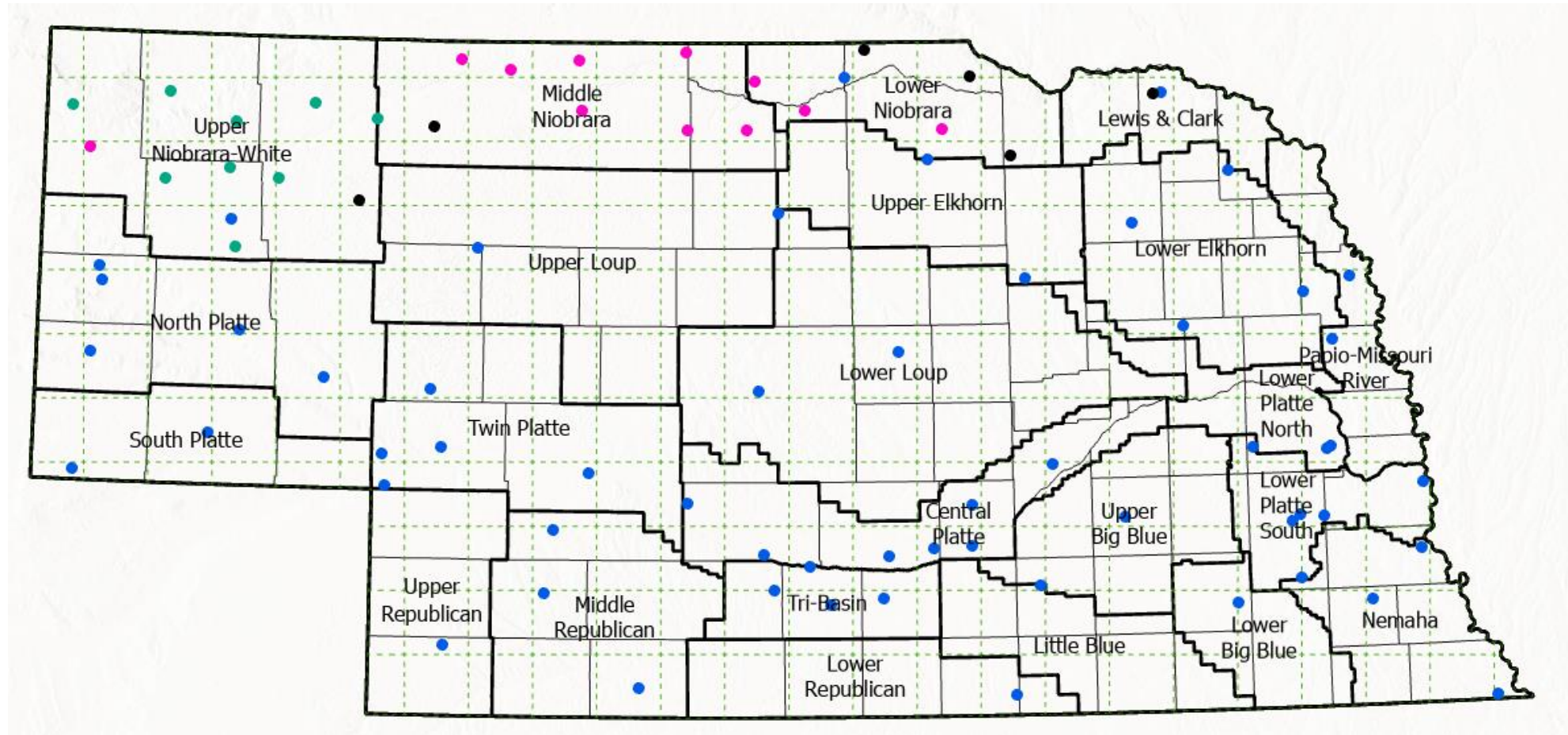


An Update on the Expansion of the NE Mesonet

2024 Nebraska Association of Resource Districts Legislative Conference



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The NE Mesonet
It's more than weather data...

**Critical Infrastructure
for ALL Nebraskans**

What is a “Mesonet”?

