

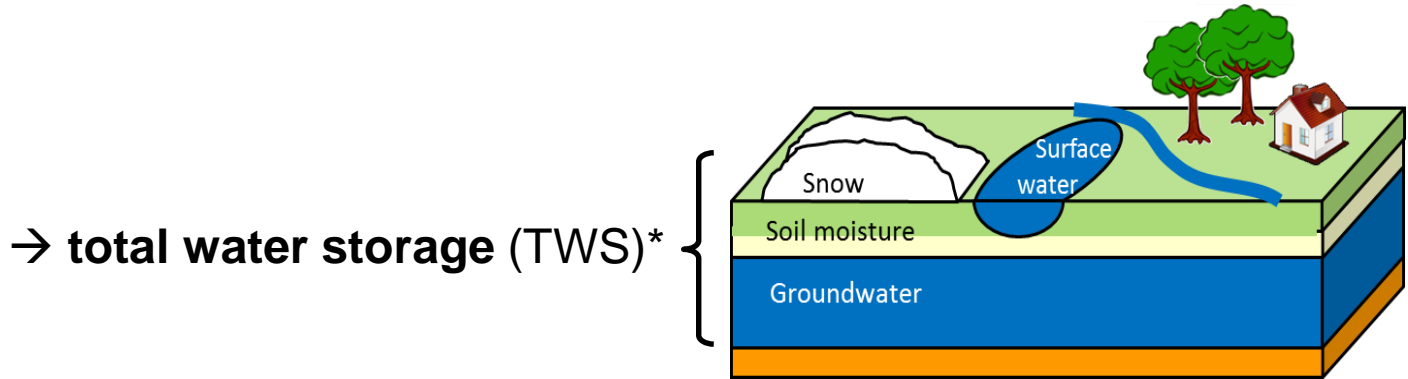
IGNITE talk
Geodetic applications of
LISFLOOD @ GFZ

3rd CEMS GloFAS and GFM Meeting
March 5th, 2024

Laura Jensen
(*GFZ German Research Centre for Geosciences*)

Hydrological models in geodetic context

Various applications for (high-resolution) **hydrological models in geodesy**

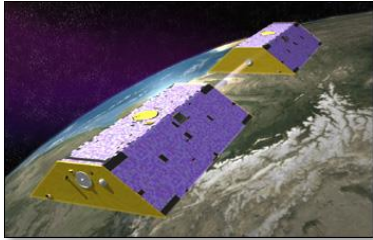


Is **LISFLOOD** a suitable replacement for **LSDM**
(Land Surface Discharge Model)?

* expressed in equivalent water height ($1\text{m} \triangleq 1000 \text{ kg/m}^2$)

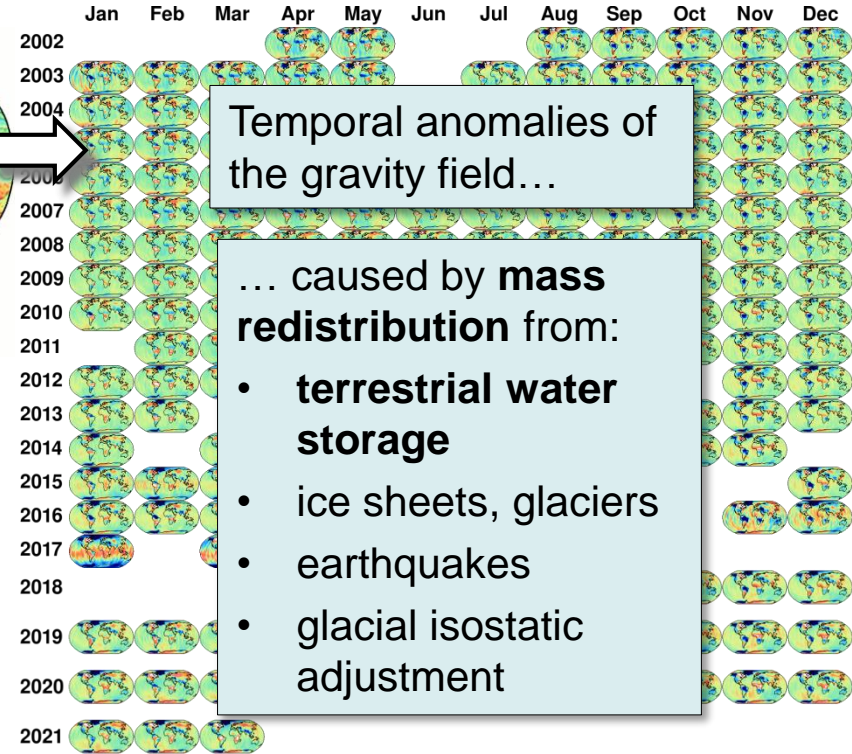
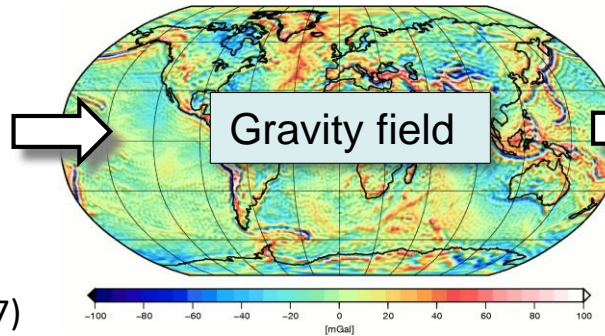
Observing TWS

Gravity Recovery And Climate Experiment (GRACE)



GRACE (03/2002-10/2017)

