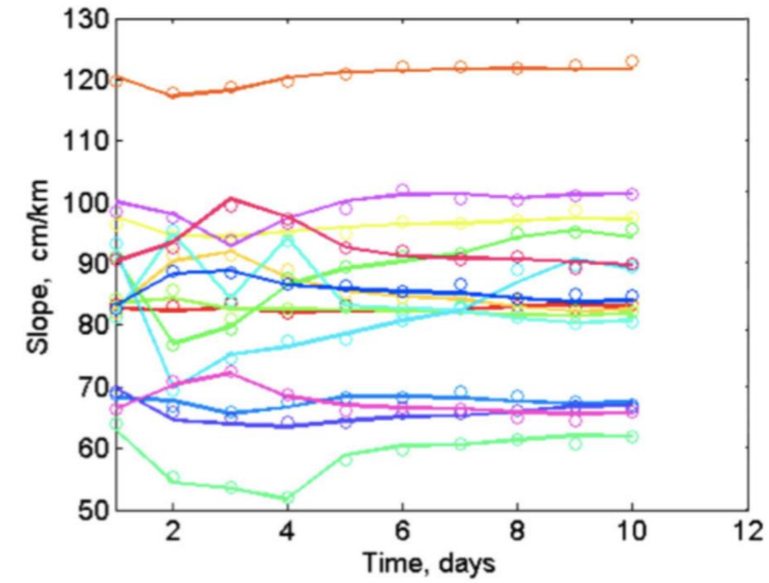
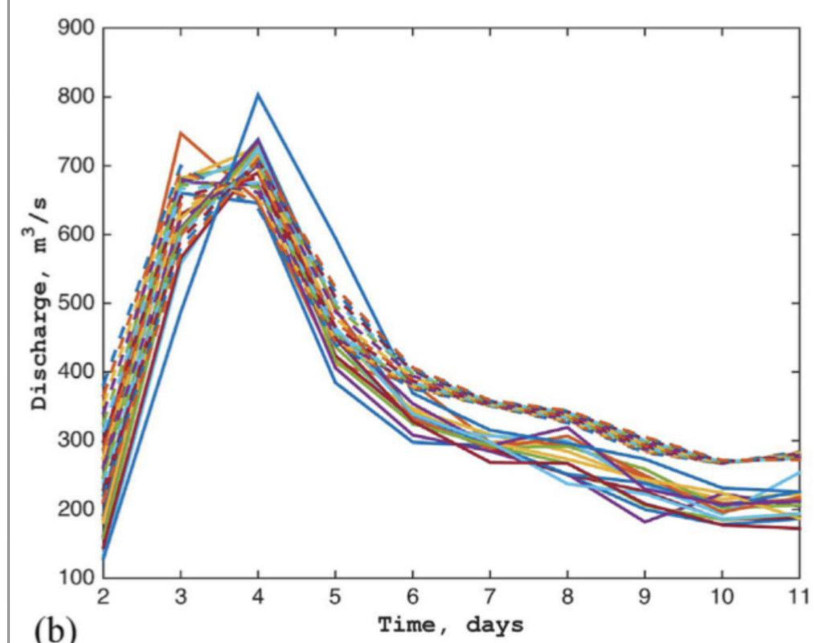
Discharge Algorithms Working Group: Lessons Learned & Outstanding Questions

Michael Durand for the Discharge Algorithm Working Group
SWOT Science Team Meeting • Bordeaux
June 18, 2019

The discharge algorithm working group (DAWG) develops methods to compute river discharge from SWOT observations

SWOT measures river height, width, and slope





Yoon et al., 2016. Flow estimates on Garonne (by PA Garambois)

