On using water surface slope for estimating discharge in critical backwater conditions: case study of the Poyang lake, China.

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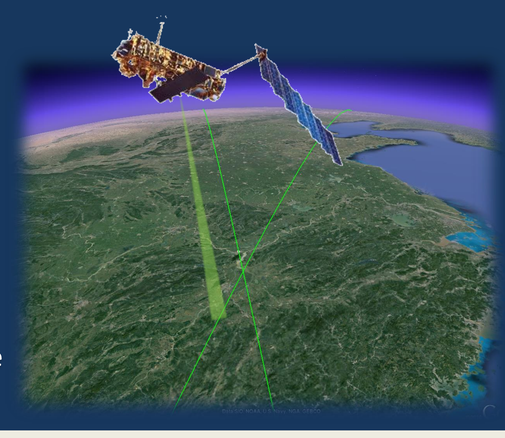
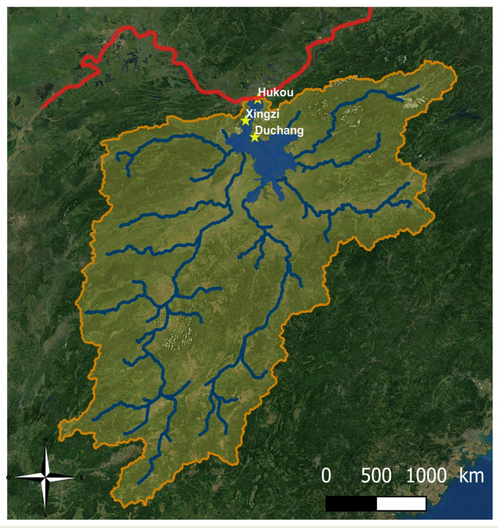
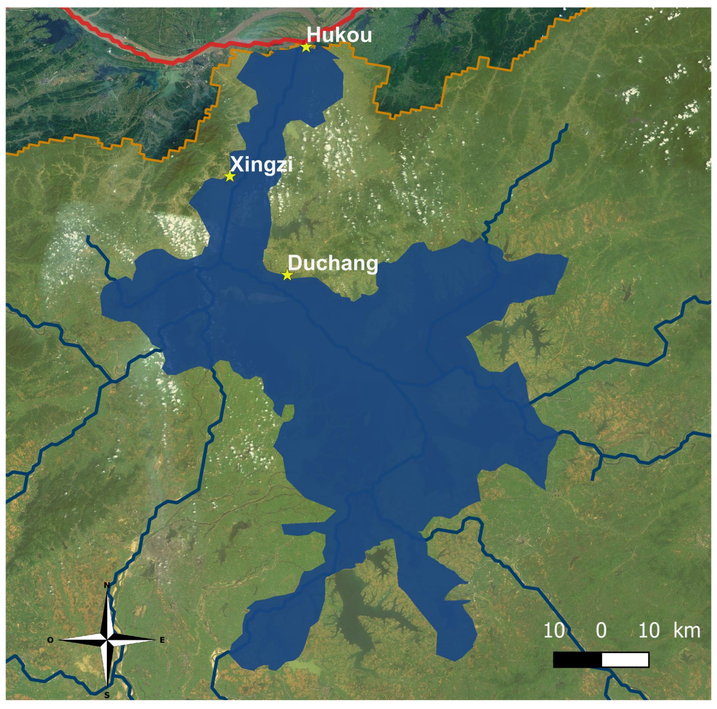


The Poyang lake

- Located in Jiangxi province
- connected to the middle reach of the Yangtzé River
- Watershed 162000 km^2
- Water levels variations from 8m to 20m
- Water surface variation from 350 km^2 to 3500 km^2

