

Evaluating the sensitivity of LSM surface soil moisture dynamics to soil profile layering schemes

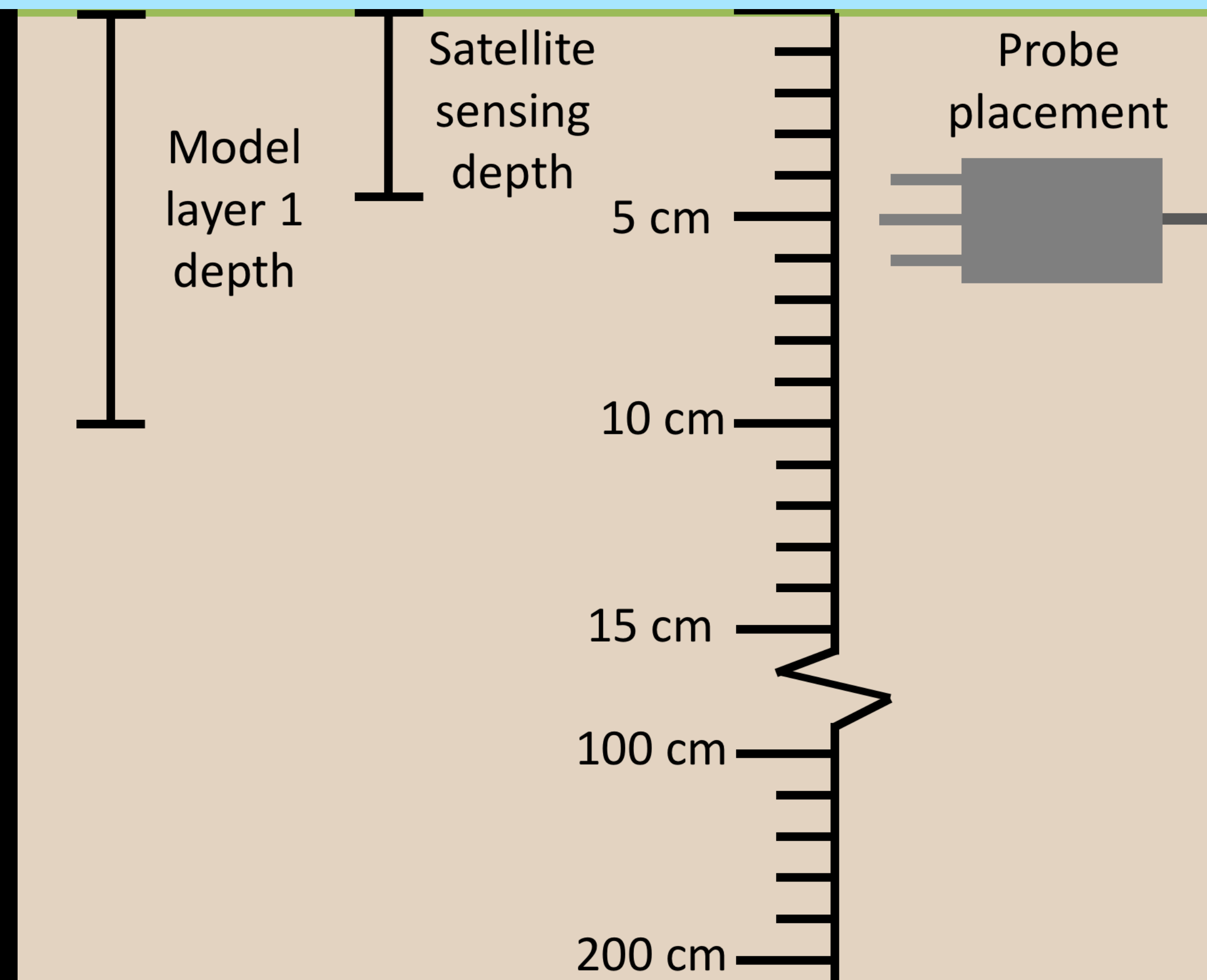
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October 22, 2018
SMAP cal/val workshop

