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Good Practices for the Use and Interpretation of "Core Site" Validation Products

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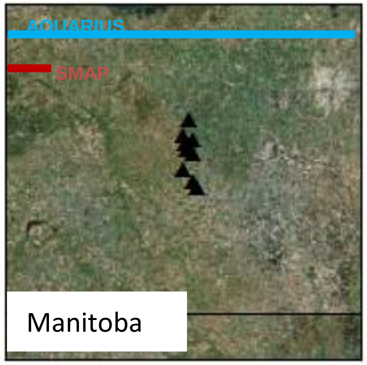
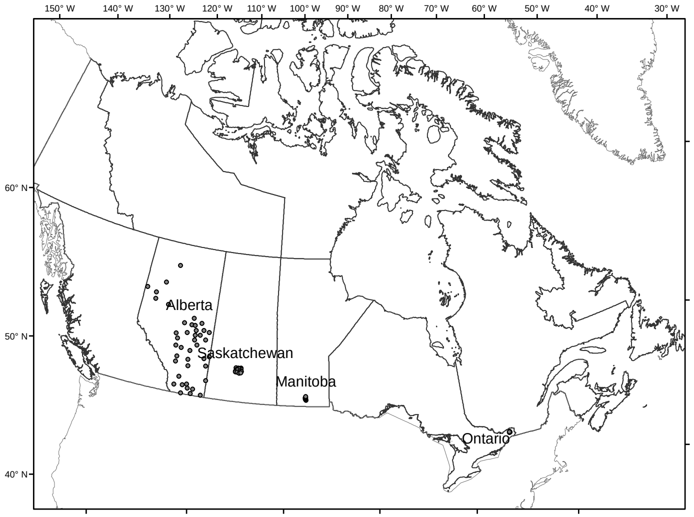
Outline

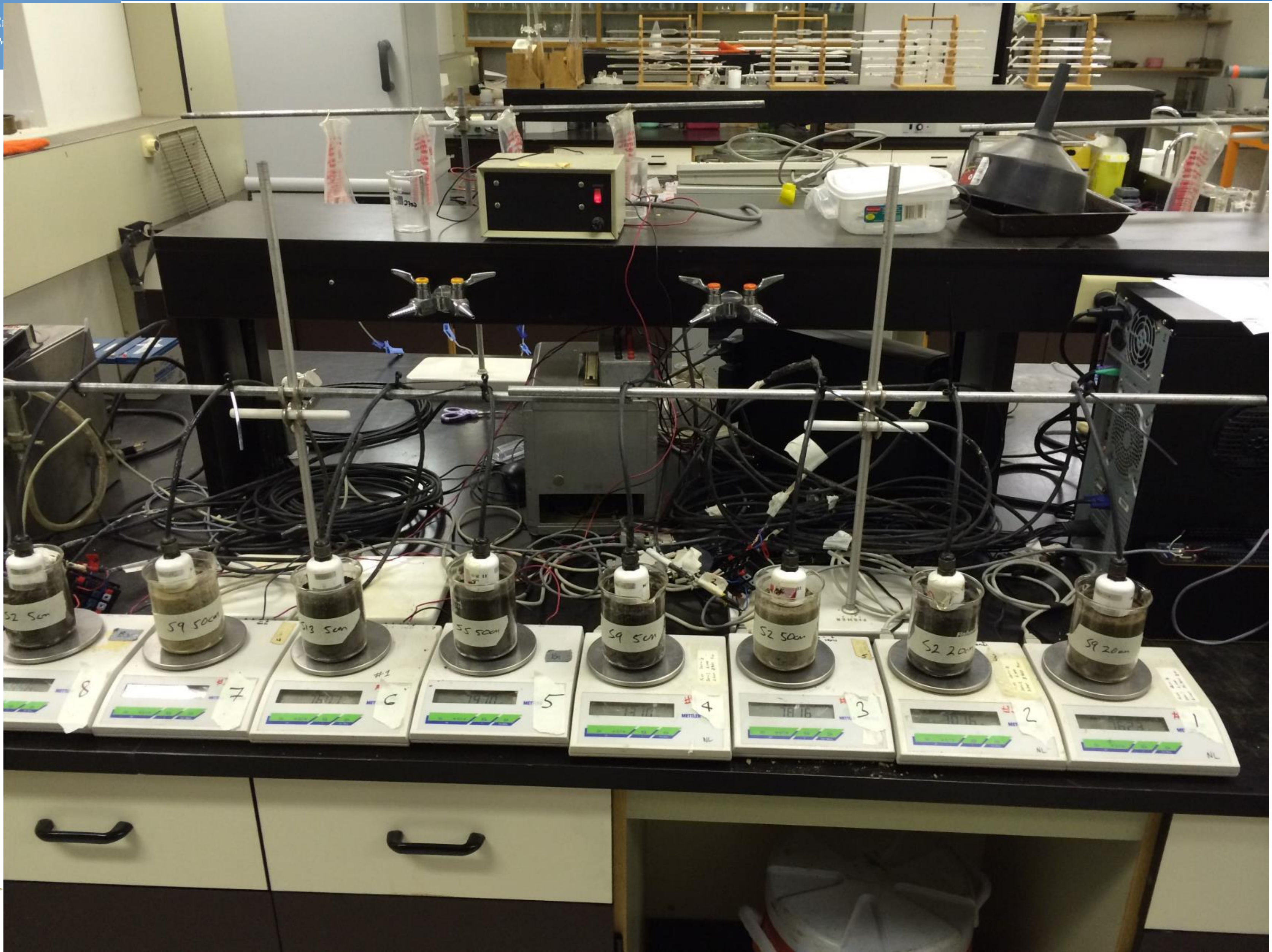
- Importance of instrument calibration
- Use of field campaigns for understanding network scaling
- Sensors and potential sensor bias
- Use of sensors in freeze thaw calibration validation





Location of major in situ sampling networks in Canada.

