

Neural Network approach to retrieve and assimilate SMAP soil moisture

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Outline

1. Motivation
2. SMAP Neural Network Soil Moisture Retrieval
3. SMAP Neural Network Soil Moisture Assimilation
4. Conclusions

1. Motivation

- Localized bias correction removes independent satellite information
- Disadvantageous for high quality SMAP retrievals

Objective: investigate Neural Network (NN) as a global bias correction that retains more independent satellite information

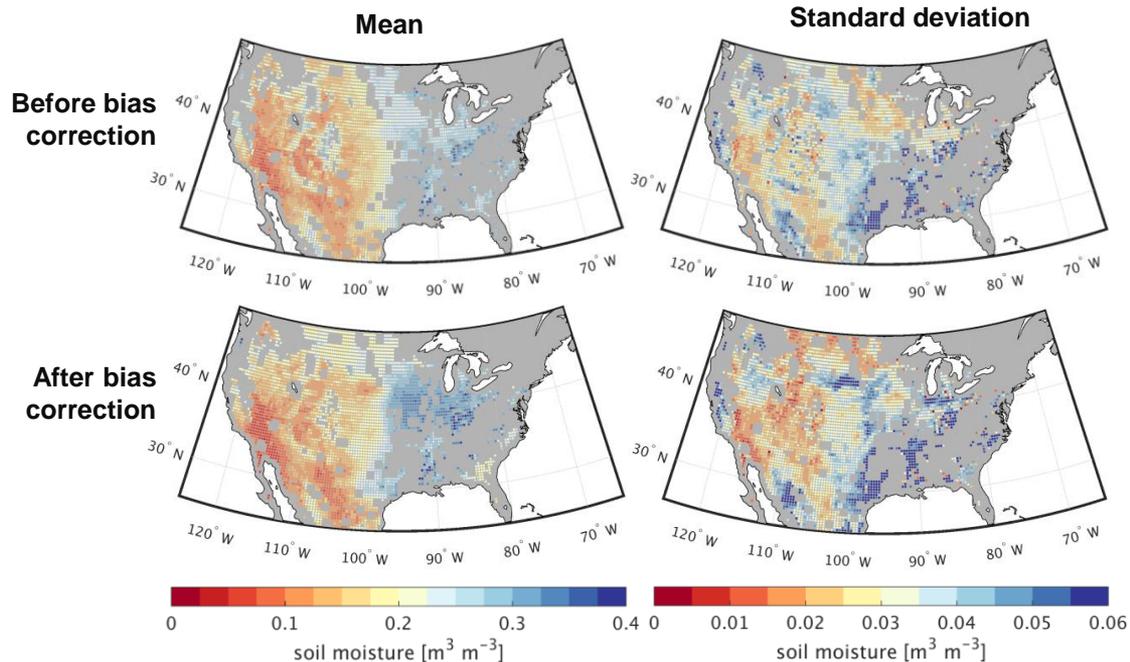


Figure 1: Effect of localized bias correction (CDF-matching) on soil moisture retrieval.

