Introduction and Status Update to the Oklahoma Statewide Soil Moisture Mapping Project

Jason Patton, Tyson Ochsner, Geano Dong, Andres Patrignani, Matthew Haffner, Wade Crow, Fan Chen
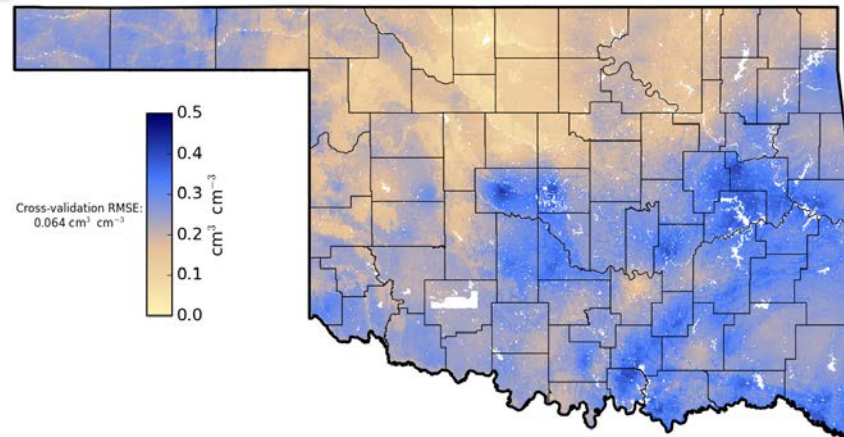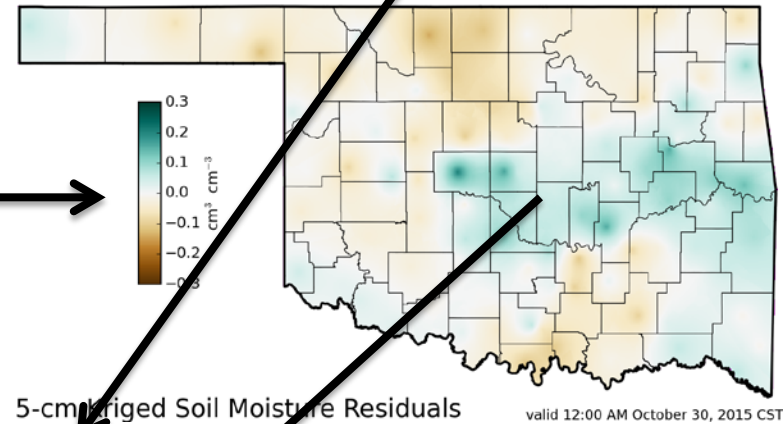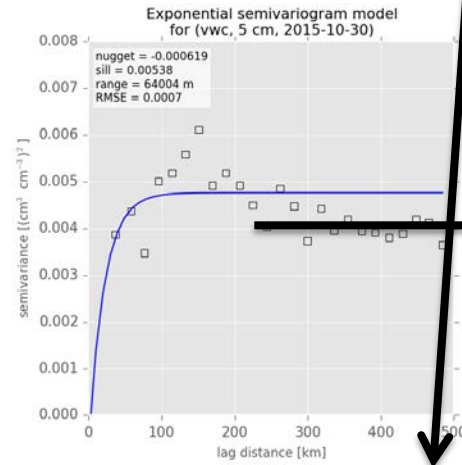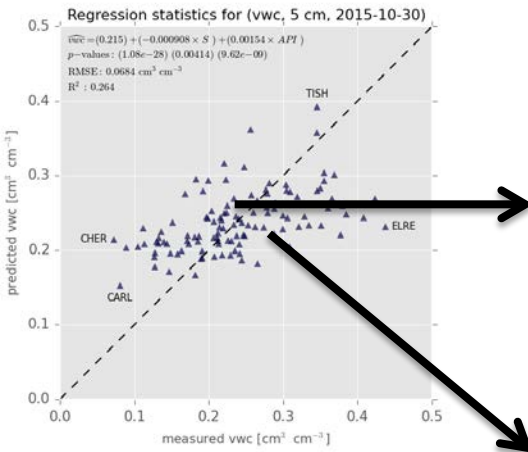
2016 MOISST Workshop
May 17, 2016