Approach to In-Situ Instrument Calibration



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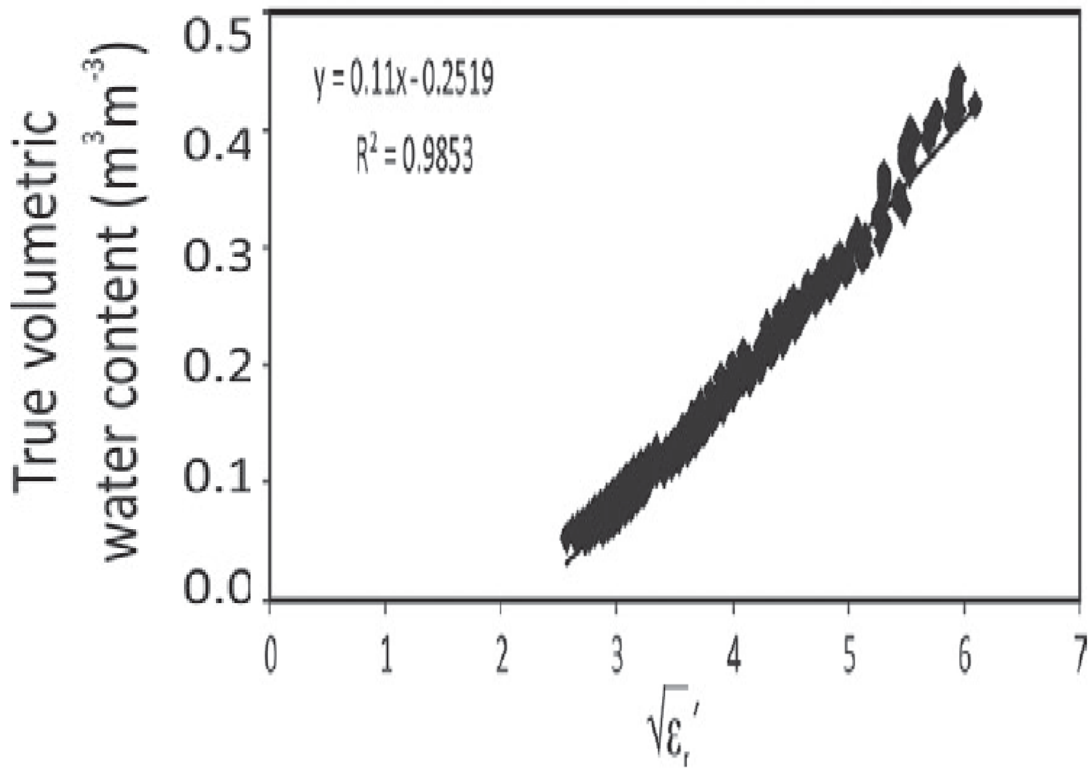
Approach to In-Situ Instrument Calibration



Example
water content calibration equation (Site 1 - 5 cm depth soil sample)

Several calibration experiments performed (e.g. Rowlandson et al. 2013) identified that factory calibration is > 0.04 VWC)

Dry down calibration of cores obtained from in-situ sensor sites is recommended (RMSE < 0.02 VWC) (Burns et al. 2014)