2. SMAP NN Soil Moisture Retrieval

Properties

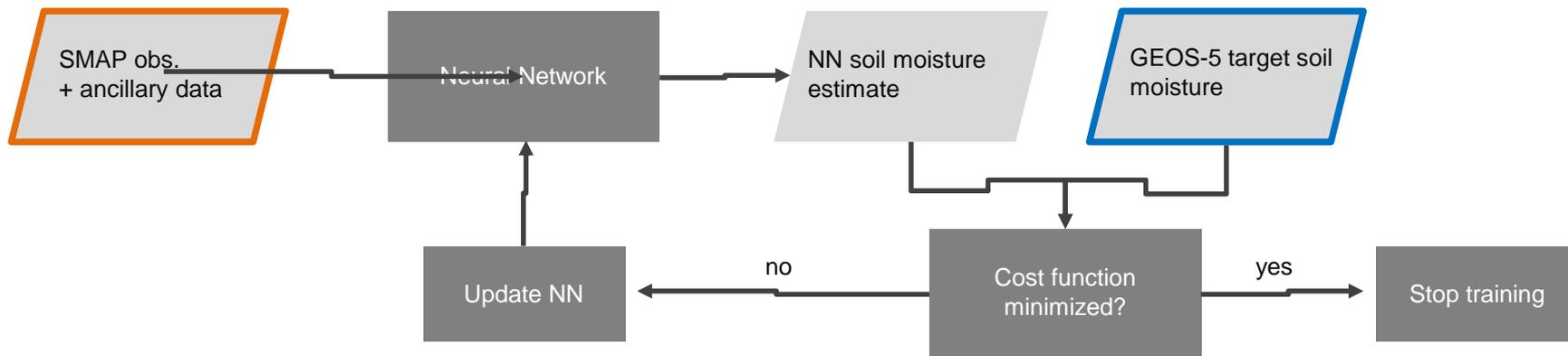


Figure 2: NN training procedure.

- Retrieve soil moisture in model space
- Global dynamic range and bias from [model \(GEOS-5\)](#)
- Spatial and temporal patterns from [observations \(SMAP + ancillary data\)](#)
- April 2015 – June 2016; 36 km EASE v2 grid; global

