

Smart Agriculture Research

2022 Summary: Validation of Wind, Temperature, Rain Sensor Readings and Forecast Accuracy of the Tempest Weather System

INTRODUCTION

Olds College Centre for Innovation (OCCI) completed an evaluation of the Tempest weather station for TELUS. The evaluation explored the accuracy of the weather station's measurements in comparison to other devices, and assessed its 10-day forecast accuracy. Additionally, a literature review was conducted to explore proper weather station placement and define the economic decisions based on localized weather data on farms.

OBJECTIVES

- Validate the accuracy of wind, temperature and rainfall measurements reported by the Tempest weather station against other weather stations including ACIS (Alberta Climate Information Service).
- Assess the accuracy of the Tempest 10-day forecast against its own measurements.
- Literature review outlining:
 - Spatial distribution and ideal placement for on-farm weather stations in dryland, irrigated and livestock operations.
 - List farm management decisions specific to dryland broadacre agriculture production that make use of localized weather data.

STUDY DETAILS

Tempest station installed within the Weather Station Array of the Olds College Smart Farm in April 2022 accompanied with 3 scientific rain gauges.

Sensor measurement evaluation:

- April 15 - Aug. 30, 2022

Forecast accuracy assessed:

- June 16 - Aug. 30, 2022

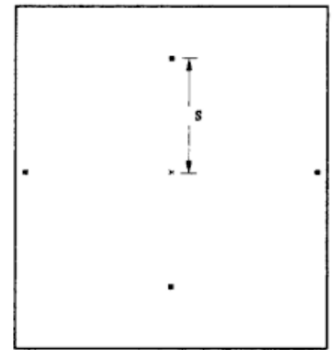
RESULTS: LITERATURE REVIEW

To collect correlated data between weather stations for the following parameters, devices should be installed within the respective distances:

- Temperature: 100 km or less
- Wind: 20 km or less
- Precipitation: 10 km or less

Utilizing a standardized scorecard to evaluate placements, by installing weather stations in locations with similar ratings, the quality of data will be more uniform and comparable.

Optimal placement of multiple weather stations to create a weather station network is 4 stations installed in a diagonal pattern around the point of interest (shown right).



Ashraf, M., Loftis, J. C., & Hubbard, K. G. (1997). Application of geostatistics to evaluate partial weather station networks. *Agricultural and Forest Meteorology*, 84(3-4), 255-271.



Learn more at oldscollege.ca/SmartFarm

Smart Agriculture Research

2022 Summary: Validation of Wind, Temperature, Rain Sensor Readings and Forecast Accuracy of the Tempest Weather System

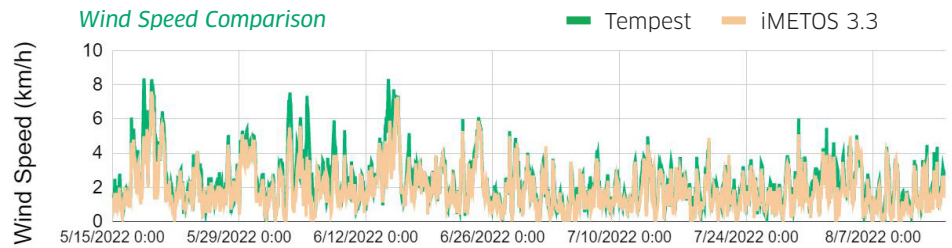
RESULTS: SENSOR ACCURACY

Wind Direction

- The mean difference between the ACIS and Tempest weather station was 19.49 degrees.

Wind Speed

- The Tempest weather station had a mean difference of 8.6 km/h slower than the ACIS weather station.
- Difference between the iMETOS 3.3 and the Tempest weather station was +/- 0.45 km/h.



Temperature

- The difference between the Tempest and ACIS weather station was +/- 1.2°C.

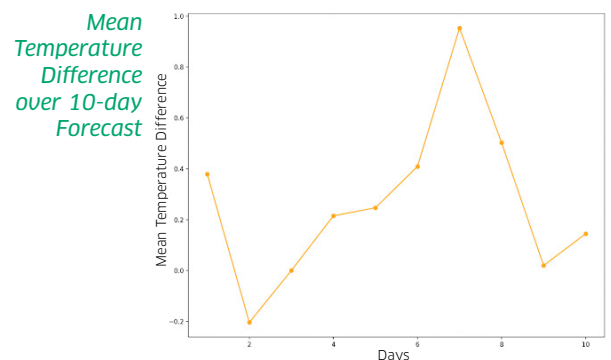
Precipitation

- Measurements of individual rainfall events and season accumulation were considered to be reasonable to the OCCI research team.
- During the end-of-season data analysis, it was identified that a calibration of the Tempest weather station was available to further improve the accuracy of future rainfall measurements. Olds College provided the 2022 season precipitation data to TELUS and Tempest to perform the calibration.

Forecast

Tempest forecast model accuracy difference in daily average:

- Temperature across 10 days: < 1°C
- Temperature maximum/minimum is approx. 1.2°C and 0.7°C respectively
- Rainfall across 10 days: < 0.1 mm
- Wind speed across 10 days: < 2 km/h
- Wind direction during first 4 days of forecast: < 35 degrees
- Wind direction across 10 days: within 90 degrees



FUTURE RESEARCH

The evaluation of the Tempest weather system is complete. The Tempest will remain installed as a part of the Olds College Weather Station Array to provide the research team an additional set of weather data, and source for local weather forecasting.