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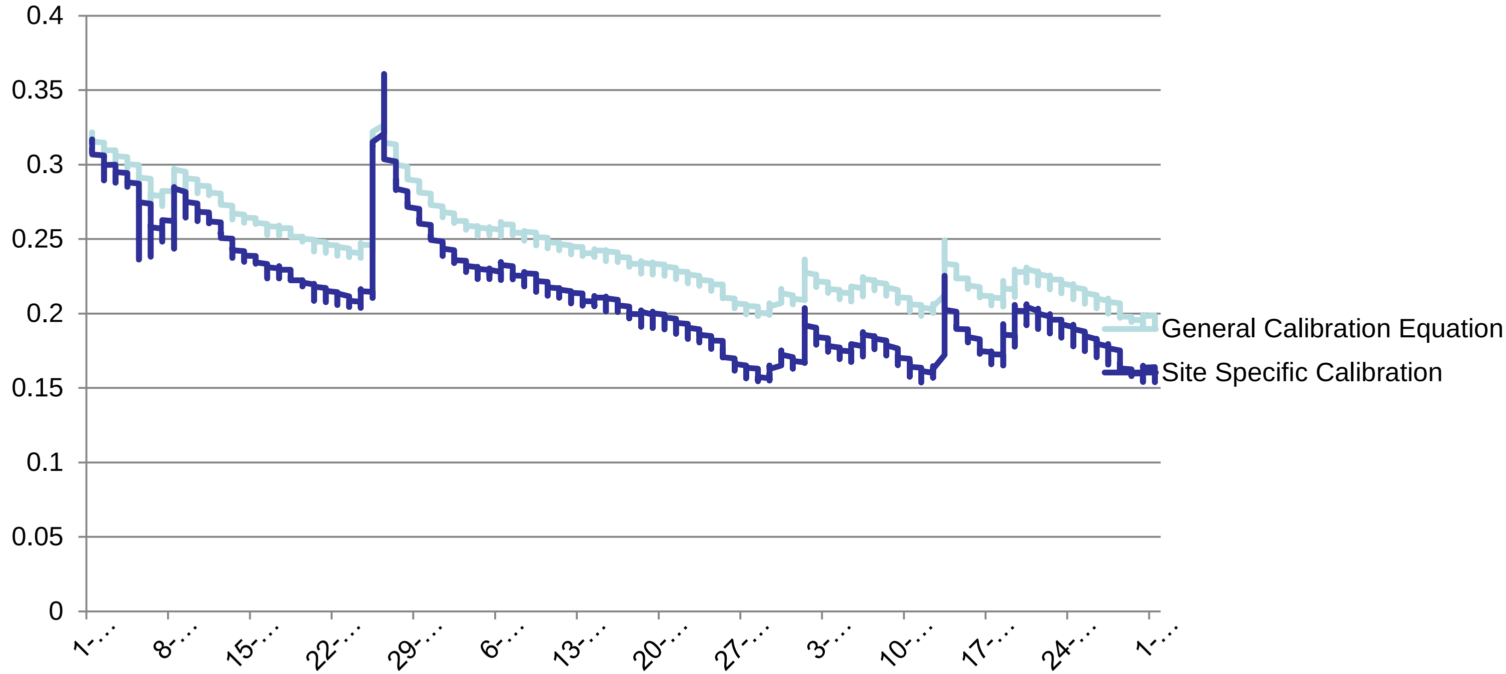
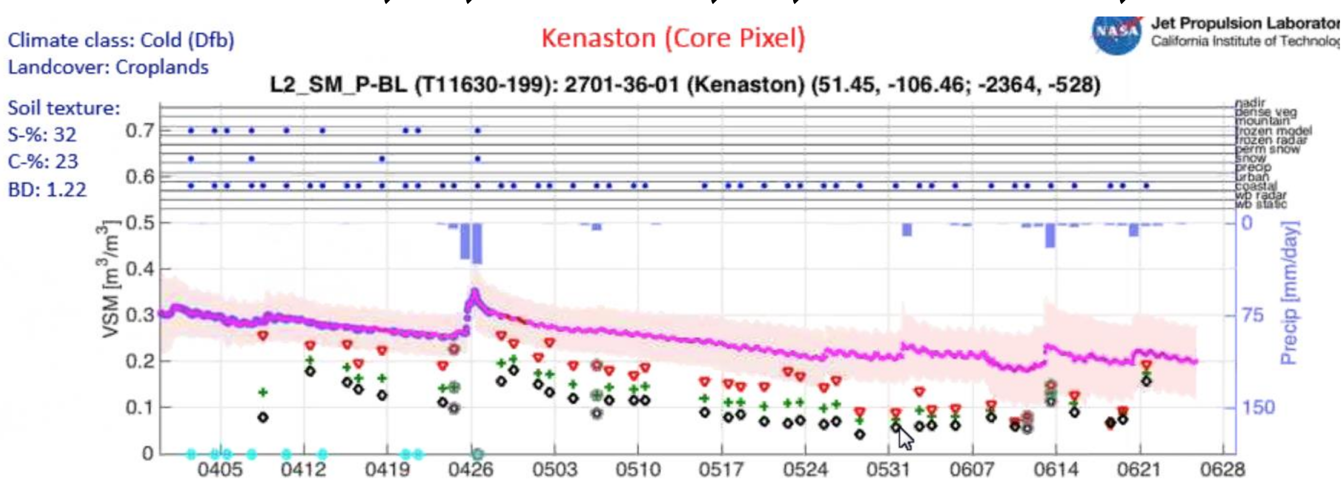
Approach to In-Situ Instrument Calibration





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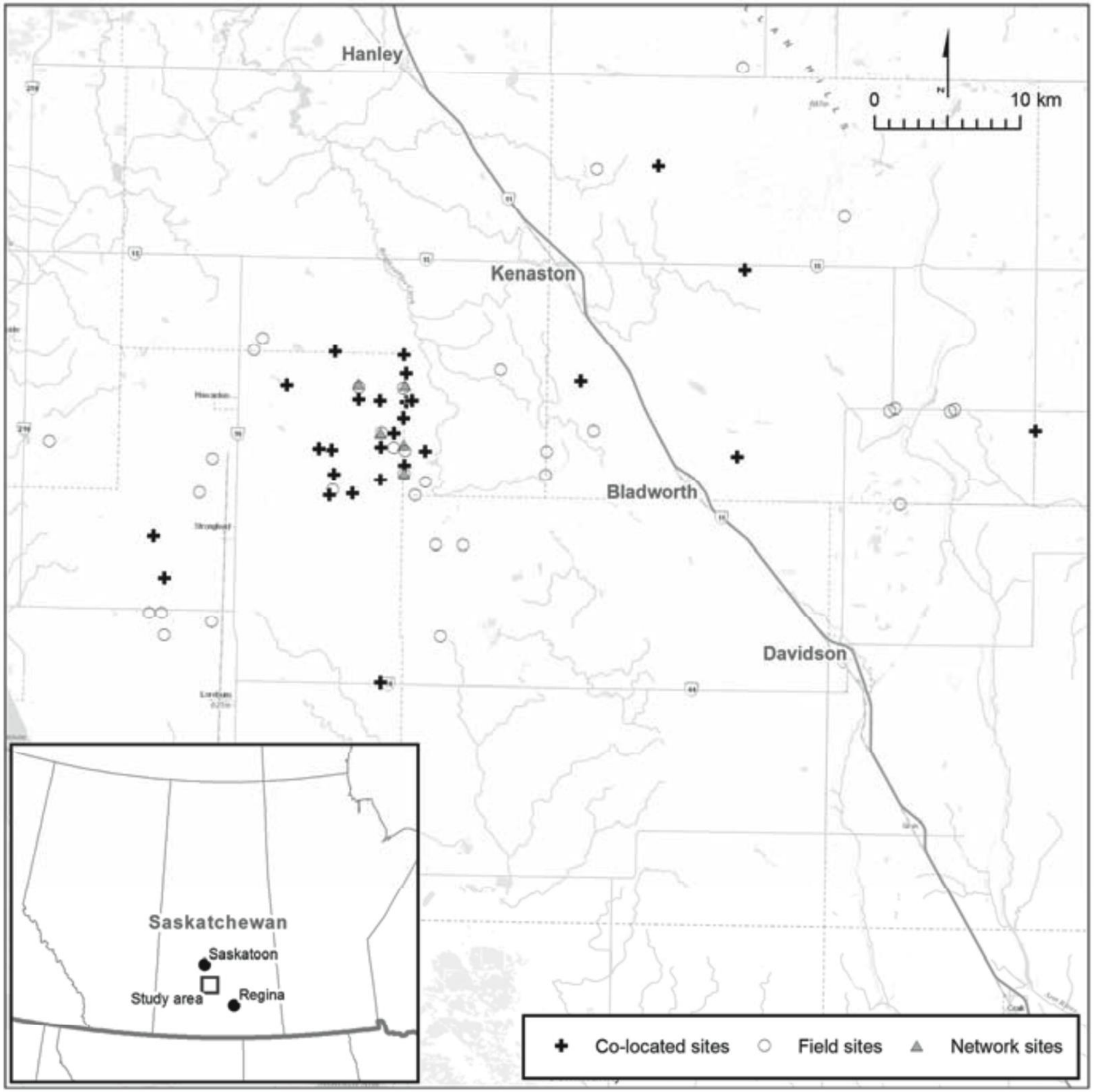
Value of field Campaigns for Understanding Network Up-Scaling Approaches