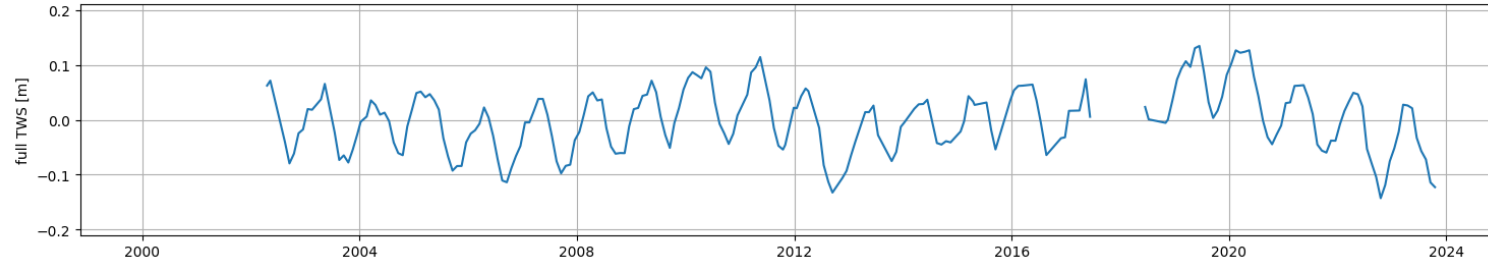
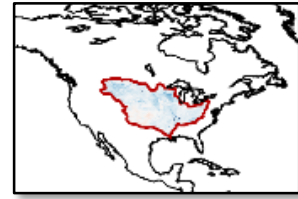
GRACE Follow-On (since 05/2018)



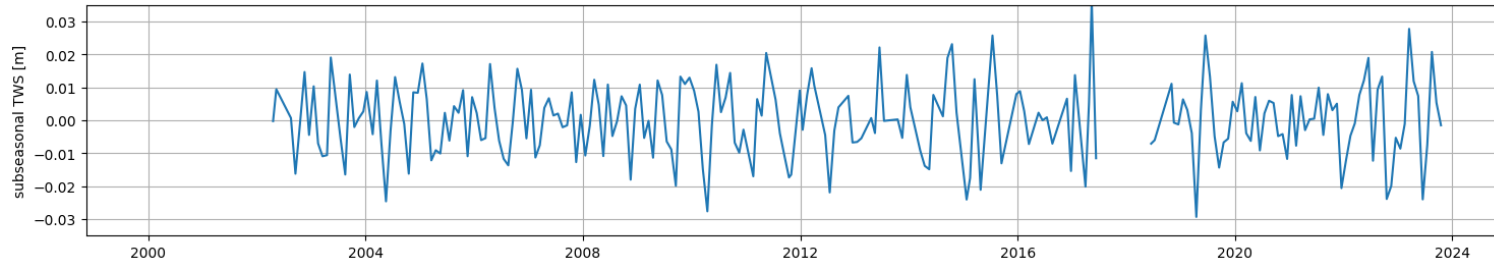
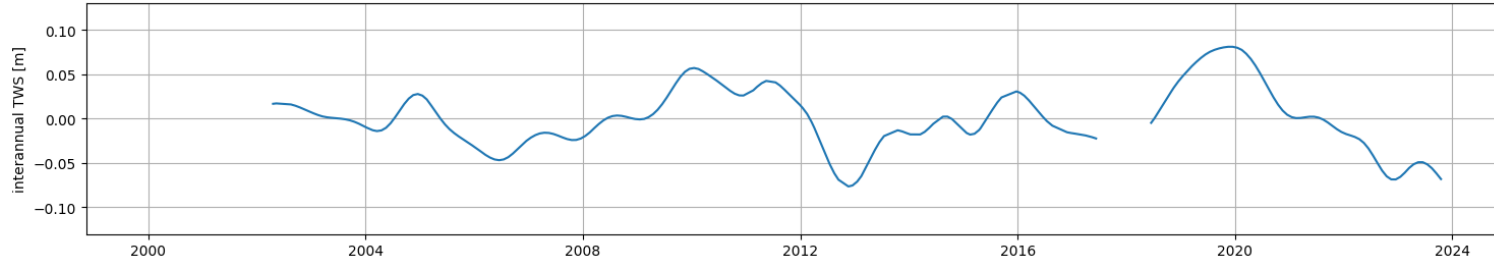
- *Spatial resolution:* ~300km
- *Temporal resolution:* ~monthly

