The Iowa Environmental Mesonet

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Outline:

- Motivations for our Mesonet
- IEM Component Networks
- 'Super-charging' Networks
- Working with the NWS
- 411 on the KELO WeatherNet
- IEM Applications
- Conclusions / No Questions
Motivations

• The baseline NWS/FAA ASOS network is not spatially or temporally dense enough to resolve many mesoscale phenomena.

• Building a new observational network is very expensive.

• Building a mesonet of existing networks increases the value, use, and awareness of each member network.
The need for a mesonet

You are a forecaster at the Des Moines WFO. It is 9PM on 8 May 2003. It is dark, so spotters may not be able to help.

What surface observing resources are available to give you situational awareness?
The need for a Mesonet

The baseline ASOS network provides you with hourly and some sub-hourly updates. The storm system is moving fast, so issuing timely warnings relies on timely current data.
The need for a Mesonet

The Iowa Mesonet collaboration increases your resolution of the near storm environment.

Whoaaa! Dude, where is my RADAR?
What the Mesonet provided

Newton School
0.6 in / 15min

Various sensors indicating non-severe winds with these cells

Most importantly, 51 realtime sensors recording rainfall just for the DMX CWA.
IEM Component Networks
ASOS - Automated Surface Observing System

- Sites
  - 15 +2 (CWI+FOD)
- Location
  - Primary Airports
- Purpose
  - Support aviation
AWOS – Automated Weather Observing System

- Sites
  - 35 +2 (CWI+FOD)
- Location
  - Smaller Airports
- Purpose
  - Support aviation
RWIS – Roadway Weather Information System

• Sites
  - 49 Online

• Location
  - Along major roads near bridges

• Purpose
  - Road maintenance support in winter
DCP – Data Collection Platforms

- Sites
  - 161

- Location
  - Along rivers

- Purpose
  - Monitor river stages
SchoolNet
(KCCI-TV & KELO-TV)

- Sites in Iowa
  - 55 (84 total)
- Locations
  - Roofs of schools
- Purpose
  - Support local science curriculum
NWS COOP – Cooperative Observing Program

- **Sites**
  - 145

- **Locations**
  - Backyards, fields, about anywhere

- **Purpose**
  - Climate and hydro monitoring
ISU Ag Climate Network

- Sites
  - 12
- Location
  - Open areas near research farms
- Purpose
  - Support Ag activities at the farms
SCAN – Soil Climate Analysis Network

- Sites in Iowa
  - 2
- Location
  - Fields
- Purpose
  - Monitor soil conditions
### Data Processed Daily

<table>
<thead>
<tr>
<th>Network</th>
<th># of Sites</th>
<th>Obs/Site/Day</th>
<th>Obs/Day</th>
<th>Obs/Year</th>
</tr>
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<tr>
<td>ASOS</td>
<td>15</td>
<td>24</td>
<td>360</td>
<td>131,400</td>
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<tr>
<td>AWOS</td>
<td>37</td>
<td>1,440</td>
<td>53,280</td>
<td>19,447,200</td>
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<tr>
<td>IA NWS COOP</td>
<td>145</td>
<td>1</td>
<td>145</td>
<td>52,925</td>
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<tr>
<td>DCP</td>
<td>161</td>
<td>48</td>
<td>7,728</td>
<td>2,820,720</td>
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<tr>
<td>ISU AgClimate</td>
<td>12</td>
<td>24</td>
<td>288</td>
<td>105,120</td>
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<tr>
<td>RWIS</td>
<td>49</td>
<td>144</td>
<td>7,056</td>
<td>2,575,440</td>
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<tr>
<td>SCAN</td>
<td>2</td>
<td>24</td>
<td>48</td>
<td>17,520</td>
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<tr>
<td>IA SchoolNet</td>
<td>55</td>
<td>1,440</td>
<td>79,200</td>
<td>28,908,000</td>
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<tr>
<td>Misc/Other/RAWS</td>
<td>3</td>
<td>24</td>
<td>72</td>
<td>26,280</td>
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<tr>
<td>Non-Iowa SchoolNet</td>
<td>29</td>
<td>1,440</td>
<td>41,760</td>
<td>15,242,400</td>
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<tr>
<td>Non-Iowa ASOS</td>
<td>400</td>
<td>24</td>
<td>9,600</td>
<td>3,504,000</td>
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<tr>
<td>Non-Iowa COOP</td>
<td>1,000</td>
<td>1</td>
<td>1,000</td>
<td>365,000</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>1,908</strong></td>
<td><strong>200,537</strong></td>
<td><strong>73,196,005</strong></td>
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</tr>
<tr>
<td></td>
<td>Average</td>
<td>Maximum</td>
<td></td>
<td></td>
</tr>
<tr>
<td>--------------------------------</td>
<td>---------</td>
<td>---------</td>
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<td></td>
</tr>
<tr>
<td>Visits per day</td>
<td>500</td>
<td>3,500</td>
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<tr>
<td>Hits per day</td>
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<td>750,000</td>
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<td>Megabytes transferred per day</td>
<td>800</td>
<td>2,500</td>
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<tr>
<td>Pure Data Downloads / day</td>
<td>50</td>
<td>100</td>
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</tr>
</tbody>
</table>

While website stats are nice, the IEM is much more than just another weather data website!
'Super-Charging' Networks
Value Added Processing

- Too many folks just collect data from network X, use data in application Y
- We make major efforts to help the various networks out.
  - Routing their own data back to them
  - Routing other data to them
  - Website application development
  - Archiving services (download, analysis)
  - QUALITY CONTROL!!!
Why work with the networks?