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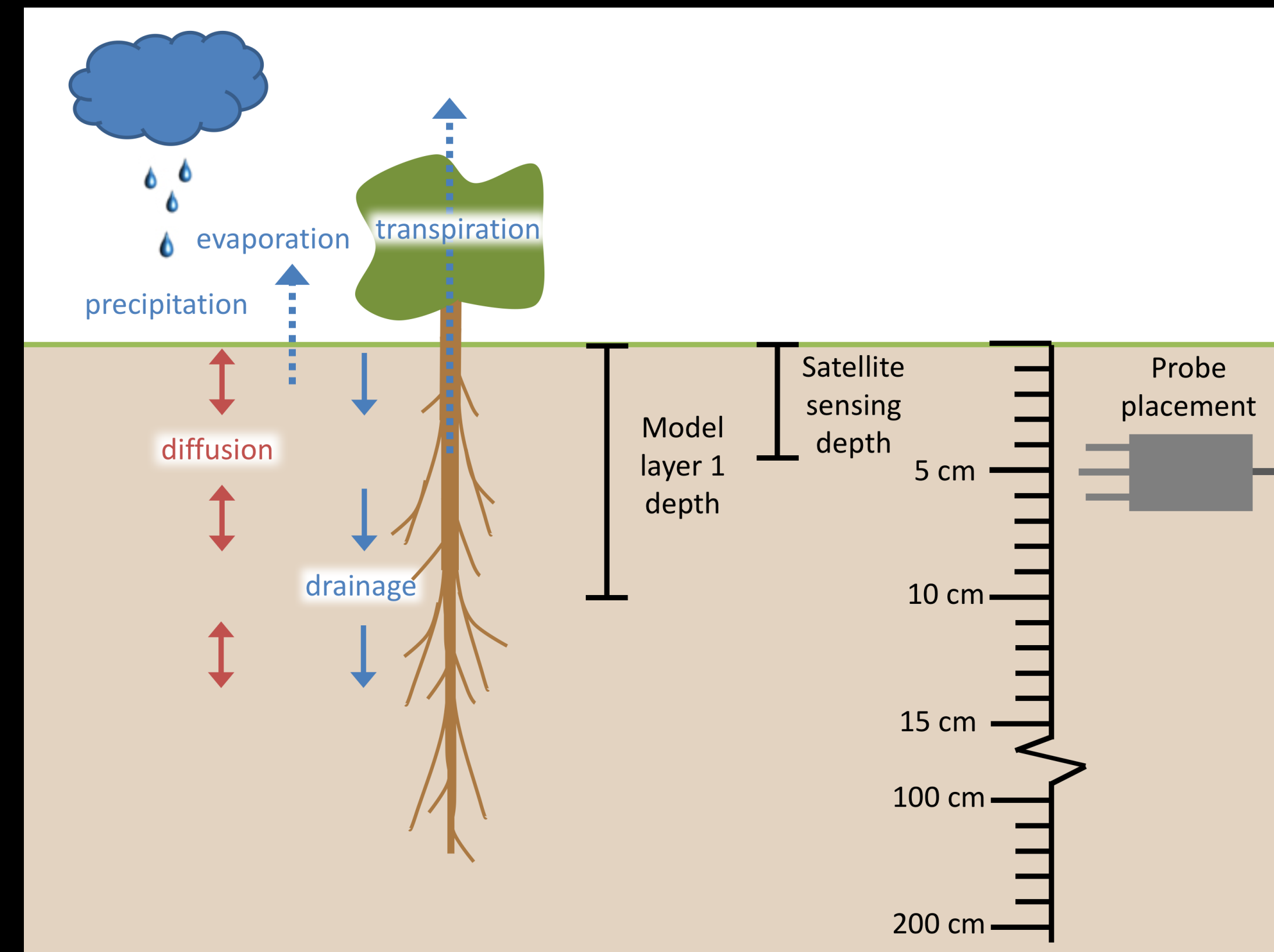
²NASA Goddard Space Flight Center

³U.S. Department of Agriculture



Motivation

- Improve simulated soil moisture *observability* for SMAP data assimilation applications
- How model layering structure affects surface drying behavior
 - Noah-MP: 10 cm
 - SMAP: 5 cm or less



Model layering configurations

- Noah-MP 3.6 with dynamic vegetation
- NLDAS-2 forcings
- April 2015 through April 2018
- 1/8 degree resolution over CONUS

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Layer thicknesses (cm)