TWS = integrated signal of mass variations on the surface and below

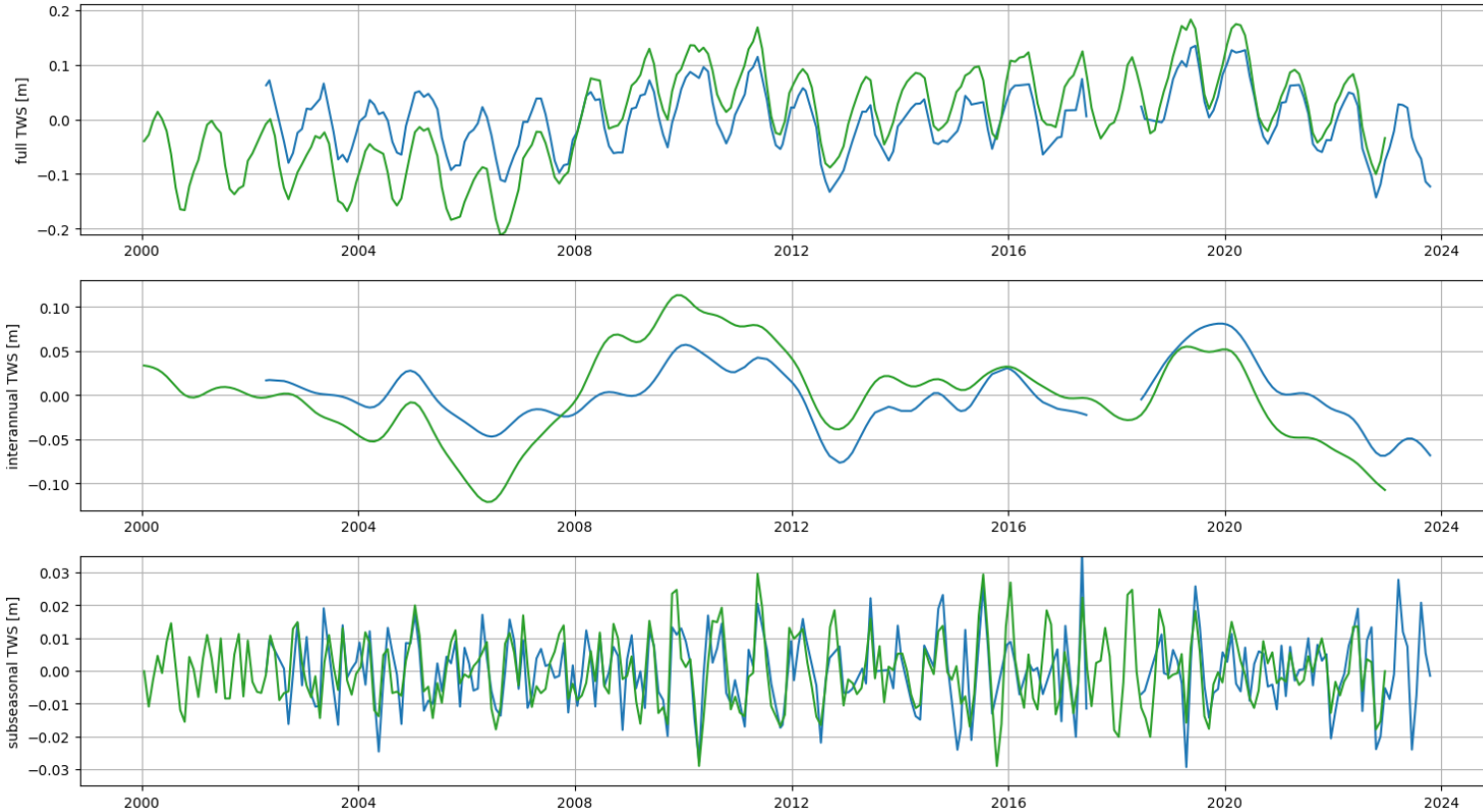
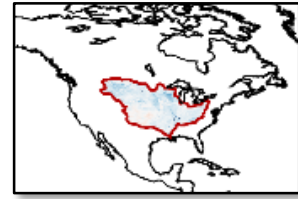
Mississippi river basin



GRACE/FO



Mississippi river basin

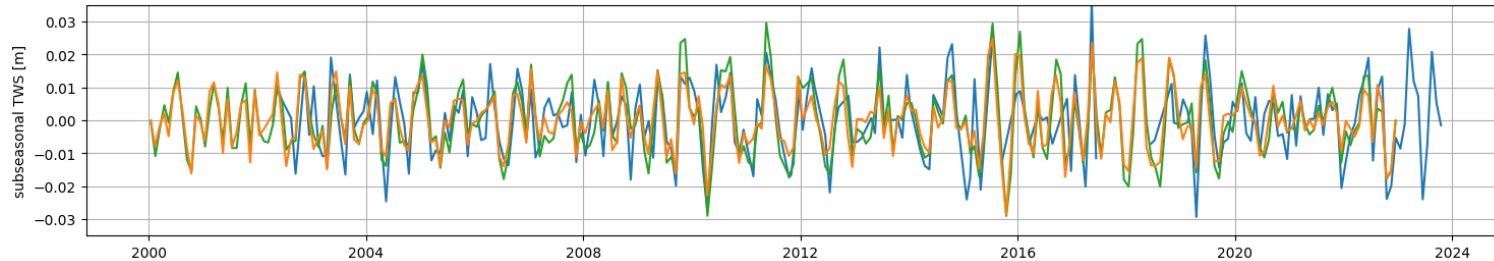
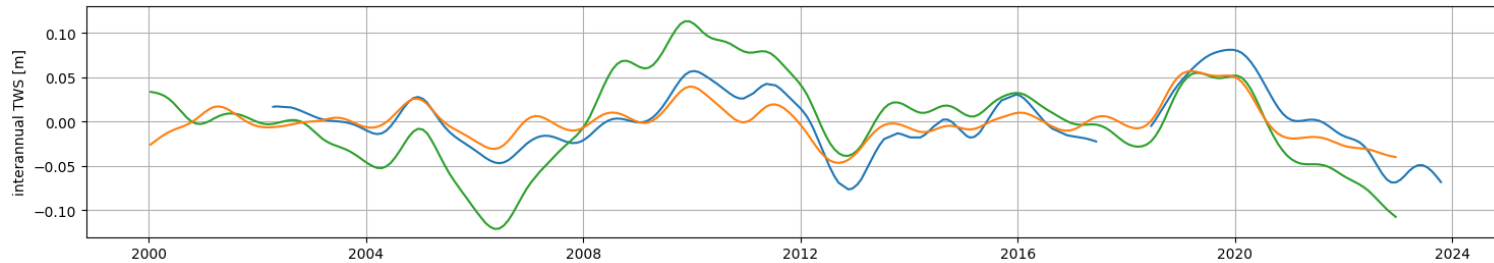
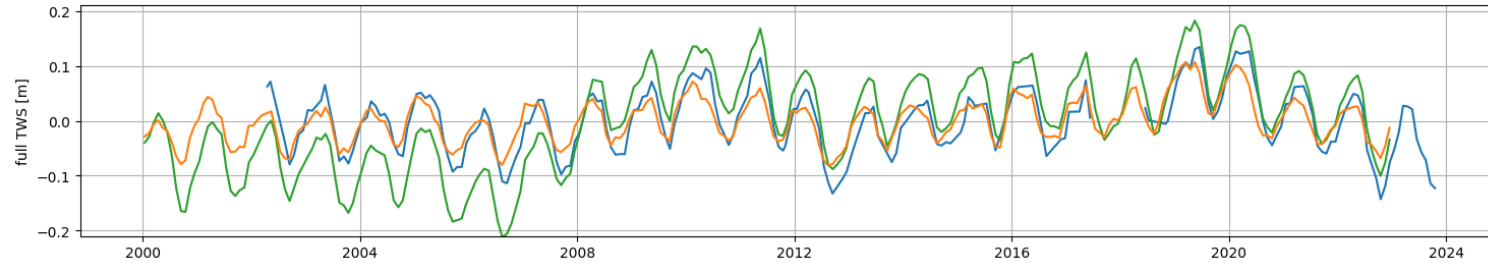
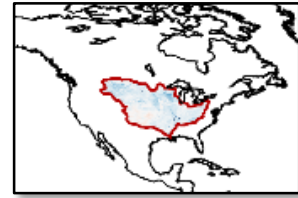


