Near Rear Time 1 km SMAP Soil Moisture Data Product for Potential Use in National Water Model

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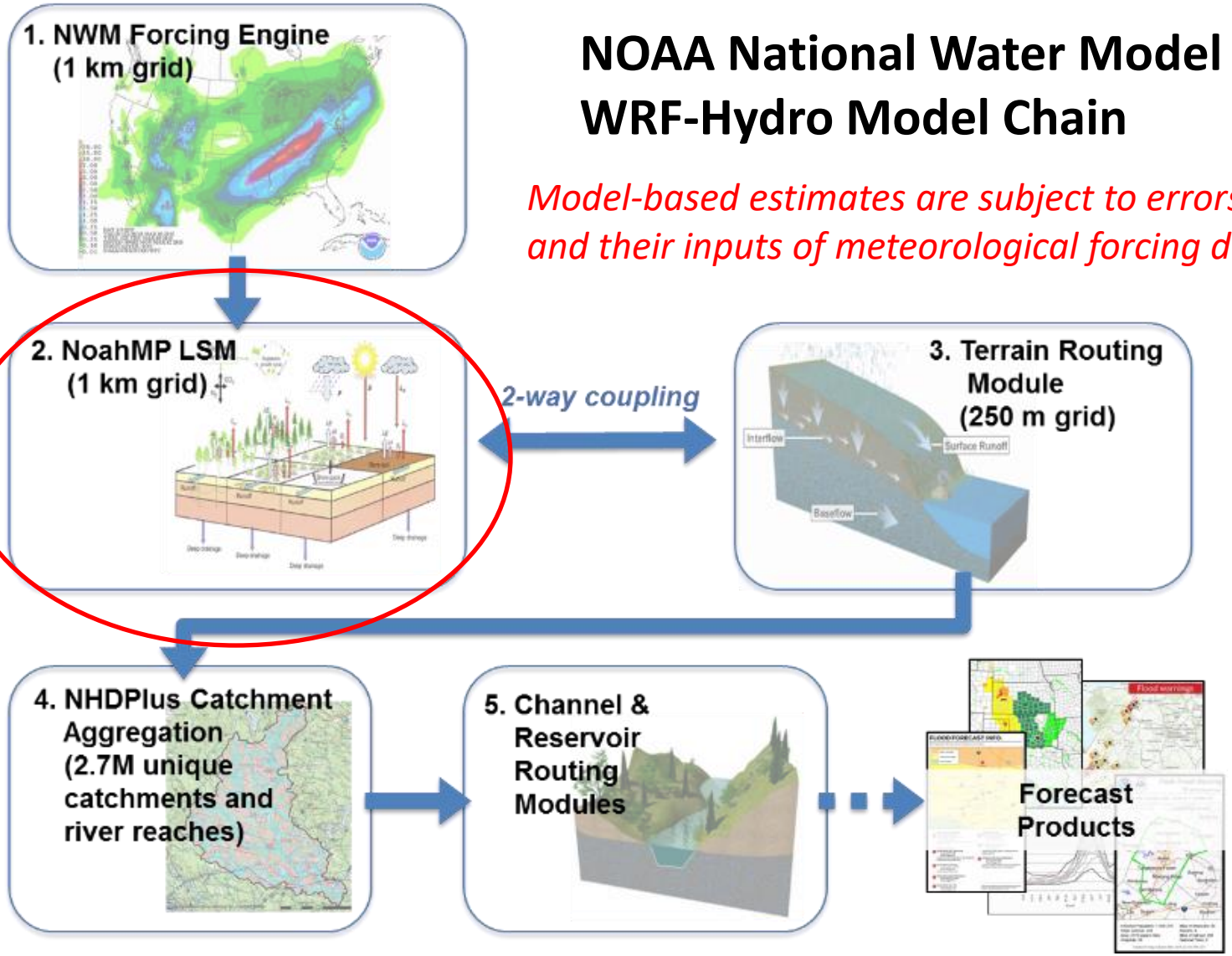
Outline

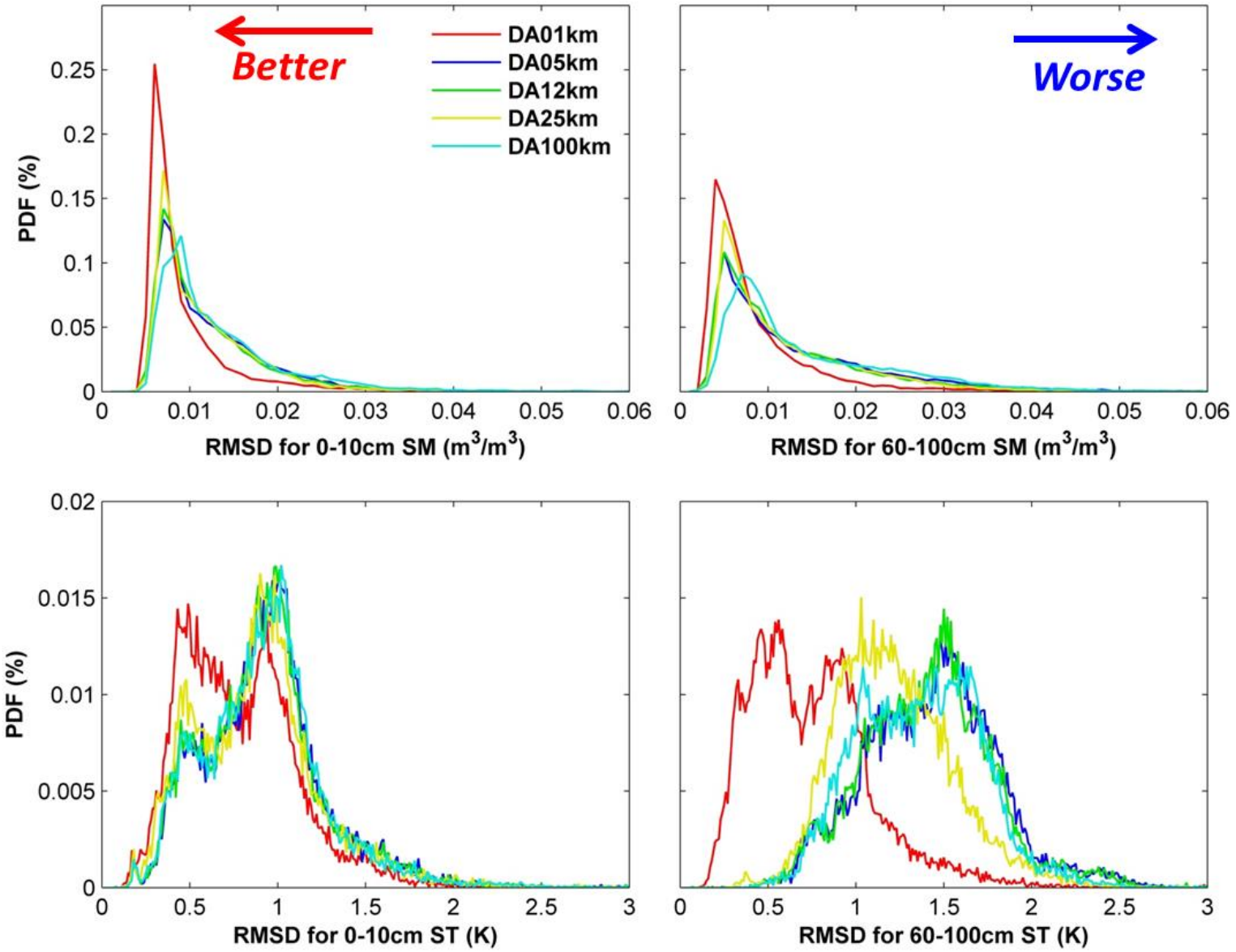
- ***Motivations***
- ***Downscaling Strategic***
- ***Validations***
- ***Operational Pathway***
- ***Summary***

