

River water input from upstream areas into the Cuvette Centrale peatland complex detected via SMOS data assimilation

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HS10.7 - Peatland hydrology: from tropical to subarctic latitudes
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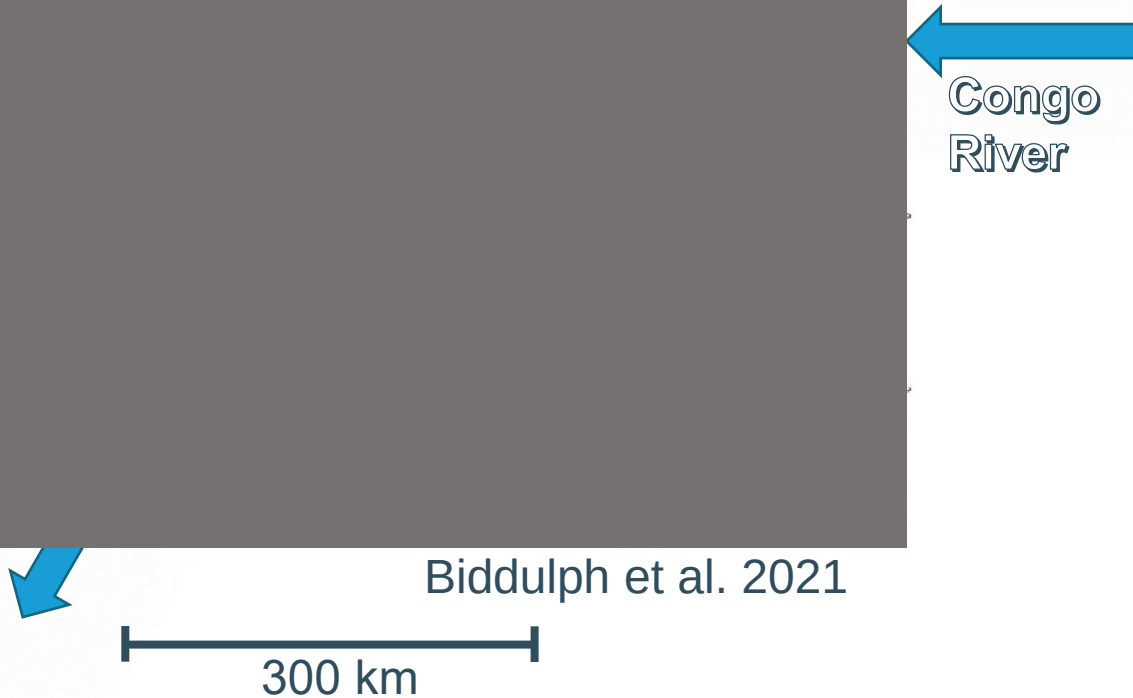


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Research question

See reference below for relevant graphics.

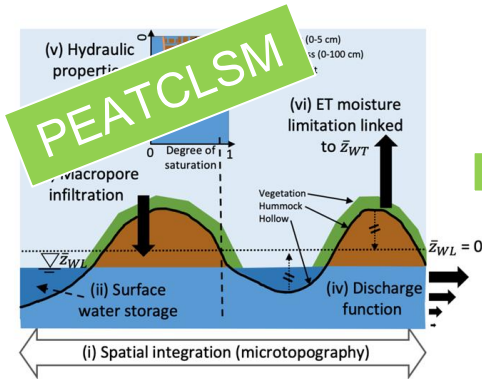


Does the Congo peatland depend on upstream water inputs?

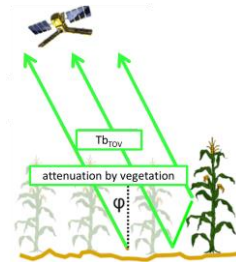
- Peatlands are domed but with very low gradients: ~1m over 10km (Davenport et al. 2020)

Approach

Peatland-Enabled Land Surface Modeling

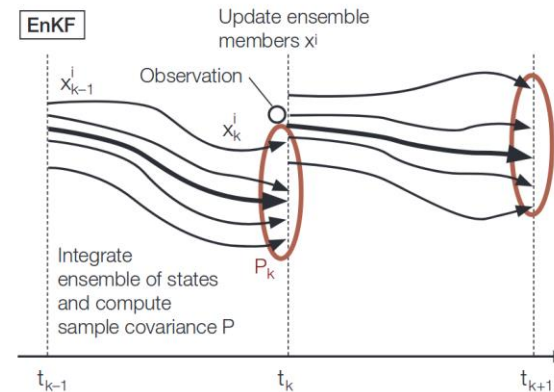


Radiative Transfer Model



3D Ensemble Kalman Filter

$$Tb(mod) \Leftrightarrow Tb(obs)$$



L-band Brightness Temperature (Tb)