GRACE/FO

LSDM

$\rho = 80.1\% / 72.3\%$

Mississippi river basin



GRACE/FO

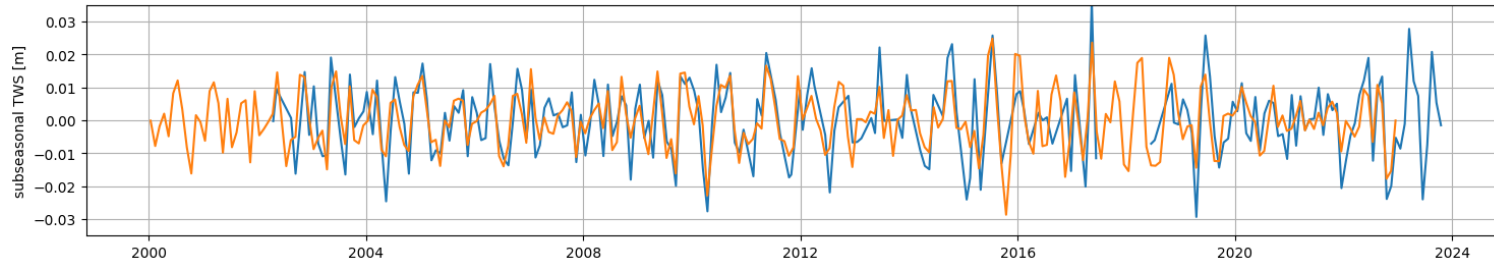
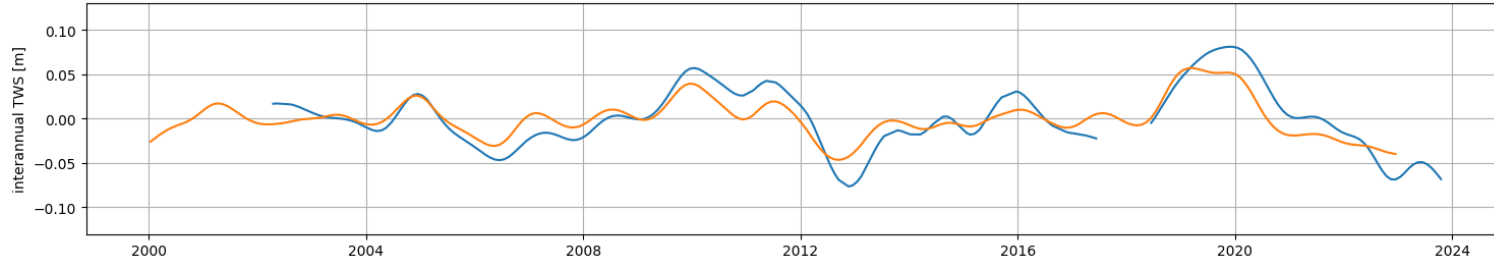
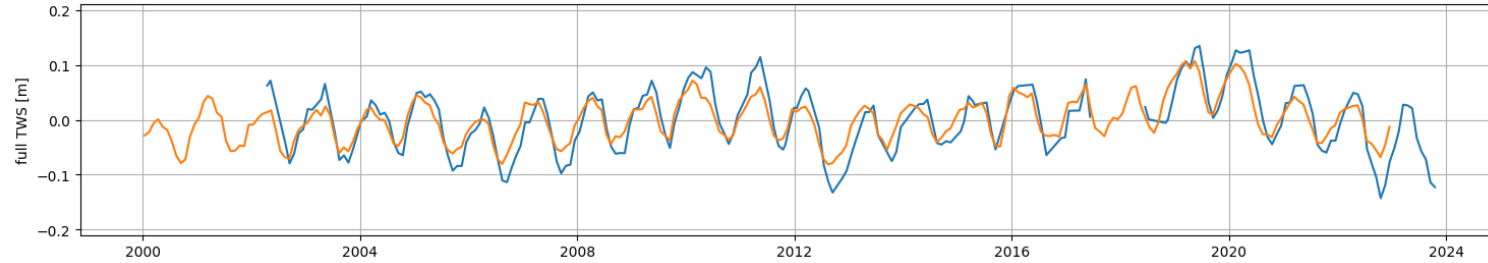
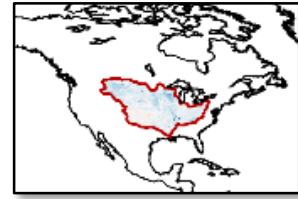
LSDM

$\rho = 80.1\% / 72.3\%$

LISF LR (0.1°)