NOAA National Water Model WRF-Hydro Model Chain

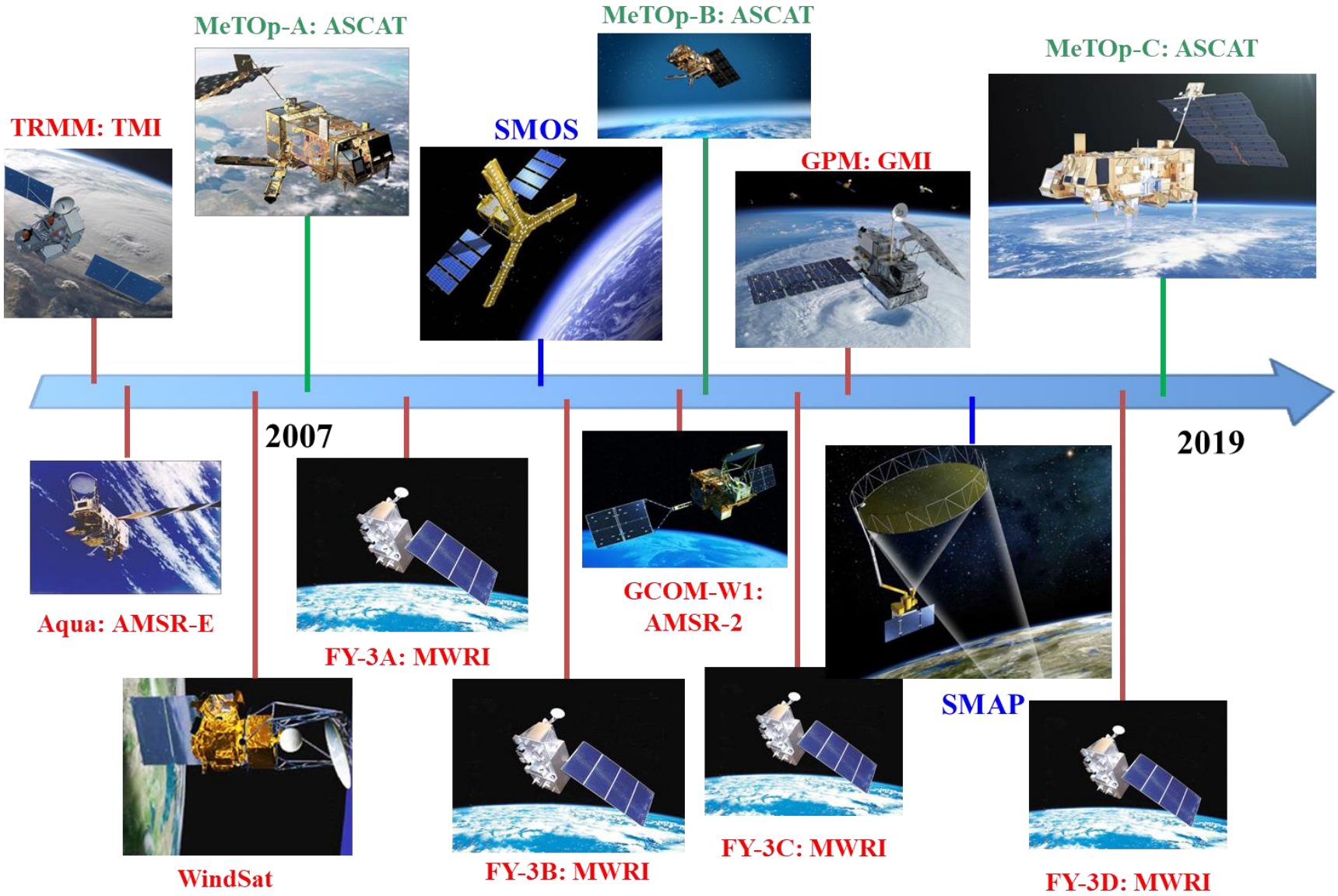
Model-based estimates are subject to errors of models and their inputs of meteorological forcing data.



