AAFC’s RISMA Network: Validating SMAP L2SMP Products
Anna Pacheco, Heather McNairn, Jarrett Powers, Allan Howard, Patrick Rollin, Kurt Gottfried, Jacqueline Freeman, and Matthew Friesen
Science and Technology Branch
Carman – AAFC
Carman, Manitoba, Canada
Network Status

- SMAP Soil Moisture
- 9 stations (points)
- Near real-time, wireless
- 1 hour from data collection

<table>
<thead>
<tr>
<th>Measurement Type</th>
<th>Method</th>
<th>Depths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil moisture</td>
<td>Hydra sensors</td>
<td>0-5 cm; 5 cm; 20 cm; 50 cm; 100 cm.</td>
</tr>
<tr>
<td>Soil temperature</td>
<td>Hydra sensors</td>
<td>0-5 cm; 5 cm; 20 cm; 50 cm; 100 cm.</td>
</tr>
</tbody>
</table>

*Other measurements include air temperature, relative humidity, wind speed and direction, precipitation.
Comparing Carman (MB) Soil Moisture Data with SMAP

Observations:
1) Data should be removed from the dataset due to freeze conditions; consider increasing the frozen flag to 4°C (not 0°C)
2) Increases in soil moisture (>20%); SMAP seems to be over-sensitive; >50% soil moisture is excessive, sometimes greater than water holding capacity (measured during soils surveys)
3) Dry down from SMAP too rapid given that rainfall has been consistent with little extended drying events; for example second point - ~13% on average is way too low given clays present in pixel
Potential Sources of Errors

- **L2SMP Soil Moisture Algorithm**
  - Modelling: dielectric model, model coefficients,
  - Parameterization (optical thickness, roughness, etc)
  - Ancillary datasets (soil texture, land cover, etc)

- **Network Representation of SMAP pixel**
  - Currently using area weighted function based on soil texture
  - Other scaling techniques?

- **In-situ Network**
  - 0-5 cm vs 5-cm soil moisture depth
  - Freeze/thaw conditions
  - Dynamic range
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L2SMP Soil Fraction Input Dataset

Climate class:
Cold (Dfb)

Dominant landcover:
Croplands

Soil texture:
S-%: 23
C-%: 35
BD: 1.18

<table>
<thead>
<tr>
<th>Soil Texture Type</th>
<th>Percent Area</th>
</tr>
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<tbody>
<tr>
<td>Unclassified</td>
<td>0.60</td>
</tr>
<tr>
<td>Rock</td>
<td>0.29</td>
</tr>
<tr>
<td>Clayey</td>
<td>46.48</td>
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<tr>
<td>Loamy</td>
<td>31.59</td>
</tr>
<tr>
<td>Coarse Loamy</td>
<td>8.73</td>
</tr>
<tr>
<td>Sands</td>
<td>10.95</td>
</tr>
<tr>
<td>Organic</td>
<td>1.37</td>
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- **In-situ Network**
  - 0-5 cm vs 5-cm soil moisture depth
  - Frozen conditions should be better flagged
  - Dynamic range could be improved on a drier year
  - Issues with “stubborn” clays
AAFC Carman In Situ Soil Moisture vs SMAP Soil Moisture – A cleaner picture

RISMA Soil Moisture Average at 5-cm Depth vs SMAP Soil Moisture

- SM-1 (SCA-H)
- SM-2 (SCA-V)
- RISMA_5cm_AVG_Best_Sensor
- RISMA_5cm_AVG_All_Sensors
- Precipitation (mm)
Comparing the Clays and the Sands in Carman (MB)

“We choose to study clays, not because it is easy, but because it is hard.”

- J. Powers at AAFC (borrowed from Kennedy)