$\rho = 90.1\% / 88.5\%$

Mississippi river basin



GRACE/FO

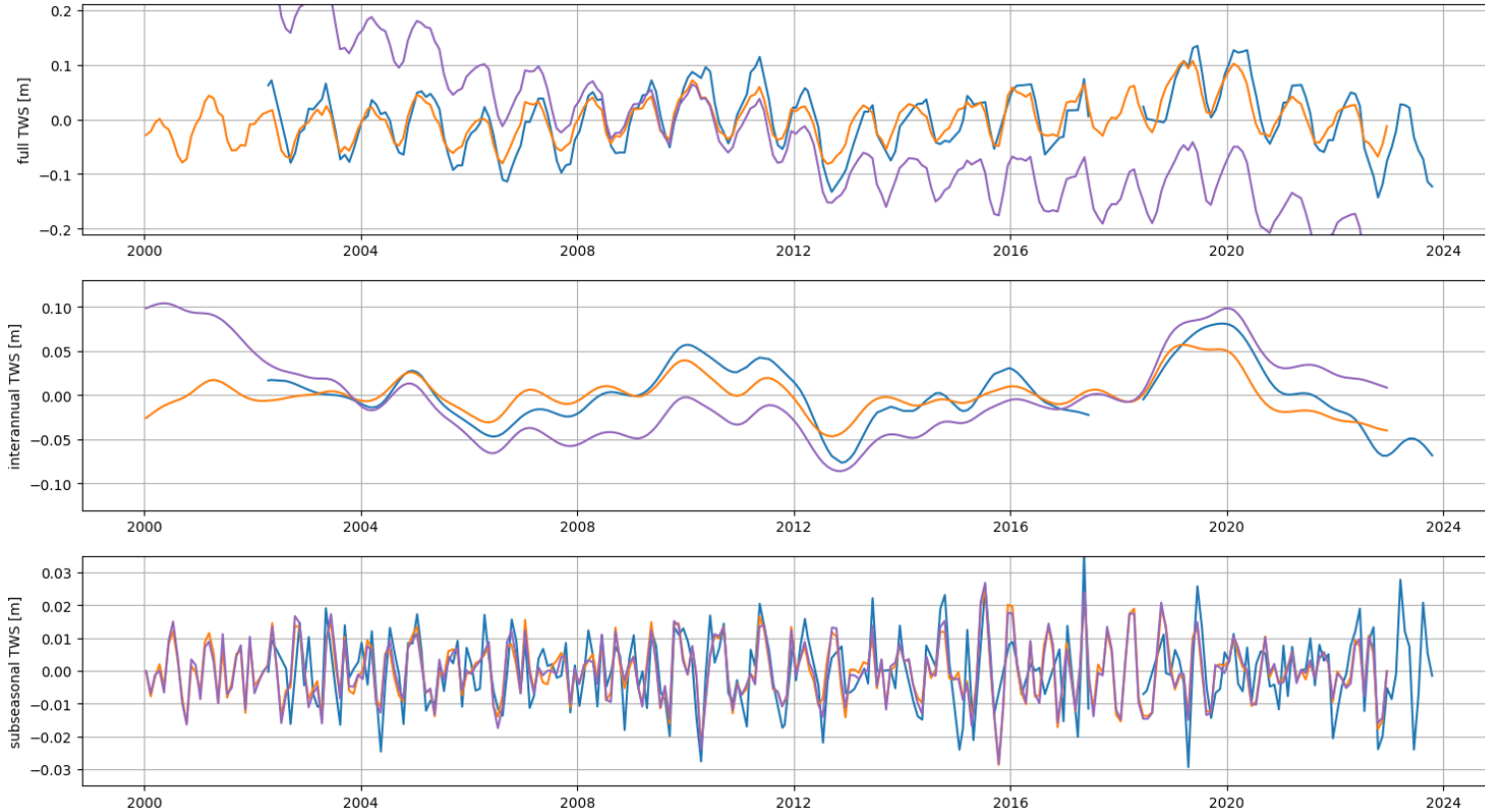
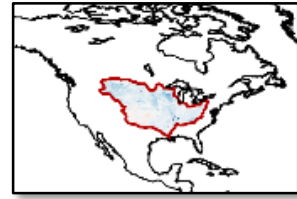
LSDM