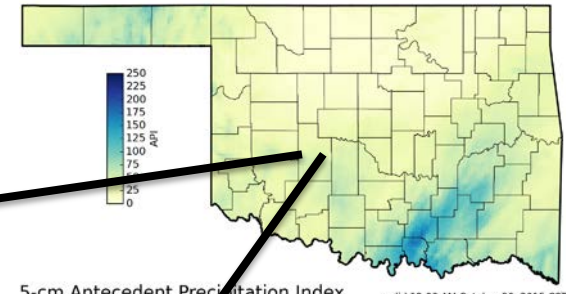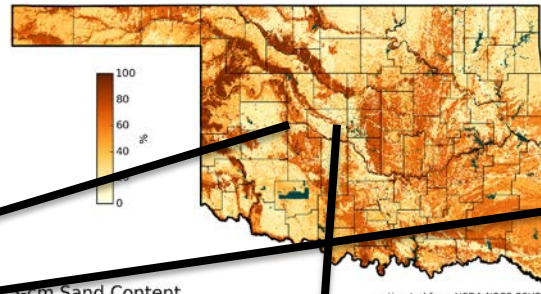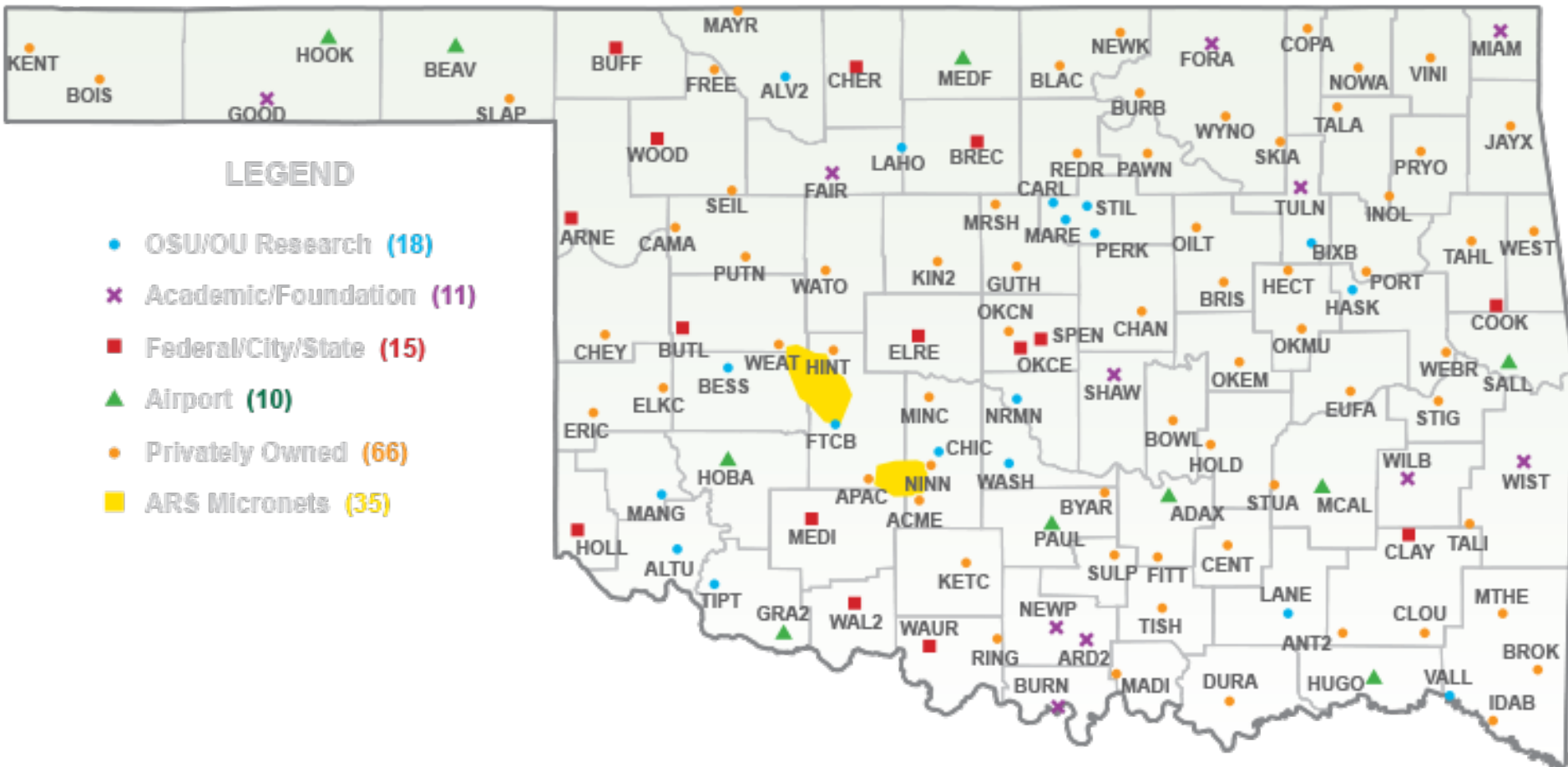# http://soilmoisture.okstate.edu/

Current major caveats:

- Only valid over grasslands

- Wet bias (as far as we can tell at the moment)

How are the maps made?

5-cm Sand Content

estimated from USDA-NRCS SSURGO

5-cm Antecedent Precipitation Index   valid 12:00 AM October 30, 2015 CST

Regression statistics for (vwc, 5 cm, 2015-10-30)

Exponential semivariogram model for (vwc, 5 cm, 2015-10-30)

5-cm Kriged Soil Moisture Residuals   valid 12:00 AM October 30, 2015 CST

Cross-validation RMSE: 0.064 cm³ cm⁻³

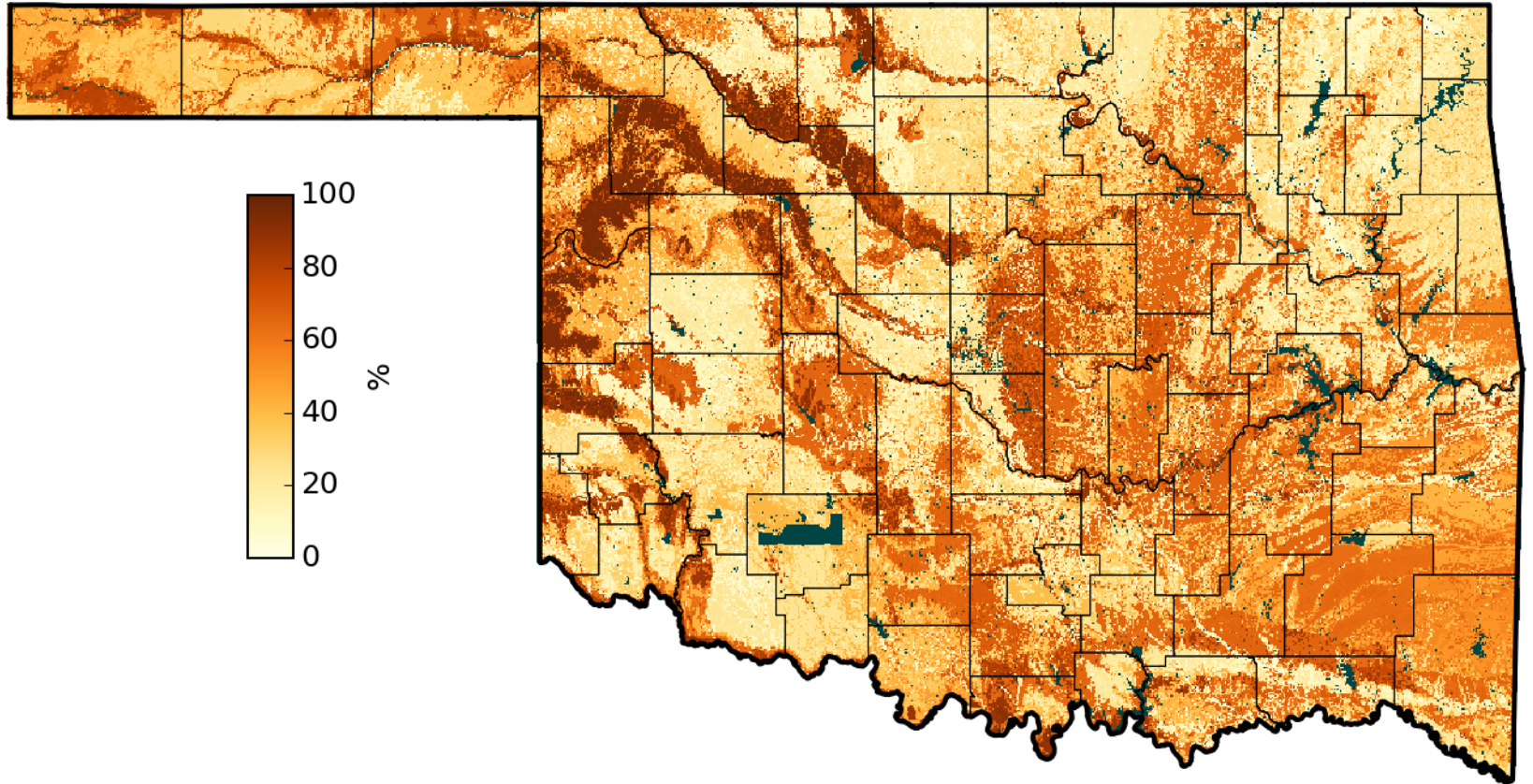5-cm Volumetric Water Content   valid 12:00 AM October 30, 2015 CST

How are the maps made?