Corroboration of network average to field data evaluated during CanEX-SM10. 60 fields sampled (48 measurements/field) across domain while network was operated.



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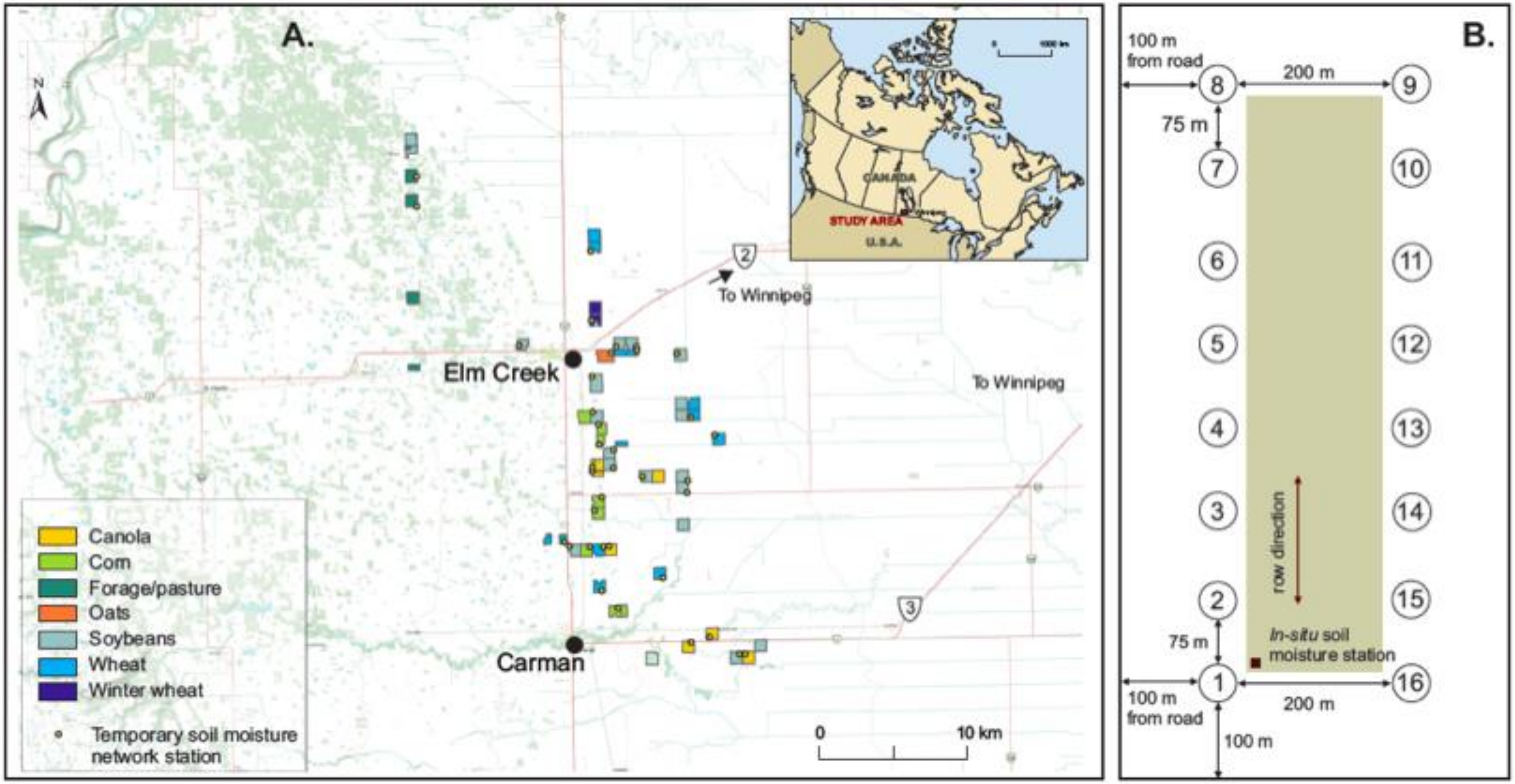
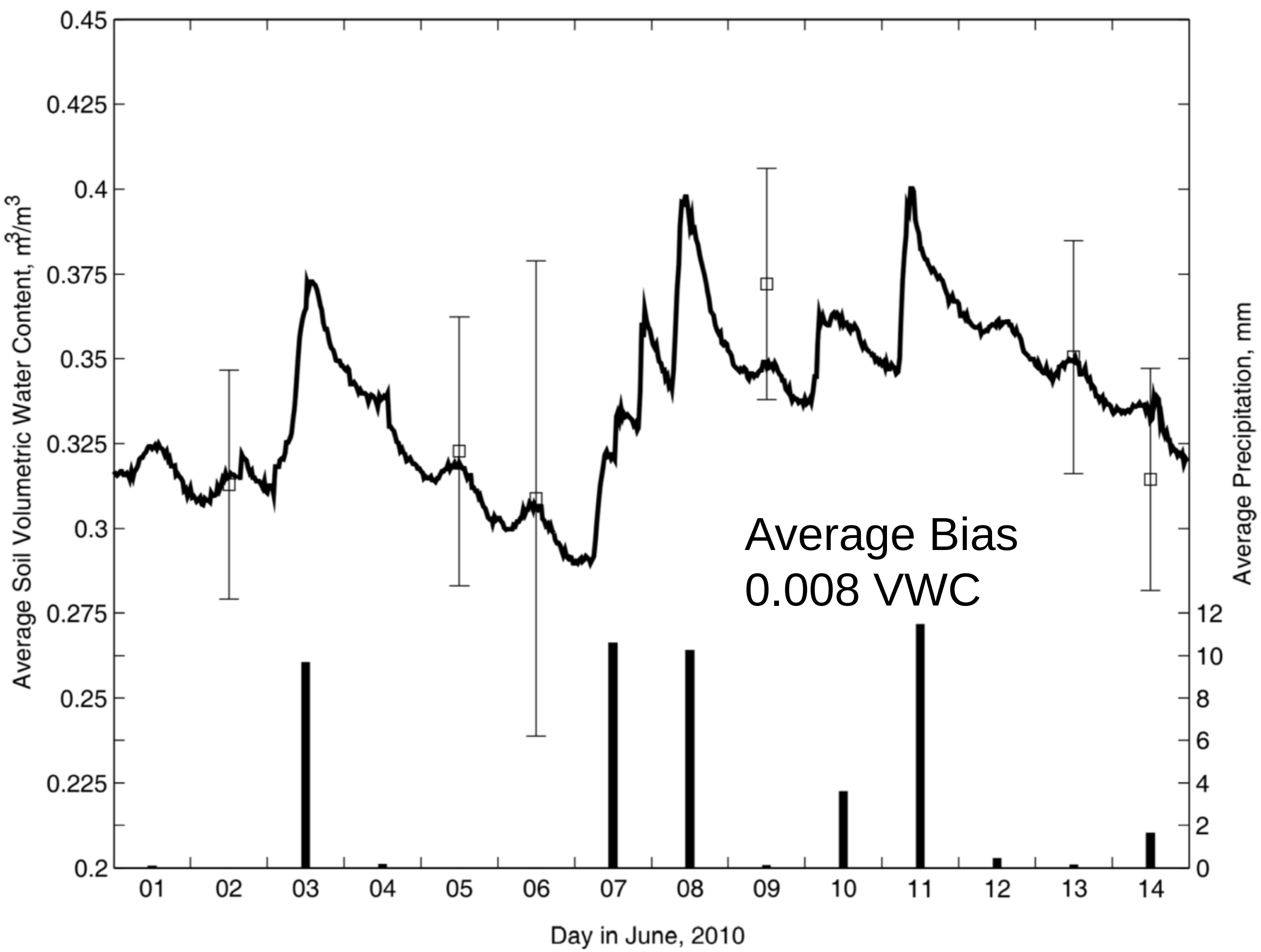
Value of field Campaigns for Understanding Network Up-Scaling Approaches

