DAWG STATUS UPDATE

Colin J Gleason
UMass Amherst

On behalf of the
Discharge Algorithm Working Group

What is the DAWG?

The DAWG is the Discharge Algorithm Working Group. We are charged with estimating river discharge from SWOT measurements

During the SDT, we worked on hydraulic inversion algorithms- what we now call McFLI (Mass conserved Flow Law Inversion)

The goal is to use SWOT to give partial observations of hydraulic laws and rely on mass conservation to back out discharge *WITHOUT ANY PRIOR OR IN SITU DATA*

See e.g. Durand et al. 2016 *WRR* “the Pepsi Challenge” or many papers by individual authors

The DAWG in the ST

During the ST, DAWG continues to work on McFLI algorithms and theory, but teams are also focusing on data assimilation and the role of ancillary data

Principle activity to date: NYC Discharge Algorithm Workshop in October 2016 (25 attendees)

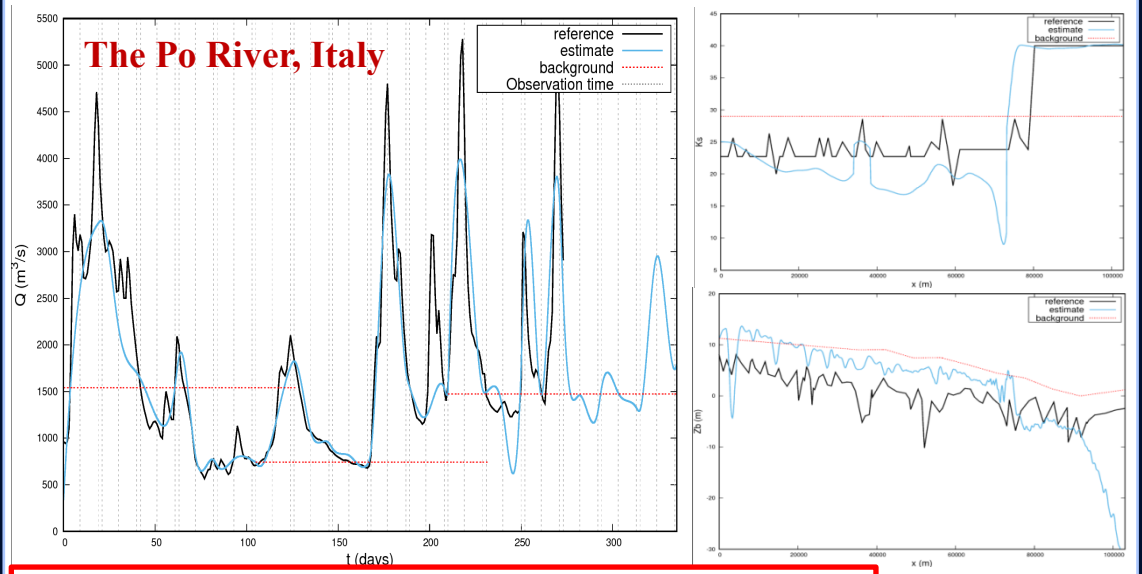
- Reviewed state of the art
- Productive (and rare) brainstorming time
- Identified key challenges ahead, including
  - We need more data to test algorithms!
  - We need to move toward concrete implementation plans with the project
  - We need to standardize assessment of algorithms and explicitly report uncertainty
  - More at: http://swotdawg.wordpress.com

Specific investigator progress/plans

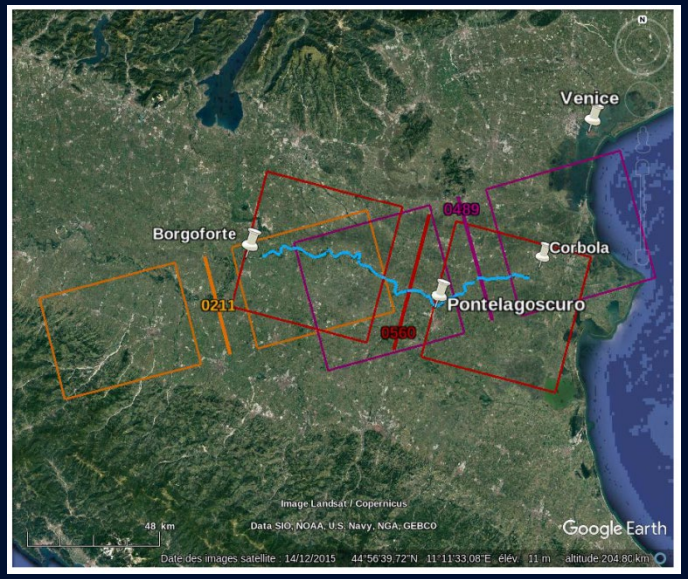
River discharge estimation under uncertainty from SWOT-like observations using variational data assimilation and a full Saint-Venant hydraulic model