10, 30, 60, 100

5, 5, 30, 60, 100

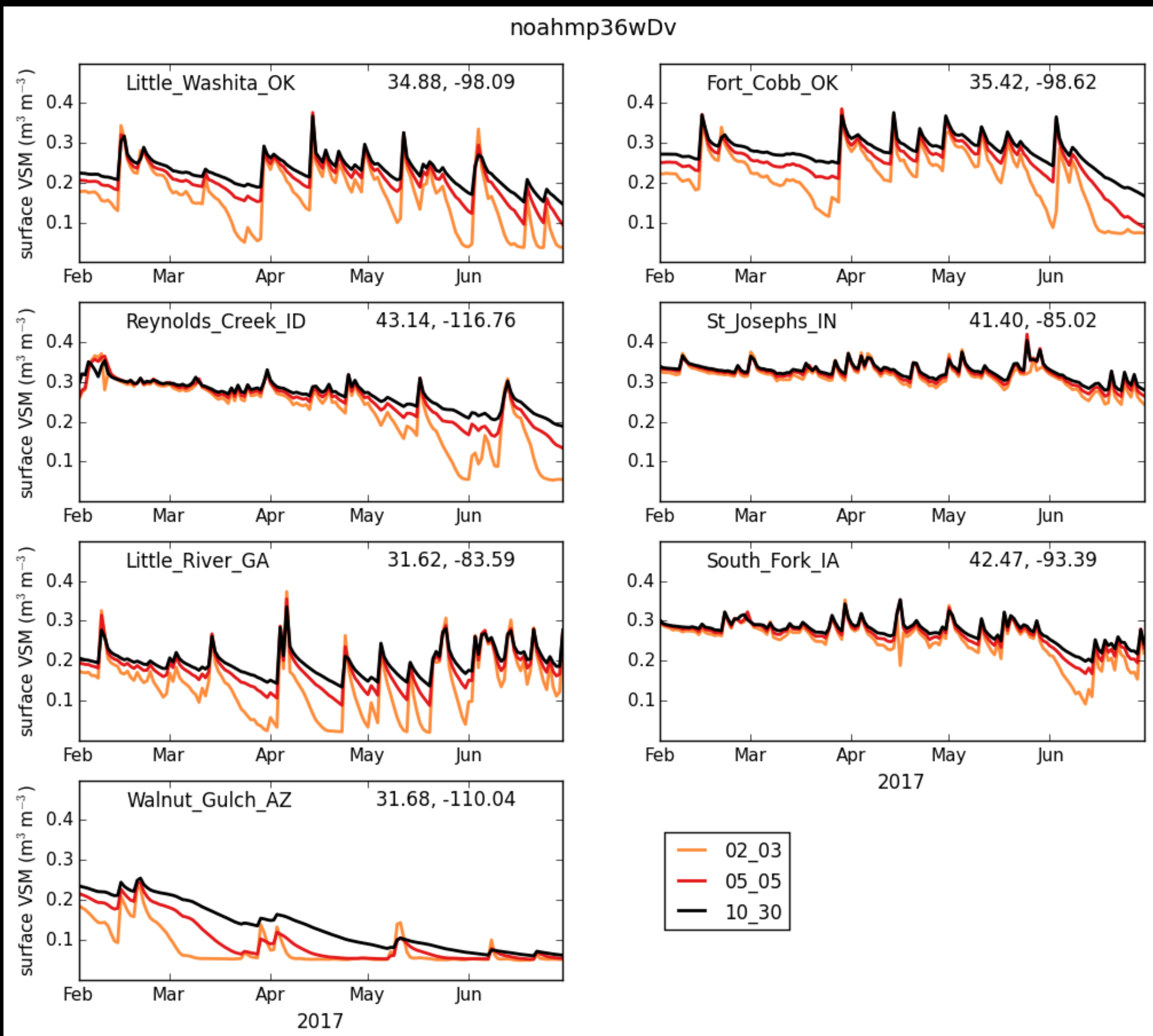
2, 3, 6, 9, 15, 24, 40, 100

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