1. Title Slide

<u>Title</u>: Assessment of SCaMPR and NEXRAD Q2 Precipitation Estimates with Oklahoma MESONET Observations

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<u>Topics:</u> (From the poster topic list on the web page)

Hydrology

<u>Program:</u> (AWG, GOES-R3, JPSS RR/PG, Proving Ground, Training, etc)

GOES-R3

2. Introduction

- **In our previous studies (Xiquan Dong's presentation/poster in 2011 and 2012 GOES-R3 meetings), we found that GOES-R SCaMPR precipitation estimates underestimate for DCS convective cores and overestimate for stratiform regions when compared to NEXRAD Q2 precipitation estimates.**
- **These problems with the GOES-R precipitation estimates arise because the estimates are primarily based on cloud-top IR brightness temperatures, which can be the same for both convective cores and non-precipitating anvil clouds.**
- **In this study, SCaMPR (Kuligowski 2002) and NEXRAD Q2 precipitation estimates are compared to a dense precipitation gauge network (OK MESONET) to quantitatively evaluate the quality of these estimates and identify potential biases.**

3. Methodology/Expected Outcomes

- **The Q2 precipitation estimates are collected and collocated with 120 OK MESONET stations. The SCaMPR estimated precipitation was also compared to the MESONET precipitation observations.**
- **Time period: From January, 1st, 2010 through December, 31st, 2011.**
- **It is expected that Q2 estimates will be a good representation of ground truth, but with relatively large uncertainties in some regions, such as DCS convective cores and areas of poor coverage (Zhang et al. 2011).**
- **It is also expected that SCaMPR estimates will have some biases or uncertainties and will not replicate the detail in spatial precipitation distribution that is apparent from the MESONET observations and Q2 estimates.**
- **The Q2 estimates will be adjusted based on the comparison with OK Mesonet observations. The adjusted Q2 estimates will provide a substitute for ground truth in regions throughout tile 6 with more sparse gauge networks.**
- **SCaMPR estimates will be compared to the adjusted Q2 estimates to evaluate the performance of SCaMPR in estimating precipitation amounts and producing the spatial detail in precipitation amounts associated with DCS's.**

4. Results

Fig. 1. Probability Distribution Comparison

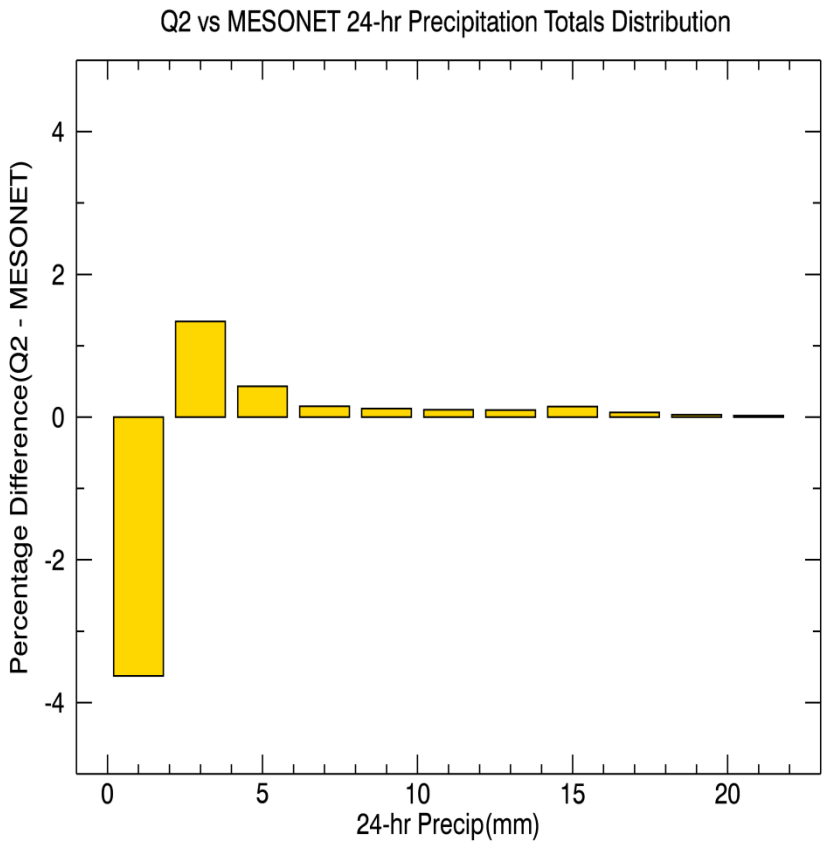


Figure 1 shows the difference in the distribution of 24-hour precipitation amounts between MESONET observations and Q2 estimates for 2mm bins.