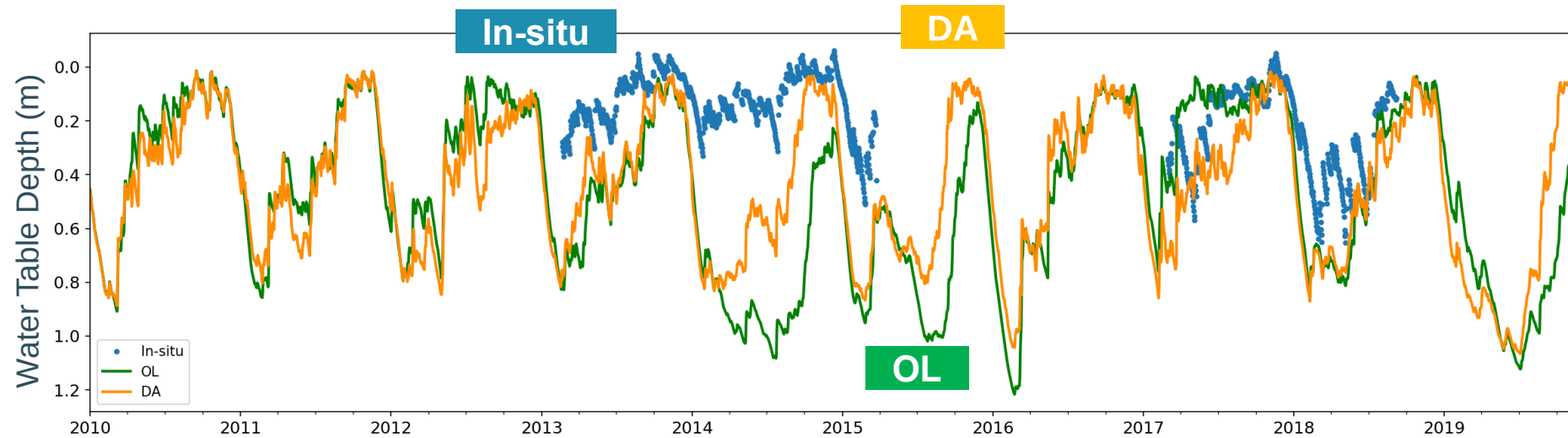


Bechtold et al, 2019, JAMES
→ North
Apers et al., 2022, JAMES
→ Tropics

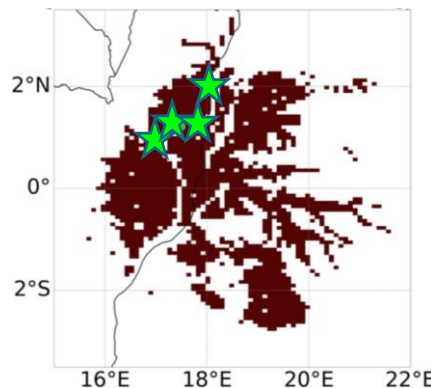
“Influence of river stage height NOT modeled in PEATCLSM” → Seen by SMOS ?

- State updating due to errors in meteorological forcings and model errors
- Only assimilation of anomalies after removing climatological bias
- Analysis of temporal correlation

Assimilation of SMOS L-band brightness temperature improves water table depth estimates