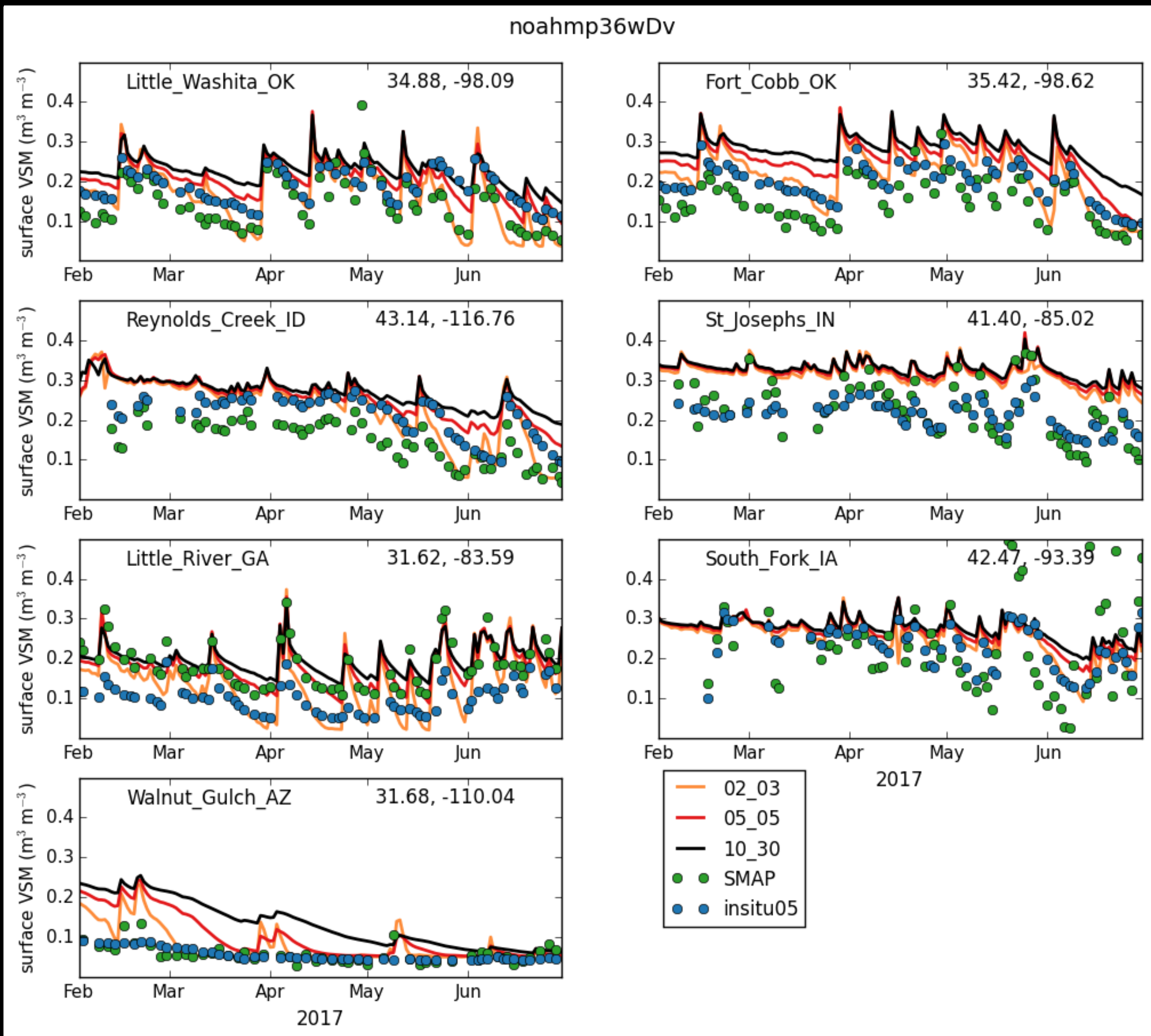
<u>Layer thicknesses (cm)</u>	<u>Experiment label</u>
10, 30, 60, 100	10_30
5, 5, 30, 60, 100	05_05
2, 3, 6, 9, 15, 24, 40, 100	02_03