- Network of weather stations
- Takes weather observations at a scale or resolution of ~ 20km.
- Name comes from “mesoscale” atmospheric phenomenon

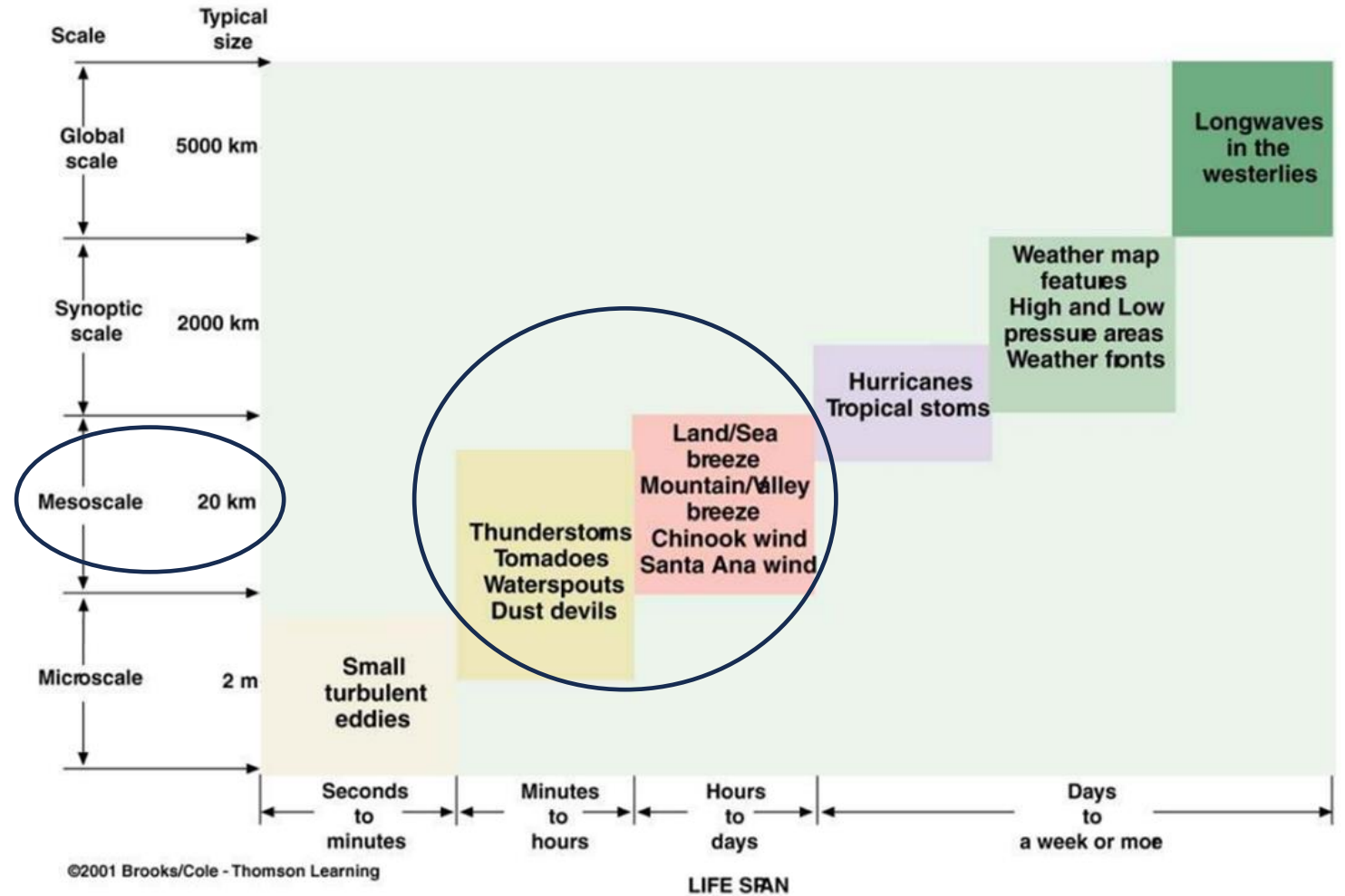


