The intercomparison challenge PEPSI-2
Context and motivations

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Outline

- Hydraulic inverse problem(s) from river surface observables

- Scientific goals and motivations

- Algorithms

- The intercomparison challenge PEPSI-2

Hydraulic inverse problems from river surface observables
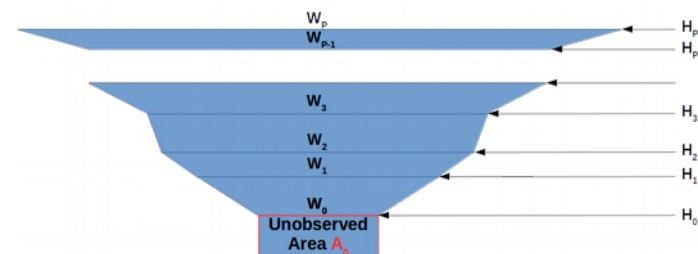
- Forthcoming SWOT mission (2021)
  - Swath radar interferometer. 1 to 4 revisits per cycle (21 days)
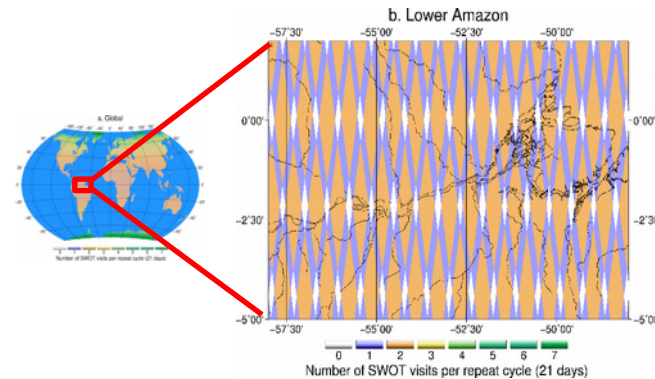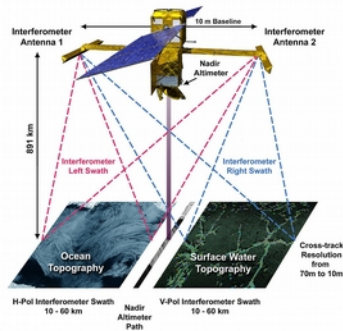
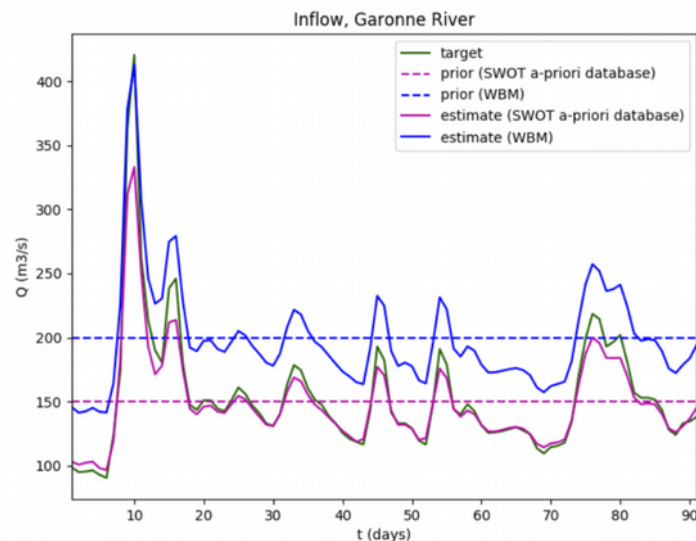(Biancamaria et al., 2016)

- RiverObs
  - Water surface height Z, width W and slope S at reach scale (~ few kms)
  - Water surface height Z and width W at node scale (~ 200 m)

