Locating Weather and Climate Data Sets

Beth Bishop and Jeff Andresen
Michigan State University
Online Information

• Basic weather data

• Summaries
  – Tables, graphs, interpretations

• Applications using weather data
What you need? How do you find it?

Part 1
– Determine your needs
– Where to find information
  • pros and cons

Part 2
– Examine one source: MSU’s Enviro-weather
– Hands on exercise: locating and using data
What are my real data needs?

- Which variables are needed?
- For which geographical area and for how long?
- Data accuracy/quality?
- Is the spatial scale of my application point-based? Or is it area-based?
- Budget?
General Data Types/Sources

- Conventional/Traditional
- Ad hoc Networks
- Gridded Data Sets
Conventional/Traditional
Advantages & Disadvantages

• Advantages
  – Data almost always taken from standardized networks
  – Quality typically relatively high
  – Metadata typically available
  – Usually source of longest historical records/series
  – Applications may be available

• Disadvantages
  – Data may not be available for location of interest
  – Data may not be easily accessible or in usable format
  – Potential costs
Revisiting the Statewide Climate Extremes

NCDC manually evaluated the records of extreme climate events for each state to determine their validity and accuracy.
The MRCC is one of six regional climate centers in the U.S.
General Data Types/Sources

Conventional/Traditional

- National Climatic Data Center
- Regional Climate Centers
- State Climatology Offices

www.stateclimate.org
Midwest Mesonets and Specialized Instrumented Sites

Surface weather data are collected by many networks on a National or Regional Scale. Often these data either do not include desired variables or the sites are spaced too widely to meet the needs of individual states. Thus many states in the Midwest collect data at time resolutions of one hour or better, with many sites including relative humidity, solar radiation, soil temperature, and soil moisture measurements and estimates of potential evapotranspiration. Select a state link for more detailed information on that network, or see the summary table below for an overview of available observations.

States:
Illinois • Indiana • Iowa • Kentucky • Michigan • Minnesota • Missouri • North Dakota • Ohio • Oklahoma

Summary Table of Midwest Mesonets

Near real-time/archived data available for air temperature (AirT); relative humidity (RH); wind (speed, direction, sometimes gust); precipitation (Ppt); solar radiation (Solar); leaf wetness (Leaf); soil temperature at various levels; soil moisture at various levels; derived dew point temperature (Td) and derived potential evapotranspiration (PET). Number of sites refers to in-state number. ( ) data only at a few sites.

<table>
<thead>
<tr>
<th>State</th>
<th>Network</th>
<th>Start Year</th>
<th>Sites</th>
<th>AirT</th>
<th>RH</th>
<th>Wind</th>
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Welcome to CoCoRaHS! "Volunteers working together to measure precipitation across the nation."

5,596 daily precipitation reports received today as of 9/25/2012 11:07 AM EDT

Map of the United States showing precipitation data.
General Data Types/Sources

• Conventional/Traditional
  – National Climatic Data Center
  – Regional Climate Centers
  – State Climatology Offices
  – Regional/State Mesonetworks
  – CoCoRaHS

• Ad hoc Networks
Ad hoc Networks
Advantages & Disadvantages

• Advantages
  – Data are typically highly accessible in a variety of formats
  – Useful applications (e.g. cell phone apps)

• Disadvantages
  – Data may not originate from standardized networks
  – Quality control may not be highest priority
  – Data typically not available for long historical applications
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  - Regional/State Mesonetworks
  - CoCoRaHS

- **Ad hoc Networks**
  - Wunderground
    - www.wunderground.com
  - Weatherbug
    - www.weatherbug.com
Data for a Single Month

(202395) EAST LANSING 4 S MI

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<th>Date</th>
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  - Wunderground
  - Weatherbug

- **Gridded Data Sets**
Gridded Data
Advantages & Disadvantages

• Advantages
  – Data theoretically cover spatial and temporal domain of interest
  – Gridded surfaces typically use high quality observations which have been quality controlled

• Disadvantages
  – While grid may cover an area of interest, the smoothed values are still dependent on the number and quality of the original source data
  – Spatial averaging smooths out local scale variability (particular problem if your application is on a point level)
Relative Spatial Continuity by Variable

**Best**
- Solar Radiation
- Air Temperature (maximum)
- Soil Temperature
- Wind Direction
- Humidity
- Air Temperature (minimum)
- Wind Speed
- Precipitation
- Leaf Wetness Duration