Oklahoma Mesonet stations

How are the maps made?

5-cm Sand Content

estimated from USDA-NRCS SSURGO
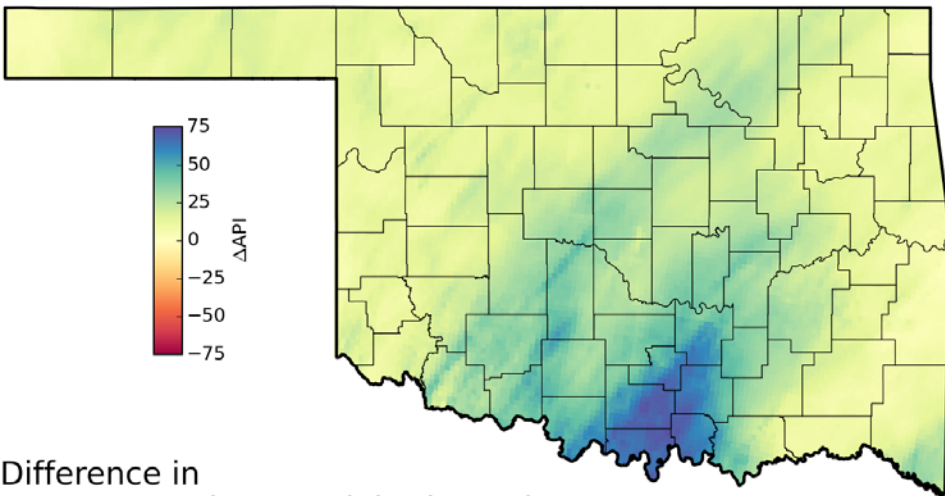
How are the maps made?

Oct 30 2015

Oct 31 2015
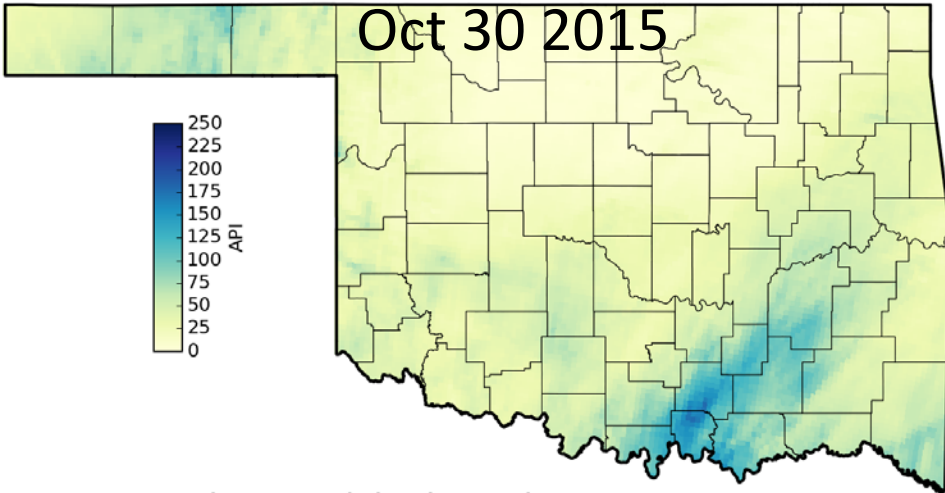
5-cm Antecedent Precipitation Index — valid 12:00 AM October 30, 2015 CST
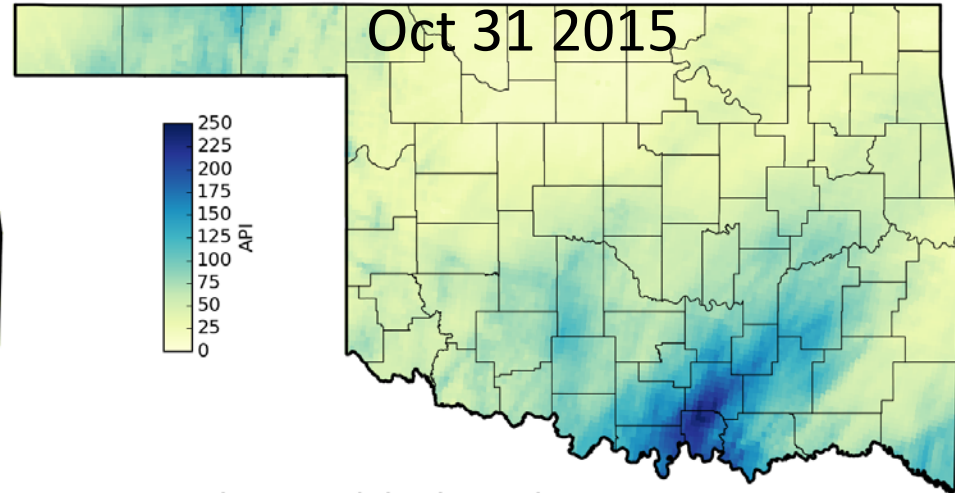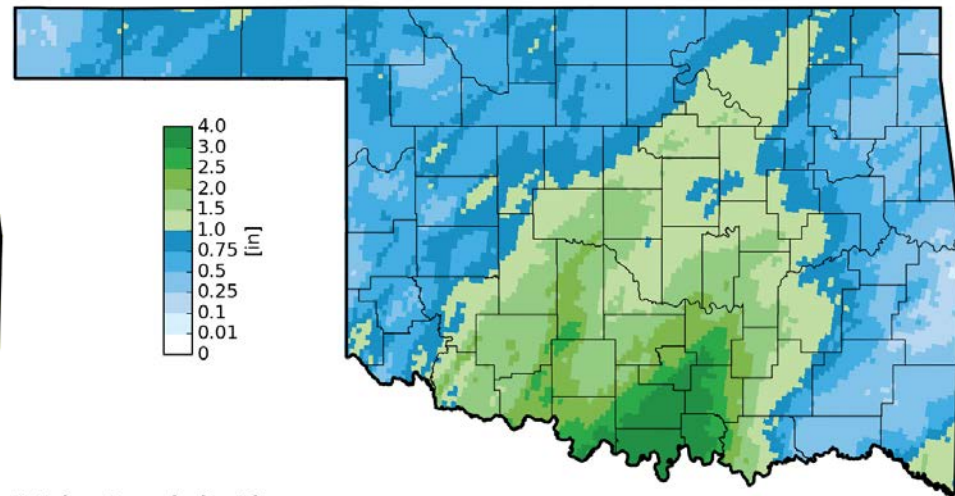
5-cm Antecedent Precipitation Index — valid 12:00 AM October 31, 2015 CST

