**P3.3** Improving the observation of the water cycle in Iowa using the Iowa Environmental Mesonet

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## 1. INTRODUCTION

One problem in measuring the water balance for any area is assessing the components of the water balance in sufficient detail to accurately describe them. One method to overcome this is by incorporating more observations. The Iowa Environmental Mesonet (IEM) (Todey et al. 2002) is using this methodology to improve water balance measurement in Iowa.

## 2. EXISTING NETWORKS

Iowa has the advantage of eight existing observational networks, which measure some component of the water balance. The IEM has been focusing on gathering all existing data and expanding observing capability as possible. Combining networks provides the opportunity to increase the spatial density of precipitation measurement.

Seven of the networks currently measure rainfall totals in the state. The total number of stations (Table 1) observing rainfall is over 400 (Fig. 1).

Table 1. Raingauges in Iowa

| Observing System | Stations Recording Precipitation |
|---|---|
| National Weather Service ASOS | 15 |
| Iowa DOT AWOS | 33 |
| NRCS - SCAN | 2 |
| Iowa State University Ag-Climate | 12 |
| USGS/USACOE | 115 |
| National Weather Service COOP | 169 |
| Schoolnet | 49 |

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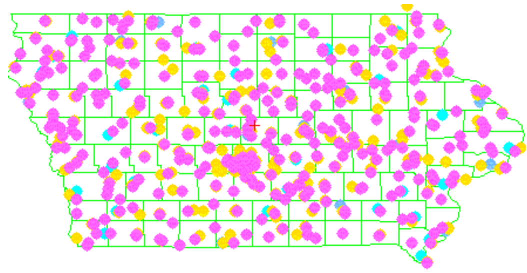

Fig. 1 Precipitation stations in Iowa

The time scales of the various networks range from 24 hours for the cooperative observers down to minute and sub-minute recording for the Automated Weather Observing Systems (AWOS) and Schoolnet stations. The disparity of accumulation length and reset time for the individual networks also presents difficult issues. The cooperative observers are considered the base line network for climate observation. But the measurement period is not exact for these network. This presents issues is accumulating precipitation for comparison.

## 3. WATER BALANCE

The balance of the precipitation in the water balance is the water use extraction from the soil by evaporation and transpiration. These are even more difficult to measure than precipitation. The main method of assessing this use has been using pan evaporation with derived coefficients for different crops. The number of pan evaporation stations has been decreasing.

To overcome this problem, evapotranspiration values can be estimated using various atmospheric methods. One of these is can be computing using atmospheric variables from automated weather stations (Meyer et al. 1989) (Fig. 2). The limitation with this method is the need for solar radiation measurements, usually only measured at specific sites. Crop coefficients can then be applied to these, also to determine the water use by a crop.

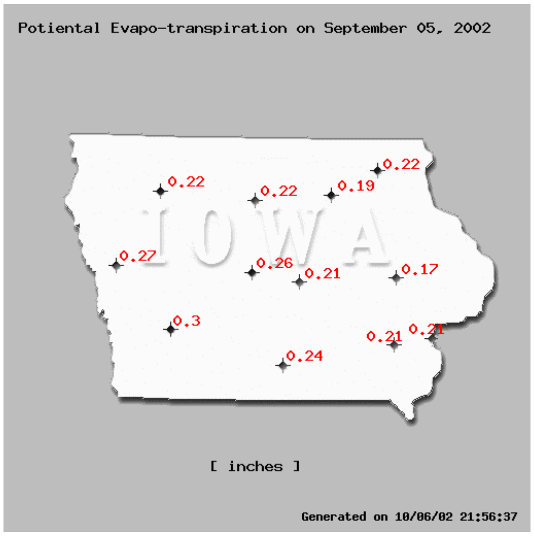


Fig. 2 Estimated ET amounts from ISU Ag Climate stations

Current network measurements do not allow assessing downward water transport through percolation in the soil. Therefore water balance measurements are restricted to the precipitation ET balance.

## 4. NETWORK IMPROVEMENTS

Two stations from the NRCS SCAN (Natural Resource Conservation Service – Soil Climate Analysis Network) have initiated soil moisture measurement in the state. The soil assessment can provide assessment of soil moisture conditions. While soil variability is great, soil moisture measurements are beginning to fill the gap in the unknown area of soil moisture holding capacity. Hourly data from these sites indicates how the soil responds to rainfall and ET over time (Fig. 3)

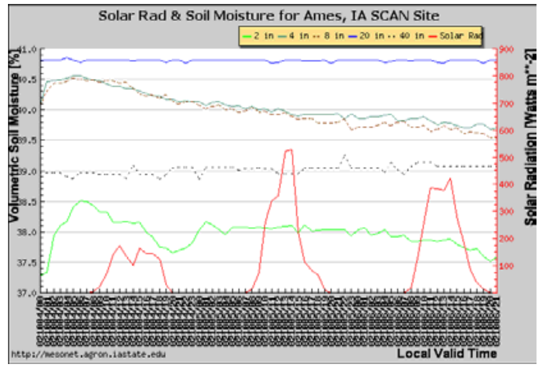


Fig. 3 Soil moisture and solar radiation for the Ames, IA SCAN site.

Further integration and comparison of networks is continuing to assess comparability of rainfall measurement between the cooperative 8” rain gauges and the various tipping buckets of the different networks.

## 5. CONCLUSIONS

Combining networks is rapidly becoming a popular method of increasing spatial density of measurements. The IEM has shown that applications such as water balance measurements can be accomplished through such a technique. Useful applications are easily derived from such methods.

## 6. REFERENCES

Meyer, Hubbard, K.G. and D. Wilhite, 1989: Estimating potential evapotranspiration – the effect of random and systematic errors. *Agric. For. Meteor.*, **46**, 285-296.

Todey, D.P., D.E. Herzmann, and G.S. Takle, 2002. The Iowa Environmental Mesonet – combining networks into a single network. *Preprints 6th Symposium on Integrated Observing Systems*, Orlando, FL, Amer. Meteor. Soc.