**Worst**
Illustration of Microclimate:
Min. Temperatures(°C) During Radiation Freeze Event
17 April 2012
Gridded Data Set Limitations
Winter Cold Injury
2002 Season
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• Gridded Data Sets
  – N.American Reanalysis (NARR): www.emc.ncep.noaa.gov/mmb/rreanl
  – NLDAS/GLDAS: ldas.gsfc.nasa.gov
  – DAYMET: daymet.ornl.gov
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  – NLDAS/GLDAS: ldas.gsfc.nasa.gov
  – DAYMET: daymet.ornl.gov
  – PRISM: www.prism.oregonstate.edu

The data sets available on this web site were created using the PRISM (Parameter-elevation Regressions on Independent Slopes Model) climate mapping system, developed by Dr. Christopher Daly, PRISM Climate Group director. PRISM is a unique knowledge-based system that uses point measurements of precipitation, temperature, and other climatic factors to produce continuous, digital grid estimates of monthly, yearly, and event-based climatic parameters. Continuously updated, this
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  – DAYMET: daymet.ornl.gov
  – PRISM: www.prism.oregonstate.edu
  – NOAA Multi-Sensor Precip. Estimates: water.weather.gov/precip
  – Offsite Data Sets: (e.g. Zed-X: www.zedxinc.com)
Moral:

Caveat emptor! (Buyer Beware)
Enviro-weather

ON-LINE, WEATHER-BASED, PEST AND PRODUCTION MANAGEMENT TOOLS FOR AGRICULTURE AND NATURAL RESOURCES

www.enviroweather.msu.edu
Data collected by weather stations
Enviro-weather Station Network
Enviro-weather Product Types

- Plant phenology models
- Pest models
- Irrigation management models
- Weather summaries

www.enviroweather.msu.edu
Automated Weather Network via cell modem

MSU Enviro-weather

via satellite, Internet

National Weather Service forecast information

Evaluated Weather, Climate Applications and Products

via Internet

MSU Extension

via phone, Internet, other

Training

Information for Growers/Managers

via Internet

Scouting Input

Feedback Loop:
Problems, Needs, New Ideas

Enviro-weather Information Flow
Latest observations at Benton Harbor (SWMREC)
02/01/2011 01:00 PM  (Station online).
Measurements by 5-minute average or total unless otherwise indicated.

19.8 F   Air temperature
0.0 in.  Rainfall (02/01/2011)
67.3%   Relative Humidity
10.8 F  Dewpoint
NE    Wind Direction (hourly average)
16.6 mi./hr. Windspeed
Dry    Leaf wetness (tripod-mount)
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Benton Harbor (SWMREC), Michigan

Latest observations at Benton Harbor (SWMREC)
09/26/2012 12:00 PM (Station online). Measurements by 5-minute average or total unless otherwise indicated.

- 60.8°F Air temperature
- 0.0 in. Rainfall (09/26/2012)
- 86.8% Relative Humidity
- 56.8°F Dewpoint
- WNW Wind Direction (hourly average)
- 3.1 mi./hr Windspeed
- Dry Leaf wetness (tripod-mount)

Weather observations and summaries
- Overnight temperatures/ hours below freezing
- Rainfall comparisons for Region
- Temperature, rainfall and degree-day summary
- Rainfall comparisons last 5 years at this station
- Soil conditions
- More weather for this station

Degree-day tools
- Current degree day maps
- Degree Day accumulations for Region
- Degree Day accumulations for Region (alfalfa and corn development)
- Average degree day summary
- Temperature, rainfall and degree-day summary
- Degree day comparisons: Compare 2 sensors
- Degree day comparisons: last 5 years at this station
- Degree day comparisons: last 5 years at this station (alfalfa and corn)

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Cherries
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- Michigan State University AgBio Research
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Join our supporters.
Station: swmrec
Station ID: swm
Location: MSU Southwest MI Research & Extension Center
City: Benton Harbor
Latitude: 42.0841 deg.
Longitude: -86.3570 deg.
Elevation: 220 m
Hands-On Exercise
Using Enviro-weather Data

1. Divide into Teams of 2 to 3 people
2. Each team log onto www.enviroweather.msu.edu
3. Each team select a weather station
4. Go to “more weather for this station”
5. Select “Custom Reports” → “Select Data Type” → ”Daily Data”
6. Click on “precipitation” and “reference potential evapotranspiration” (plus any other data you would like).
7. Select date range (April 1 – Aug 31, 2012).
8. Choose “csv” output
9. Click on “generate report”