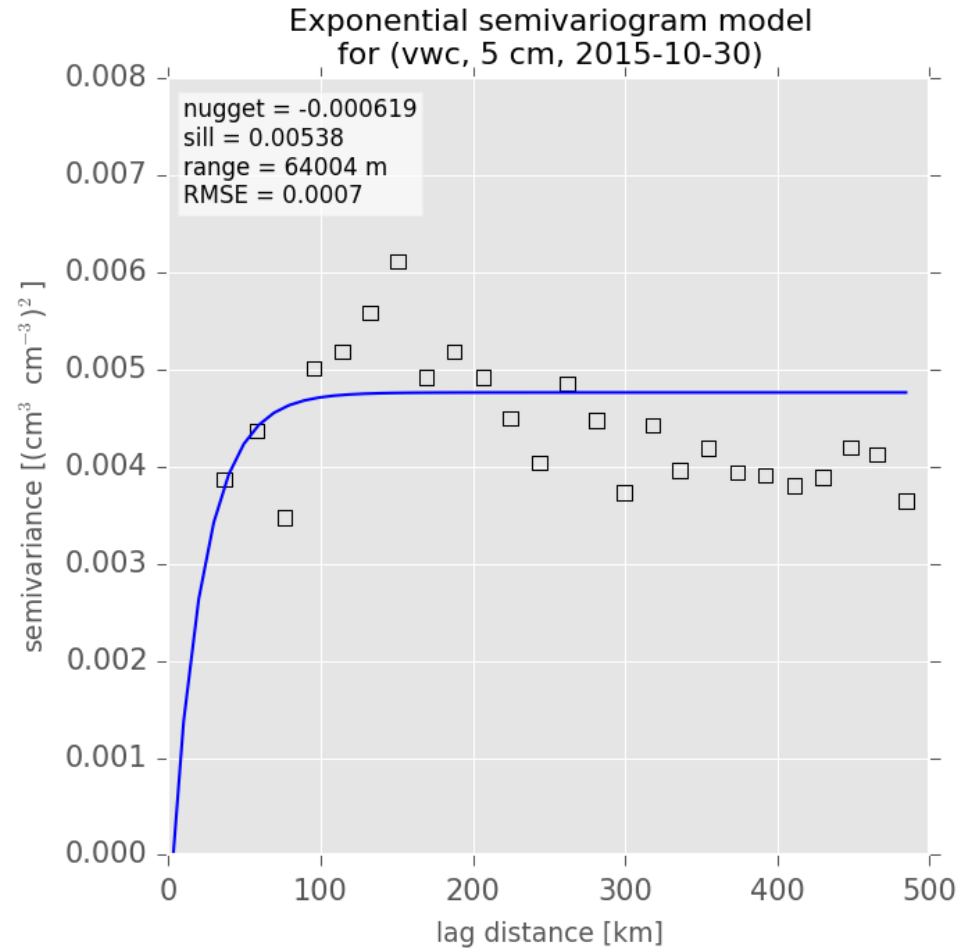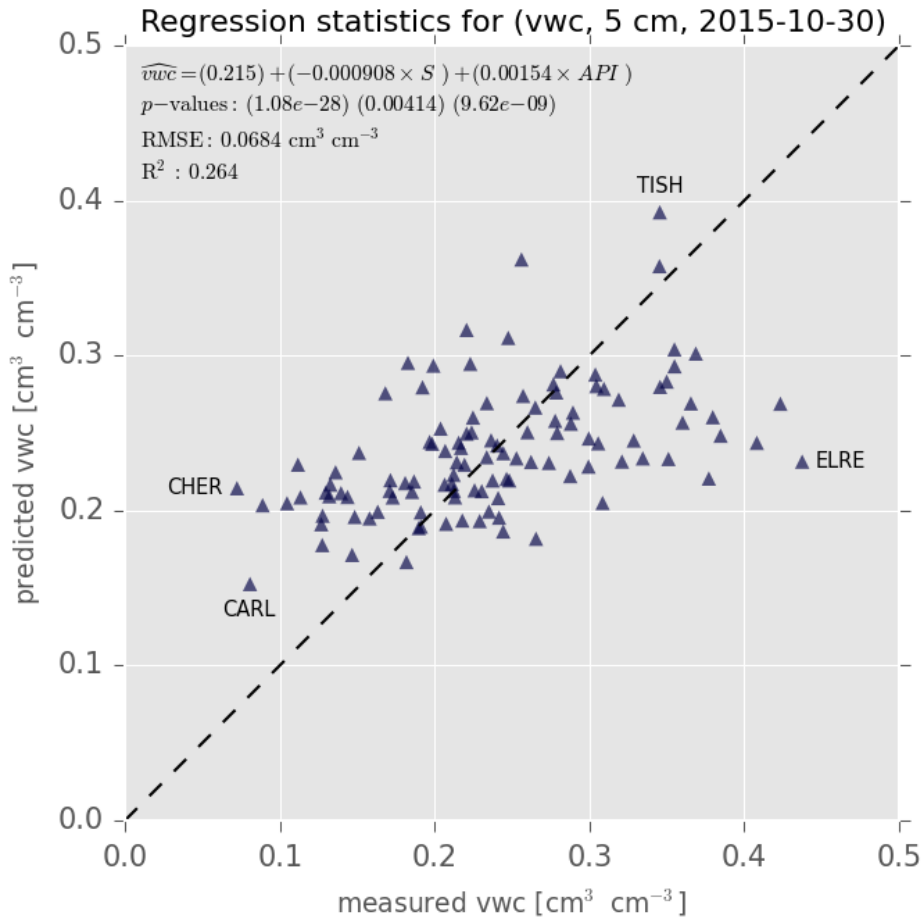Difference in 5-cm Antecedent Precipitation Index — 2015-10-30 to 2015-10-31

24-hr Precipitation — ending at 12:00 AM October 31, 2015 CST

How are the maps made?