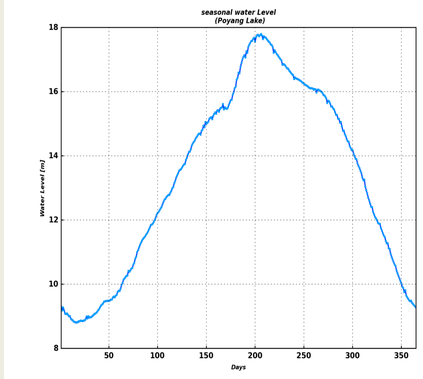




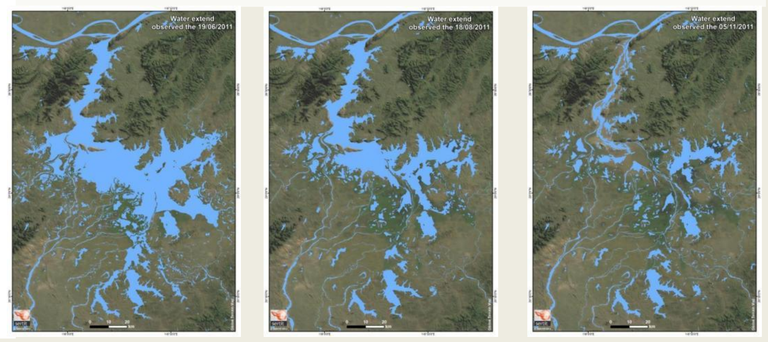
Legend :

Poyang Lake watershed — Tributaries
Poyang Lake — Gauge station
Yangtze River

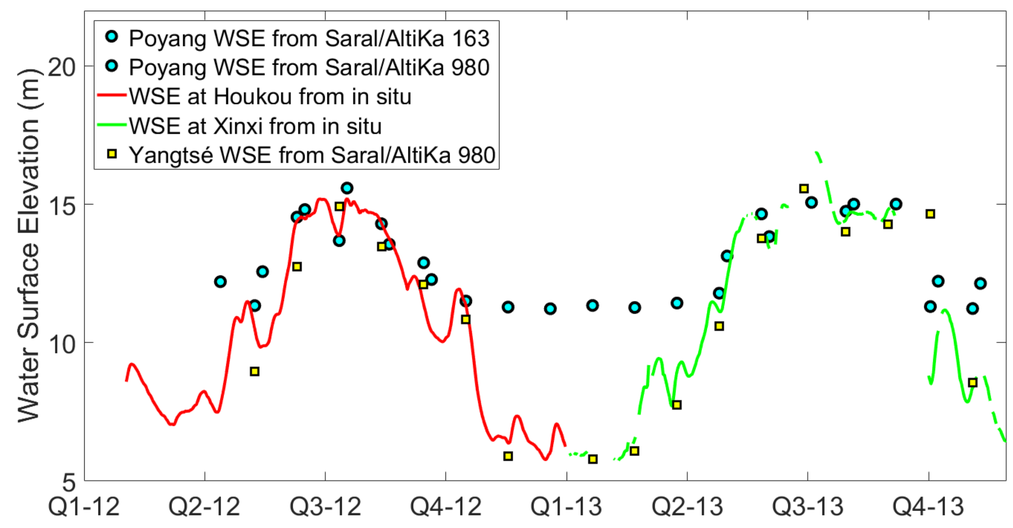
The water level in Poyang Lake is ruled by 1°) water from the watershed and 2°) water from the Yangtze River. And that impact the water Discharge of Poyang Lake.