Paradigm for computing river discharge

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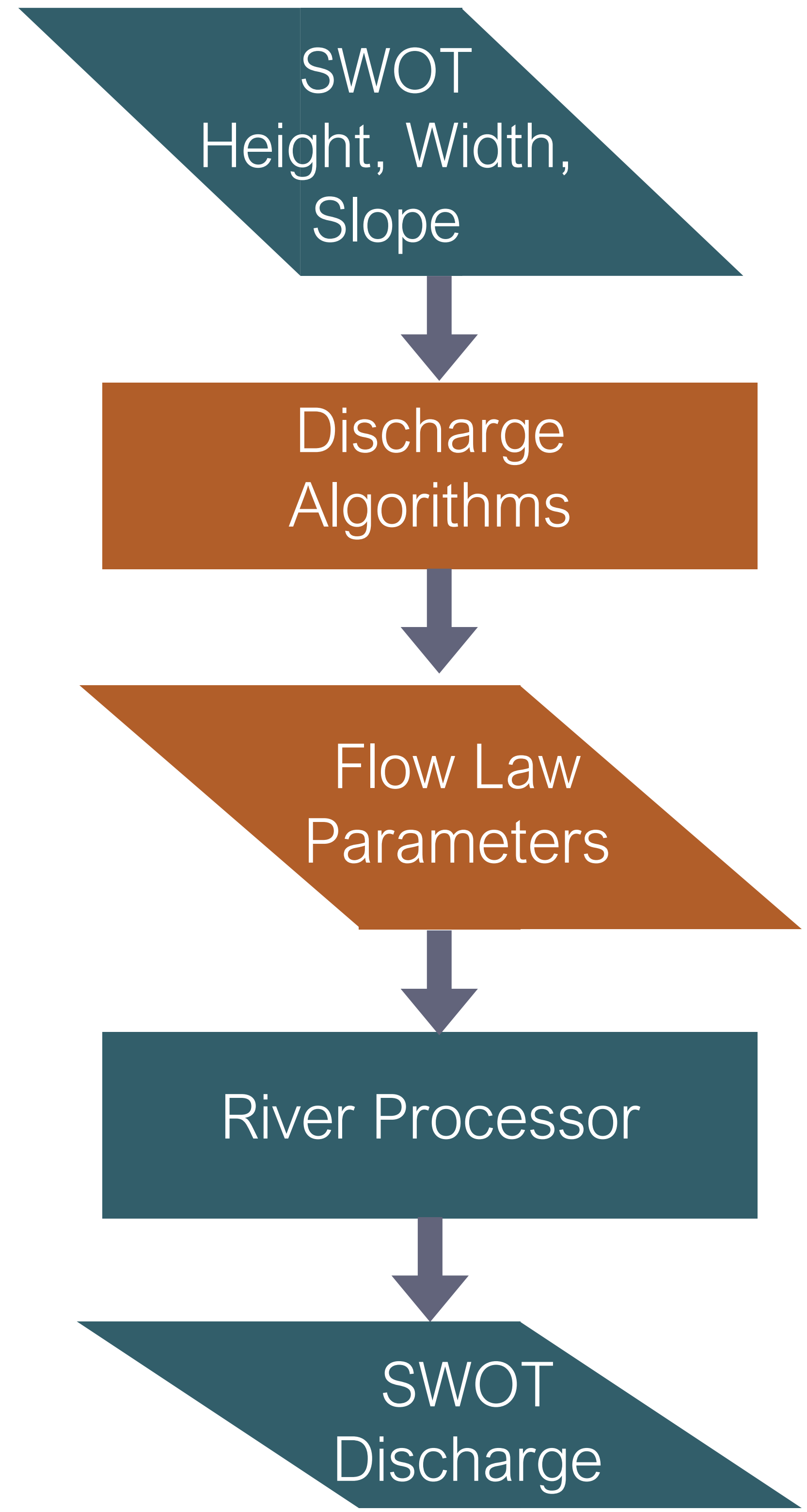
- Discharge will be computed with relatively simple flow laws
- SWOT does not measure flow law parameters necessary to compute discharge
- The Science Team will use discharge algorithms to compute flow law parameters using SWOT data, and provide these to the Project via the a priori river database. There are on the order of 10^5 reaches.
- The Project will then compute discharge for each pass using SWOT observations and parameters in the SWOT river tile processor