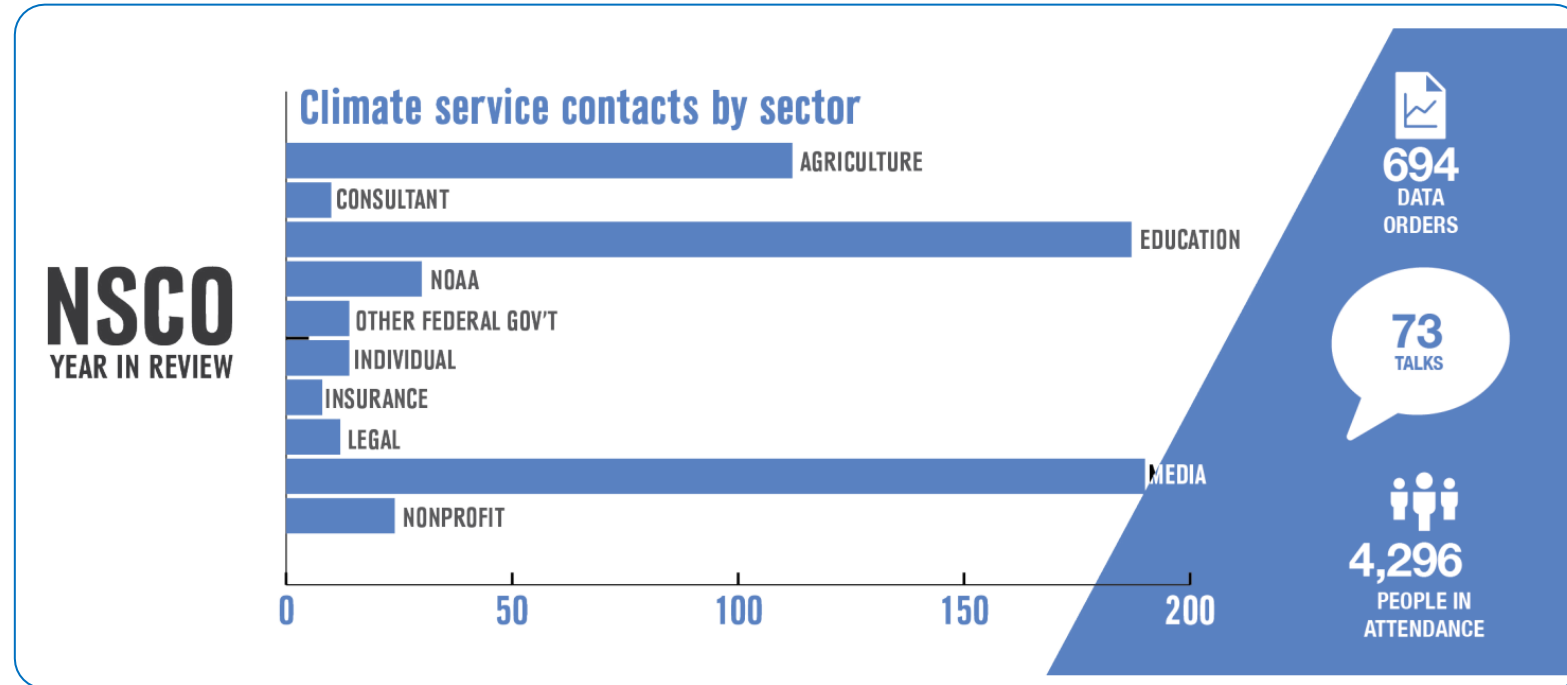
Table 7.1: Scales of atmospheric motion

MISSION

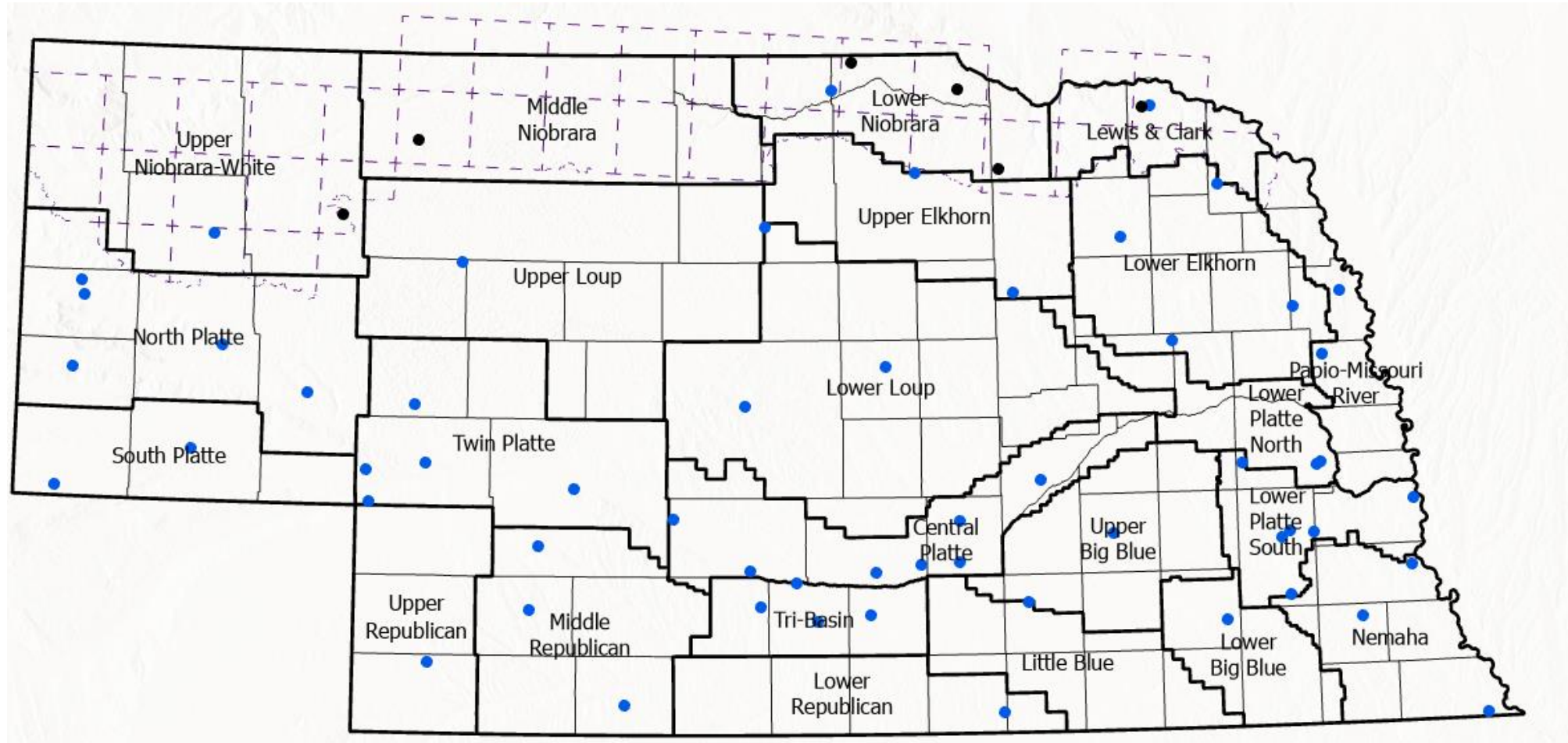
Deliver science-based weather and climate information for decision-making.

OBJECTIVES

- Provide high quality and timely services.
- Engage stakeholders to understand needs.
- Operate a statewide weather network.