Regression statistics for (vwc, 5 cm, 2015-10-30)

$\widehat{vwc} = (0.215) + (-0.000908 \times S) + (0.00154 \times API)$

p-values: $(1.08e{-}28)$ (0.00414) $(9.62e{-}09)$

RMSE: 0.0684 cm^3 cm^{-3}

R^2 : 0.264

Exponential semivariogram model for (vwc, 5 cm, 2015-10-30)

nugget = -0.000619
sill = 0.00538
range = 64004 m
RMSE = 0.0007

How are the maps made?

5-cm Kriged Soil Moisture Residuals

valid 12:00 AM October 30, 2015 CST

How are the maps made?

Cross-validation RMSE:
0.064 cm^3 cm^{-3}
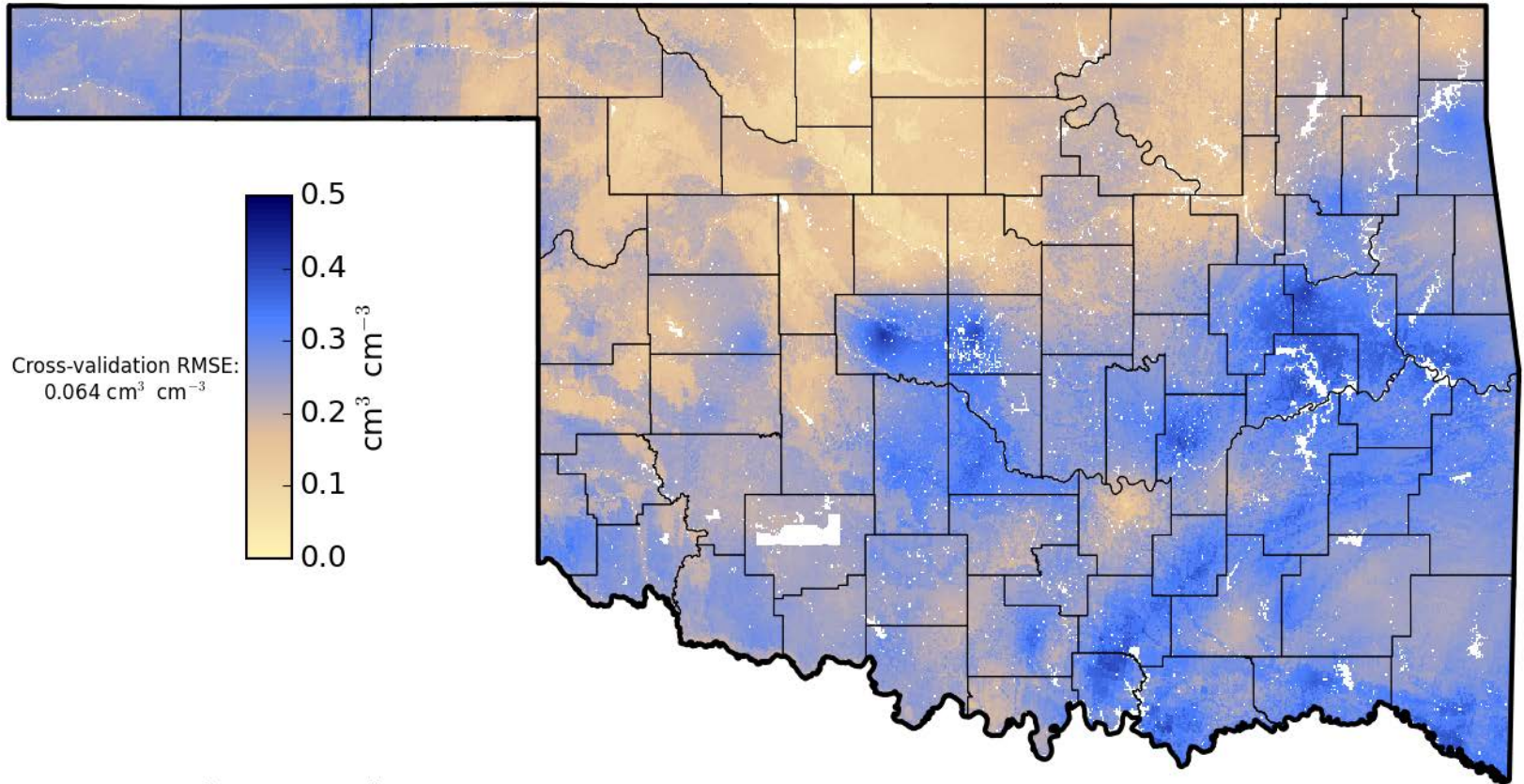
5-cm Volumetric Water Content

valid 12:00 AM October 30, 2015 CST

How good are the maps?

Comparison of:

Our regression kriged maps (RK)