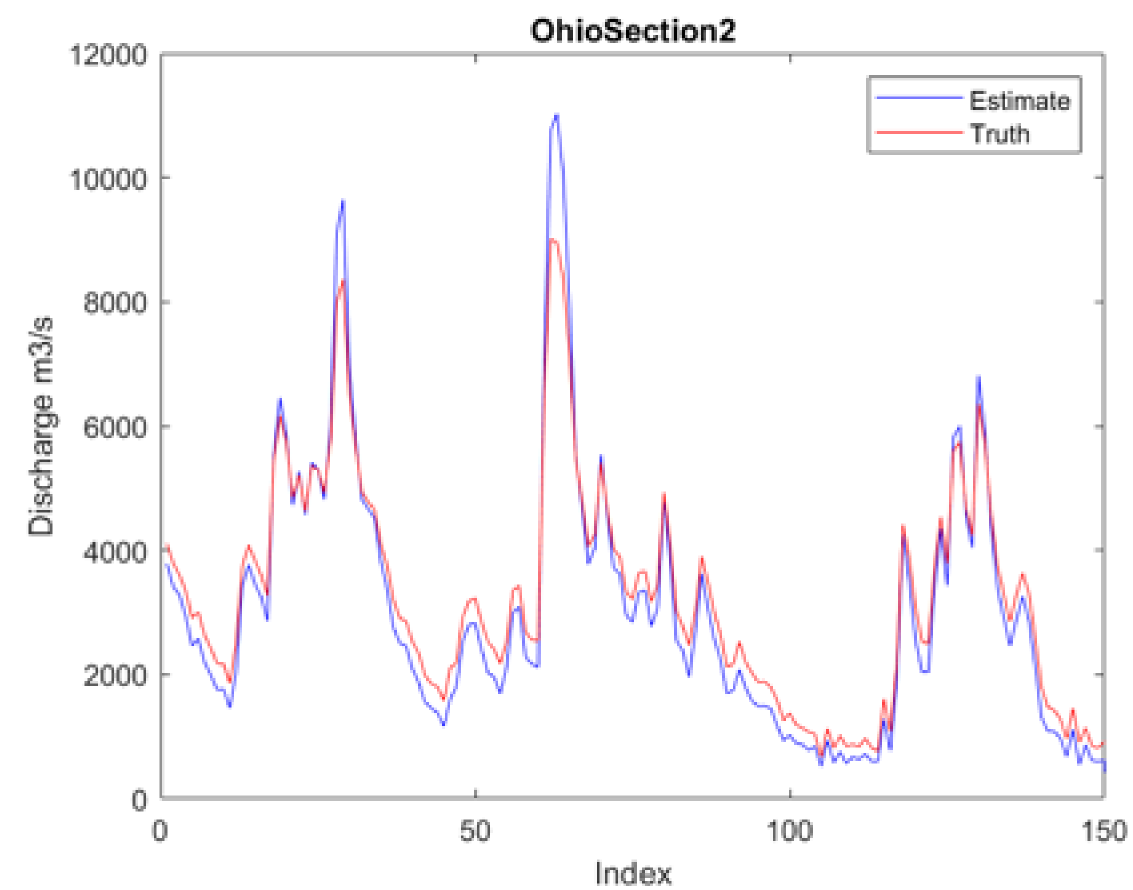


Discharge Algorithm Intercomparison Project (Pepsi Challenge 2.0)

- Four algorithms estimated discharge using synthetic observations for many rivers. Sensitivity to observation error and frequency investigated