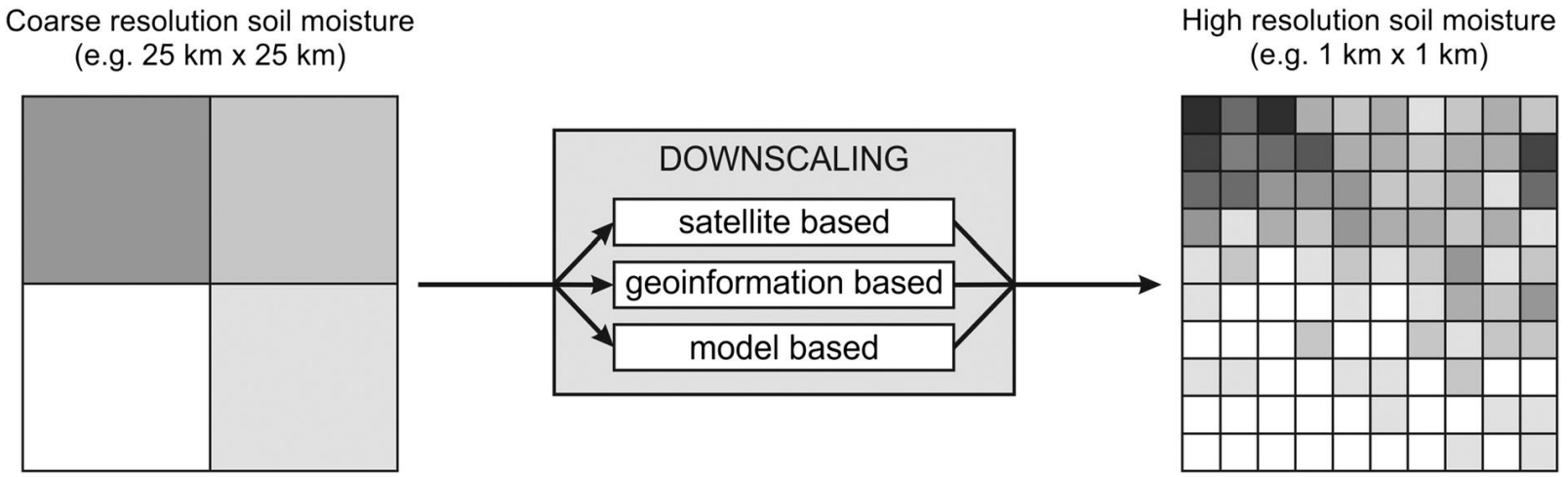
1 Motivations



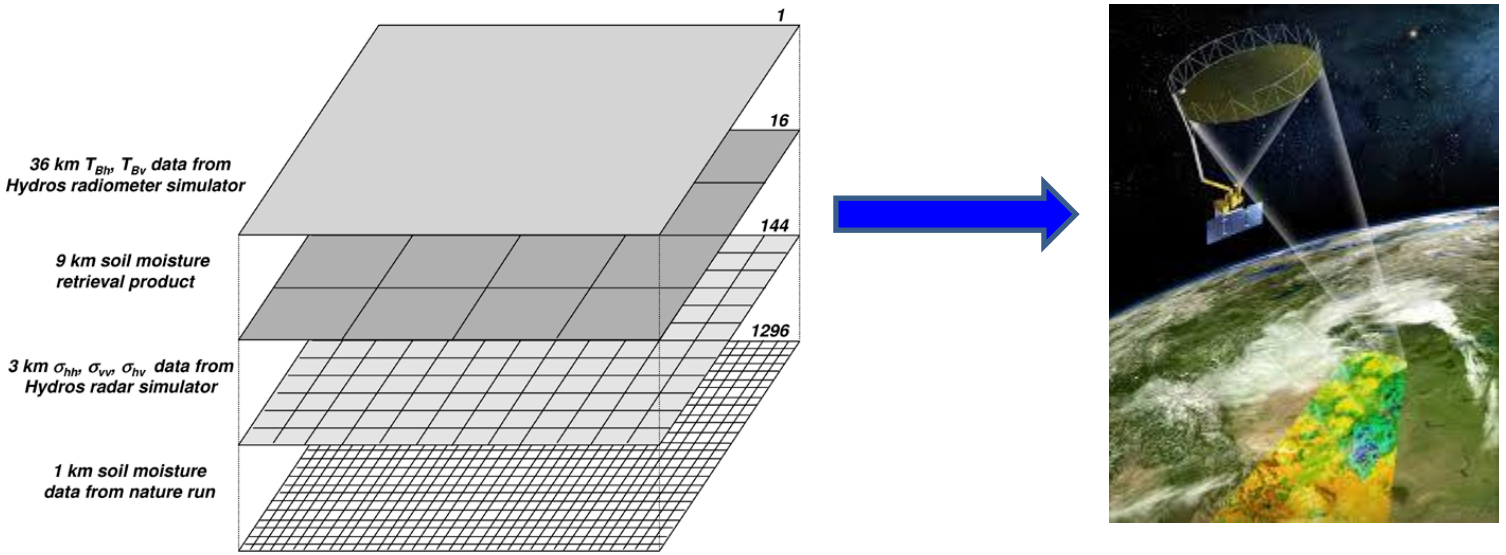
1 Motivations



2 Downscaling Strategic

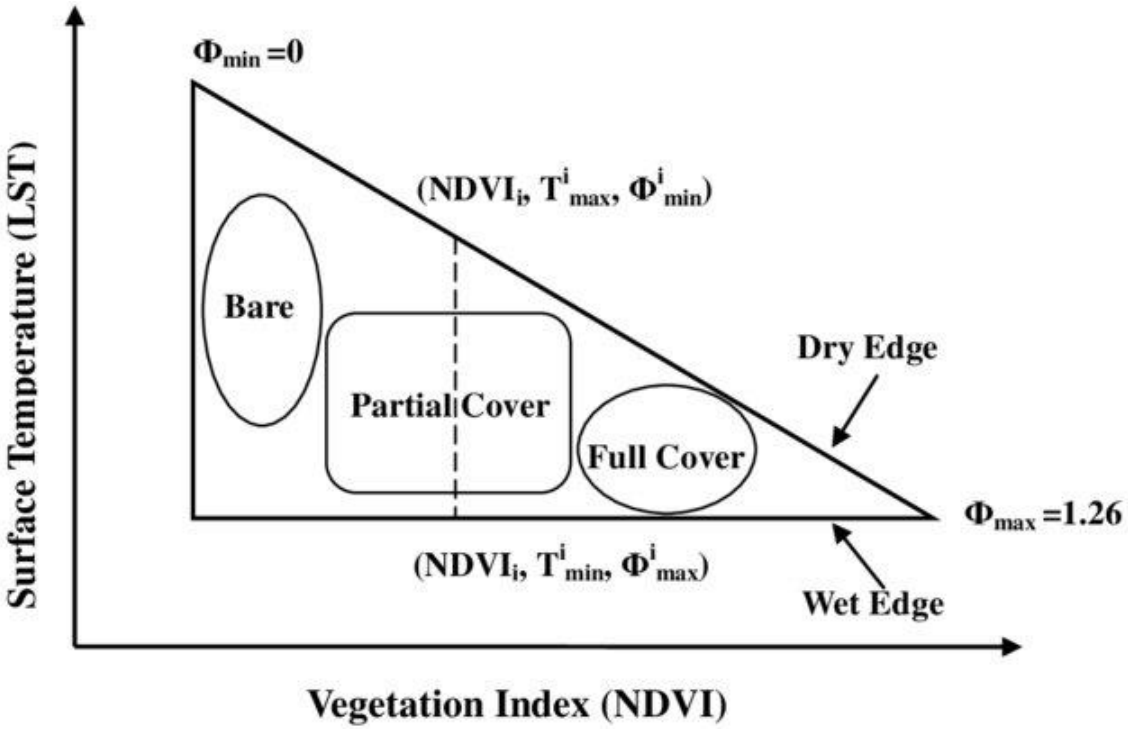


Flowchart of soil moisture downscaling methods (Peng et al., 2017)



Merging radar backscatter and radiometer Tb (Zhan et al., 2006; Entekhabi et al., 2010).