- Goal: to infer the discharge **Q** at reach scale

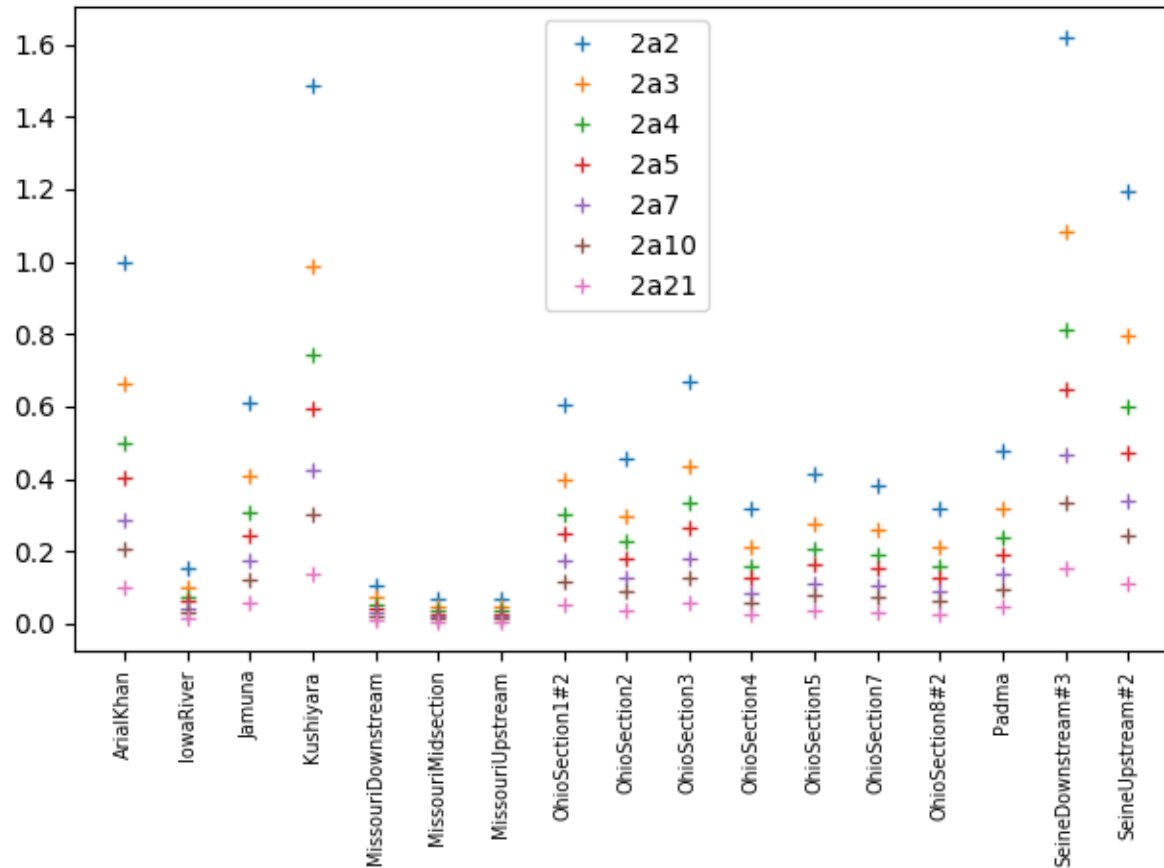# Scientific goals and motivation

- Inference of discharge and algorithm parameters from surface observations only

  - Inference of **Q** => inference of the other **unknowns**

  - For Manning's law based models (MacFLI), need to infer A_0, **Q** and **K**

    - Manning Equation: $Q = K(A_0 + \delta A)^{5/3} W^{-2/3} S^{1/2}$

      => We can infer ratios only (e.g. **Q**/**K**) => estimations depend on the priors

      => Ill-posed problem. The so-called "equifinality" issue

  - A similar equifinality issue occurs for the complete 1D Saint-Venant dynamic model (INSA-IMT, Larnier et al, *submitted*)

Inflow, Garonne River
- target
- prior (SWOT a-priori database)
- prior (WBM)
- estimate (SWOT a-priori database)
- estimate (WBM)

We need good priors !