2. SMAP NN Soil Moisture Retrieval

Evaluation

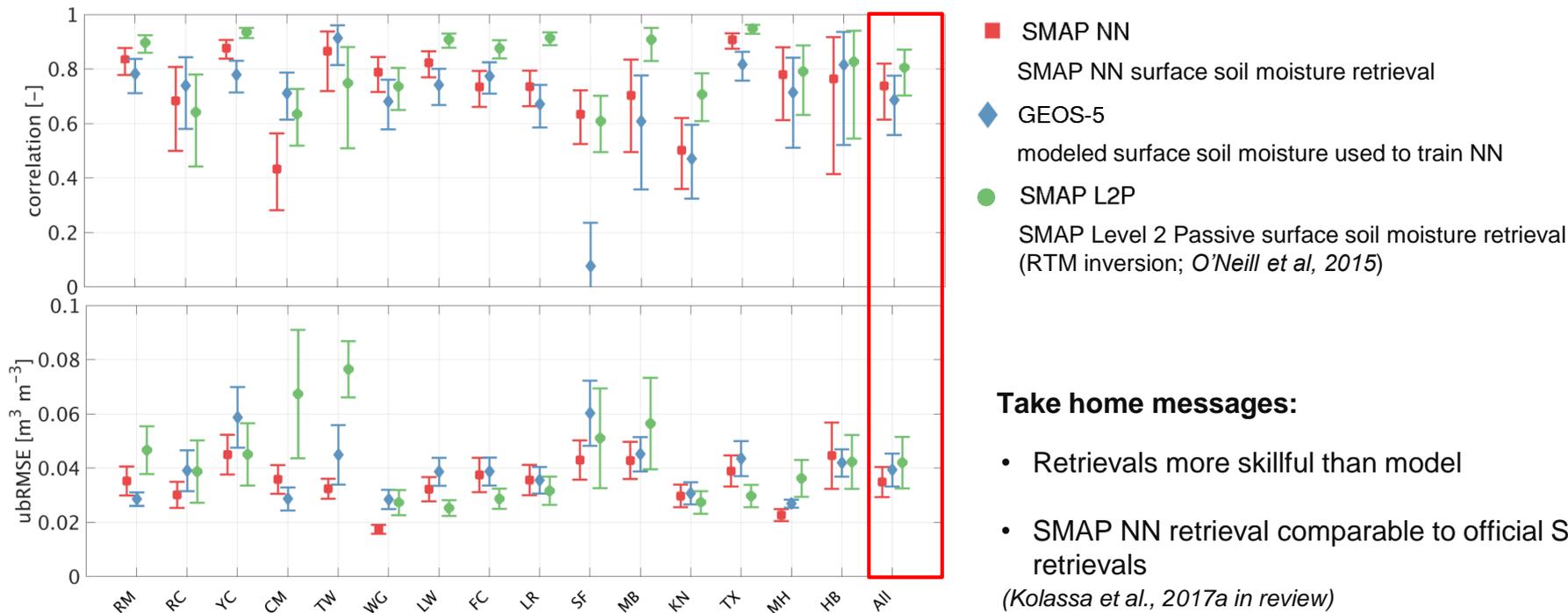


Figure 3: Skill of SMAP NN surface soil moisture at SMAP Cal/Val core sites (Colliander et al., 2017).

3. SMAP NN Soil Moisture Assimilation

Data Assimilation Experiments

- **SMAP NN DA:** Assimilation of NN retrieval **without further bias correction**
 - **SMAP NN DA + CDF:** Assimilation of NN retrieval **with localized bias correction (CDF-matching)**
 - **OL:** Open loop; model run without data assimilation
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- April 2015 – June 2016
 - 9 km EASE v2 grid
 - Contiguous United States
 - 3-hourly analysis