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Mississippi river basin



GRACE/FO

LSDM

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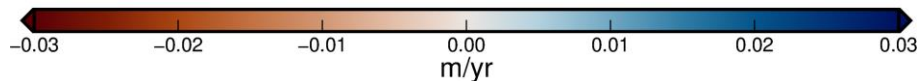
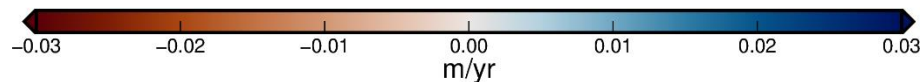
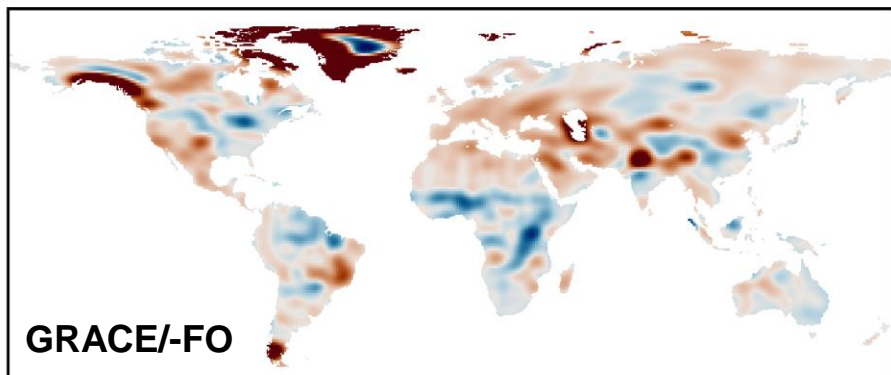
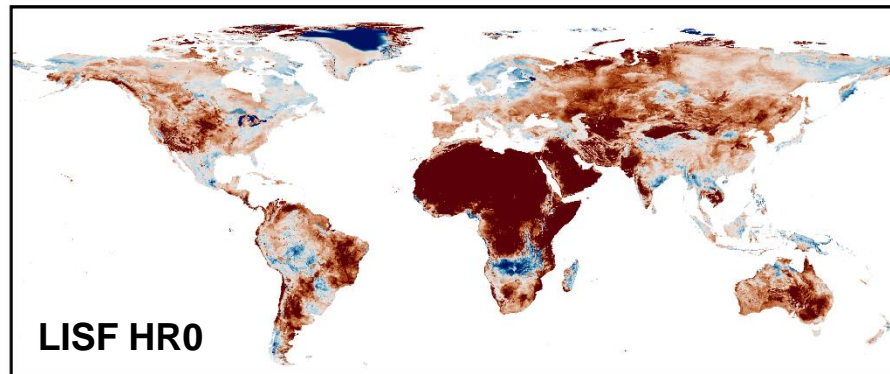
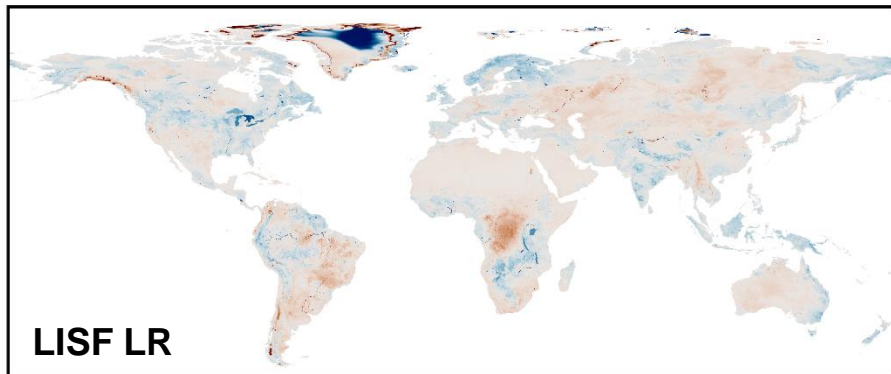
LISF LR (0.1°)

$\rho = 90.1\% / 88.5\%$

LISF HR0 (0.05°)

