

Improving Meteorological Measurements at Kansas Mesonet Weather Stations to Assist with Herbicide Drift Monitoring

August 2019 Progress Update (and Final Update below).

Updated: 4/14/19

- **May 2019:** Rossville and Silver Lake weather station installations complete and data began quality control processes (Figure 1).
- **June 2019:** Both weather stations were added to the webpage with data readily accessible to all local land owners and users.
- **July 2019:** Twelve presentations were given based on inversion data available from these locations to producers and K-State agronomy students.
- **August 2019:** Ribbon Cutting Ceremony at Rossville 2SE station (Figure 4).

All project activities were completed on schedule.



Figure 1. Left, Rossville 2SE station viewed from the south. Right, Silver Lake 4E station from the east - being shown to visiting students from India.

Final Report

- **Project results:**

- Four weather stations within the soybean regime of Kansas (Hutchinson 10SW, Scandia - now Belleville 2W, Rossville - now Rossville 2SE, and Silver Lake - now Silver Lake 4E) were updated during the period of this project as anticipated. All four of these observing stations now measure the presence of inversions within locale K-State Experiment Fields for future research and are available to the public.
- **Deliverables/Performance Metrics:**
 - Four stations were installed to provide additional coverage of inversion data in Kansas.
 - Data is provided, realtime, through the Kansas Mesonet's webpage: mesonet.ksu.edu (Figure 2). This data provide users with both current and historical inversion data aimed to prevent spray drift issues.
 - Presentations and numerous outreach events occurred/planned to educate producers, agencies, and spray applicators on weather conditions conducive to spraying and utilization of the new weather data as a guidance tool.

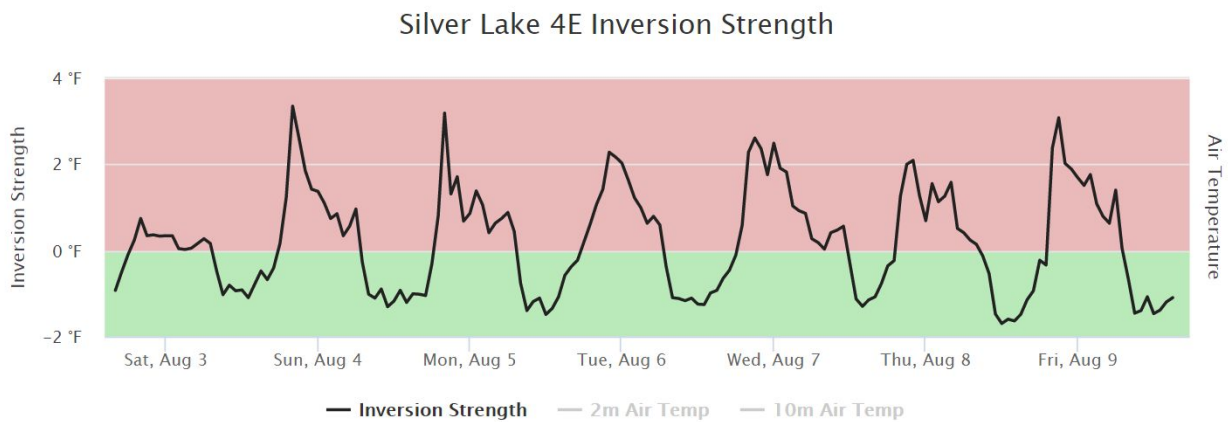


Figure 2. Chart from Silver Lake 4E showing nightly presence of inversions over the last seven days. A critical tool for local sprayers. Data from: mesonet.ksu.edu/agriculture/inversion

- **Findings:**
 - Inversions occur daily at all locations. Inversions typically develop an hour before sunset and persist until an hour after sunrise. All four station upgrades (Hutchinson 10SW, Belleville 2W, Rossville 2SE, and Silver Lake 4E) are representative of the region and not influenced by micrometeorology (trees, buildings, unrepresentative terrain, water sources). Therefore, data suffice as a guidance tool to sprayers in the region prior to application - however, data remains not a replacement for in the field measurements still required by labeling. This tool is provided online for anyone with internet access (Figure 3).