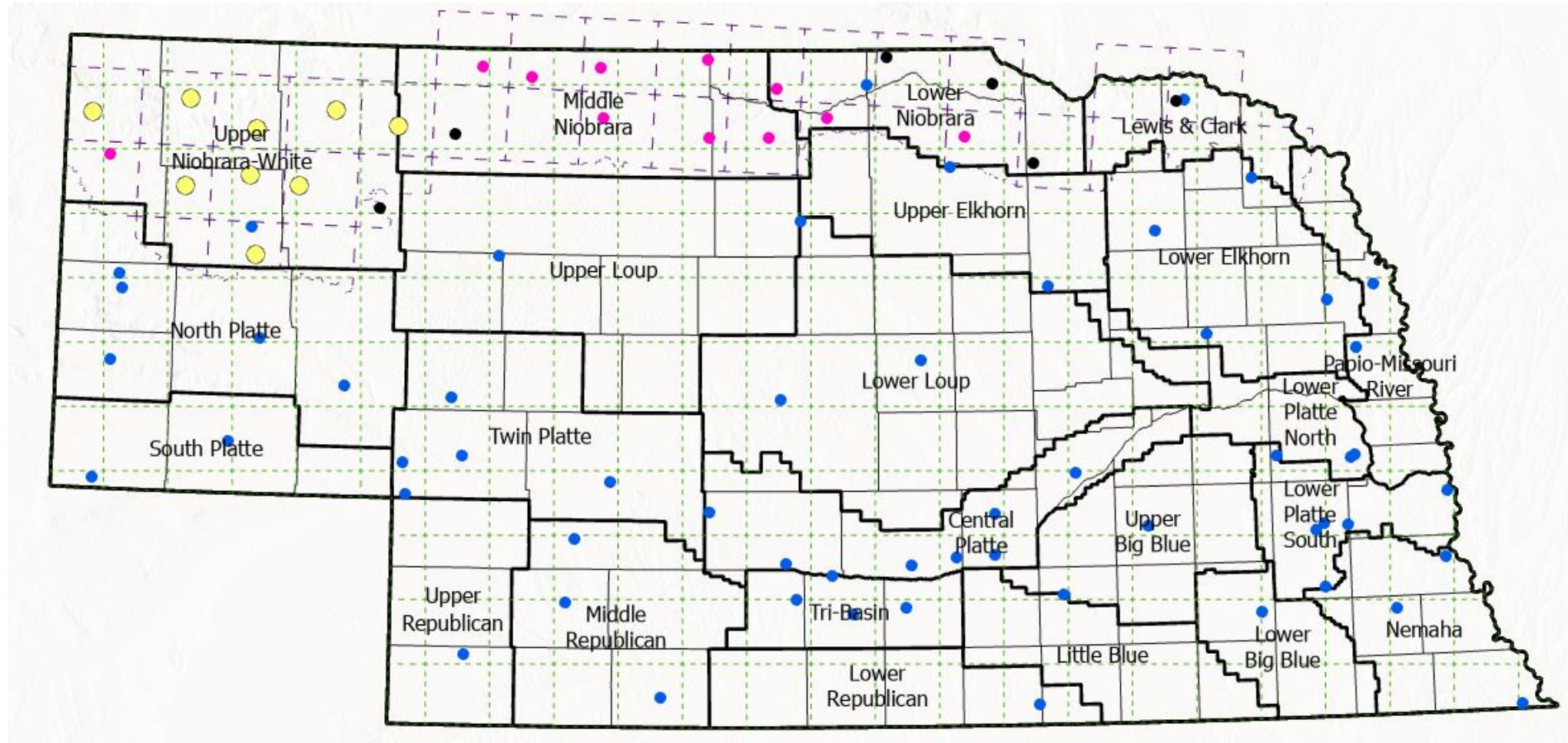
Current State of the NE Mesonet



BLUE – 57 currently active NE Mesonet stations (47 sponsored)

BLACK – 6 United States Army Corps of Engineers funded stations (installed 2023)