Hind Oubanas, Igor Gejadze, Pierre-Olivier Malaterre

- River discharge estimation problem under uncertainties in river bathymetry and bed roughness.
- 1.5D full Saint-Venant hydraulic model: SIC² - Irstea Montpellier (http://sic.g-eau.net).
- A variant of the standard variational DA method '4D-Var', adapted to hydraulic systems.
- Generalized observation operator (in-situ & satellite measurements, irregular spatial and temporal distributions).
- Application to gauged as well as ungauged basins: all priors needed are generated from the observations (Irstea/OSU) ⇒ Trapezoidal approximation of the bathymetry.
- Assimilation of synthetic SWOT-like data at the reach scale ($\Delta x \sim 10km$ and $\sigma_{obs} \sim 0{,}1\ m$) for different temporal frequencies – **The Garonne River** (rRMSE = 4,6% and 24,1% for 1 and 5 days, respectively).
- Assimilation of the SWOT simulations at the nodes scale of RiverObs ($\Delta x \sim 200\ m$ and $\sigma_{obs} \sim 2{,}5\ m$) – **The Po** (rRMSE = 14,5%) **& Sacramento Rivers** (rRMSE = 12,3%).



RMSE	rRMSE	NRMSE	NSE	VE
$297.5\ m^3 s^{-1}$	14,5%	16,4%	0,93	0,89



D Bjerklie on behalf of USGS DAWG:

- Updated HYDRoSWOT data base with slope information.
- New paper on slope and flow resistance from findings within HYDRoSWOT in prep
- Journal article, *"Satellite Remote Sensing Estimation of River Discharge: Application to the Yukon River Alaska"* in review at Journal of Hydrology. Once published, I will forward the paper and the data from the paper to the DAWG.
- Participate in SWOT ST meetings and Discharge Algorithm Working Group contributing to publications, calibration/validation (Cal/Val) activities, and develop work plans.
- Prepared draft of peer-reviewed journal article, *"SWOT-based River Discharge: Ground-truthing using the Probability Concept and Continuous-wave Velocity Radars."*

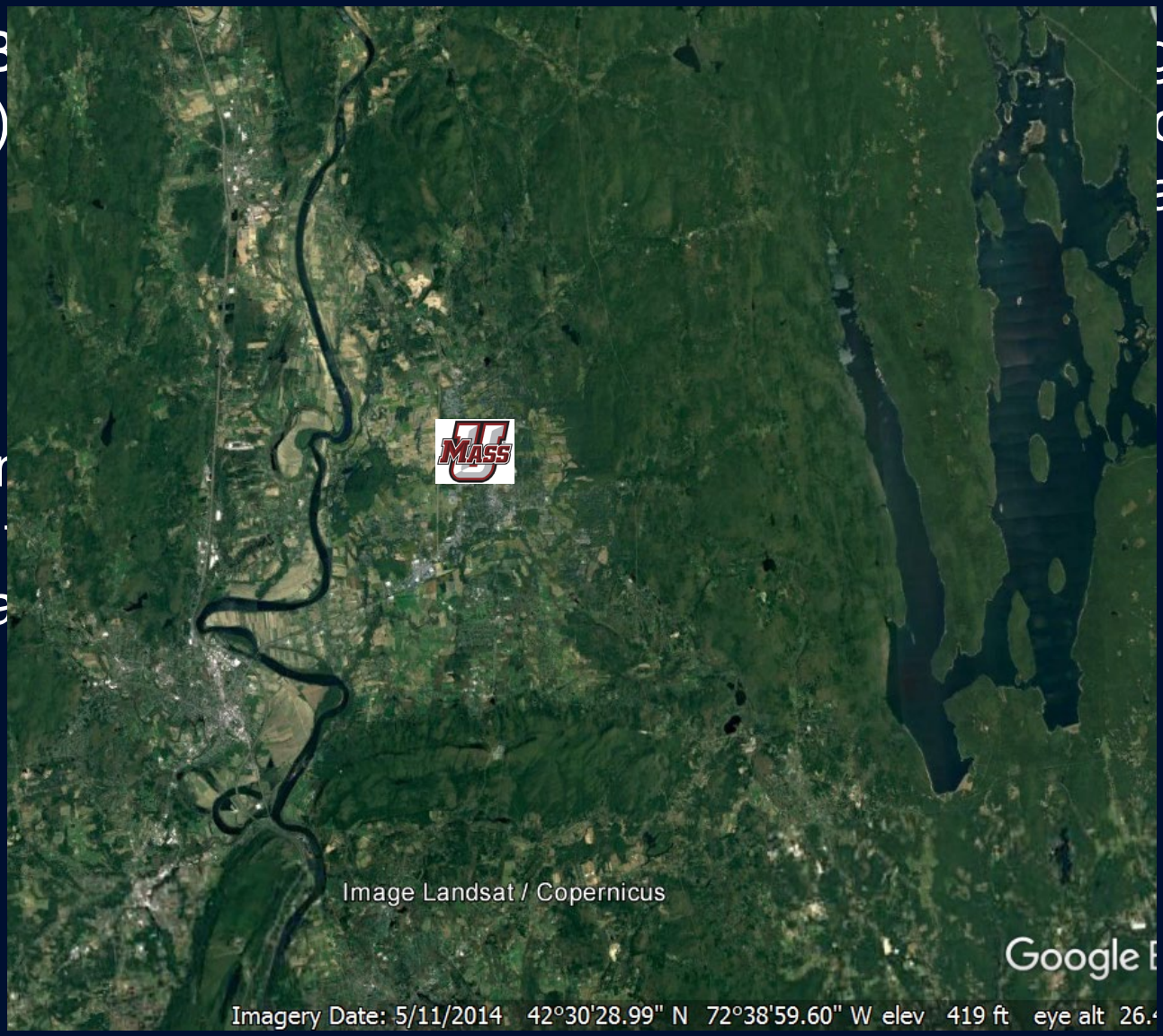
P.-A. Garambois, K. Larnier, J. Monnier, A. Montazem, H. Roux, J. Verley