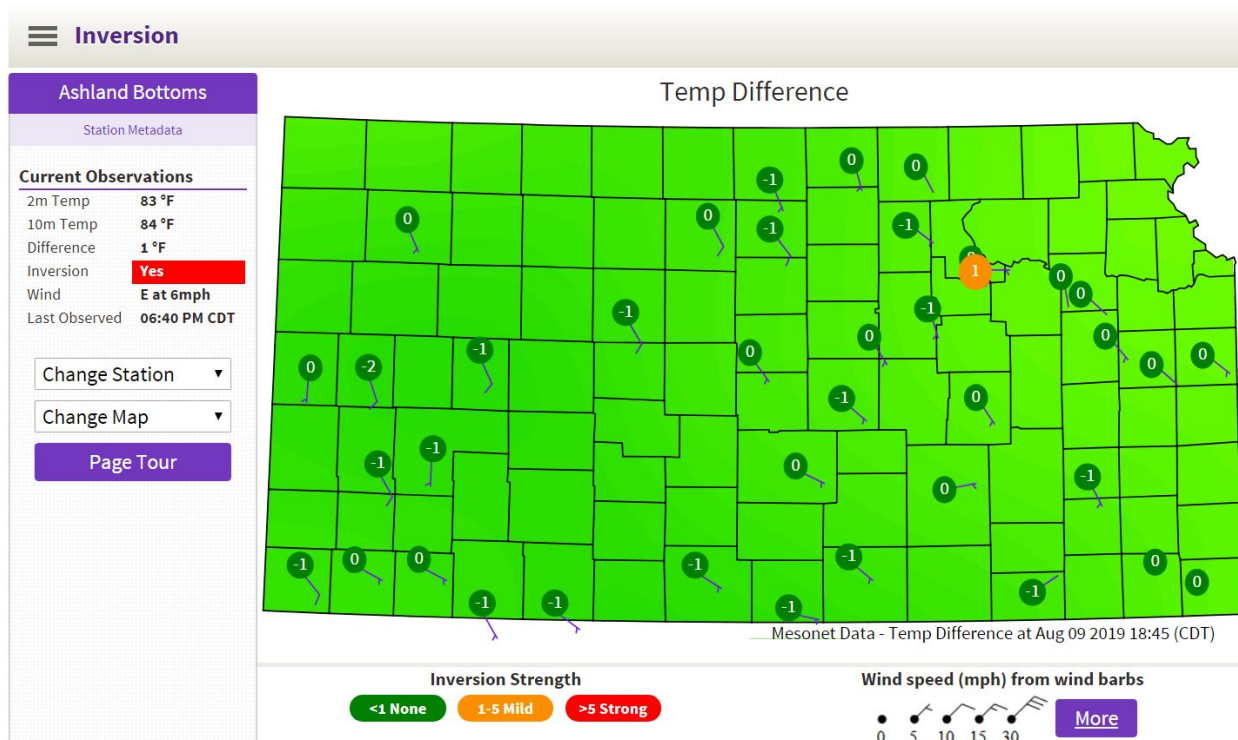


Figure 3. Real-time data available graphically for users. Above shows a localized inversion at Ashland Bottoms station an hour and a half before sunset. Data from: mesonet.ksu.edu/agriculture/inversion