Goals of the NE Mesonet



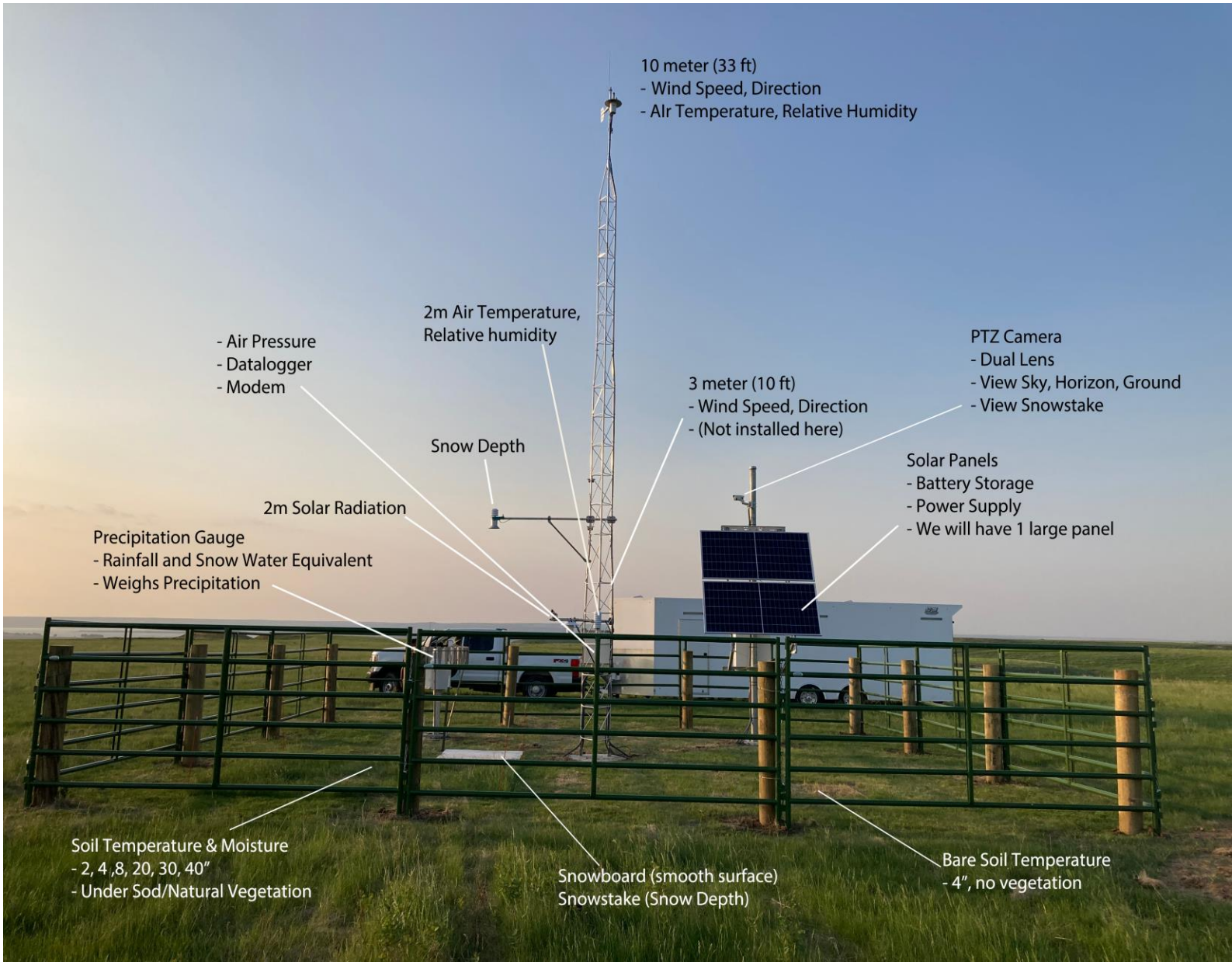
- 35 stations funded by USACE Upper Missouri River Basin Project (yellow = 2024 installs; purple = 2025)
- One station/1000km²; total of 200 stations through Nebraska (one site/**green** dashed grid cell)

What does a typical NE Mesonet station look like (currently)?

- 3-meter tripod
- Air temperature (2m)
- Humidity (2m)
- Wind speed (3m)
- Wind direction (3m)
- Warm season precipitation
- Solar radiation
- Soil temperature
10cm, bare ground
- Soil moisture
10, 25, 50, 100 cm, grass
- Barometric pressure



What would a fully developed NE Mesonet consist of?

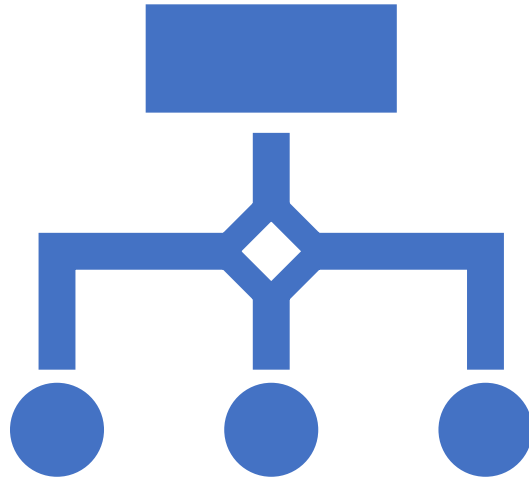


Why build a Mesonet when other data is out there?