➔The percentage of MESONET cases in each bin is subtracted from the percentage of Q2 cases in that respective bin to compare the distributions between the observations and estimates.

➔The percentage of Q2 estimates is greater than the percentage of MESONET observations in every bin except for the 0-2 mm bin.

4. Results

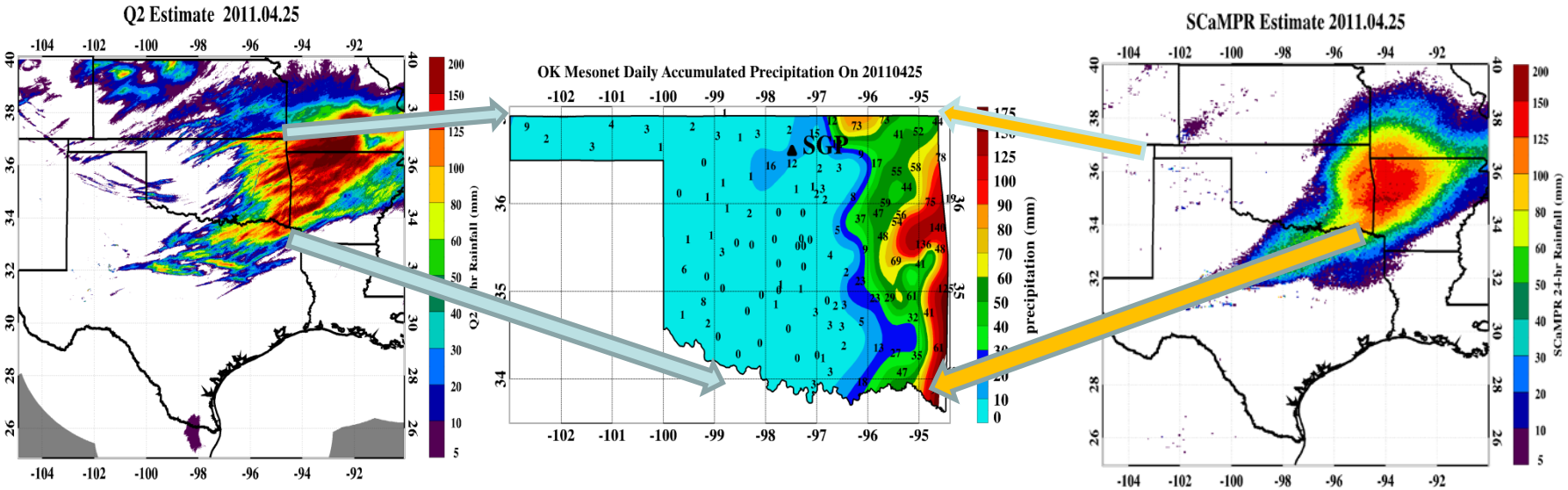


Fig. 2. Estimated and Observed Daily Precipitation for April 25, 2011

Figure 2 demonstrates the following points:

1) **Compared to OK mesonet observations, Q2 estimates collocate the convective core precipitation very well (Eastern OK).**
2) **Q2 estimates have better coverage and resolution than precipitation gauge networks, which will make the comparison between Q2 and SCaMPR much easier.**
3) **SCaMPR estimates lack the detailed structure of Q2 estimates.**