- **Presentations:**

- August 21, 2018 - Belleville Field Day
- October 29, 2018 - Wichita Applicator Training
- November 4, 2018 - Presentation to K-State Students
- November 5, 2018 - Salina Applicator Training
- November 18, 2018 - Olathe Applicator Training
- December 5, 2018 - North Central Weed Science Meeting (Milwaulke, WI)
- February 13, 2019 - Groundwater Management District #4
- March 19, 2019 - Seneca Special Interest Group
- March 27, 2019 - Noxious Weed Sprayer Training
- July 15, 2019 - Jetmore Area Producers
- July 24, 2019 - Protection Area Producers
- August 13, 2019 - Rossville Ribbon Cutting Ceremony (Figure 4)
- August 13, 2019 - Rossville Field Day
- August 21, 2019 - Ottawa Field Day
- August 27, 2019 - Tribune Field Day
- September 4, 2019 - Northwest Technical College - Water Tech Field Day
- September 5, 2019 - T&O, Roth Farm - Water Tech Field Day
- September 5, 2019 - Liberal - Water Tech Field Day

- September 6, 2019 - Kansas Prescribed Burn School
- September 10, 2019 - Troy - Water Tech Field Day
- September 20, 2019 - Manhattan Field Day
- October 29, 2019 - McPherson Spray Applicators Class
- October 30, 2019 - Scott City Spray Applicators Class



**Figure 4. Rossville 2SE Ribbon Cutting Ceremony on August 13, 2019.
Photo from the National Weather Service.**

- **Benefits to farmers and other researchers:**
 - Data is now available real-time for producers/sprayers to utilize in advance of spraying (Figure 3). This guidance tool aids in making better decisions to avoid off target drift issues. Measurements collected have already been utilized by numerous agencies to examine off target impact cases. Data is also providing a platform for K-State researchers to carry out their research on nearby Experiment Fields. With crop studies focused at these locations, it provides an ideal location to examine drift and potential impacts due to inversions. Numerous presentations (and future discussions) continue to disseminate this important guidance tools to producers and agencies.

Previously Reported Project Details

- Project Summary (project goal):
 - This project would fund four station upgrades: Hutchinson 10SW, Scandia, Rossville and Silver Lake weather stations. These upgrades would be completed by the end of the first year. After the upgrade, data will be tested internally for quality control/assurance for two months and the stations become operational on Kansas Mesonet website (mesonet.ksu.edu). This data will be accessible free of charge to the public, government, and the private sector. Data will also be available via the Mesonet REST API and incorporated into the inversion monitoring tool. Upon completion, the data will be available for on-farm research at the respective locations. The associated research will provide additional insight to inversions, their timing, strength, and impacts on spraying via either physical drift or volatilization. This data will be disseminated through publications, outreach events, and various other KSRE publications.
- Project Objectives:
 - Develop a platform for monitoring temperature inversions, by utilizing temperatures at two heights, and for supporting spray volatilization research through upgrading Kansas Mesonet weather stations located on Kansas State University Research and Extension (KSRE) Experiment Fields.
- Project Deliverables: (deliverable and key performance indicators.)
 - Upgrade four mesonet stations.
 - Four Kansas Mesonet weather stations located at KSRE Experiment Fields will be upgraded: Hutchinson, Scandia, Rossville and Topeka (Silver Lake). These field research facilities currently have shorter 10 feet-high weather station towers with temperature measurement at only one height: 6 foot. To measure the presence of inversions, two temperature sensors are needed at different heights (Enz et al., 2014). On the Kansas Mesonet stations this is achieved at 30 and 6 feet, coinciding with wind speed and direction measurements. These observations provide valuable insight to the stability of the lower atmosphere, closest to the surface. This installation process entails removing the current tripod completely and installing an entirely new tower/equipment in replacement.
 - Application of the data.
 - Labeling on several herbicides have begun to consider temperature inversions in their restrictions for spraying (Monsanto Company, 2016). However, the procedure to verify inversions present, it is not easily achieved in the field. Therefore, the data provided at these weather stations will be incorporated into the Kansas Mesonet Inversion Monitor webpage: mesonet.ksu.edu/agriculture/inversion. This will provide real-time (updated every five minutes) inversion monitoring for research on the farms, where herbicide applications are often tested. This data also will be readily available to the public using the Kansas Mesonet current

infrastructure. Implementing this upgrade will also create a historical data record available for the region for supporting of herbicide drift/volatilization and climatology studies.