- **Consistent, Top of the line data quality and availability.**
 - Regular sensor and station maintenance is performed
 - Data quality control is regularly performed
- **Mesonets are an “all-purpose” network, not made for a specific entity**
 - High station density – LOCAL data is needed!
 - Modern State Mesonets are never built as a “fill the gap” measure
 - Mesonets are their **own, complete, network**. ASOS/AWOS/RAWS are their own complete networks, as well. But, their purpose is significantly different, meaning their value for the average consumer is limited.
 - Mesonets provide **consistency and quality** in their methods, installations, data, etc.
 - Mesonets are becoming a staple in the NWS and forecasting sector. As COOP sites are steadily decreasing in number, Mesonet observations are a necessity for NWS offices.
 - Mesonet Stations are often a “One Stop Weather Shop”, becoming more so all the time
 - Serve as vital infrastructure and research platforms for many states

Data, Data Everywhere!

- Once fully built-out:
 - 8.5 million observations per day!
 - 200 stations, 30+ separate variables, 1 minute resolution
- How will all this data get used?
 - Online Data Tools
 - Desktop and Mobile
 - NE Mesonet, HPRCC, NDMC, etc
 - Many specific purposes
 - Data sent to organizations that use it for their purposes
 - NDMC/National Drought Monitor
 - National Weather Service
 - High Plains Regional Climate Center
 - Many others (Forest Service, Power Districts, etc)

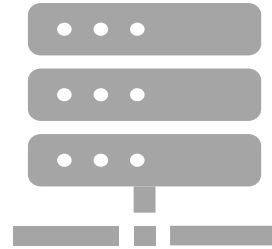


Why build a Mesonet when other data is out there?



Value Added Tools/Products

crop water use, heat index maps, climatologies, drought conditions, etc.



Mesonets are Upgradeable

Upgraded and changed as new technologies are developed

- Sensors can be added/changed easily, network-wide
- websites and data access tools keep up with new data needs



Mesonets are “Consumer Friendly”

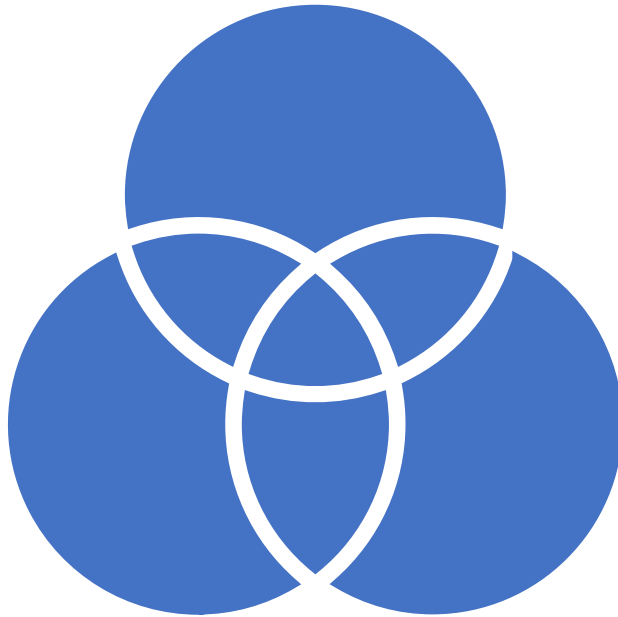
Data is accessible, made to be used by public/private org.’s
Variables measured, “near real time”, data formats, etc



Goal: No person in NE > 15 miles from a Mesonet Station

- Document severe weather events – often occur on scales ≤ 15 miles
 - Hail, severe wind, tornadoes, icing, etc.
- High precipitation and soil variability through state – especially summer precipitation
 - Local data needed!
 - Irrigation, planting, harvesting, water/land management, emergency response, etc.
 - ROI is proportional to accuracy of data
- Predictive accuracy – precise data required for weather forecasting, fire weather conditions, heat indices, road closure, etc.
- Industry standard – American Association of State Climatologists recommends one station/1000 km²

Building for the Future: Not just Weather



- Weather is the mainstay for any Mesonet. But, as technology progresses, their scope is becoming larger.
- **“Environmental Monitoring Networks”** encompass a wider range of observations.
- Soil Moisture and Temperature (already pretty common)
- Air Quality (remember the smoke we had earlier this summer?)
- Precipitation Typing (snow, sleet, hail, etc)
- Atmospheric Profilers (used by NWS for forecasting)
- Black Globe Temperature Sensor (*Wet Bulb Globe Temperature, Cattle Comfort Index*)
- A new suite of observation capabilities will become available over the next 10 years.
- A carefully planned Mesonet will be able to take advantage of these, adding to the long list of benefits a Mesonet already provides.