3. SMAP NN Soil Moisture Assimilation

Impact on soil moisture analysis

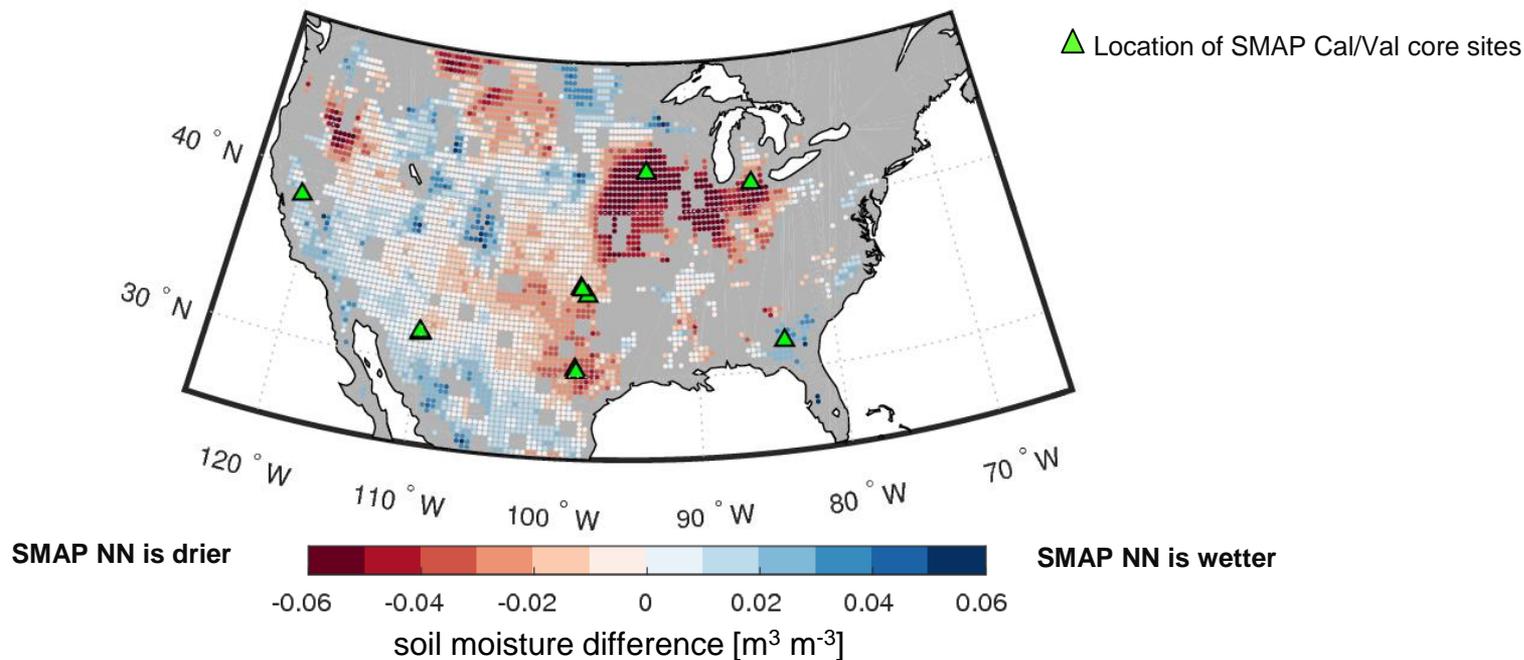
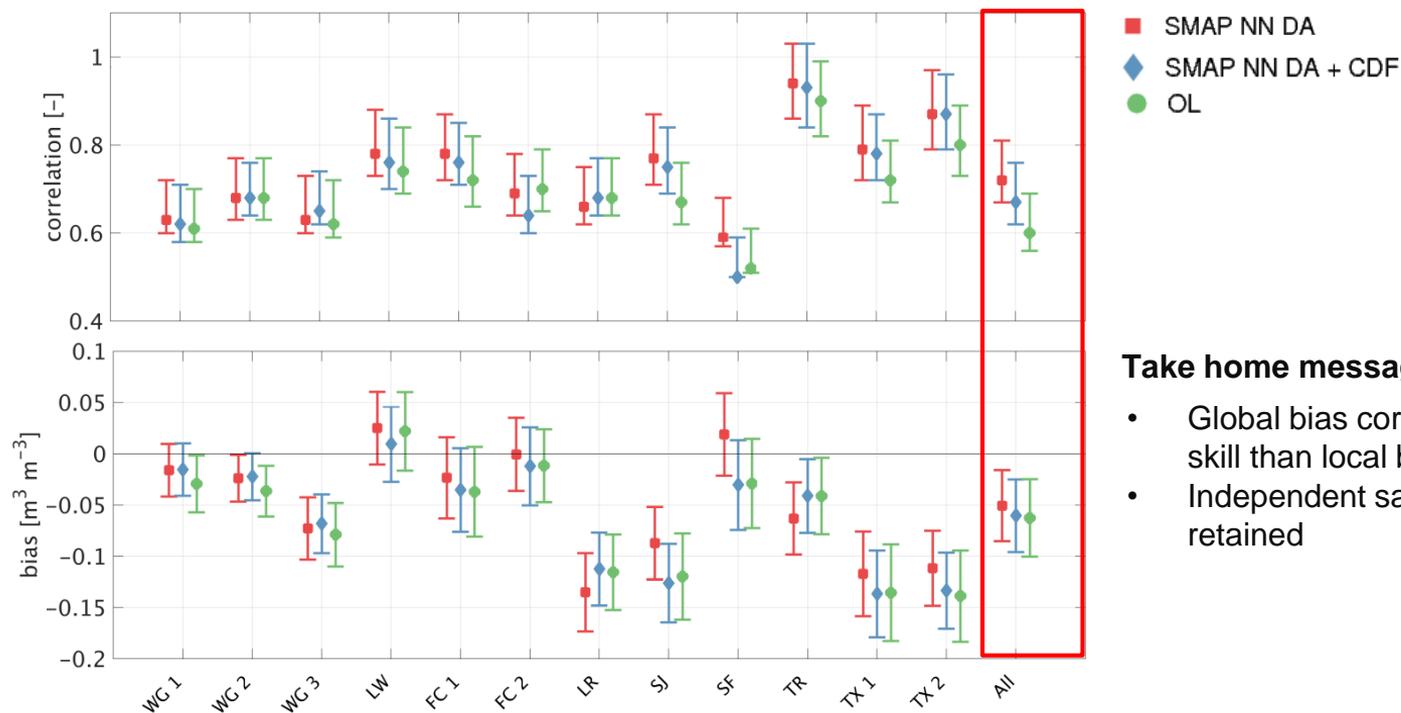


Figure 4: Difference in mean soil moisture (SMAP NN DA) – (SMAP NN DA+ CDF)

3. SMAP NN Soil Moisture Assimilation

Global vs. local bias correction



Take home messages:

- Global bias correction yields higher analysis skill than local bias correction
- Independent satellite information better retained

Figure 5: Surface soil moisture analysis skill at SMAP Cal/Val core sites.