2 Downscaling Strategic



SM↓ → ET↓ → LST↑

SM↑ → Plant↑ → VI↑

Peng et al., 2013

2 Downscaling Strategic

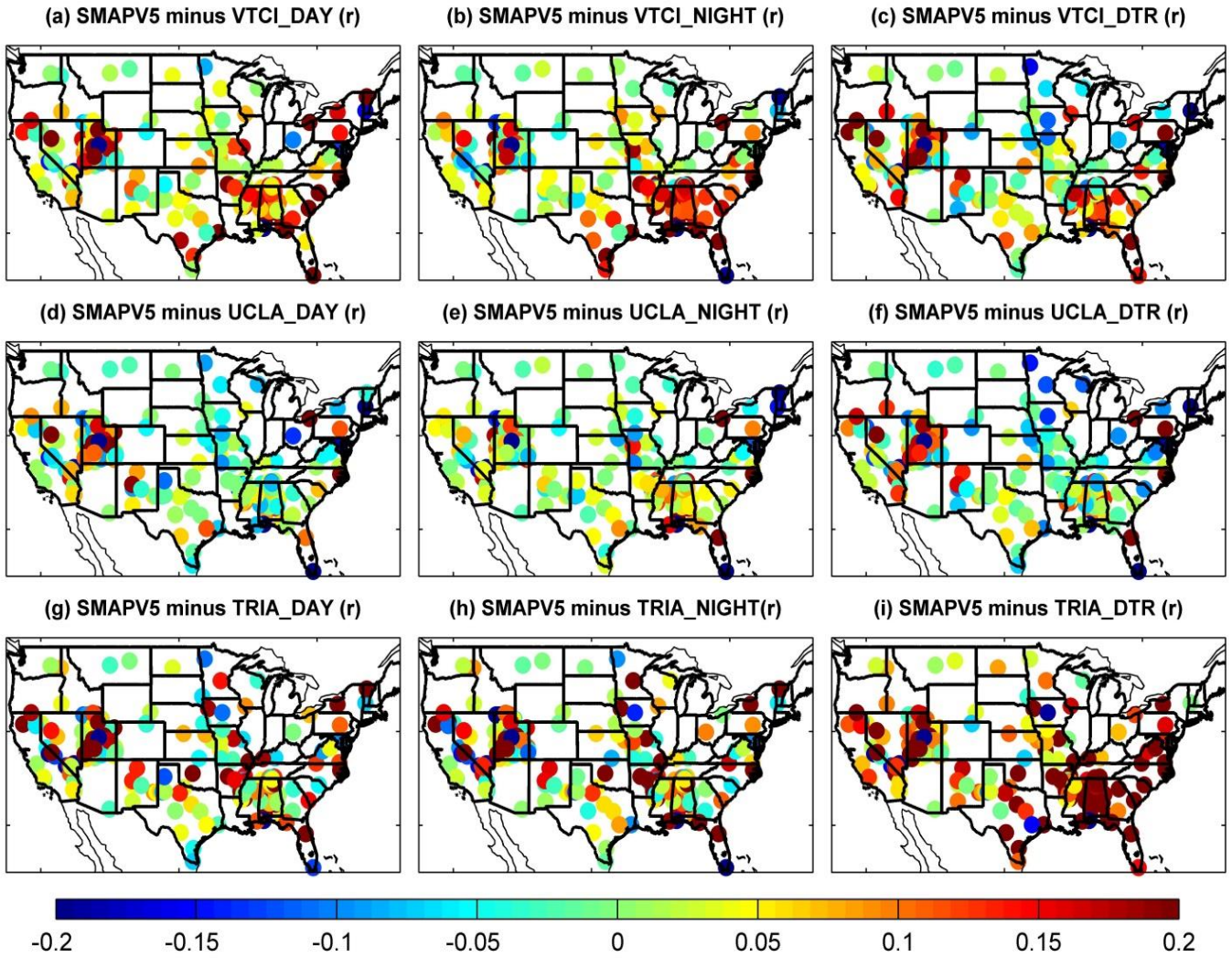
For operational users, the downscaling approach should

- Be feasible for operational implementation;
- Require limited ancillary information;
- Primarily depend on readily available satellite observations.

Downscaling Approaches:	Satellite Observations: EVI &
Temperature–vegetation Triangle (TRIA)	Daytime LST (DAY)
Vegetation temperature condition index (VTCI)	Nighttime LST (NIGHT)
Soil wetness index-based Method (UCLA)	Nighttime and daytime LST difference (DTR)

TRIA_DAY	TRIA_NIGHT	TRIA_DTR
VTCI_DAY	VTCI_NIGHT	VTCI_DTR
UCLA_DAY	UCLA_NIGHT	UCLA_DTR

3 Validations



CONUS domain-Ave *r*:

SMAPV5: 0.642

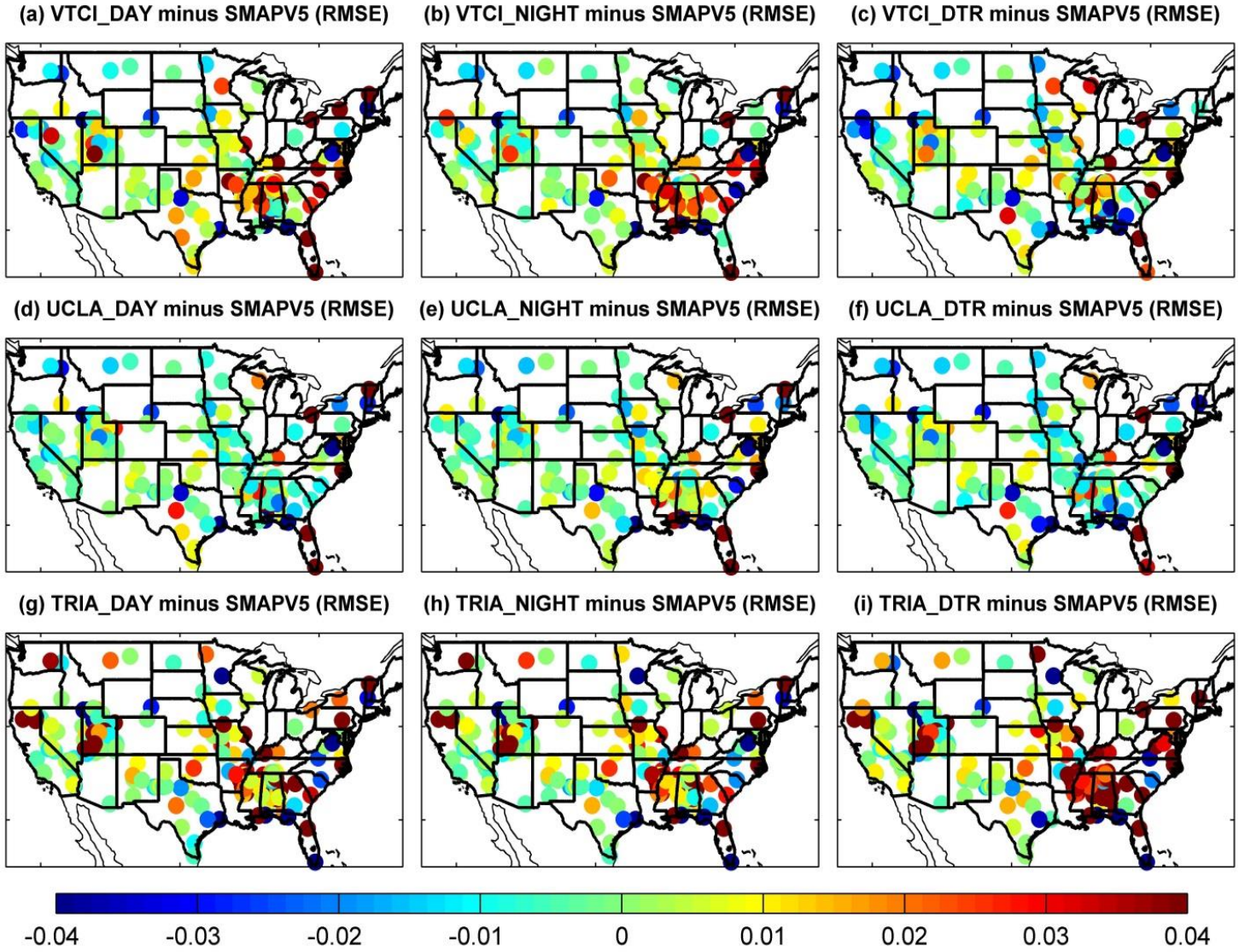
VTCI_DAY: 0.582
VTCI_NIGHT: 0.584
VTCI_DTR: 0.596