Corroboration of network average to field data evaluated during SMAPVEX-12. 55 fields sampled (48 measurements/field) across domain while network was operated.



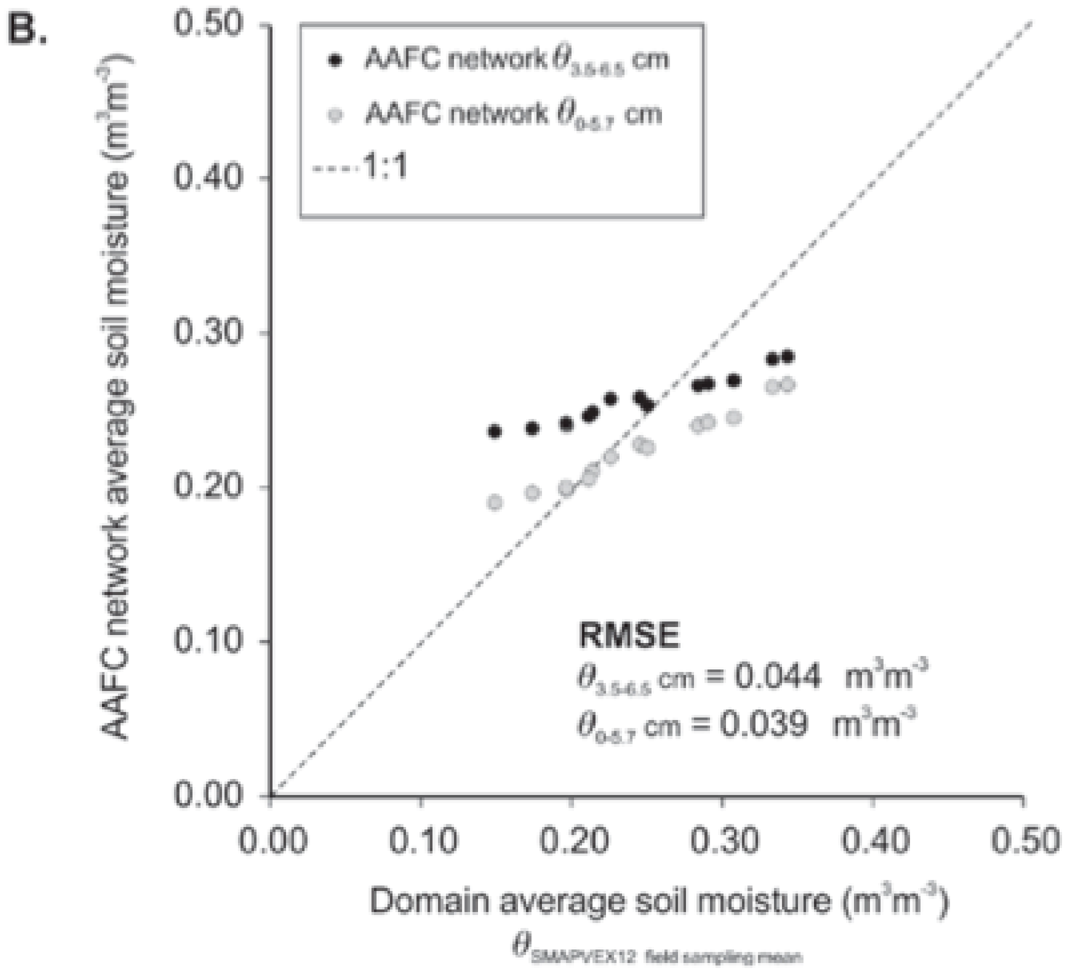
Value of field Campaigns for Understanding Network Up-Scaling Approaches