(Kolassa et al., 2017b in preparation)

3. SMAP NN Soil Moisture Assimilation

Retrieval in model space vs. global bias correction

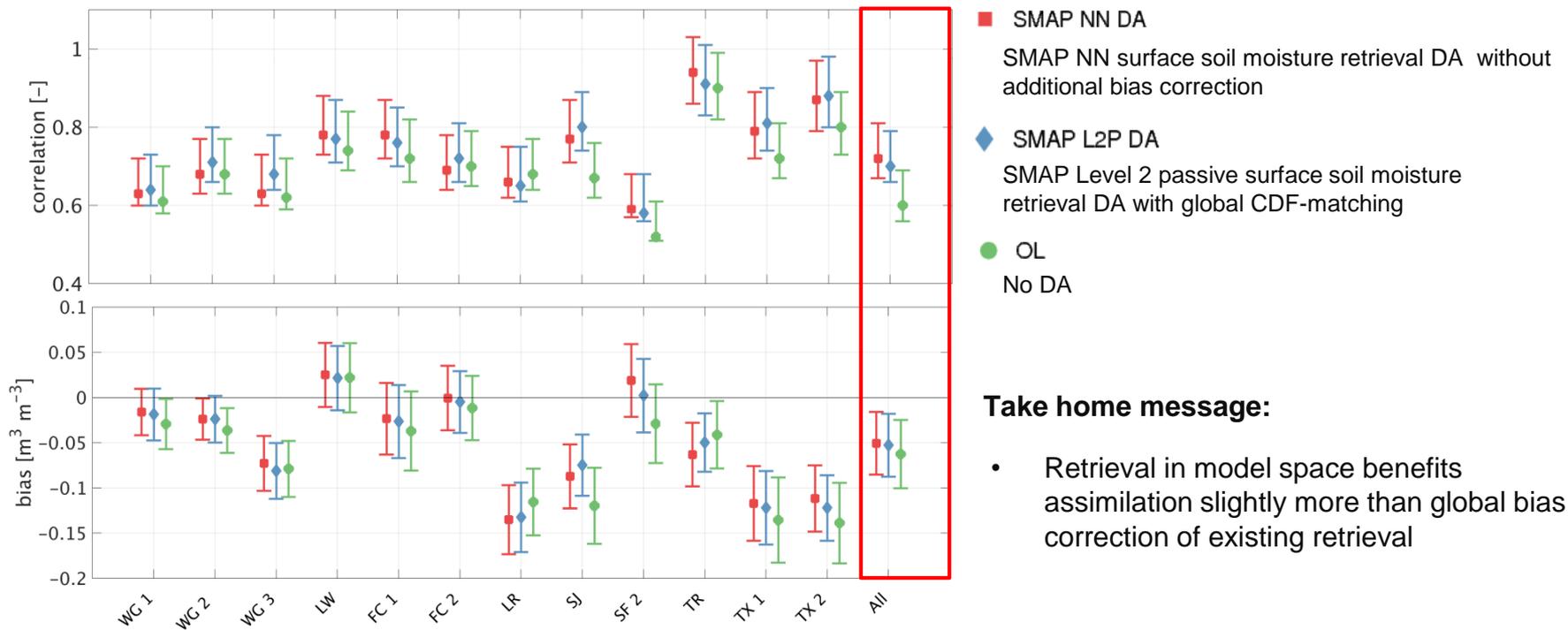


Figure 6: Comparison of NN bias correction and global CDF-matching.

