

ARM High Resolution (Sub)Surface Products for SGP

ARM

CLIMATE RESEARCH FACILITY

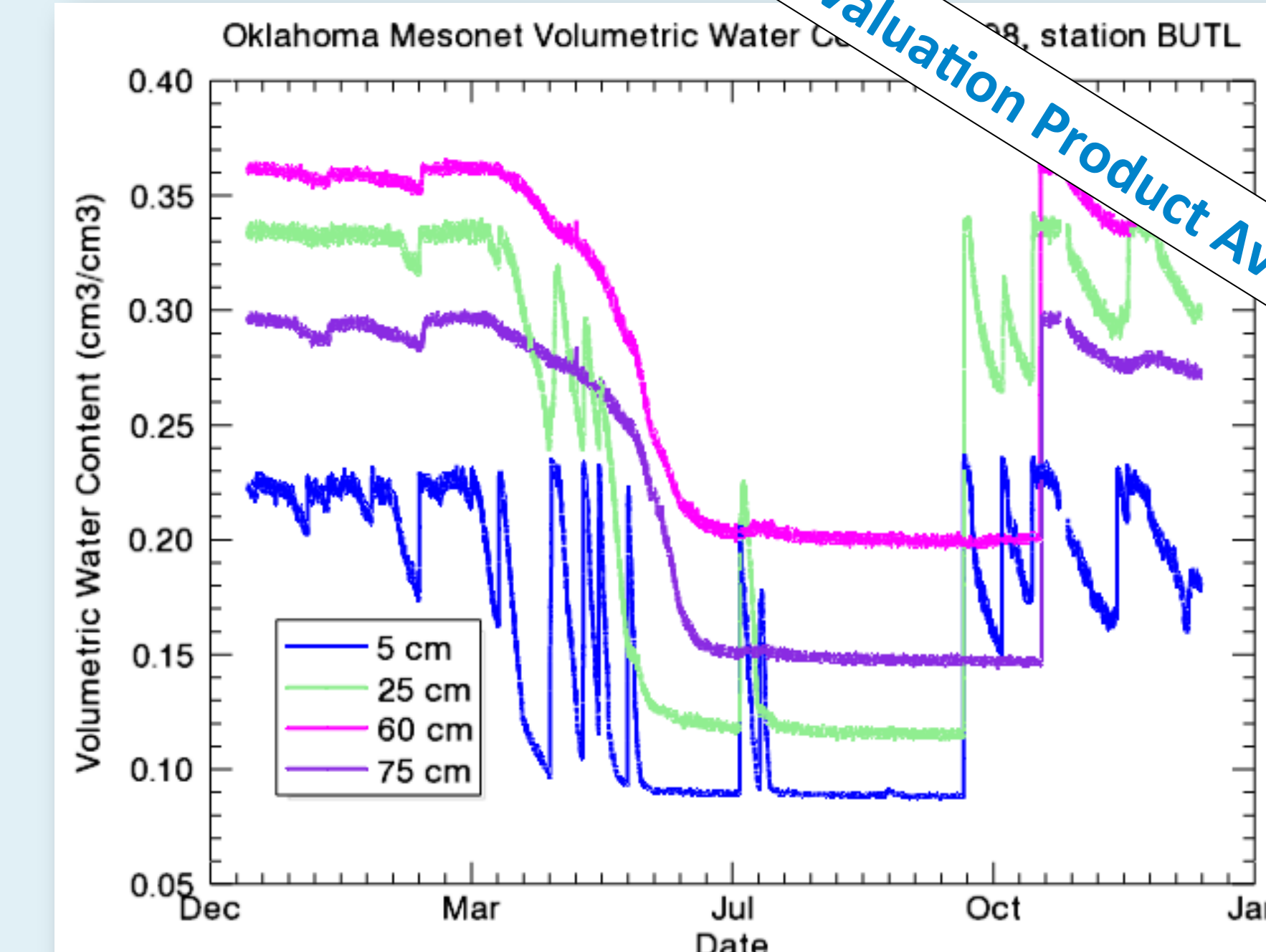
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Motivation

- Land surface and subsurface states (e.g., soil moisture) are critical for analyses of land-atmospheric interactions in climate studies.
- With the recent emphasis on land-atmospheric interactions in the context of the Next-Generation ARM Facility, requests for land surface/subsurface information including its spatial variability from the Atmospheric Systems Research (ASR) community have greatly increased.
- Two critical SGP products emerged from ASR discussions: **1) soil moisture product and 2) land use/land cover product.**

1) Oklahoma Mesonet (OKM) Soil Moisture Product

- Over 100 stations across Oklahoma
 - Land surface and subsurface conditions
 - OKM Parameter database (Meso-Soil DB)
 - XDC soil moisture evaluation product based on:
 - 30 min average OKM data
 - Meso-Soil database
 - Equations from Illston, et al.(2008)
- Available through ARM Data Discovery Tool