Previous work has suggested that at the radiometer footprint scale the network mean is adequate for representing the mean of the pixel (Rowlandson et al. 2015)



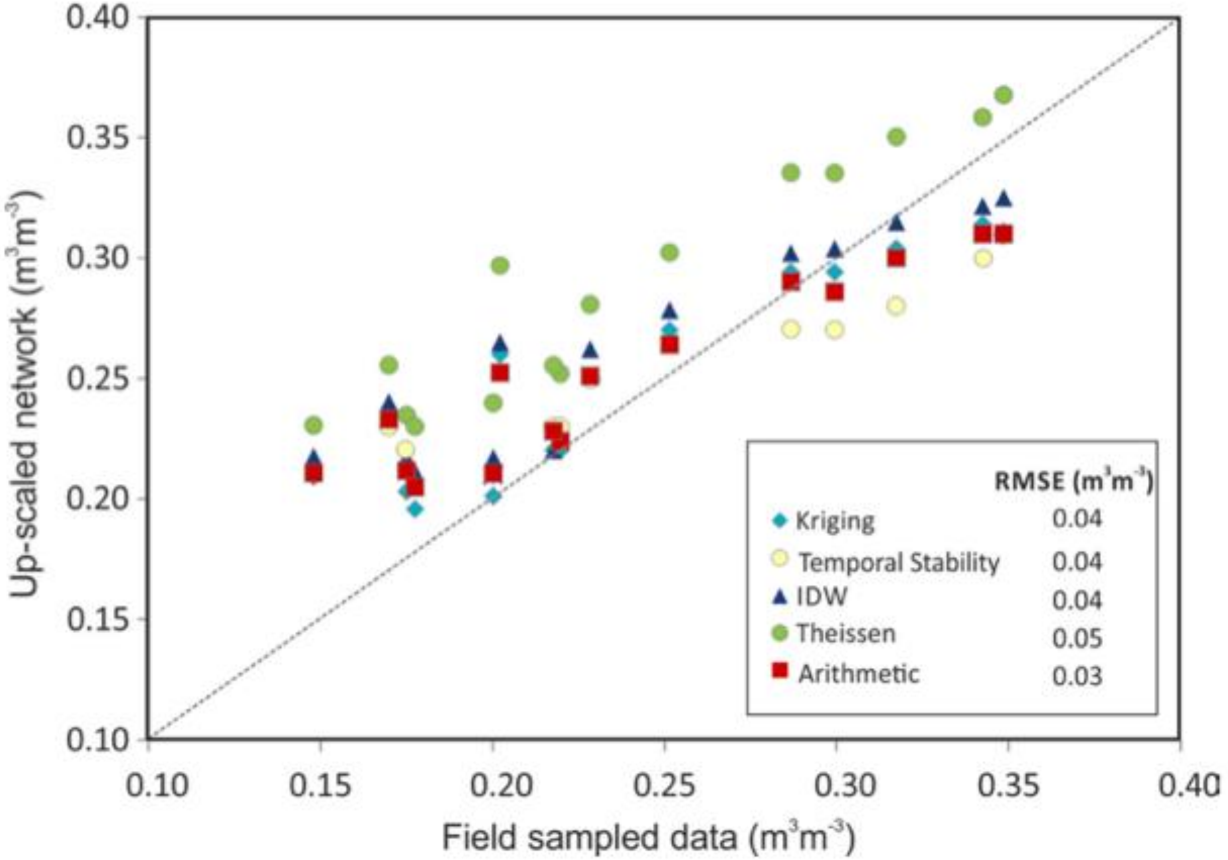
Comparison of network mean (line) to 48 measurements taken from ~60 individual fields. Bias between network and field measurements is less than 1% VWC

Value of field Campaigns for Understanding Network Up-Scaling Approaches



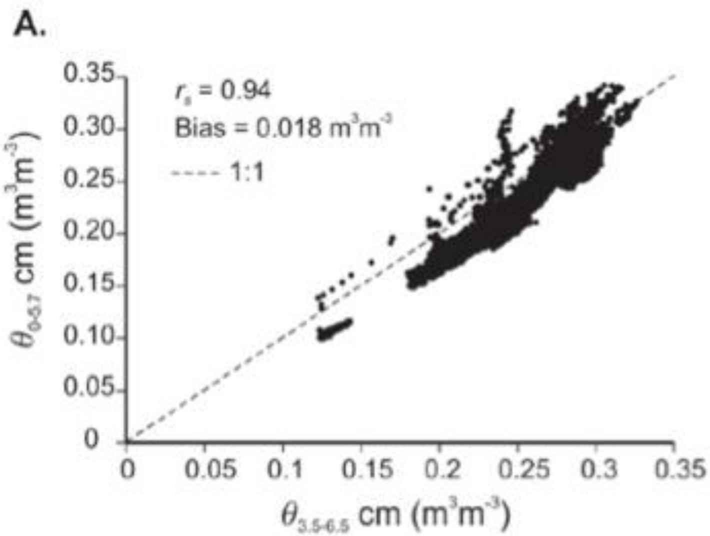
Up-scaled AAFC network soil moisture compared to field-sampled data (~55 fields) over SMAPVEX12 (Adams et al. 2015)

