ASOS) and the Iowa Department of Transportation's Automated Weather Observing System (AWOS) and Roadway Weather Information System (RWIS). Discrepancies exist among data gathered from different observing networks because of siting considerations or slightly different instrumentation.

ASOS/AWOS stations are located at airports while the RWIS are located along major highways. In some cases the roadside stations are elevated above the actual land surface to capture conditions on bridges or elevated roadways at interchanges. Despite these differences in instrumentation and siting, the data are quite often very useful. More detailed comparisons of the ASOS/AWOS/RWIS data can be found in Todey et al. (2002).

The distribution of stations across the state is not uniform. The ASOSs are located more in eastern Iowa, while the AWOS are predominantly in western Iowa. The RWIS network is the most evenly distributed of the networks.

5. MESONET DATA APPLICATIONS

Numerous applications are available for the data and are continually being developed. Soil temperature data from the ISU Ag-climate network part of the IEM are being used for an advisory on fall application of nitrogen (soil temperature < 50^{o}F reduces nitrate loss to streams).

Data gathered from the network to determine specific temperature, humidity, wind, and rainfall conditions around the state will be used to drive a soil loss model to determine daily soil erosion loss potential statewide.

IEM data are being used to run a frost model for the IaDOT to better-predict frost formation on roadways.

6. CONCLUSIONS

Further work is necessary to determine an optimal strategy for merging data from separate subnetworks. However, the eagerness of separate state agencies to cooperate, or even expand their observing systems with IEM goals in mind, provides incentive to build data-merging algorithms to accurately represent conditions across the state.

7. REFERENCES

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