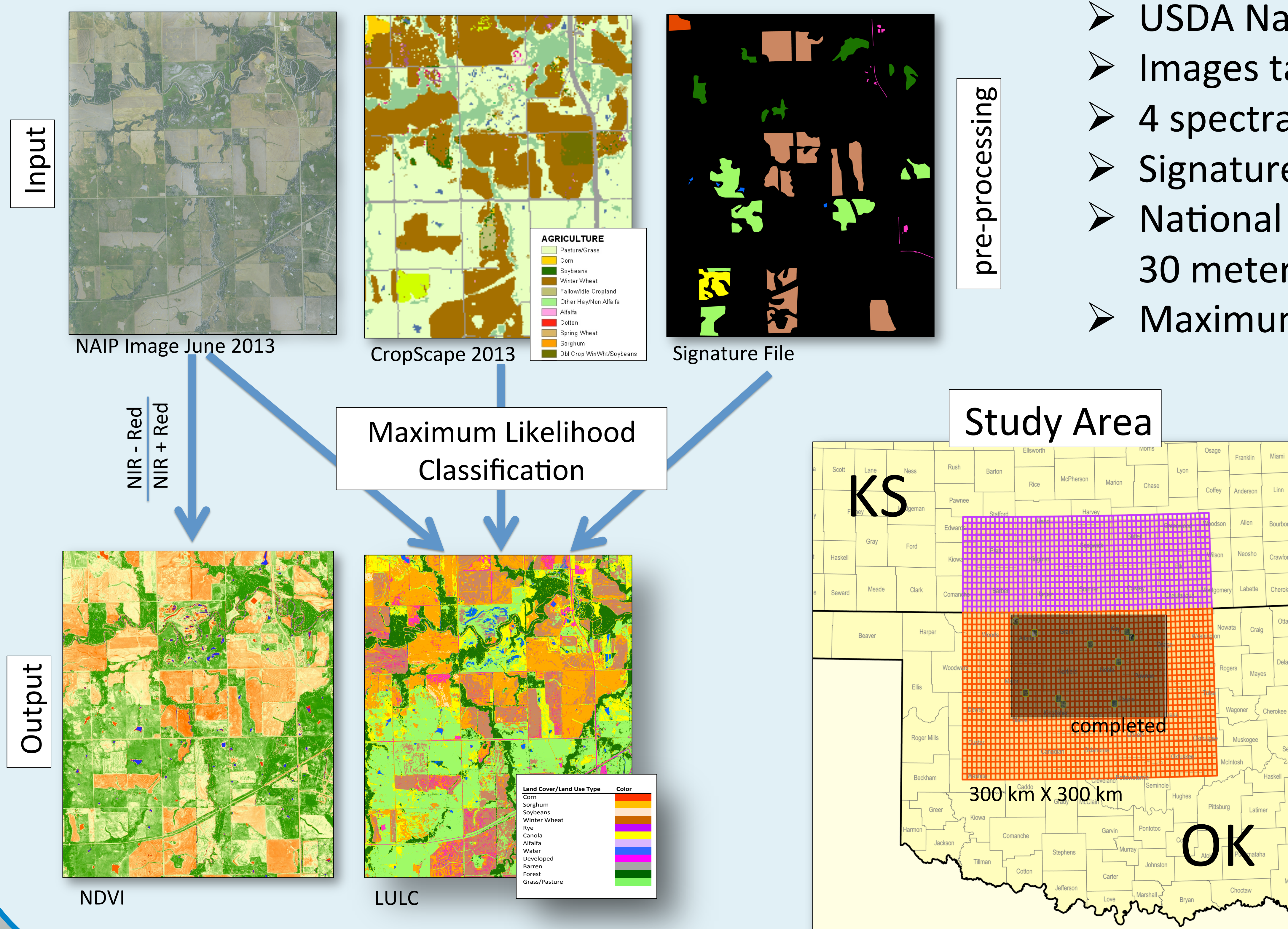
$$\text{Vol. water content} = [1 + (-\alpha\psi_m)^n]^{-m}$$

$$\text{Matric potential} = \psi_m = -c \exp(a\Delta T_{ref})$$

References

Illston, R, J Basara, D Fisher, R Elliott, C Fiebrich, K Crawford, K Humes, and E Hunt. 2008. "Mesoscale monitoring of soil moisture across a statewide network." *Journal of Atmospheric and Oceanic Technology* 25: 167-182, doi:10.1175/2007JTECHA993.1.
Scott, B, T Ochsner, B Illston, C Fiebrich, J Basara, and A Sutherland. 2013. "New soil property database improves Oklahoma Mesonet soil moisture estimates." *Journal of Atmospheric and Oceanic Technology* 00: 1-11, doi:10.1175/JETCH-D-13-00084.1.

2a) Land Use/Land Cover (LULC) Product- ArcGis



- 300 km X 300 km area centered on the ARM SGP Central Facility
- USDA National Agriculture Imaging Program (NAIP) imagery
- Images taken June 2013 (geotiffs)
- 4 spectral bands NIR, RGB- 1 meter resolution
- Signature files created for supervised classification
- National Agriculture Statistics Service (NASS) CropScape LULC product 30 meter resolution to assist in signature file creation
- Maximum Likelihood Classification method produces LULC

2b) Future: Machine Learning (ML) Exploration

- Potentially increase speed and accuracy using ML algorithms to produce LULC map
- Uses same 1 meter input imagery
- Identify features to train model (e.g. signature files, vegetation index, etc.)
- Exploring numerous vegetation indices as features (NDVI, SAVI, MSAVI)
- Non-linear classifier (Gradient Boosting Decision Tree)
- Early stages but showing promise