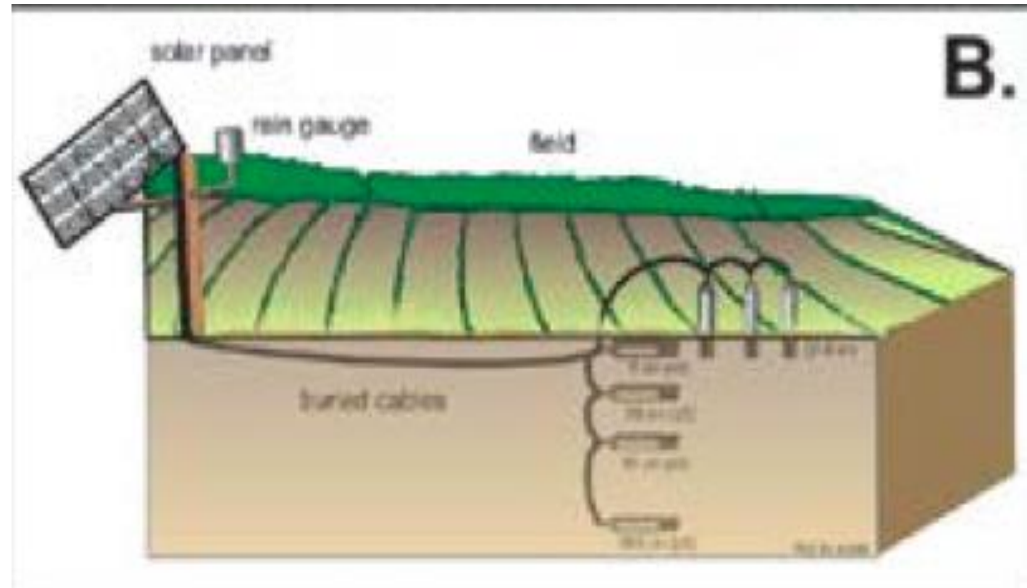
Evaluation of Soil Moisture Up-Scaling Approaches

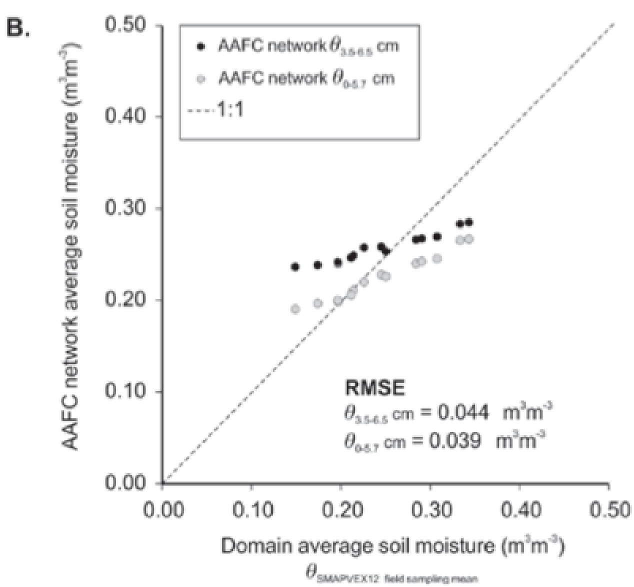


Up-scaling agreement between θSMAPVEX12 field-sampling and θSMAPVEX12 dense network datasets, where θSMAPVEX12 dense network is determined using arithmetic averaging, Temporal Stability, Inverse Distance Weighting, Kriging, and Theissen Polygons. Note: For determination of interpolation techniques a 36^2 km^2 footprint was centered on the SMAPVEX12 domain. (Adams et al. Submitted)

Issues with Sensor Orientation







AAFC network level statistical moments compared between θ3.5-6.5cm and θ0-5.7cm measurement depths over 2012-13. Figure A shows the network mean. Figure B show comparison between network and field samples based on probe orientation.