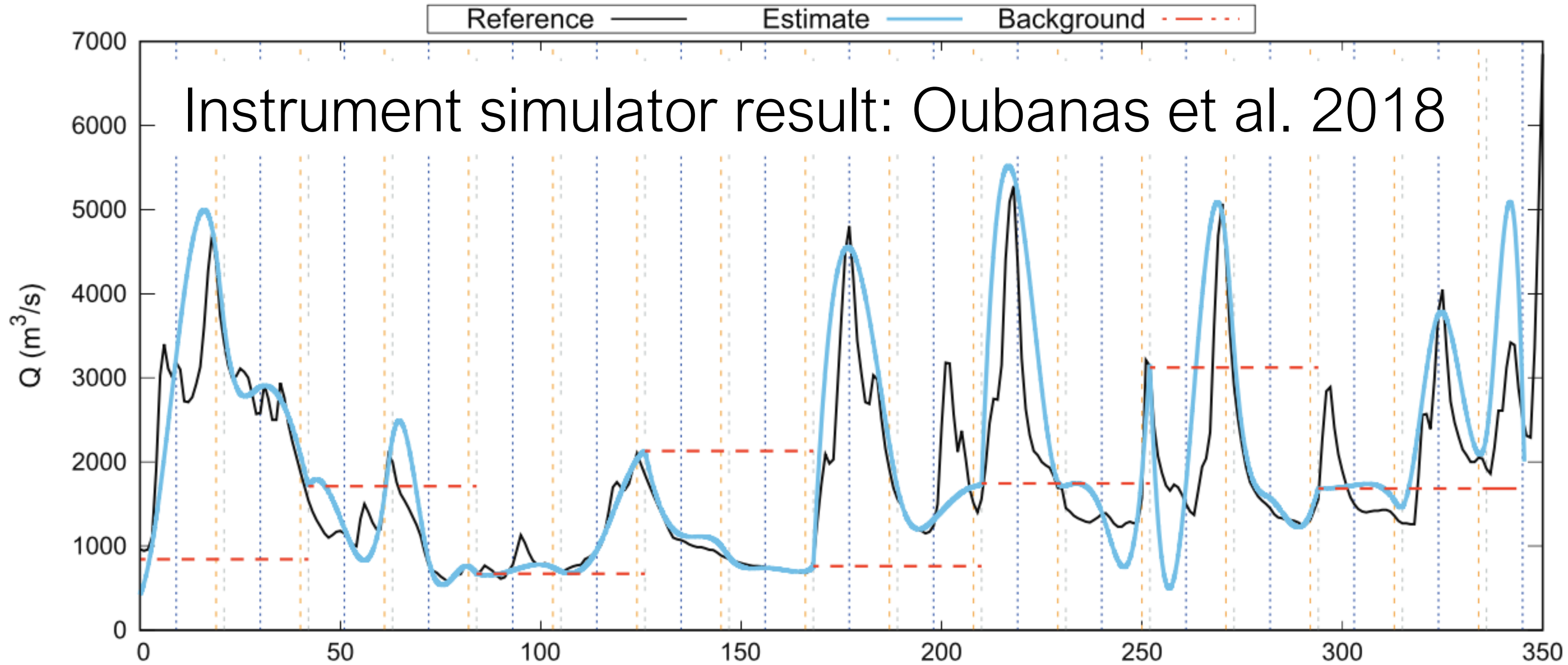
- Deficiencies identified in a previous study were overcome. Discharge accuracy improves over “first guess”