Ordinary kriged maps (OK)
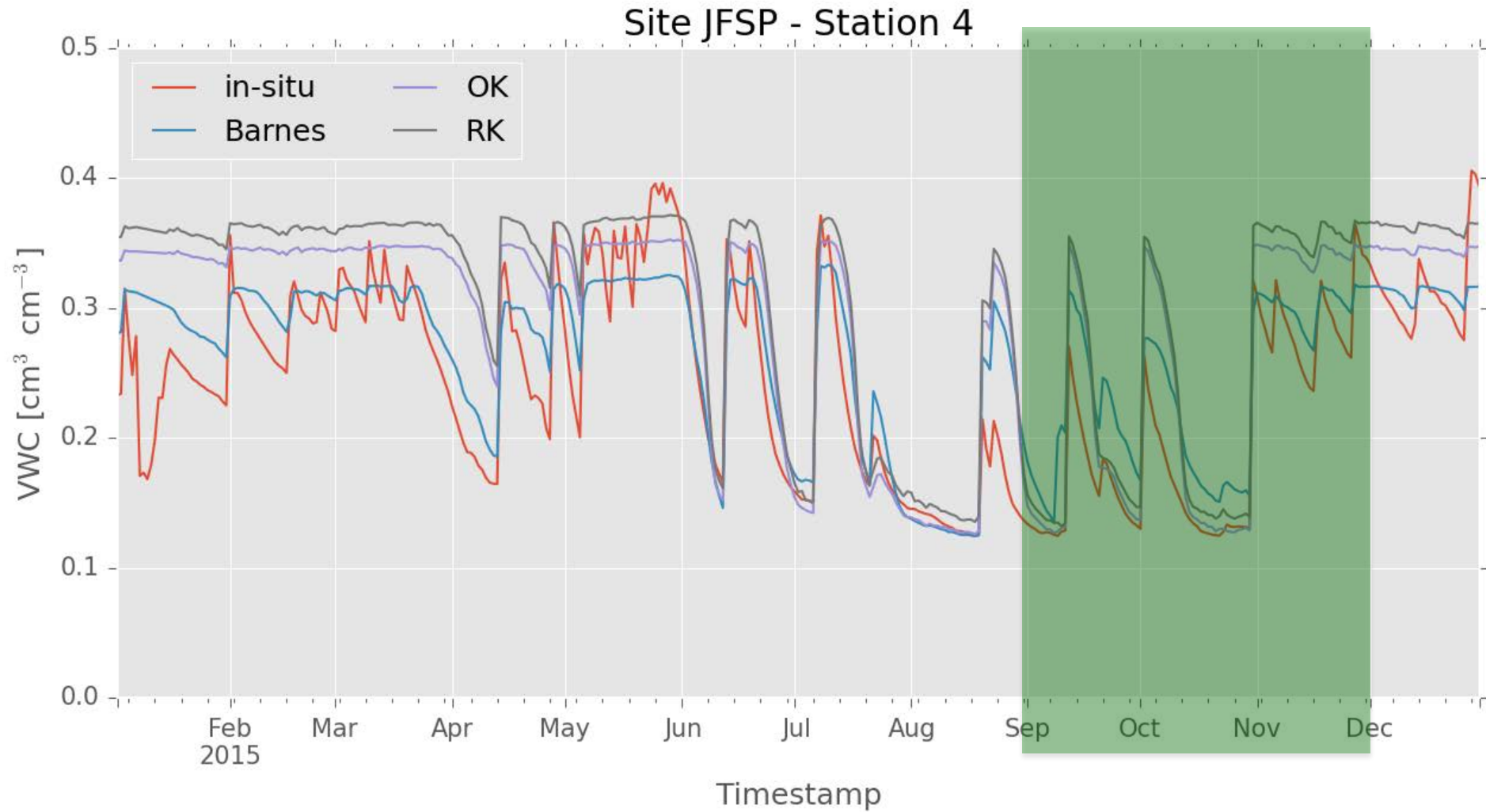
Barnes Objective Analysis (Barnes)

How good are the maps?
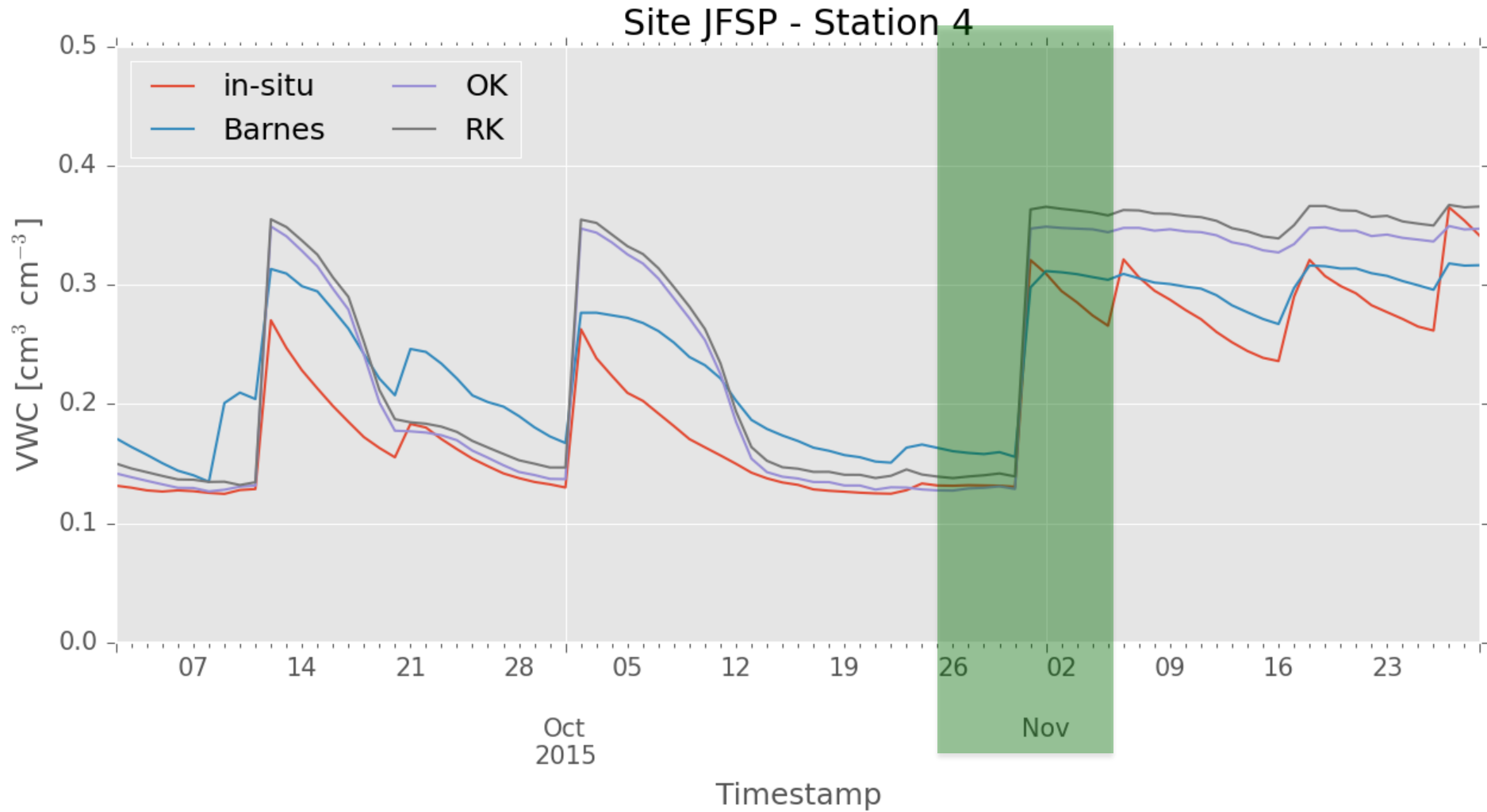
Little Washita, El Reno, & JFSP

	RMSE [cm³ cm⁻³]	Bias [cm³ cm⁻³]	ubRMSE [cm³ cm⁻³]	ρ []	RMSE [cm³ cm⁻³]
RK	0.0824	0.0443	0.0592	**0.681**	**0.0691**
OK	0.0788	0.0368	0.0516	0.670	0.0759
Barnes	**0.0738**	**0.0292**	**0.0507**	0.668	0.0823

Leave-one-out cross-validation with Mesonet data

How good are the maps?