(Kolassa et al., 2017b in preparation)

3. SMAP NN Soil Moisture Assimilation

NN soil moisture DA vs. brightness temperature DA

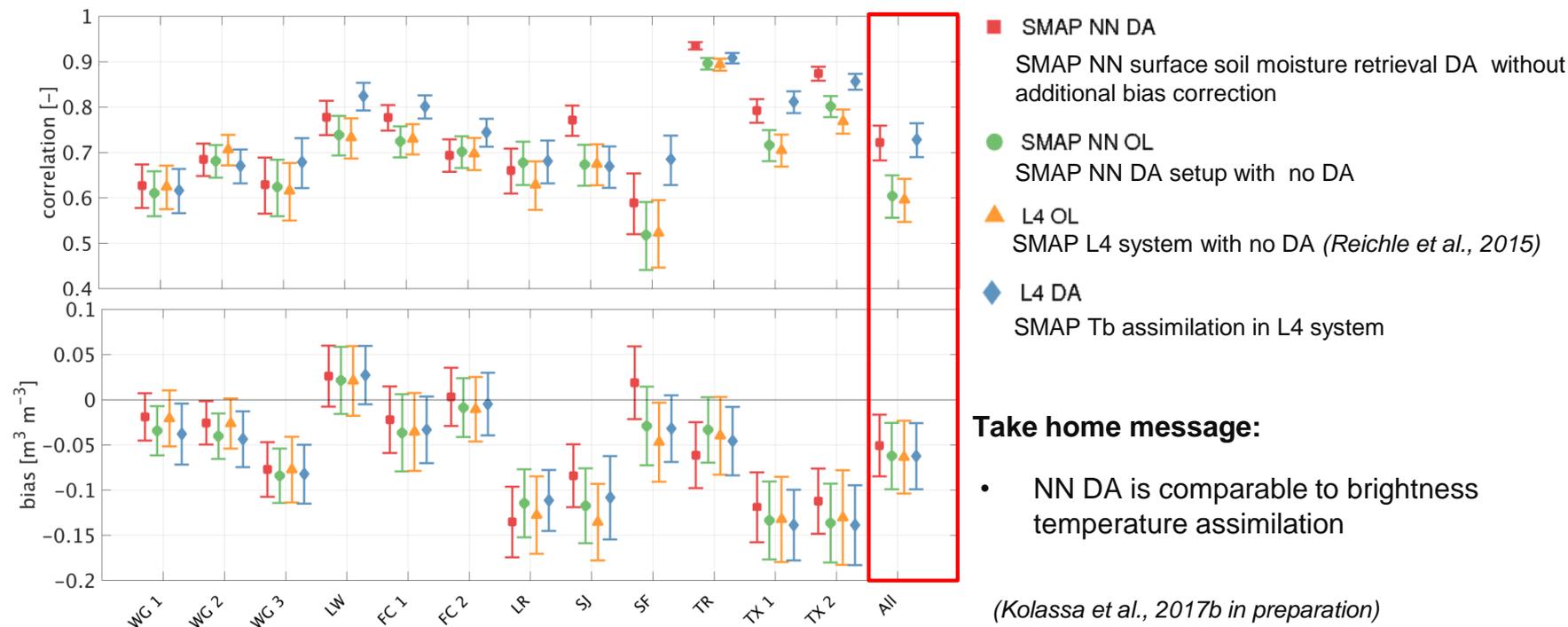


Figure 7: Comparison of NN soil moisture assimilation and L4 brightness temperature assimilation

4. Conclusions

- NN bias correction better preserves SMAP independent information leading to larger skill improvement during assimilation
- Retrieving soil moisture in model space (by means of a NN) retains satellite information better than global bias correction of existing soil moisture retrieval
- NN bias correction approach is comparable to brightness temperature assimilation

References

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