Example
time series

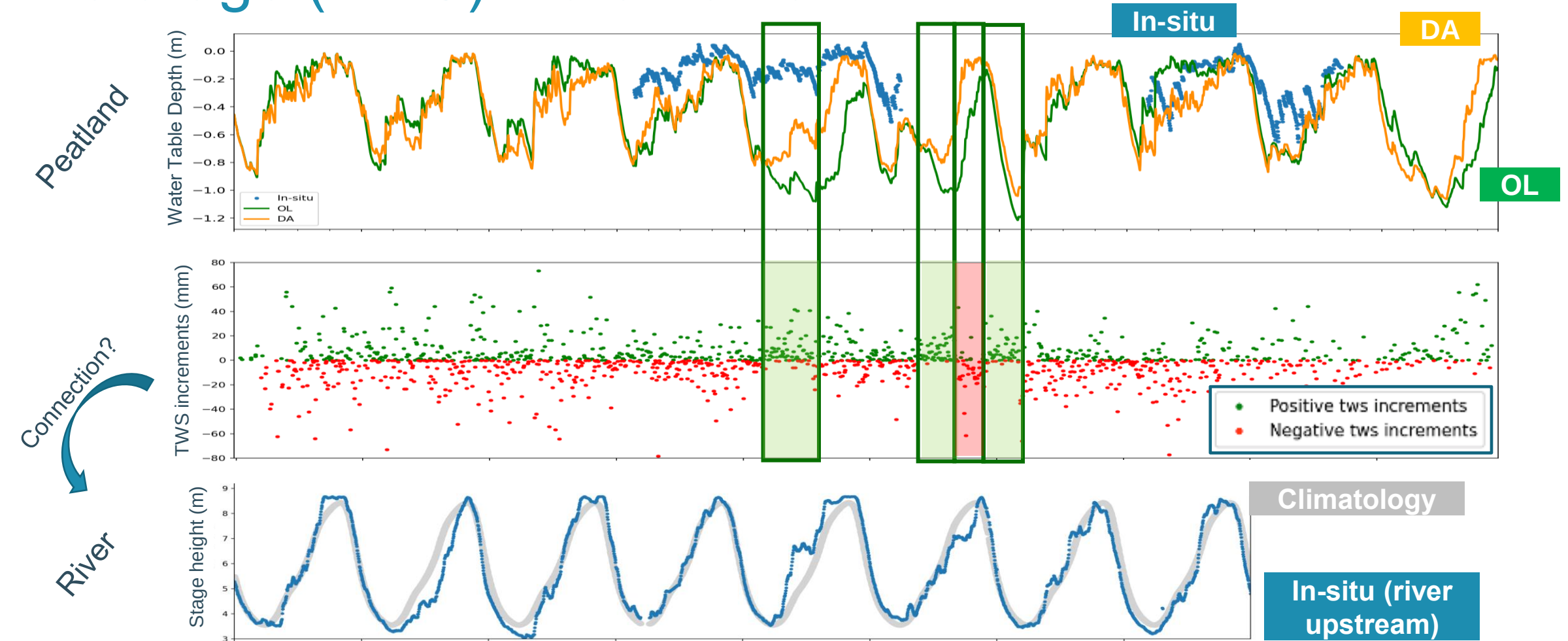


Four in-situ sites
(Dargie et al. 2017 + CongoPeat project)

R_{OL} : 0.32 $Bias_{OL}$: -0.31 m

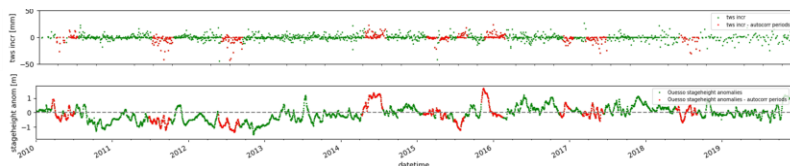
R_{DA} : 0.67 $Bias_{DA}$: -0.26 m

Long periods of temporally-autocorrelated total water storage (TWS) increments



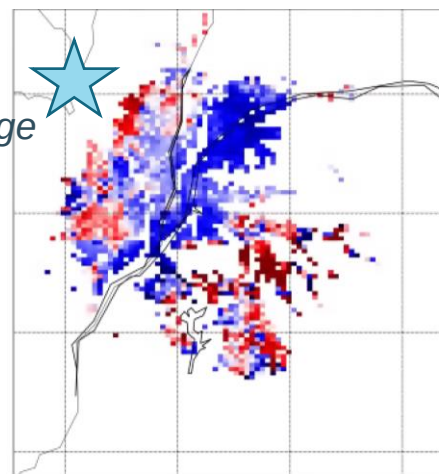
Wide spread positive correlation of increments with river stage height anomalies, with exceptions

- Systematic identification of periods of autocorrelated TWS increments

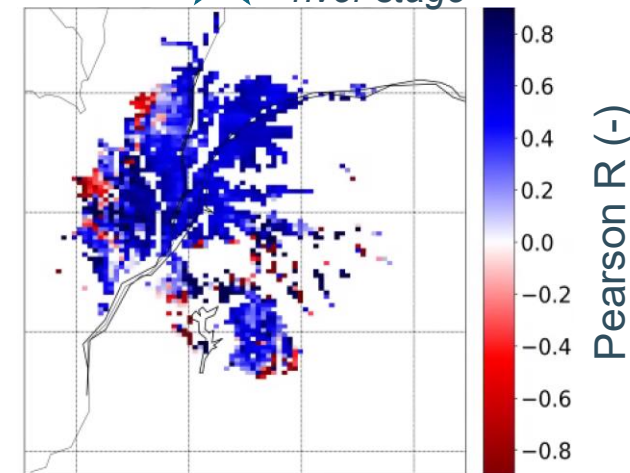


Correlation of all grid cells to specific upstream river location

Ouesso river stage



Bangui river stage



Conclusions

- Data assimilation diagnostics indicates influence of river stage height on peatland water tables
- Disentangling of impacts of river stage height and precipitation errors limited by lack of rain gauges

See reference below for relevant graphics.

References

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