- It is possible to estimate discharge from SWOT observations alone

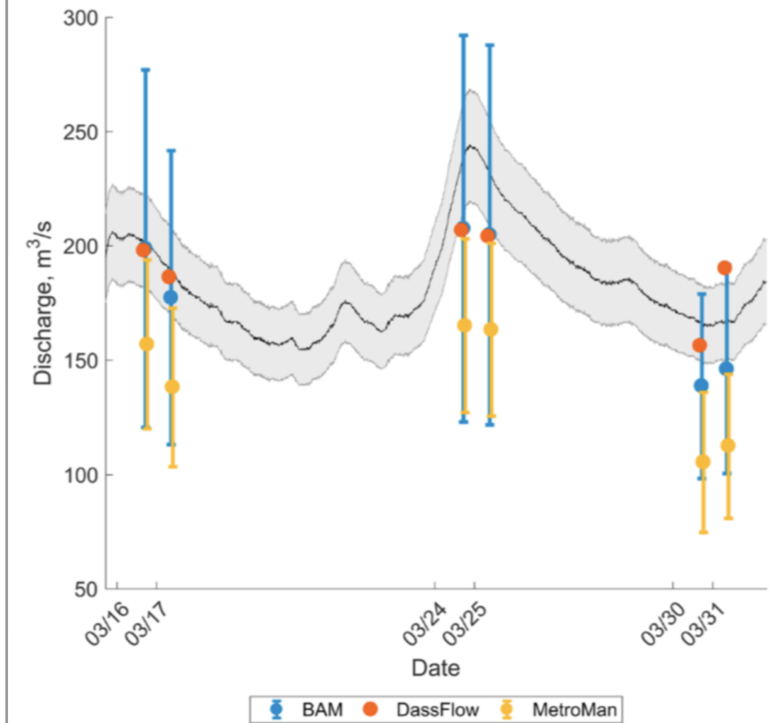


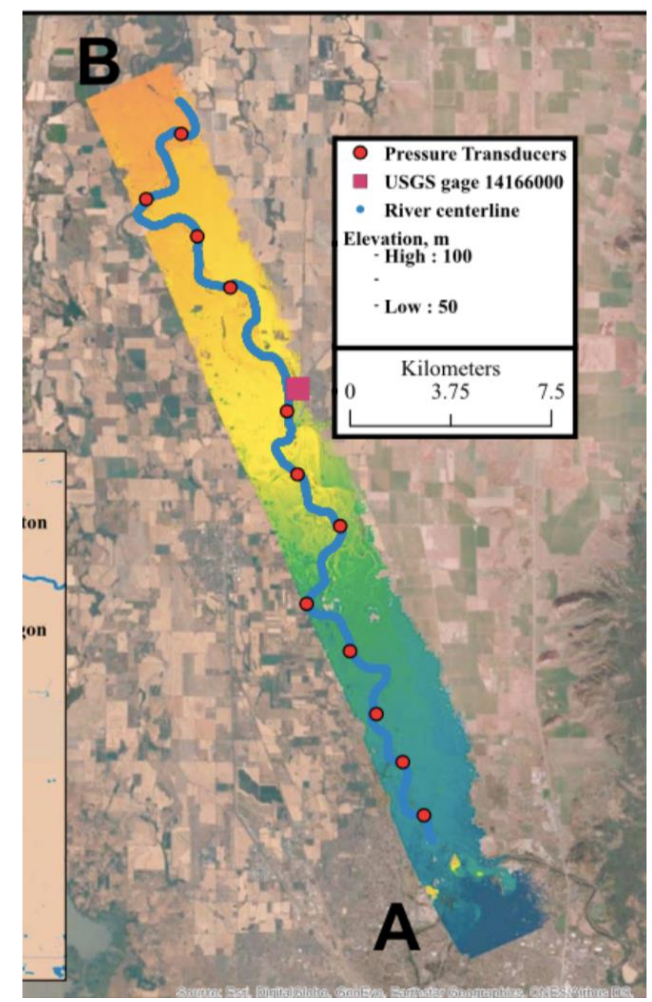
Courtesy: Renato Frasson

Median values of normalized RMSE and NSE ~0.5 for three algorithms



AirSWOT result: Tuozzolo et al. 2019





We have further tested algorithms using AirSWOT data, in situ data (cal-val collaboration) and the instrument simulator

Brief highlights of other important lessons learned

- New paradigm: “integrators” have been presented to solve problems discharge algorithms cannot tackle: analyzing entire river networks simultaneously, and incorporation of in situ data (Andreadis and Gleason, U Mass)

- “Hydraulic visibility” is a new scientific framework for understanding applicability of discharge algorithms (Garambois et al., U Strasbourg)

- A solution for lateral inflows in unobserved tributaries has been identified and tested (Nickles and Beighley, Northeastern)

- Flow law science has improved. We now have a robust theory on how spatial variability affects St Venant and SWOT-type flow laws (Rodriguez)

Several Outstanding Questions

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- How to optimally and efficiently harness the discharge algorithms and integrators to create discharge data products?
- How to best incorporate a priori data in estimating flow law parameters?
- There are at least a dozen smaller decisions to be made, issues to tackle, and much code to write to make the collaborative discharge data product possible