Effect on soil moisture



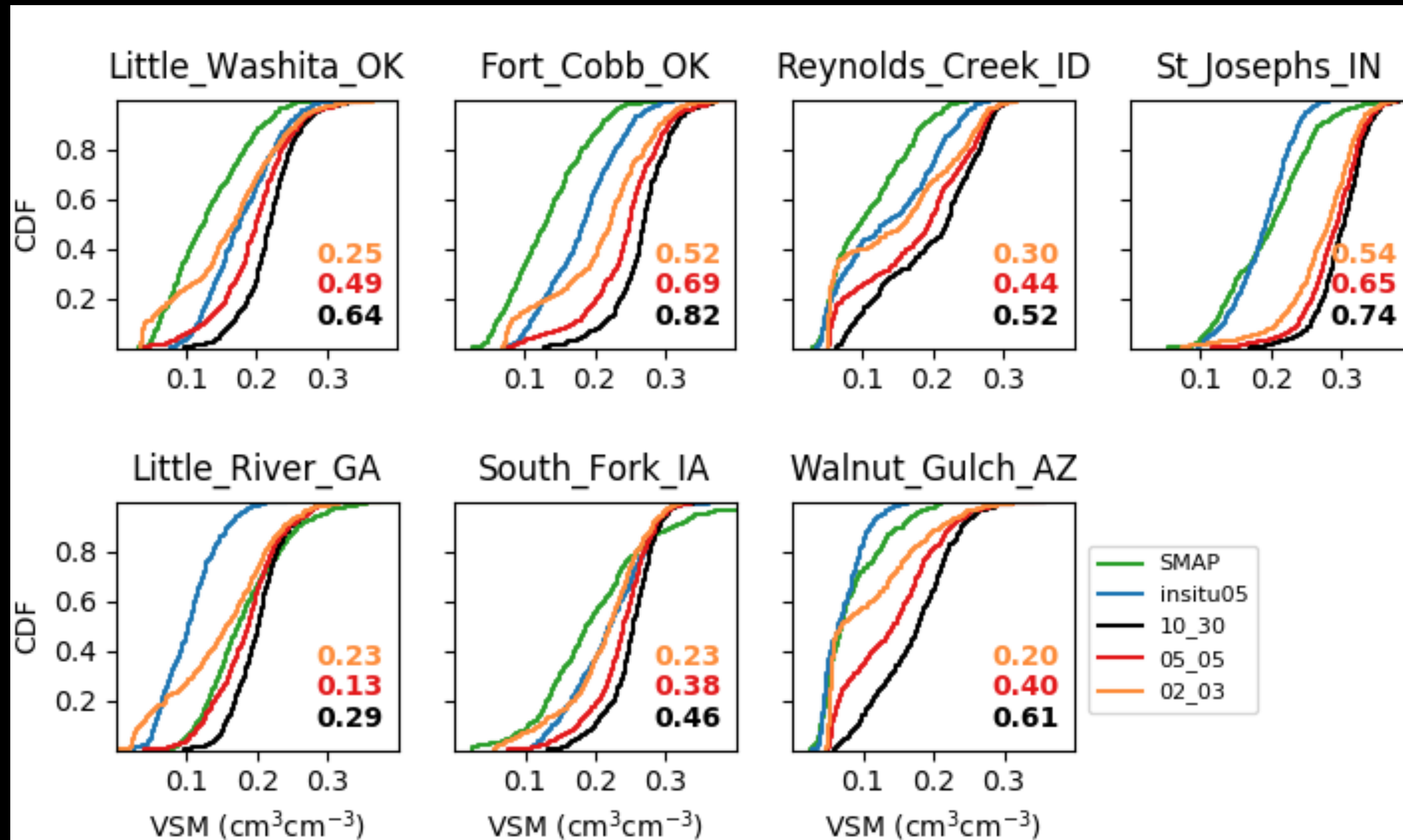
- Surface soil moisture (SSM) is more dynamic and drier when surface layer is thinner
- Decreased resistance to bare soil evaporation