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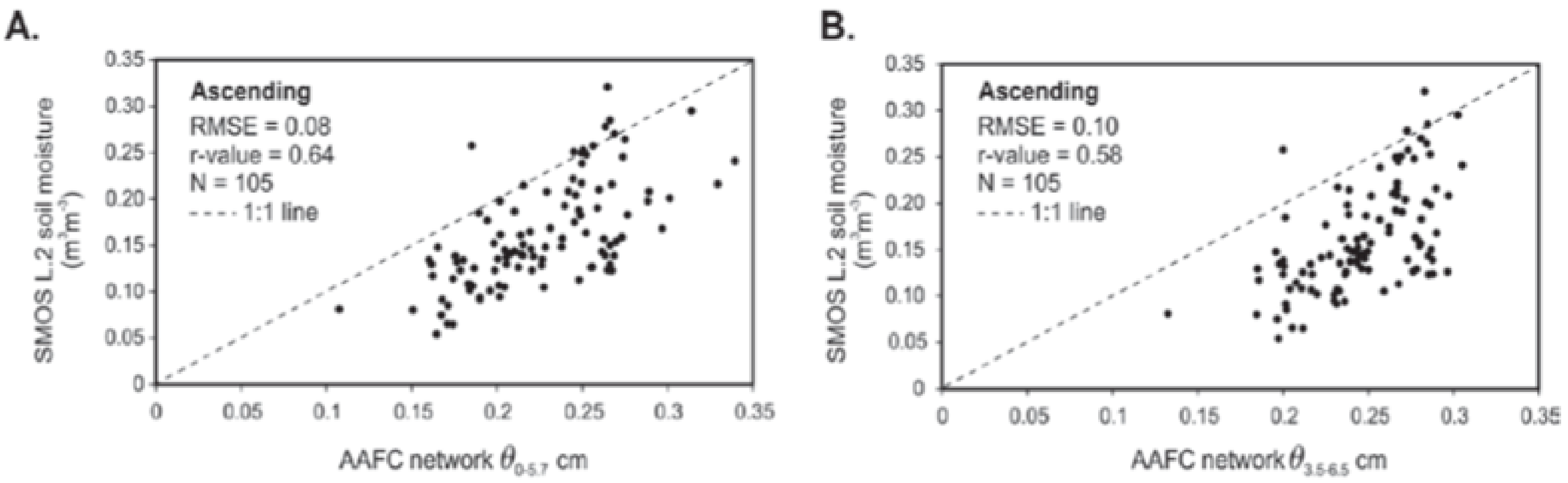
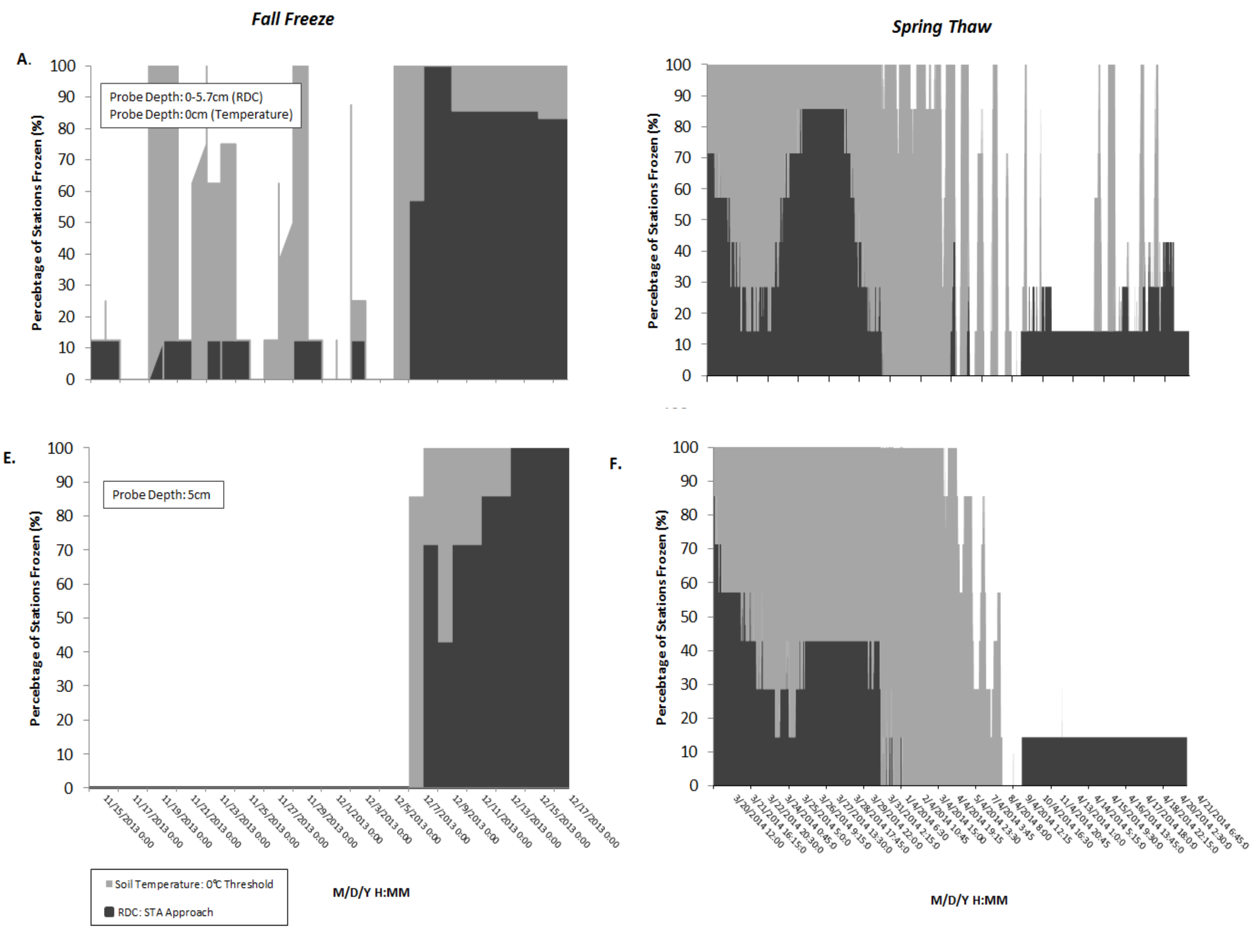
Issues with Sensor Orientation

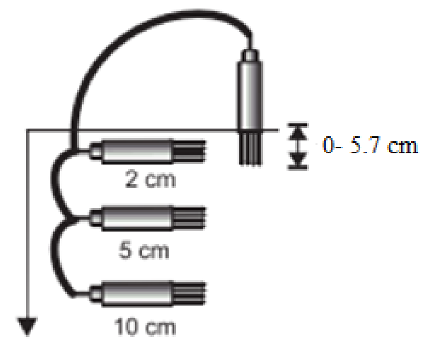


Comparisons between SMOS Level 2 soil moisture product and up-scaled AAFC network soil moisture (m3m-3) over 2012-13.

Note that the vertically oriented probes (A) have lower RMSE values and higher correlation

Issues with Calibration of Validation of Freeze Thaw Products using Hydra Probes





Variability of soil temperature and measured soil dielectric during a freeze thaw cycle at the surface and 5 cm depth (9 stations with sensors installed at 0cm Vertical, and 5cm over a 400m^2 region)

$$\Delta(t) = \frac{\varepsilon_r{}'(t) - \varepsilon_r{}'_{fr}}{\varepsilon_r{}'_{th} - \varepsilon_r{}'_{fr}}$$

Acknowledgments

Funding Support

- Environment Canada
- Agriculture and Agri-food Canada
- Canadian Space Agency
- Canadian Foundation for Innovation
- Ontario Innovation Trust
- National Science and Engineering Council of Canada

SMAPVEX12 field crew during training at the AAFC Regional Operations Centre in Winnipeg June 6th, 2012

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