- Network operators are typically lacking
  - IT support
  - An on-staff Meteorologist (a bad thing?)
  - QC expertise
- We give the networks a reason to keep sending us their data.
- We build up their user base to increase the value of their network.
IEM Tracker

• 9,000 trouble tickets have been generated since June 2002.
• All data outages documented.
• Very helpful for the SchoolNets
• Need to make tickets more visible on the website.

21 Nov 2003: NWS WFO FSD
http://mesonet.agron.iastate.edu
IEM Data Partnerships

On-Air Image generated by KCCI-TV showing IaDOT owned Roadway Weather Sensor (RWIS) information.
Working with the NWS
Automated AWIPS Wind Alerts

Des Moines NWS Forecasters using an automated wind alert from the SchoolNet. (Craig Cogil & Gary Forester)

21 Nov 2003: NWS WFO FSD

http://mesonet.agron.iastate.edu
Current/Archived RADAR

- 5 minute composites since 4 Jun 2003
- DMX displays current loop on their projection system during severe weather
- Useful for building animations for presentations (hint-hint)
- Will backfill archive as requests are made
Formatting Data for AWIPS

- Generate LDAD csv files of RWIS data
- Generate LDAD csv and SHEF encoded of School data
- Wind alerts trigger AWIPS bell
- All routed directly to LDAD via LDM
- FSD currently gets LDADcsv, SHEF, and wind alerts of KELO SchoolNet
Network Metrics

- 35 sites
- Each site reports: Air Temp, Humidity, Pressure, **Instantaneous** Winds, Rainfall (not heated), Solar Radiation
- Two subnetworks
  - Older Texas Weather Instruments
    - Report every 6-10 seconds
  - Recent addition of Peet Brothers sites
    - Report every minute
Network Topology

[Diagram of network topology with labels such as SchoolSite, Instrument, Internet, Iowa Comm Network, Barons Services, Iowa Environ Mesonet, KCCI/Iowa Mesonet/NWS, SchoolNet Relay, NWS LDAD, AWIPS, and Barons Services.]
Website Functionality

Current Sortables

Where's it raining?

Data Download

1 minute data traces

Data

Download

1 minute data traces
Current Sortables

- Variable sorting
- Dynamically updates
- Add to 'My Favorites' for a custom listing of IEM sites
- Dynamic spatial plots of any variable
- Replicated On-Air display for any single site
Where's it raining?

- 'Live' WeatherNet 15 minute rainfall amounts with NEXRAD base reflect
- Applications
  - Virga detection
  - QC sites
  - Flash Flood Guidance
  - Situational Awareness

http://mesonet.agron.iastate.edu
1 Minute Data Traces

- Dynamically generated with the latest obs or archived data
- So much variability!
Hourly data

Temperature  Dew Point  Solar Radation
1 minute data!

Temperature  Dew Point  Solar Radation

Temperature
Dew Point
Solar Radation
IEM GIS Applications
3-4 June 2002 Flooding

CID Airport: 1.16 in
NEXRAD Est: 2 in

Downtown Cedar Rapids: < 9 in
NEX: 7+ in

DBQ: 5.96 in
NEX: 7+ in
IEM RadView

- Effort to provide real-time RADAR data into GIS
- First publicly accessible NEXRAD WMS
- Mapserver HOWTO
OGC Web Services

- Open GIS Consortium (OGC) develops standards for GIS systems to inter-operate
  - Web Map Service (WMS)
  - Web Feature Service (WFS)
- Dynamically bring in Ortho Quads from the ISU GIS Lab
- All generated with Open-Source software and Open GIS standards

Map Type: Digital Ortho Quads

DECORAH

Zoom Level: (near) 1 2 3 4 5 6 (far)

Note: While the white dot marks the location of our latitude and longitude measurements, the actual station location could be anywhere within the limits set by the white box. Depending on the accuracy of the location measurements, it is feasible that the actual station location is outside the box.

Image Generation provided by Iowa State GIS lab
Iowa RADAR comparison

- Compare base reflectivity from the 8 RADARs we collect data from

- More GISish App
  - Click interface
  - Distance calculation
  - KCCI reprojected
NWS Warnings + NEXRAD

- Loop GIS layers to produce an interesting animation of warnings and NEXRAD product
- Works nationwide!

21 Nov 2003: NWS WFO FSD

http://mesonet.agron.iastate.edu
IEM Freeze

- Combine
  - RWIS pavement temperatures
  - IEM air temperatures
  - RADAR composite
- A GIS interface for custom views
- Feedback needed!
Fun with COOP data
Climatological Differences

- Interactively query the NWS COOP climate database.
- Example, compare daily temperature climatology versus what actually happened that year!

[Graph showing temperature comparison over a year]
Daily Temperature Spreads

- Accumulate all high / low temperatures for a day and produce a histogram
- Dynamically generated on the website
Historical GDD data

- Dynamically generate GDD, SDD from the COOP climate archive
- Customized Period
- Dynamically generated output plot.
- GIS Ready dataset presented immediately below
Time for WEB demos?
I'm done, questions?

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