Effect on soil moisture



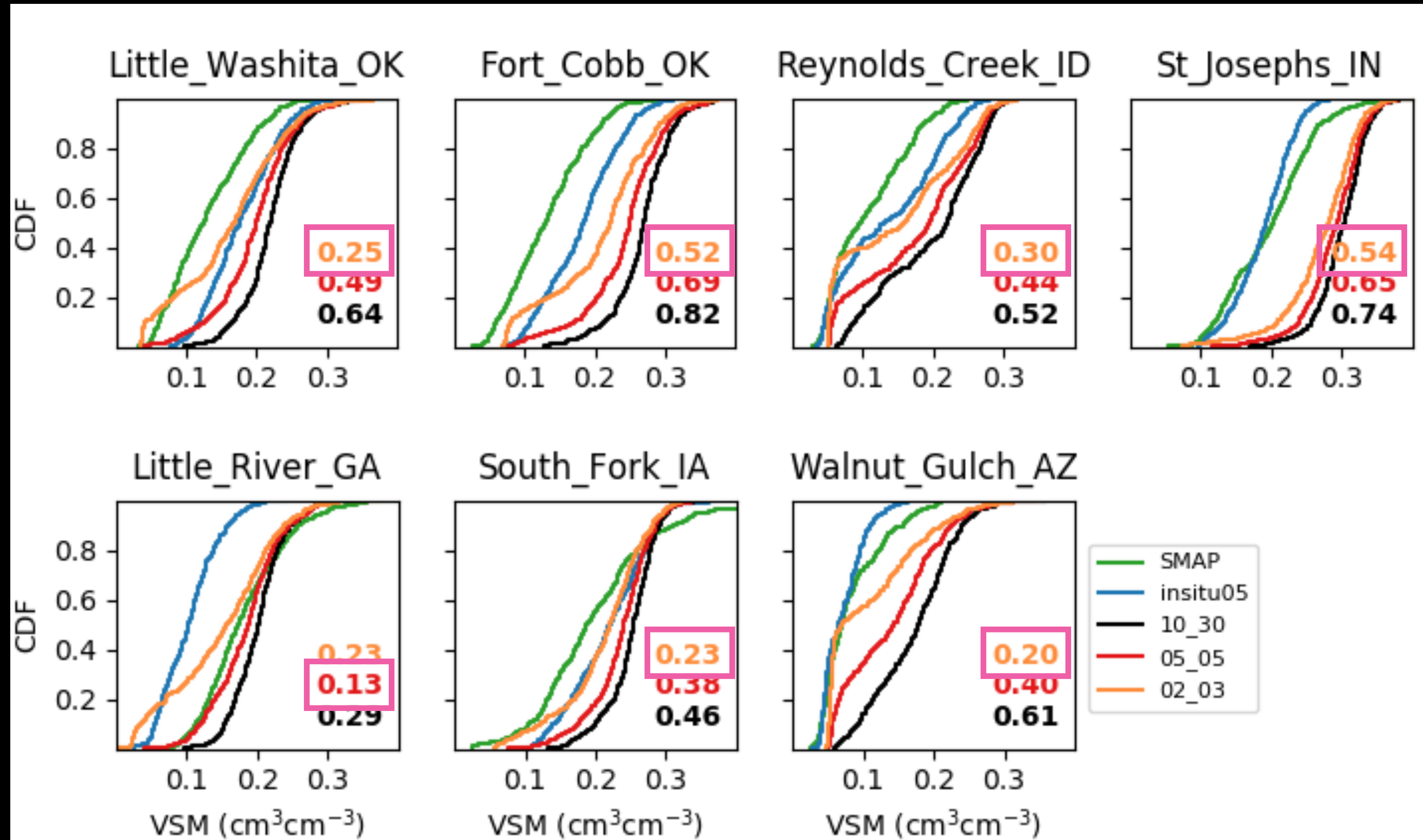
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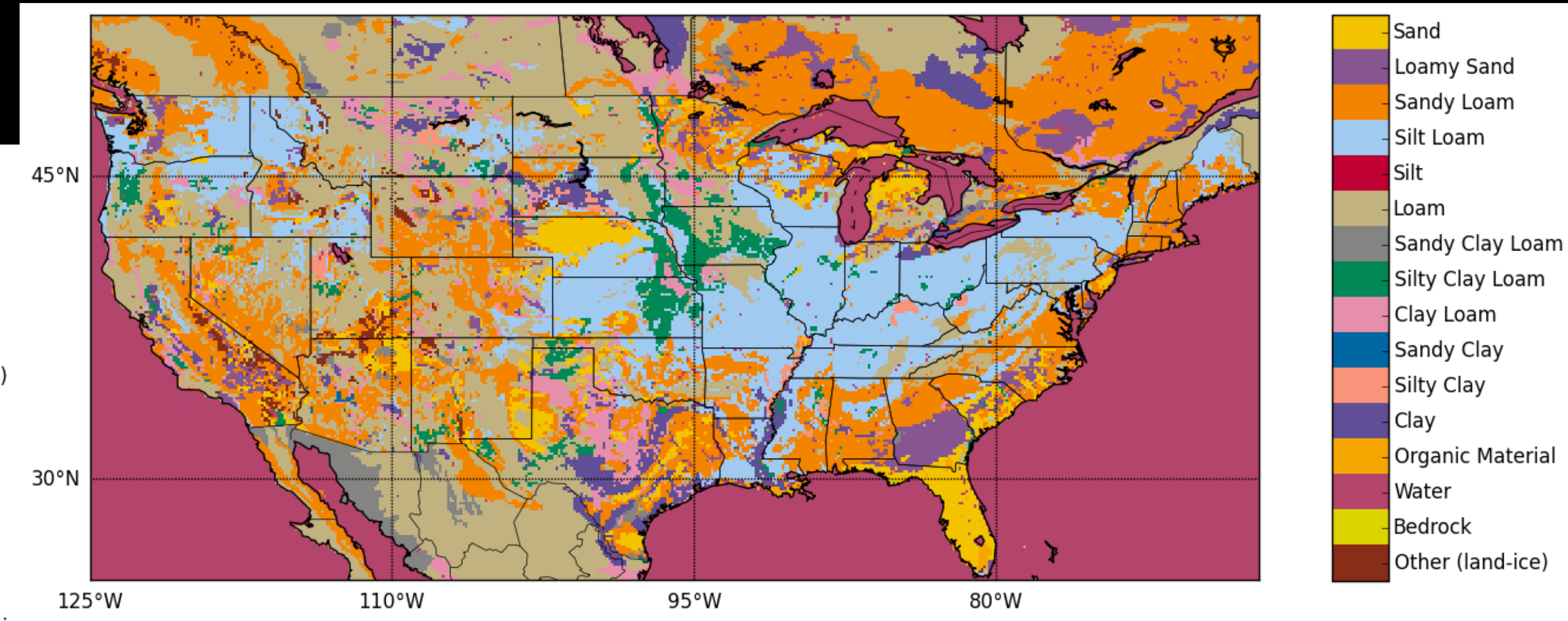