- Discharge estimation from hierarchical modeling 0.5D / 1D St-Venant & Variational Data Assimilation (VDA)
- Improving the VDA algorithms for multi-sources data & multi-scale models
- River networks segmentation and hydraulic controls
- Combining the numerical models with some regional databases (ongoing work)

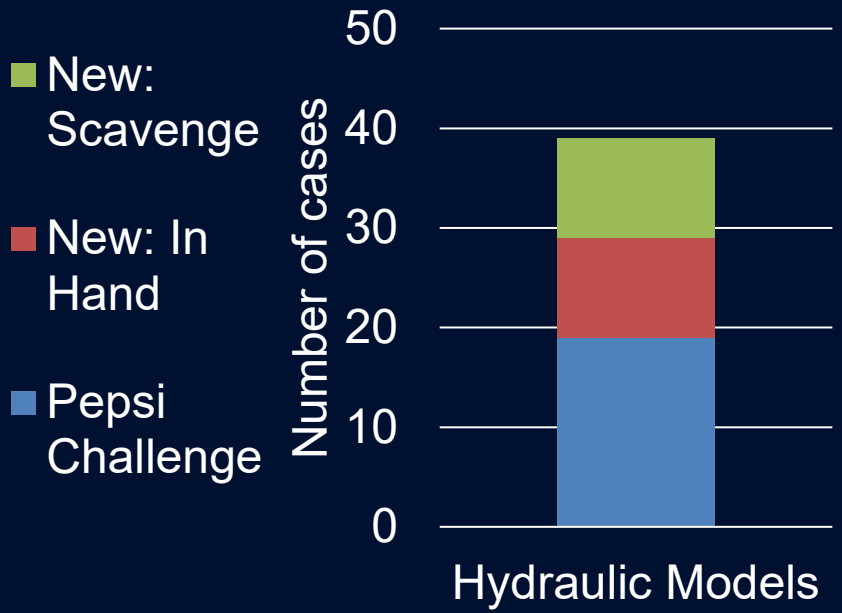
More details in the talk
“Discharge estimation from surface observables & ancillary data”