Site JFSP - Station 4

How good are the maps?

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Site JFSP - Station 4

How good are the *sensors*?

MARE Mesonet & JSFP 4 VWC

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MARE Mesonet & JSFP 4 VWC
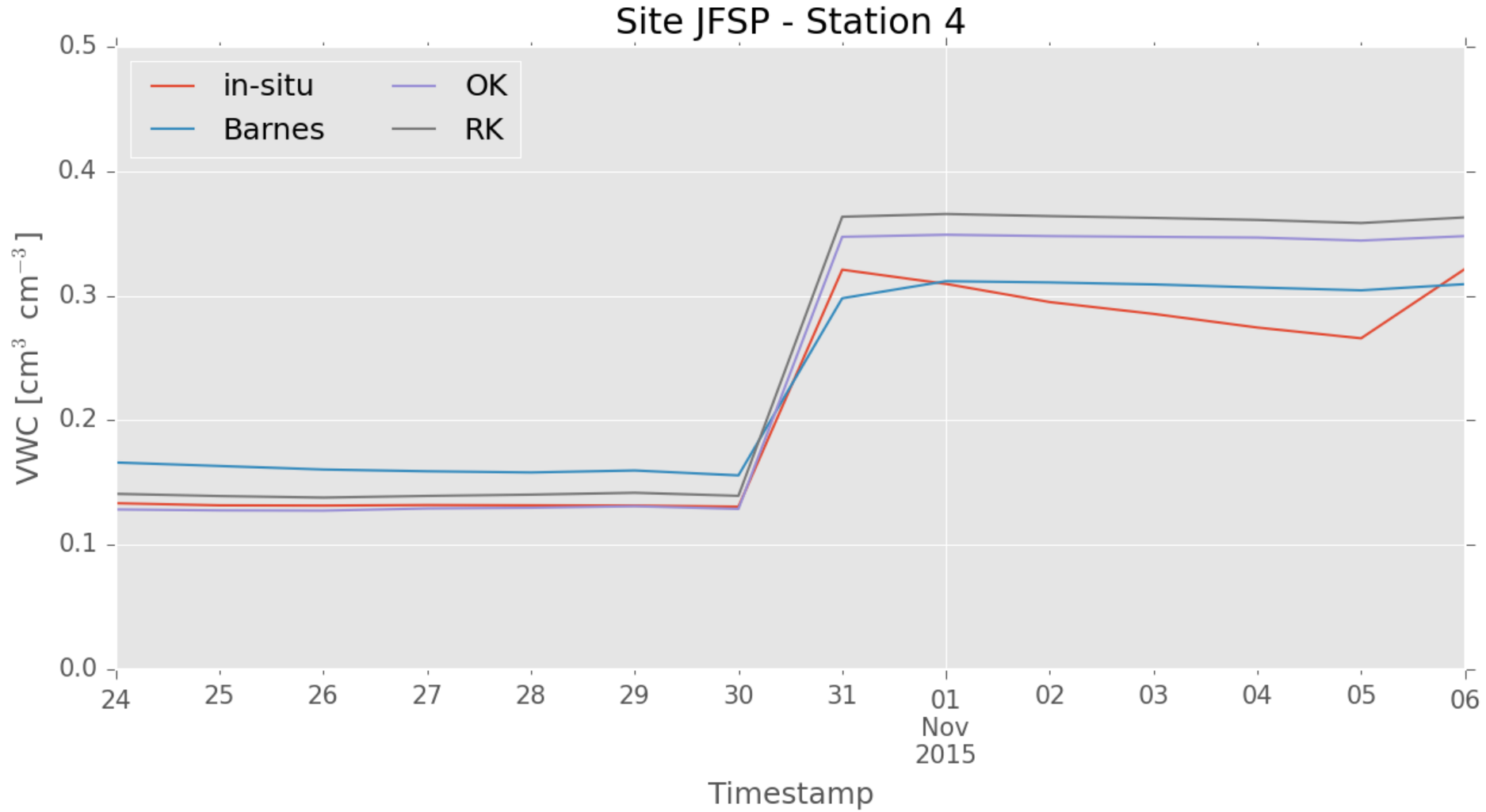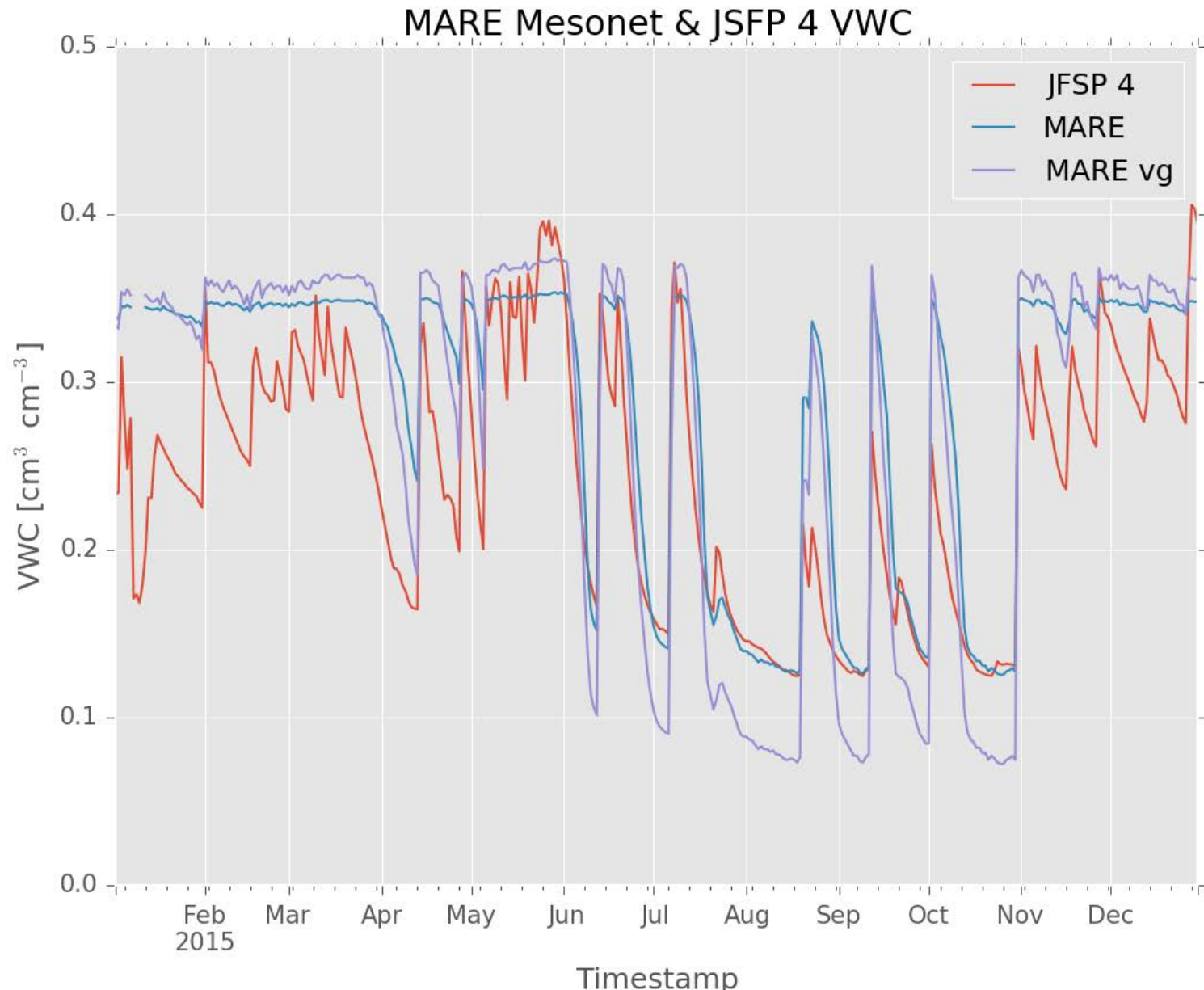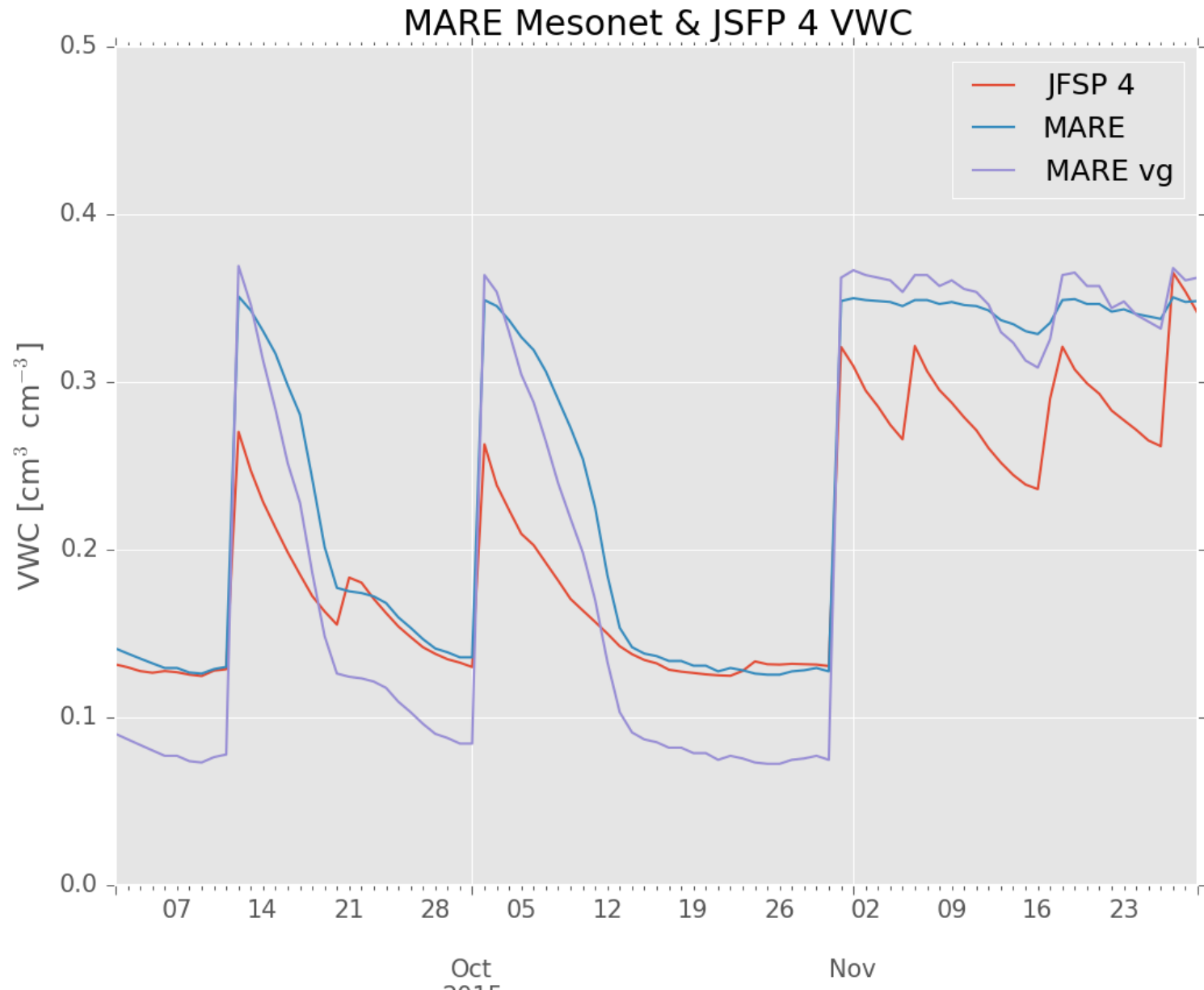
Next steps

1. Find source of bias in kriging methods

2. Check other cross-validation statistics

3. Compare with remote sensing products

4. Make data (more) easily available

5. Better estimates for croplands and forests

Acknowledgements

Mike Cosh, USDA-ARS, for providing the Little Washita and Fort Cobb soil moisture data.

Evan Linde, OSU High Performance Computing Center, for providing computing resources.

Jared Bostic, Brad Illston, and many others at the Oklahoma Mesonet, for providing hourly Stage IV precipitation data, assisting with the Barnes Objective Analysis, and answering all my questions about Mesonet data.

…and many more I can't remember (sorry)!

Thank you!   jason.c.patton@okstate.edu