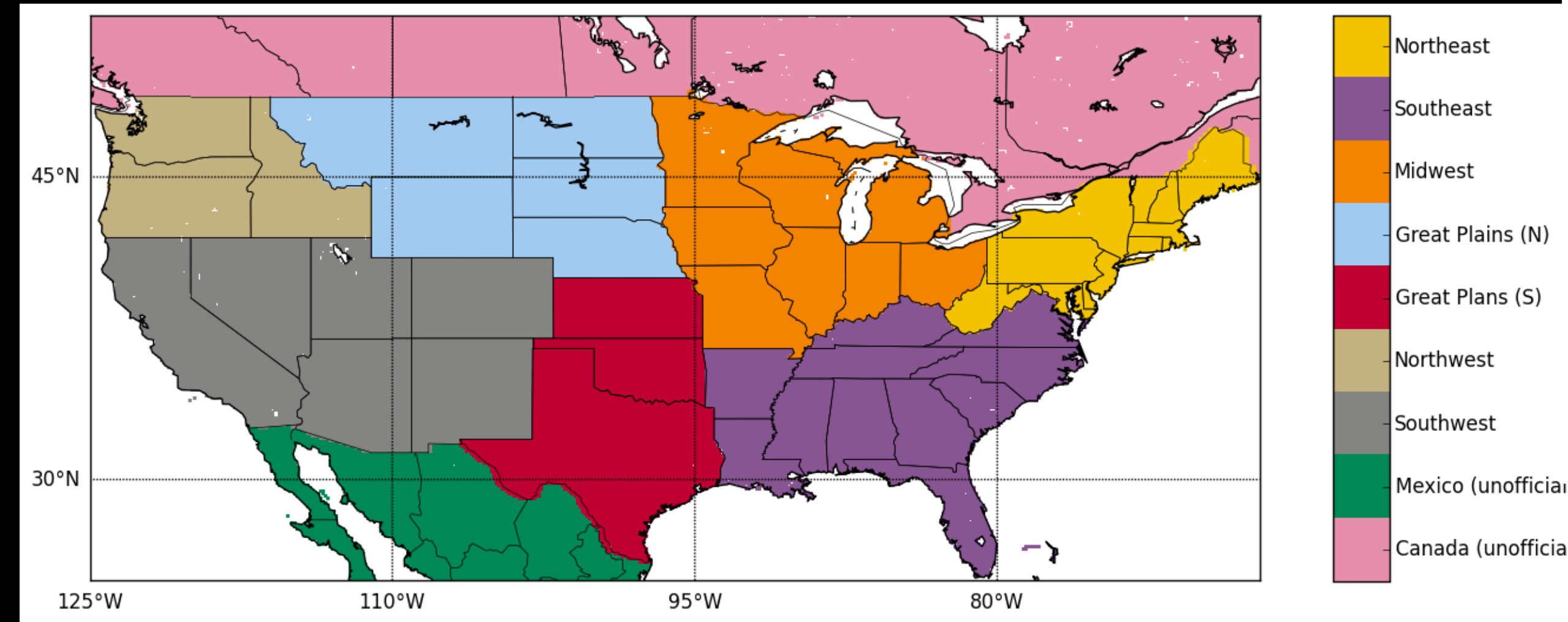
Inset values are
Kolmogorov-Smirnov
test results between
simulations and SMAP
retrievals