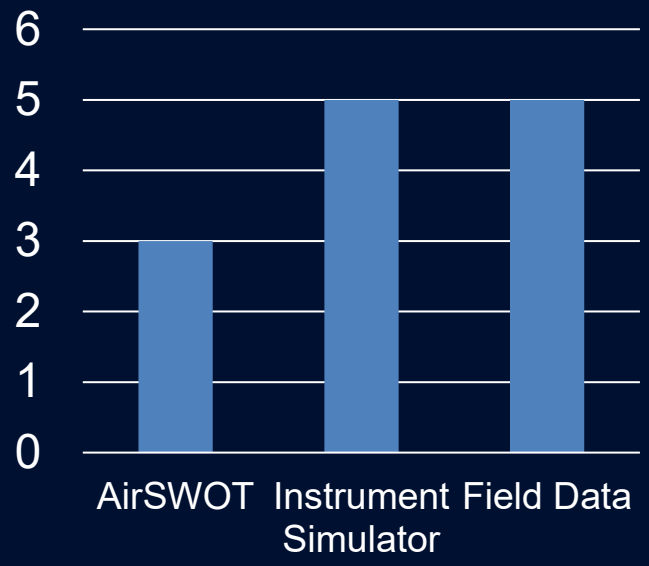
CJ Gleason, M Hagemann- UMass Amherst

- New B gorithm (BAM) orks much a)
- Serve
- Workir reposi evalua



Excellent progress on community datasets





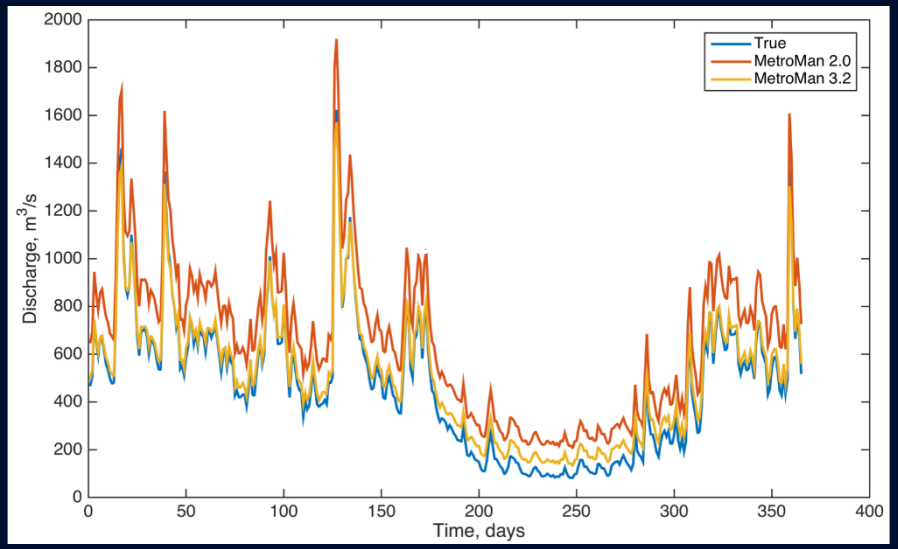
Goal: 100 cases or bust!

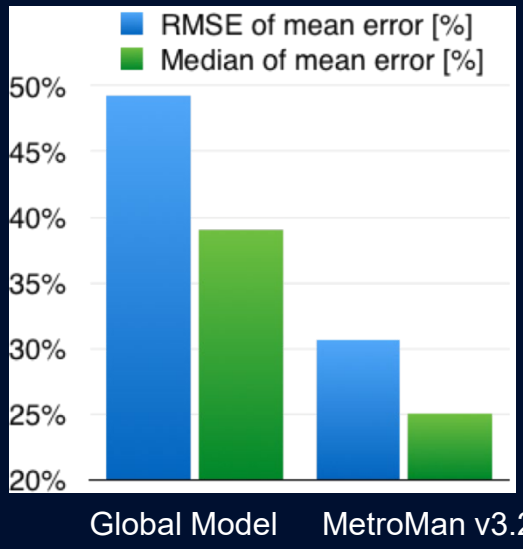
- Curtis Chen's team prioritized Willamette River dataset
- Set up shared folder for community datasets at UMass
- Need #1: More hydrauilc models! Please help
- Also need: Help modifying & running hydraulic models. Email: durand.8@osu.edu

Michael Durand, Renato Frasson, Steve Tuozzolo

THE OHIO STATE UNIVERSITY

Progress on reach average theory & algorithms





See poster 31 for more!

- Adjusted MetroMan algorithm to allow for “effective” roughness to vary temporally & other tweaks. Major improvement in algorithmic performance for Pepsi Challenge rivers (Durand et al. AGU 2016)
- Paper on reach averaging led by Dr. Renato Frasson received minor revisions in *Water Resources Research*
- Paper on reach averaging led by Steve Tuozzolo on the Olentangy River datasets (to be submitted)
- Hosted Ernesto Rodriguez (June 2017) to work towards predicting how flow laws scale spatially