4. Results

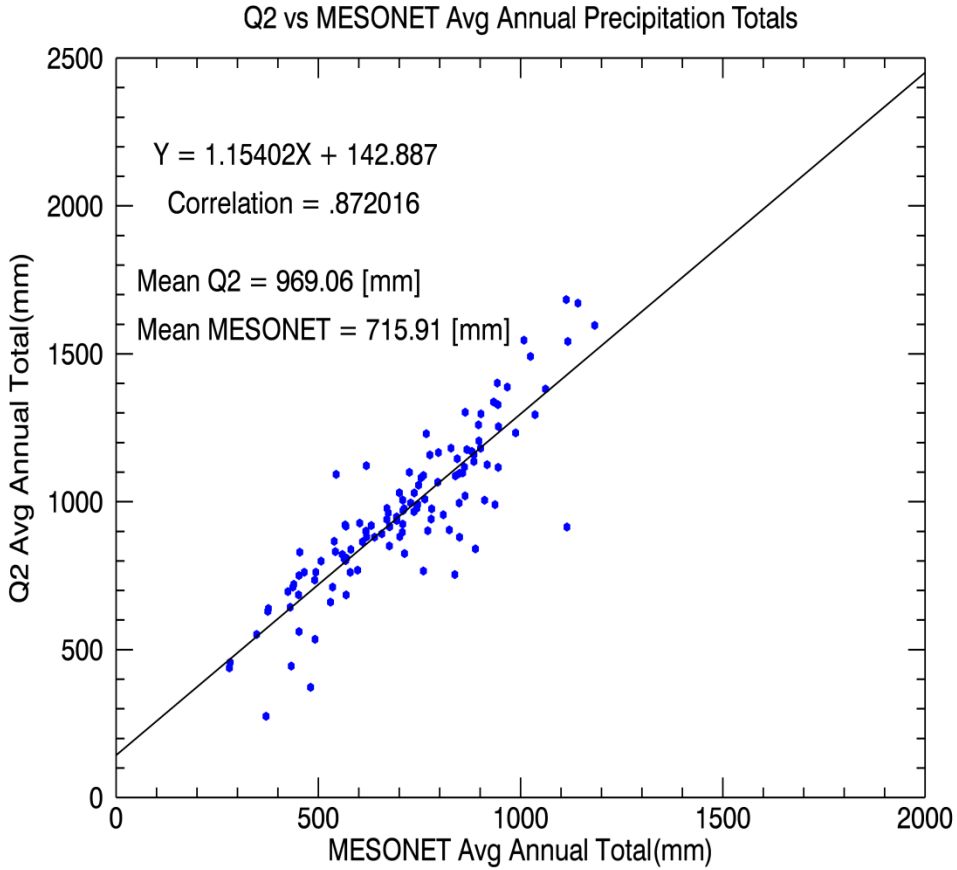
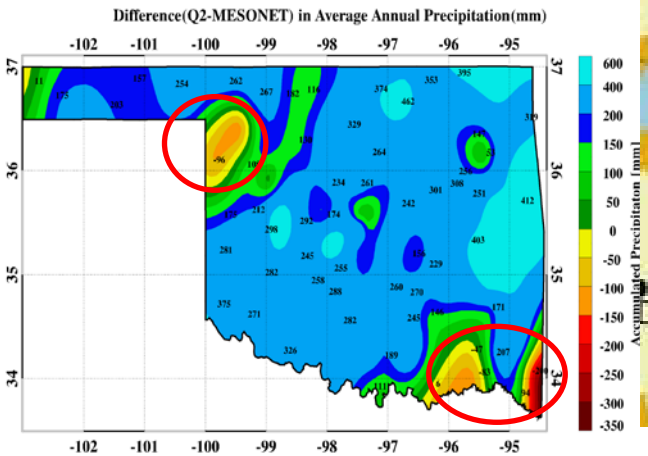
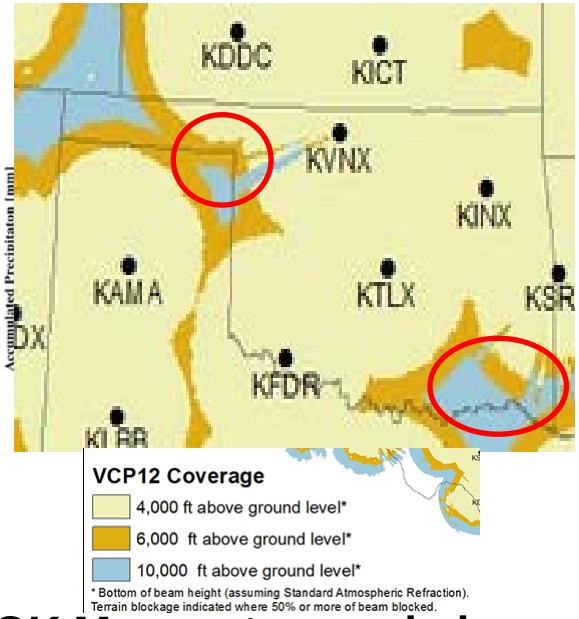