Return on Investment

- ROI Studies for Mesonet data are rare
 - not straightforward to convert weather data available to dollars.
- However, one excellent example of a Mesonet ROI investment Study exists:

Ziolkowska, Jadwiga R.. "Economic value of environmental and weather information for agricultural decisions – A case study for Oklahoma Mesonet." *Agriculture, Ecosystems & Environment* (2018)
- University of OK Mesonet Economic ROI Study
 - 3.7% of CROP producers profitability was based on access to OK Mesonet weather data
 - 73% of producers using the data across the state
 - Average annual value of the data (2006 – 2014):
 - **\$20M/yr**
 - Crop producers only



Return on Investment

- Nebraska's crop value is 9 times that of Oklahoma's (2022)*
- Farm sector financial indicators, State rankings (usda.gov);
- A simple extrapolation means that potential value of the Nebraska Mesonet to state crop producers is:
 - \$180M/yr! (on average)
 - Total NE Crop Receipts: \$16.18B
 - In extreme years (ex., 2023), value of Mesonet data is higher
- What happens when livestock is added?
 - NE Livestock Value of \$15.6B – just under crop value; USDA (2022)
- *https://data.ers.usda.gov/reports.aspx?ID=17839#P227b1b9852f1459e853f64a038f6c6a3_2_185it0R0x6

Recent Mesonet Funding Updates

- January 5, 2024
 - Senator Myron Dorn hosted a briefing at the Capitol in Lincoln, NE
 - Mesonet manager presented to 14 senators and/or their staff
 - Very positive feedback and interaction with all attendees
 - Senator Myron Dorn plans to ask for \$1M O&M funding for next two years
 - hire and train technicians
 - fix stations that need it
 - purchase required equipment
 - update mesonet website
 - prepare solid foundation for full expansion
- Grants/proposals in progress
 - National Forest Service (25 stations w/air quality and fire weather data tool)
 - Building Resilient Infrastructure and Communities (BRIC – 8 to 12 stations)
 - USDA (10 stations, including impact study)

What does a station cost to build and maintain?

- Construction and Installation (C & I; 2024)
 - \$43,240
- Operation & Maintenance
 - \$6000/year
 - Calculation: C & I / average lifetime of sensors (8 years) = \$5400
 - add travel and payroll @ \$600/yr

Why does a weather station cost this much?

A: Just like anything else, you get what you pay for.

Weather stations take a beating.

- need to be constructed solidly
- this includes instrumentation and sensors

Power supply and instrumentation will last 8 –10 years given proper maintenance.

Station tower, concrete, etc will last decades.

- Try that with a DTN or Davis or Hobo or something similar 😊

Data quality and reliability is top notch.

Final Thoughts on the NE Mesonet

- Make it a model network among all Mesonets in the country
 - station density, variables measured, data quality and reliability
 - data tool development, data access options
 - not just weather, but an “environmental monitoring network”
- A key, permanent component of NE infrastructure
 - provide key data for a huge variety of end users
 - increase the reliability of current and future infrastructure
 - build with access to LOCAL data in mind – for ALL NE Residents
 - the return on investment is HUGE
 - even if some is through “ripple effects”
 - even if putting a \$ value on everything is difficult
 - Build for the Future (decades to come)

Current NRD Sponsors – Thank you!

- **Central Platte Natural Resources District**
- **Lower Elkhorn Natural Resources District**
- **Lower Loup Natural Resources District**
- **Lower Niobrara Natural Resources District**
- **Lower Platte South Natural Resources District**
- **Nemaha Natural Resources District**
- **Papio-Missouri River Natural Resources District**
- **Upper Big Blue Natural Resources District**
- **Upper Niobrara White Natural Resources District**