$\rho = 15.1\% / 67.4\%$

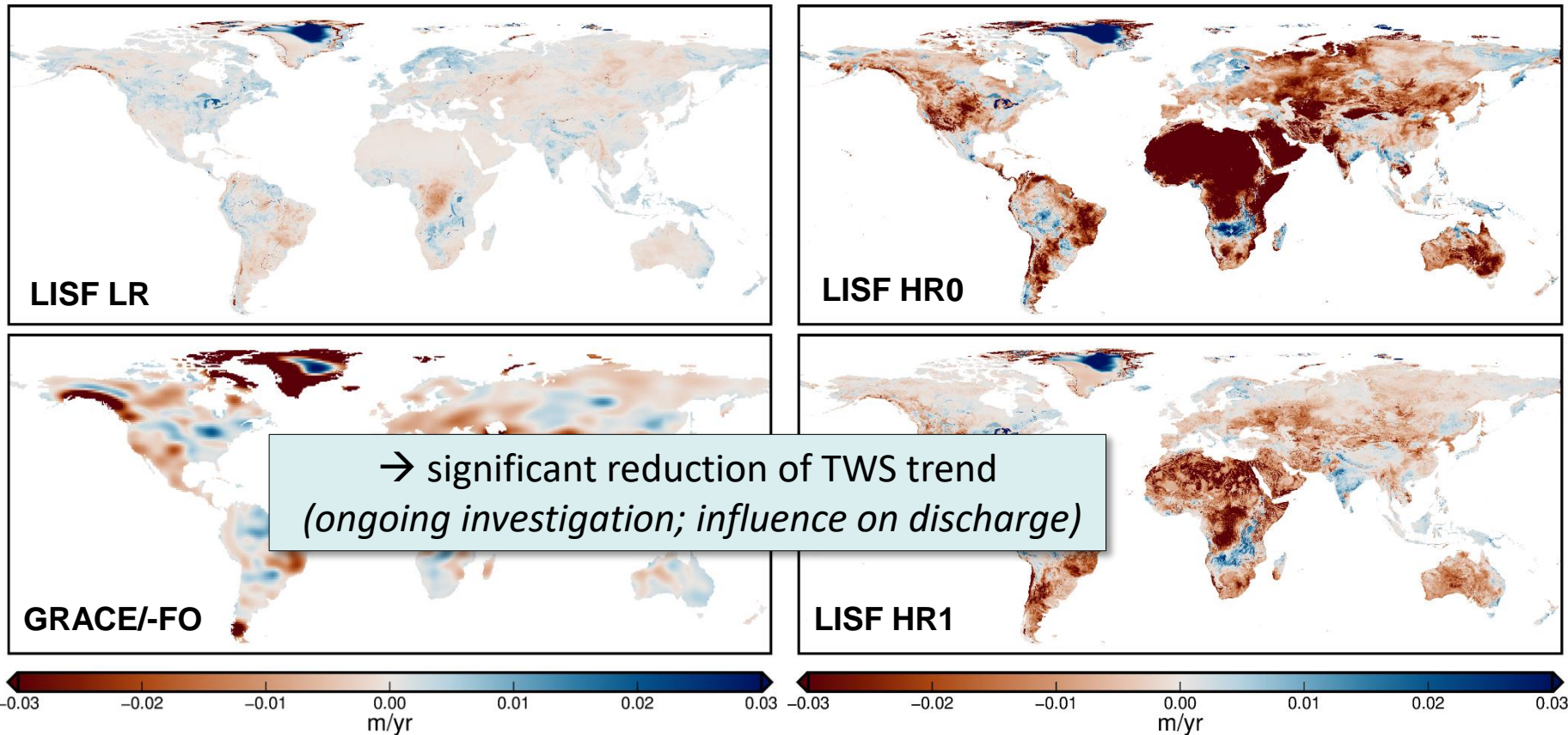
Linear TWS trend



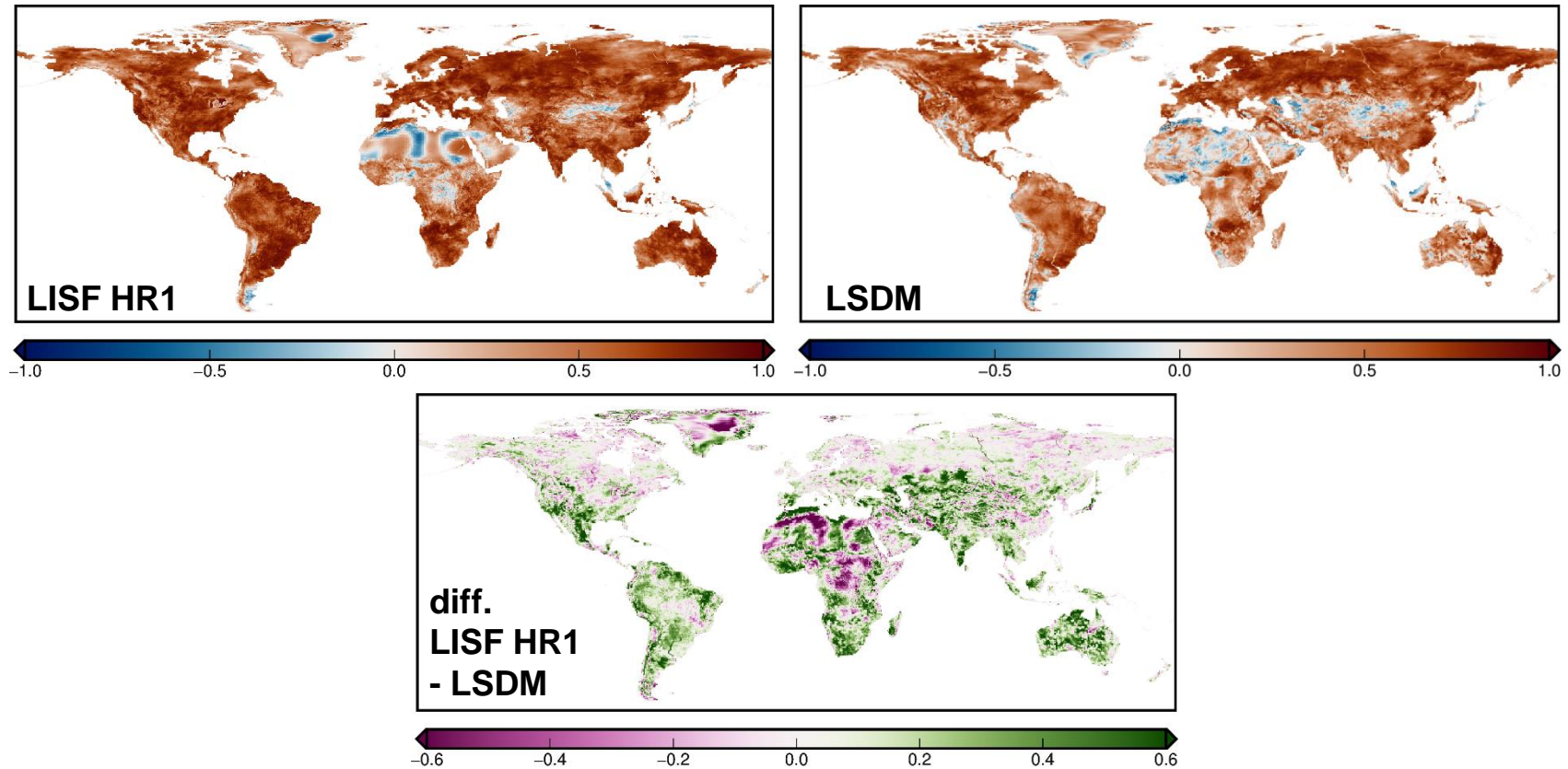
spurious TWS trend in HR0
from third soil layer

→ limit depth of soil (by
groundwater table depth)