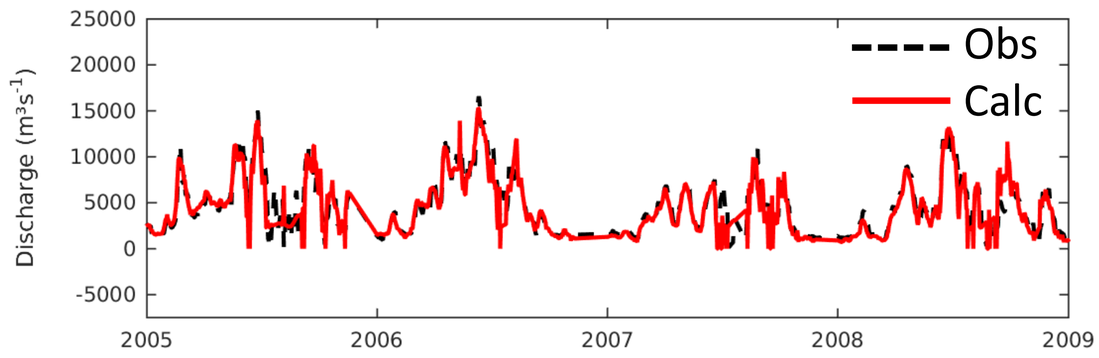
- Strong seasonality

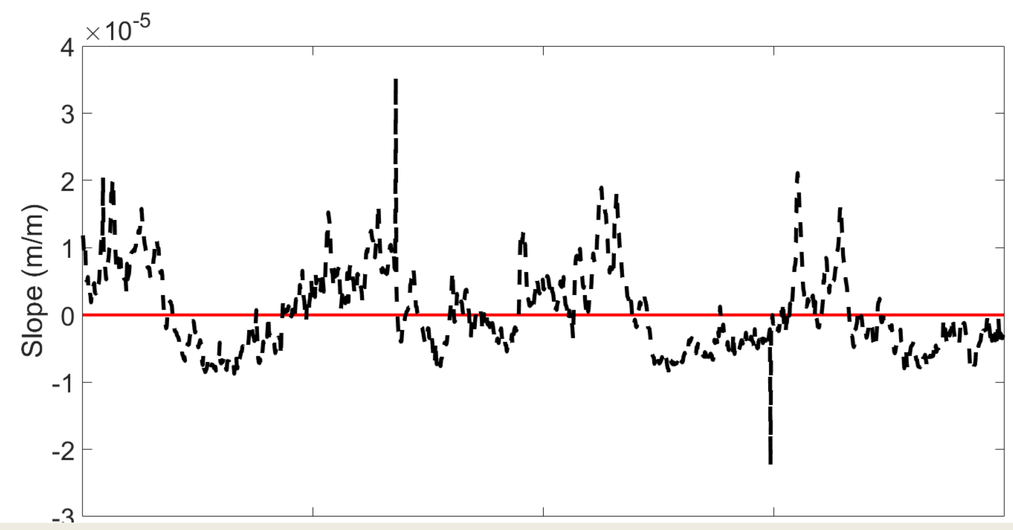


Rating curves and slopes from altimetry



- RC with backwater: $Q = a * (h - h_0)^{\frac{5}{3}} * \sqrt{S}$
- S taken from in situ, altimetry and monthly means
- Levelling approximate conditions: high water (Yangtze): Yangtze ≥ Hukou > Xingzi > Poyang; low water: Poyang > Xingzi > Hukou > Yangtze





Converting stages into discharge

To retrieve a calculated Discharge value from height we also need to take into account the slope between the yangtze River and the Poyang Lake.

- Two-variable rating curve equation first tested:

$$Q = a * (h - h_0)^{5/3}$$

- In situ data (h & Q) available at Hukou & Xingzi
- Inclusion of WSS (Water surface slope) in the RC equation tested (S from in situ & satellite altimetry)

Discussion

- The RC formulation with slope is able to retrieve correct discharges most of time; new method to be built for negative slopes.
- Altimetry data can be used to level in situ and/or to obtain slopes in NRT or at monthly time steps.
- SWOT observation (e.g. height & slope) will ensure the correct estimate of discharge input from the Poyang lake into the Yangtze river.

References:

- Paris et al. (2016), *Stage-discharge rating curves based on satellite altimetry and modeled discharge in the Amazon basin*, WRR

Aknowledgment:

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