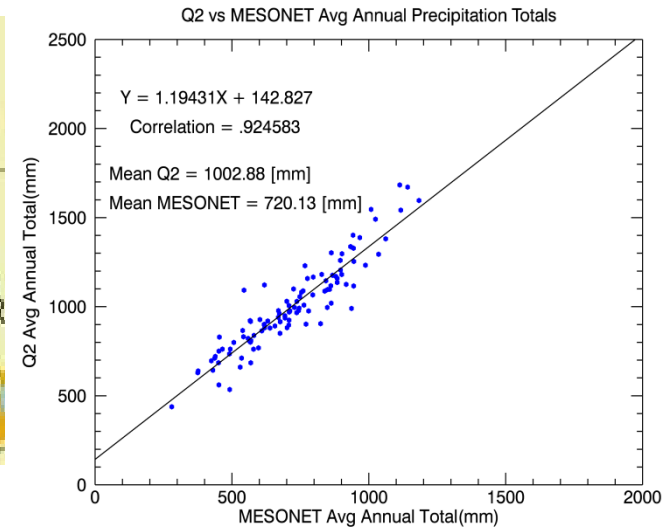
Fig. 3. Scatter Plot of MESONET observations vs Q2 Estimates

Figure 3. Each blue dot represents one of the 120 OK MESONET stations. The average annual precipitation observed at each OK mesonet station is compared with the collocated Q2 average annual precipitation.
➔The NEXRAD Q2 precipitation is about 1.4 times as much as OK Mesonet precipitation during this 2-yr period. ➔This relationship can be used to adjust Q2 estimates.
➔The adjusted Q2 estimates will serve as a substitute for ground truth in future studies.

4. Results







- **(Left image) Compared to OK Mesonet annual observations, Q2 estimates have an average positive bias of 253 mm, with underestimates in NW and SE Oklahoma.**
- **Further investigation indicated that the regions with Q2 underestimates are representative of poor radar coverage (center image provided by NSSL).**
- **After removing these regions of poor radar coverage, the comparisons have a higher correlation. So the final Q2 adjustment should be Q2'= 0.837Q2-119.6.**

Conclusion:

➔ **Annual Q2 estimates have strong correlation with OK Mesonet Observations and a positive bias of ~ 253 mm.**

➔ **The adjusted Q2 estimates can better represent ground truth and will be used as a substitute for ground truth in tile 6 to validate SCaMPR precipitation estimates.**

5. Possible Path to Operations

- **This study focuses on OK, a state in NMQ tile 6. The findings of this study will be assumed to be representative of tile 6, and used throughout tile 6.**
- **Expansion to other tiles will be done using NCDC precipitation gauge data, and possible adjustments to Q2 precipitation estimates will be calculated if necessary.**
- **Since the relative placement of accumulated precipitation for the Q2 estimates is accurate, and the amounts can be adjusted for via the linear relationship to observations, the adjusted Q2 estimates can serve as a good substitute for ground truth to compare SCaMPR estimates to.**
- **Utilizing Q2 estimates will make it possible to improve SCaMPR's performance in estimating precipitation during convective events, one of SCaMPR's current weaknesses. Having adequate spatial coverage and resolution to evaluate SCaMPR's performance will facilitate improvements made to better distinguish between convective cores and anvil regions in DCS's.**

6. Future Plans

- **We will apply the same method to other NMQ tiles (the most dense gauge network in each tile will be chosen).**
- **The error of the ground observations will be examined to make the most accurate adjustments (it is known tipping bucket gauges underestimate during high precipitation rates)**
- **An adjustment factor for the Q2 estimates would then be available for each tile, providing good substitutes for ground truth with excellent spatial coverage and resolution.**
- **SCaMPR estimates will then be compared to these Q2 estimates to evaluate their performance. Potential improvements to the SCaMPR algorithms by improving the classification of the components of DCS's will be evaluated against these Q2 estimates that serve as ground truth with better coverage and resolution than any gauge networks .**

7. Publication List

- References

- Zhang, J., et al. (2011), National Mosaic and Multi-Sensor OPEN MQ) System: Description, Results, and Future Plans, Bulletin of the American Meteorological Society, 92(10), 1321-1338.
- Kuligowski, R. J., 2002: A self-calibrating real-time GOES rainfall algorithm for short-term rainfall estimates. *J. Hydrometeor*, 3, 112–130.

- **Project Publications**

Stenz, R., X. Dong, B. Xi, B. N. Zhou, J. Tian, Z. Feng, and Kuligowski, (2013): Assessment of SCaMPR and NEXRAD Q2 precipitation estimates using Oklahoma Mesonet observations. In Preparation for J. Hydrometeor