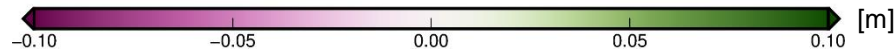
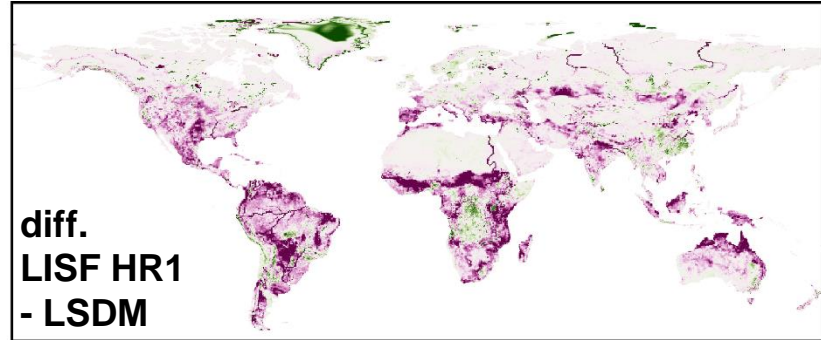
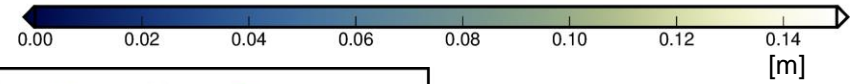
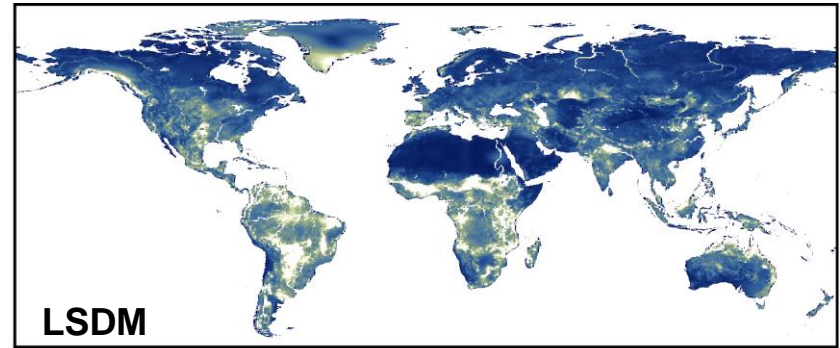
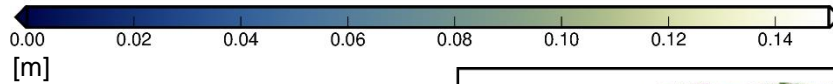
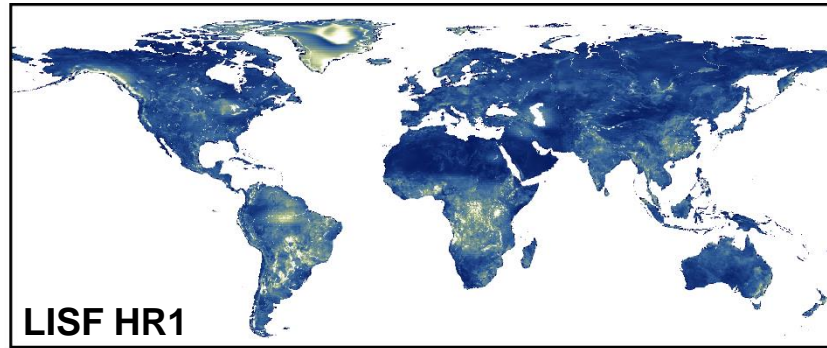
Linear TWS trend



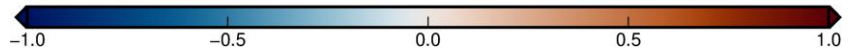
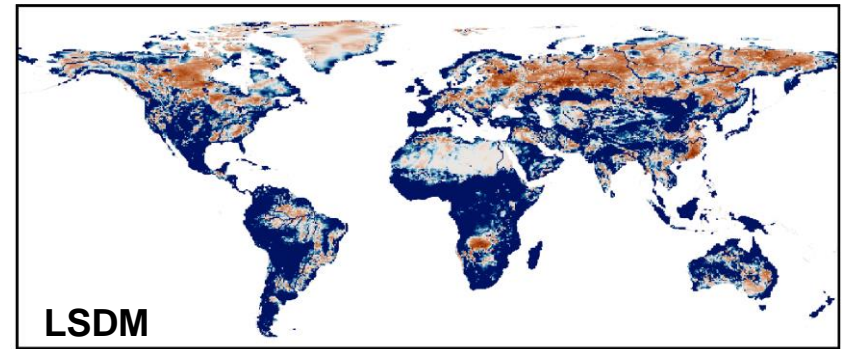
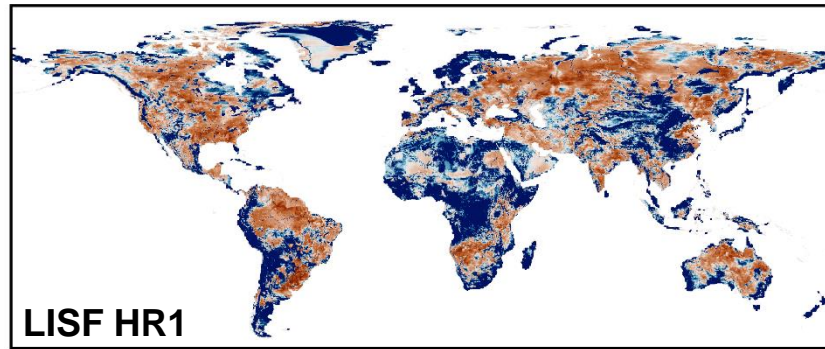
Correlation with GRACE/-FO (interannual)



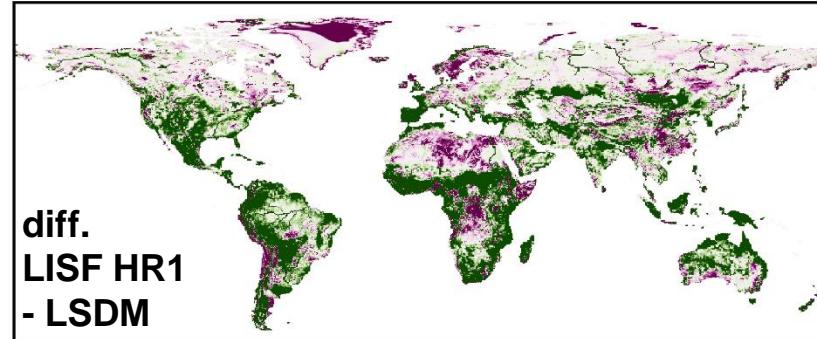
RMSD w.r.t. GRACE/-FO (interannual)



Explained variance w.r.t. GRACE/-FO (interannual)



LISFLOOD
outperforms LSDM
in many regions
(on interannual time
scales)



Future work:

- Optimize soil map
- Comparison to GNSS (loading deformations)
- Operational use
- ...