Field Notes for “104. Exploiting the Iowa Environmental Mesonet website for fun and profit”

Objectives:

* Provide an organization overview of the IEM website.
* Understand the different data sources and observation types available for download.
* Discuss which network should be used for weather data variable.

Resources:

IEM Website: https://mesonet.agron.iastate.edu

Autoplot Application: <https://mesonet.agron.iastate.edu/plotting/auto/>

AgWeather Mainpage: https://mesonet.agron.iastate.edu/agweather/

ISU Soil Moisture Network: https://mesonet.agron.iastate.edu/agclimate/

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The Iowa Environmental Mesonet (IEM) is a project within the Department of Agronomy at Iowa State University. The project’s website contains a massive amount of weather and climate data, that can be very challenging to decipher. The primary organization of the website is to group similar observation platforms into labeled “networks”. These networks also typically delineate a geographic domain of coverage. Some networks are isolated to Iowa, for example the ISU Soil Moisture Network, while others like the Automated Surface Observing Systems (ASOS) are found in every state.

Unlike most traditional University-based mesonet projects, the vast majority of the data made available on the IEM website does not come from stations owned by Iowa State University. Thus, the IEM is a data aggregation site, that attempts to remove some of the pain found by finding downloadable archives. To make things confusing, the ISU Soil Moisture Network is one of the networks aggregated om the IEM website, but the two projects are different.

The IEM website consists of atomic data download portals, generated work products summarizing data, portals to interactively view data, and index web pages organizing networks, topics, and/or data types. The website has been built out over the past 21 years as a direct result of requests made by end-users. Please feel free to reach out to Daryl with your requests and questions, which will result in website updates to meet your needs!

**Which Network to Use?**

The IEM organizes data into networks and each network has differences that have implications for the usefulness of the variables being collected. Restating, some networks are better than others at observing certain weather variables. Table 1 provides guidance on which IEM network classification to use for the given desired data type. The “Networks” tab on the website header bar provides links to the data for each of the networks listed.

|  |  |
| --- | --- |
| Data Need | Recommendation |
| Daily High/Low Temps + Precipitation | NWS COOP  IEM “Long Term Climate” / “Climodat” |
| Wind | ISU Soil Moisture ASOS (Airport weather stations) |
| Solar Radiation | ISU Soil Moisture |
| Hourly Rainfall, not snow | ASOS (Airport weather stations) |
| River Stages / Hydrology | DCP/HADS (USGS gauges) |
| Soil Temperature / Moisture | ISU Soil Moisture |
| Humidity | ASOS (Airport weather stations) |

The CropsTV presentation illustrated the end-to-end workflow of eight common end-user tasks. Some of the choices made deserve some more discussion.

**Task 2: Temperatures, Snow and Precipitation Reports**

The most common data request is for daily high and low temperatures along with precipitation. While such a basic request would seem trivial, the nuances to what is available are anything but trivial. The primary complication is that while the term “daily” implies a calendar day, there is very little data available for that exact interval. Most of the manual observations (from the National Weather Service (NWS) Cooperative Observer Network (COOP)) are made during the morning hours and much of the automated weather station data does not account for daylight saving time. The result is 24 hour totals that often span two calendar days.

The next complication is that precipitation is poorly observed during the cold season and during intense rainfall events by automated equipment. Additionally, thunderstorm events tend to have high spatial variability, which decreases the spatial area a given observation can be assumed to be accurate for. What is a mere data user mortal to do in the face of all this ambiguity? **Recommendation**: Download the once daily / quality-controlled observations from the NWS COOP Network.

**Task 3: Growing Degree Days Maps**

A common website request is for maps of Growing Degree Days (GDD) and associated departures over a specified time scale. The AgWeather Mainpage (see resources) has a number of links to raw data and dynamically generated maps for custom temperature thresholds and day periods. These maps often contain a significant amount of data noise as GDDs are very sensitive to micro-climate effects. These localized impacts create small differences in high and low temperatures when compared with nearby stations. **Recommendation:** Use these maps to show general patterns over a state and not focus on fine scale differences.

**Task 5: Solar Radiation**

The ISU Soil Moisture Network is one of the few platforms in the state which directly observes solar radiation. This variable is highly useful for modeling plant growth and development. There are a number of research entities that produce analyses of solar radiation based on satellite and weather model approaches. The IEM processes three of these: MERRAv2 (a NASA product), NARR (NOAA/NWS), and HRRR (NOAA/NWS). Grid point data is extracted for NWS COOP / IEM Long Term Climate sites and made available for download alongside the daily observations of temperature. There is a delay associated with the MERRAv2 and NARR data, so HRRR only exists for dates approximately within the past 30 days. **Recommendation:** When available, use the MERRAv2 data as it is best regarded for quality.