Effect on soil moisture



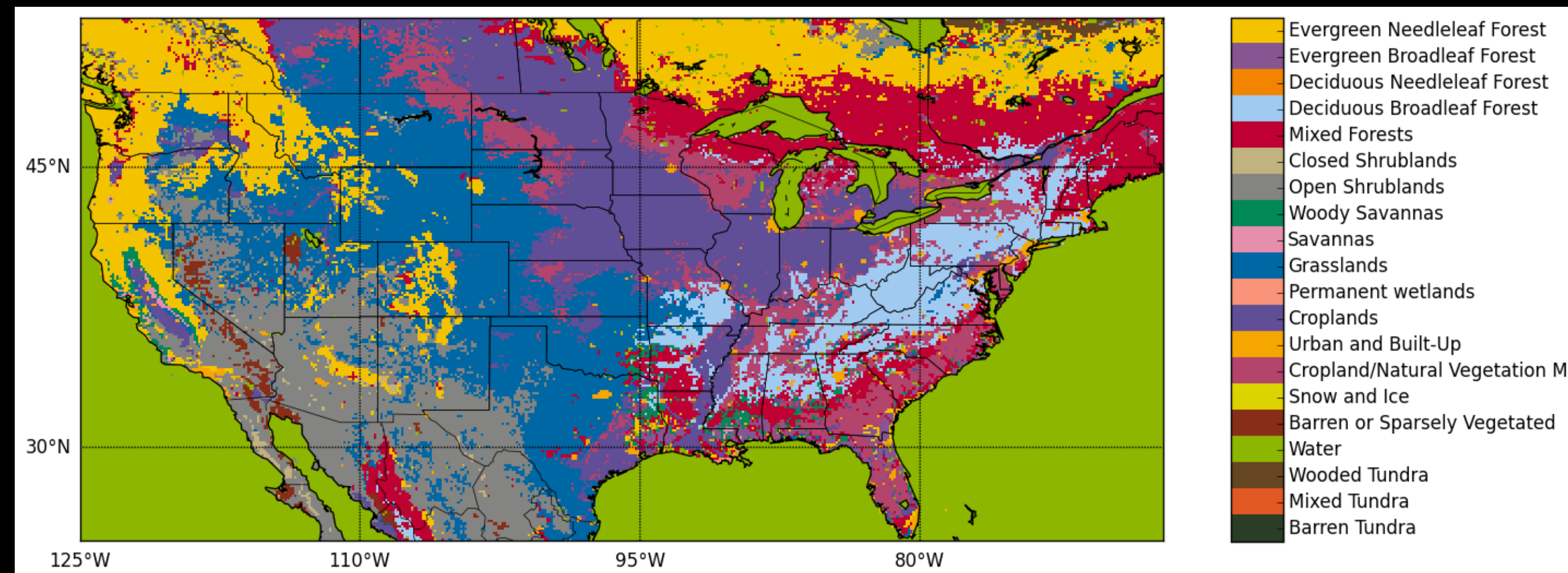
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National Climate Assessment Region



STATSGO soil texture

MODIS landcover



Conclusions

- Using Noah-MP with a shallower surface layer results in:
 - SSM values that are drier and have higher variance
 - Better match between SSM and SMAP observations
 - Increased diversity of SSM both in time and space

Next steps

- Model structure --> Parameter calibration
 - Using 2-cm layer configuration
 - In Tb space
- Provide more efficient and effective data assimilation of SMAP into Noah-MP