UCLA_DAY: 0.640
UCLA_NIGHT: 0.632
UCLA_DTR: 0.642

TRIA_DAY: 0.576
TRIA_NIGHT: 0.574
TRIA_DTR: 0.582

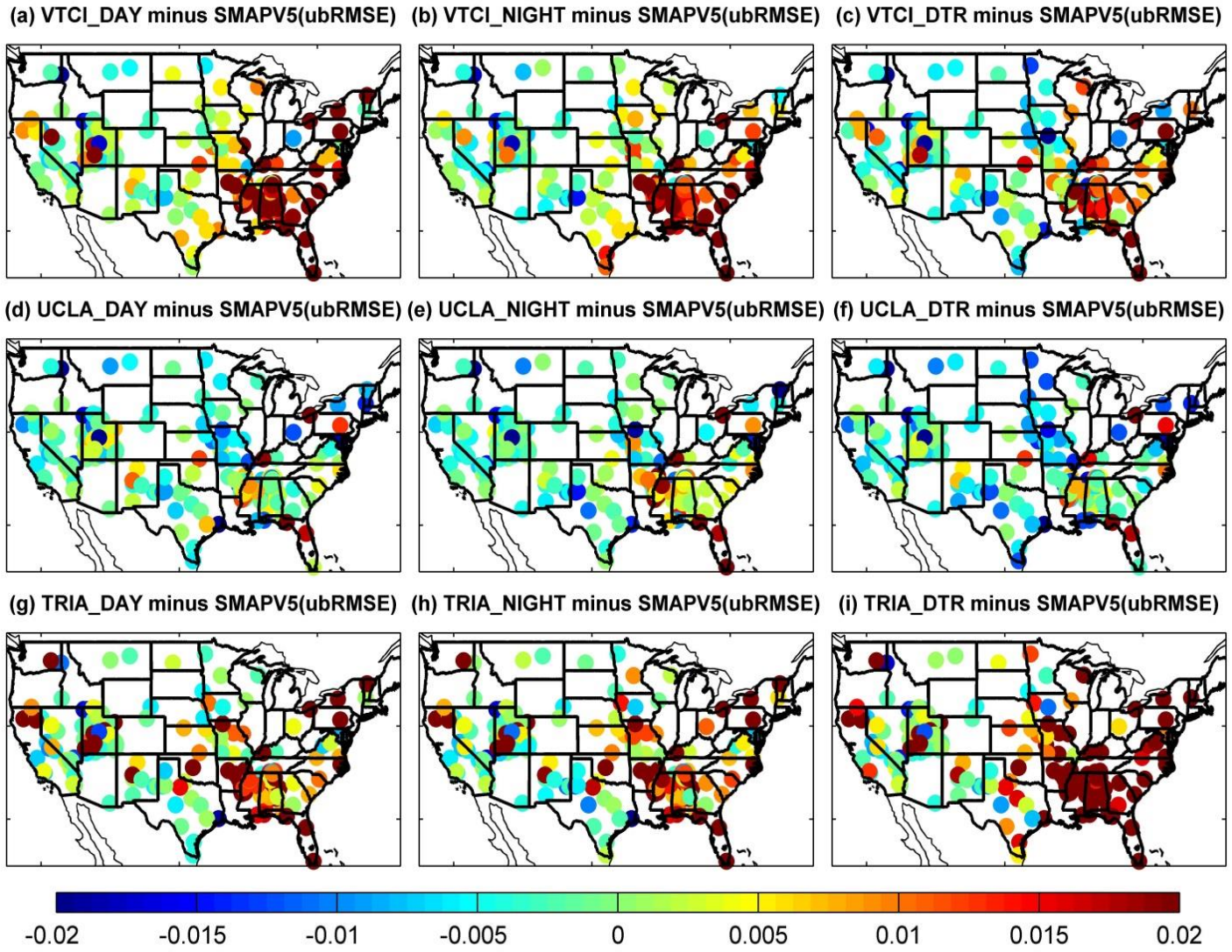
3 Validations

SMAPV5: 0.089 *UCLA_DTR: 0.082*

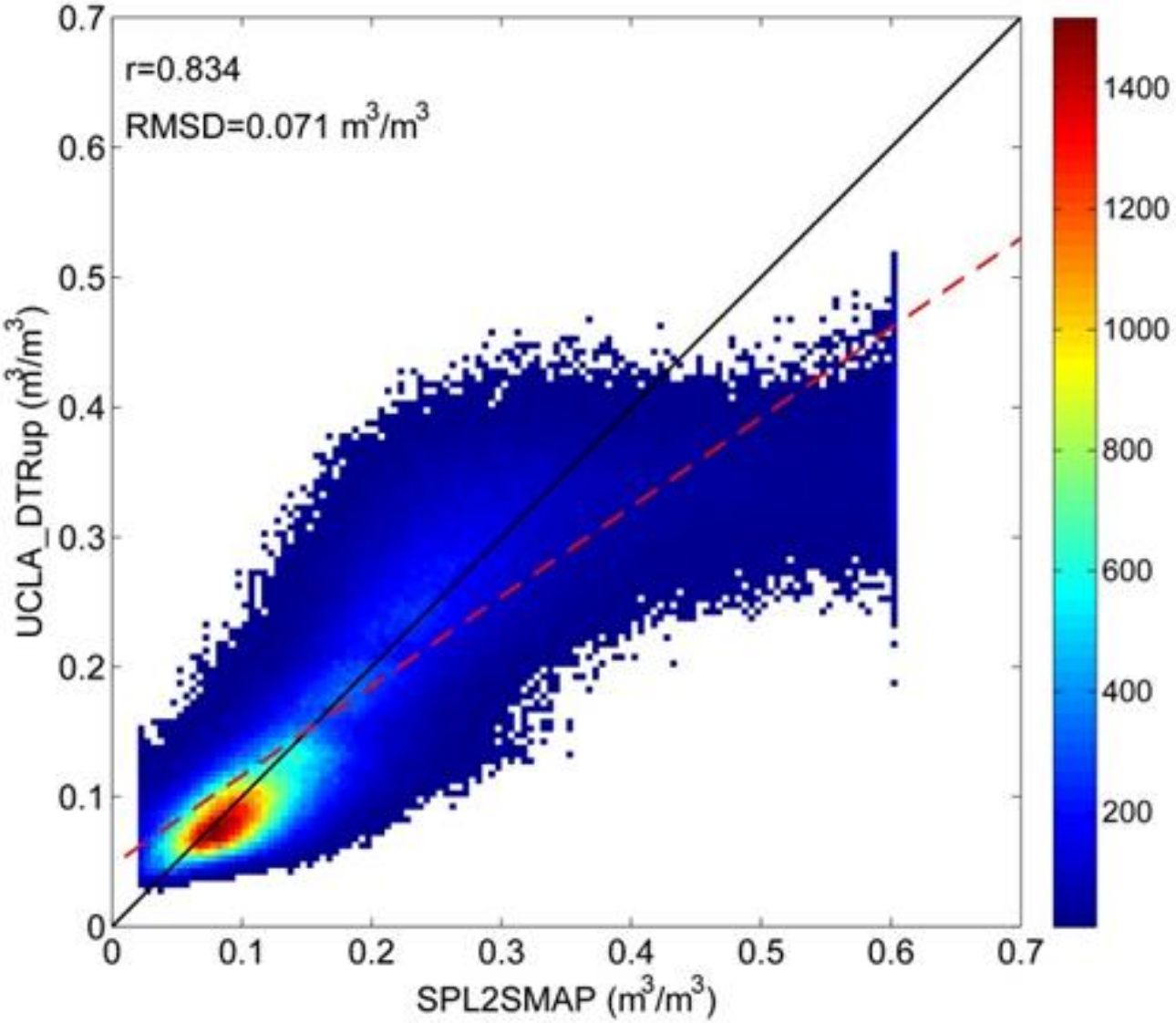


3 Validations

SMAPV5: 0.054 *UCLA_DTR: 0.049*



3 Validations



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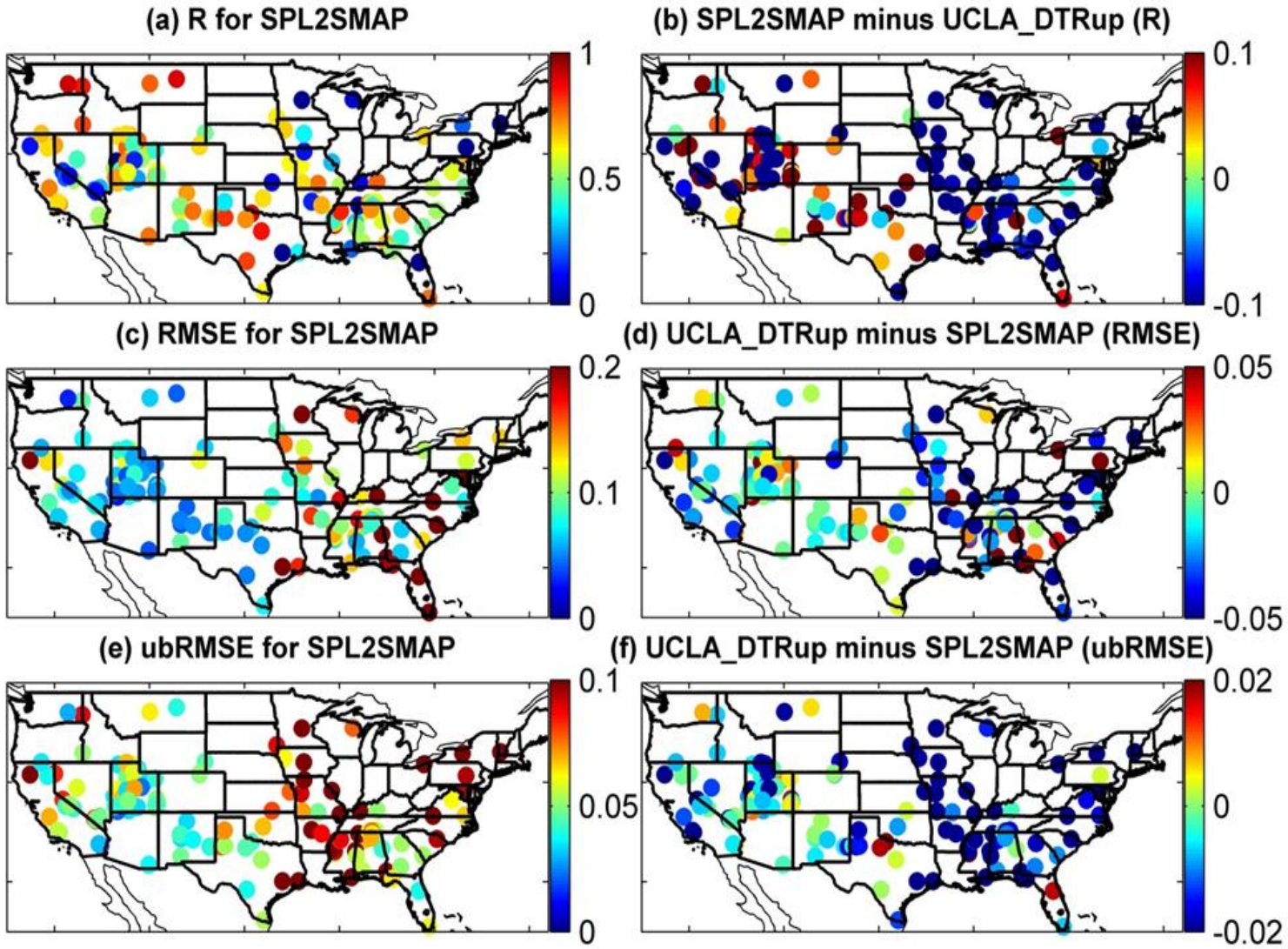


r:

SPL2SMAP:

0.532

UCLA_DTRup:

0.620

RMSE:

0.0975 m^3/m^3

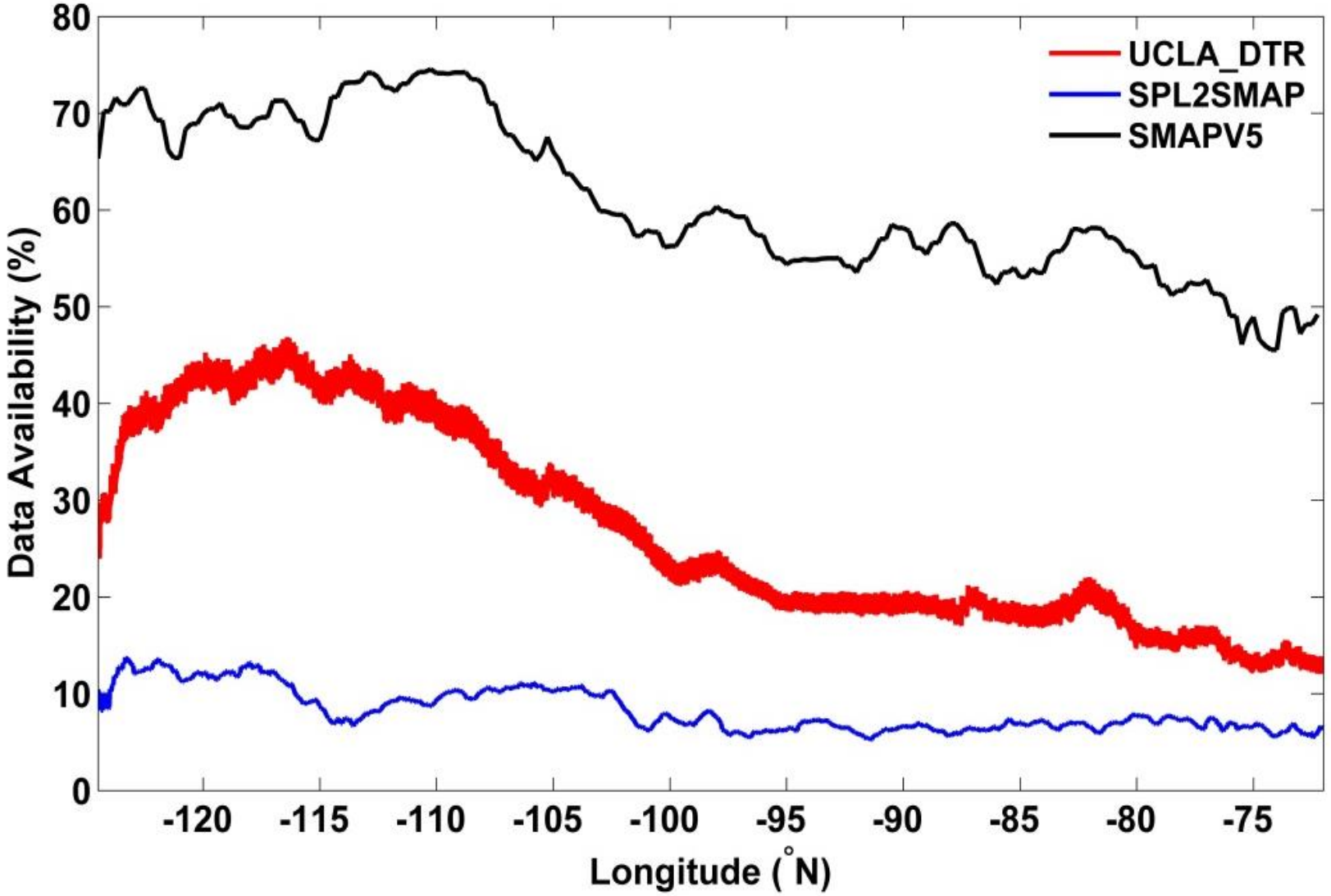
0.0835 m^3/m^3

ubRMSE:

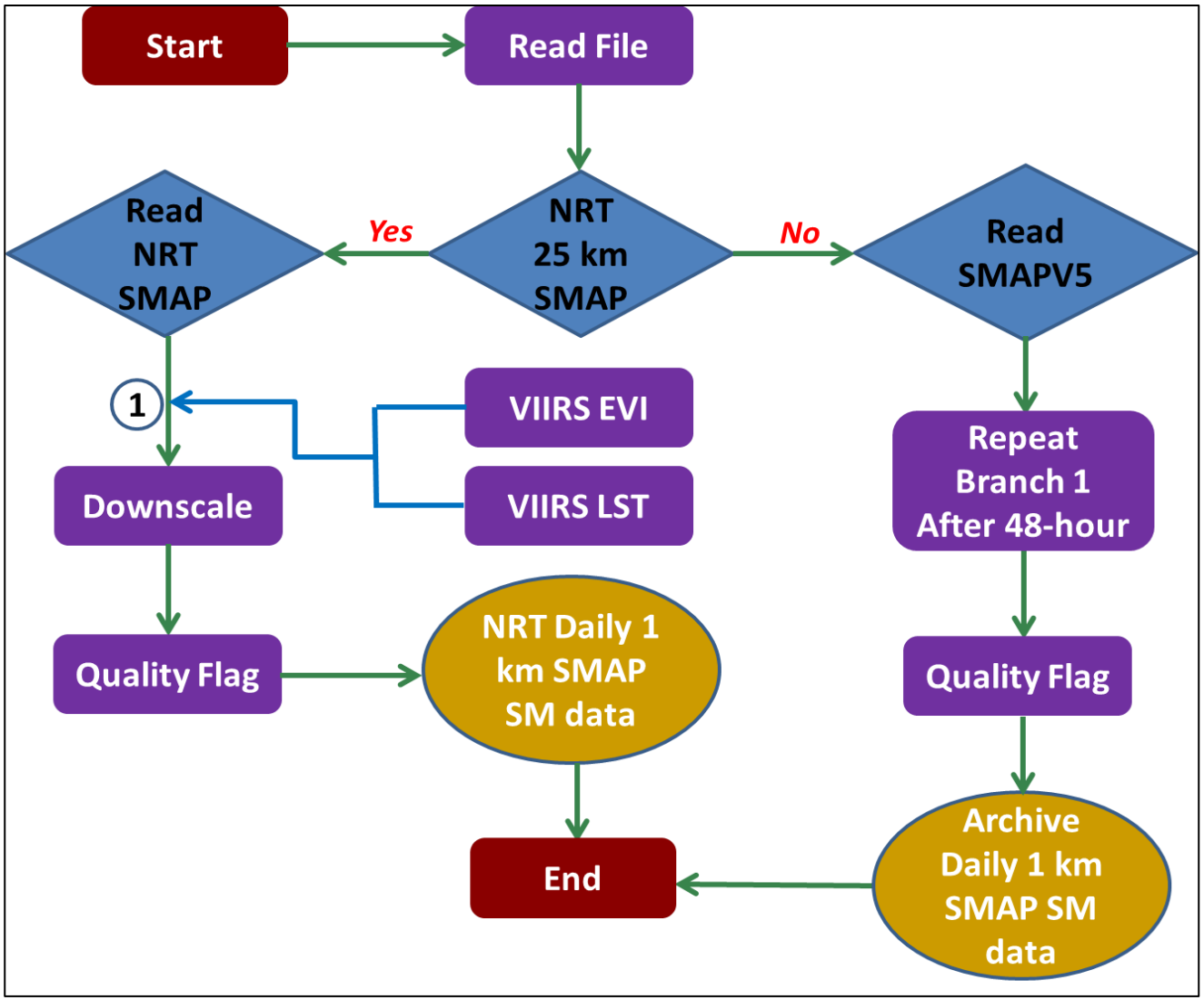
0.065 m^3/m^3

0.049 m^3/m^3

3 Validations



4 Operational Pathway



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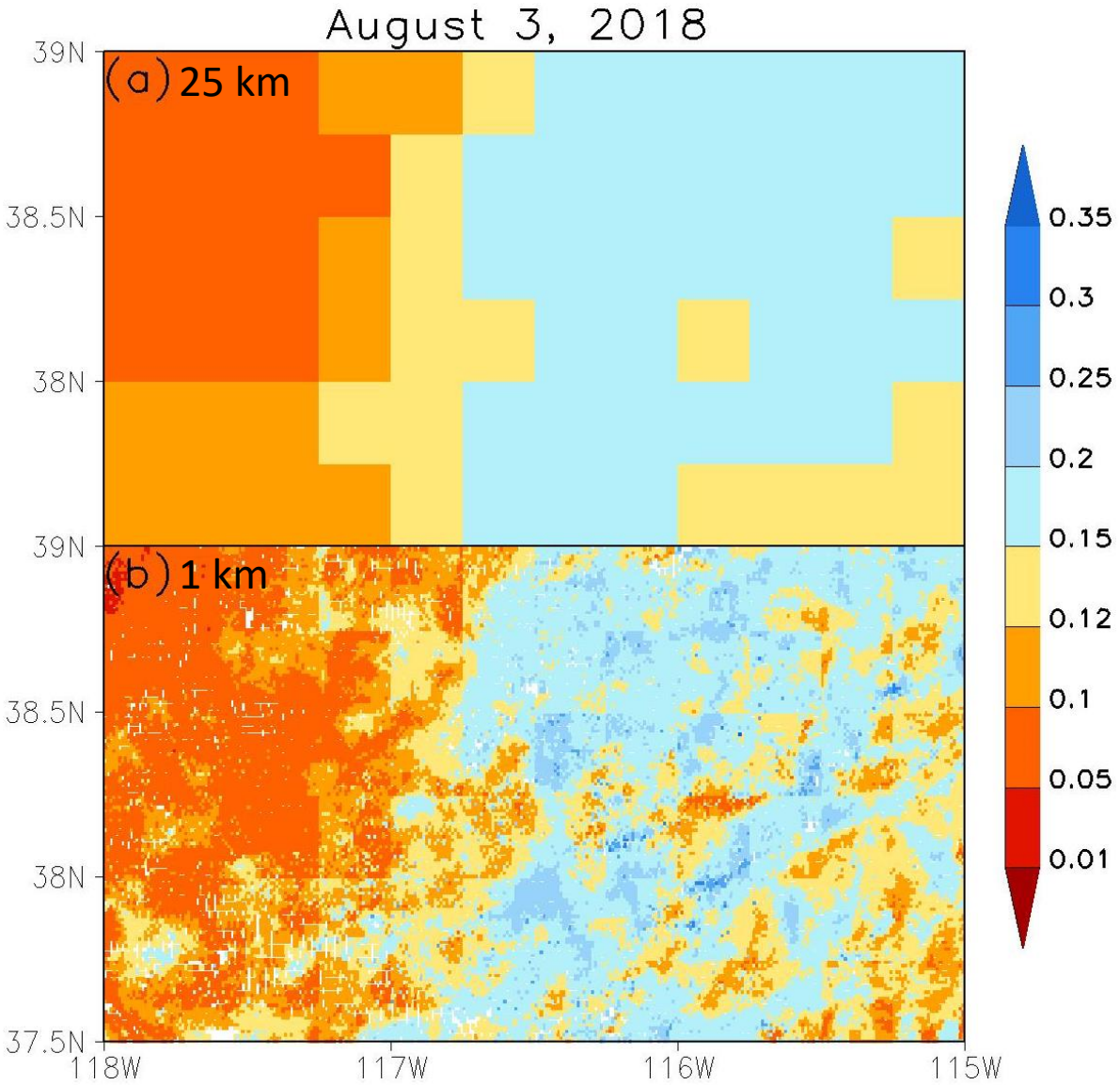

5 Summary

1 The advantages of the downscaling technique include simplicity, feasibility of operational implementation, purely depending on remote sensing measurements, computationally fast and limited ancillary information requirements.

2 With respect to the quality controlled SCAN observations, the UCLA_DTR method shows the most successful performance in the 9 downscaling schemes.

3. Compared to the original coarse spatial resolution SMAP, the downscaled 1 km SM data product presents much more spatial details. As expected, the accuracy level is significantly improved with the advance of the fine scale satellite SM measurements.

4. Compared to the NASA 3 km SMAP/Sentinel product, the accuracy level can be significantly improved by the developed 1 km SM.

5. The downscaled 1 km SMAP SM data product also provides reasonable data availability, although the VIIRS observations used as ancillary information are affected by cloud coverage.

Thanks for your patience!

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