Scientific goals and motivation
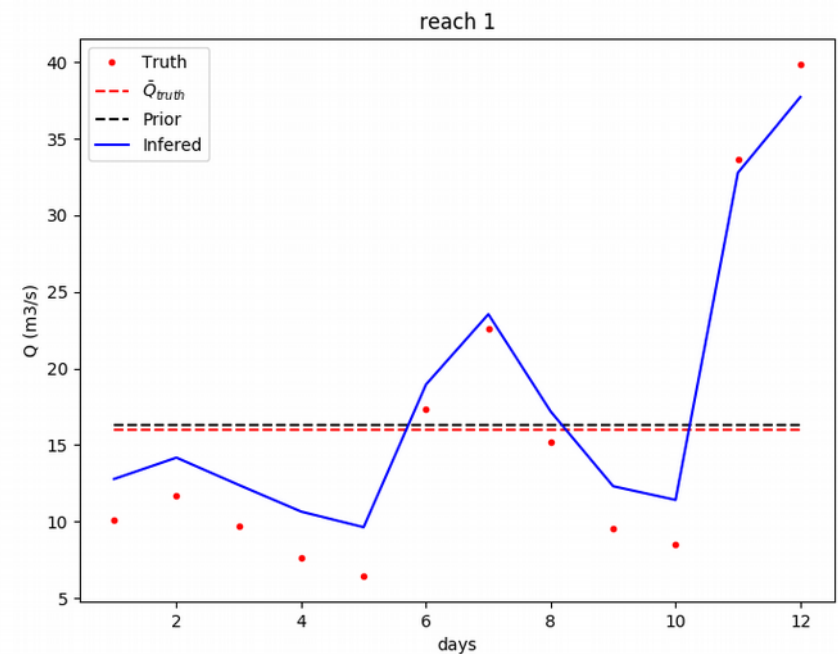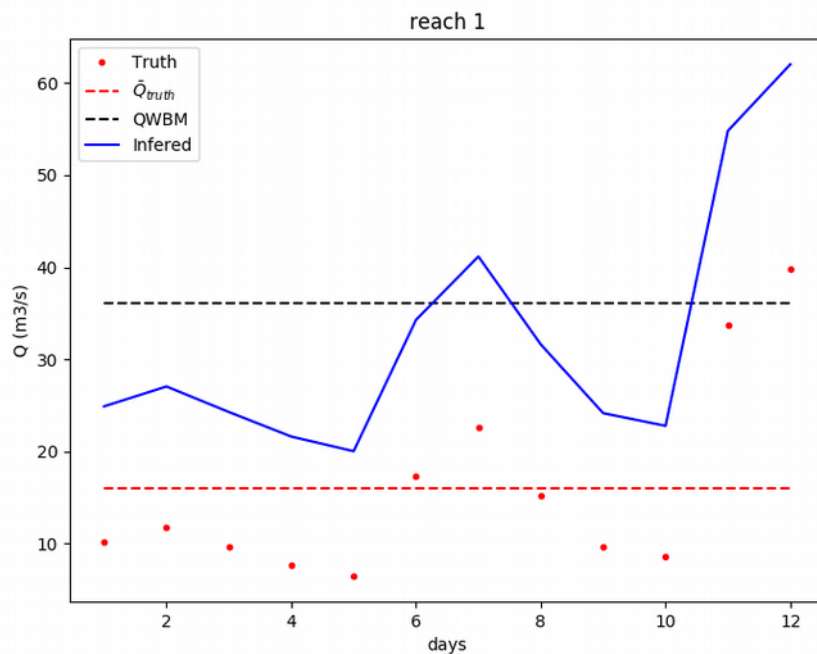
- Impact of the temporal sampling

$$I = \frac{T_{wave}}{\Delta t_{obs}}$$

Preliminary estimations of identifiability index
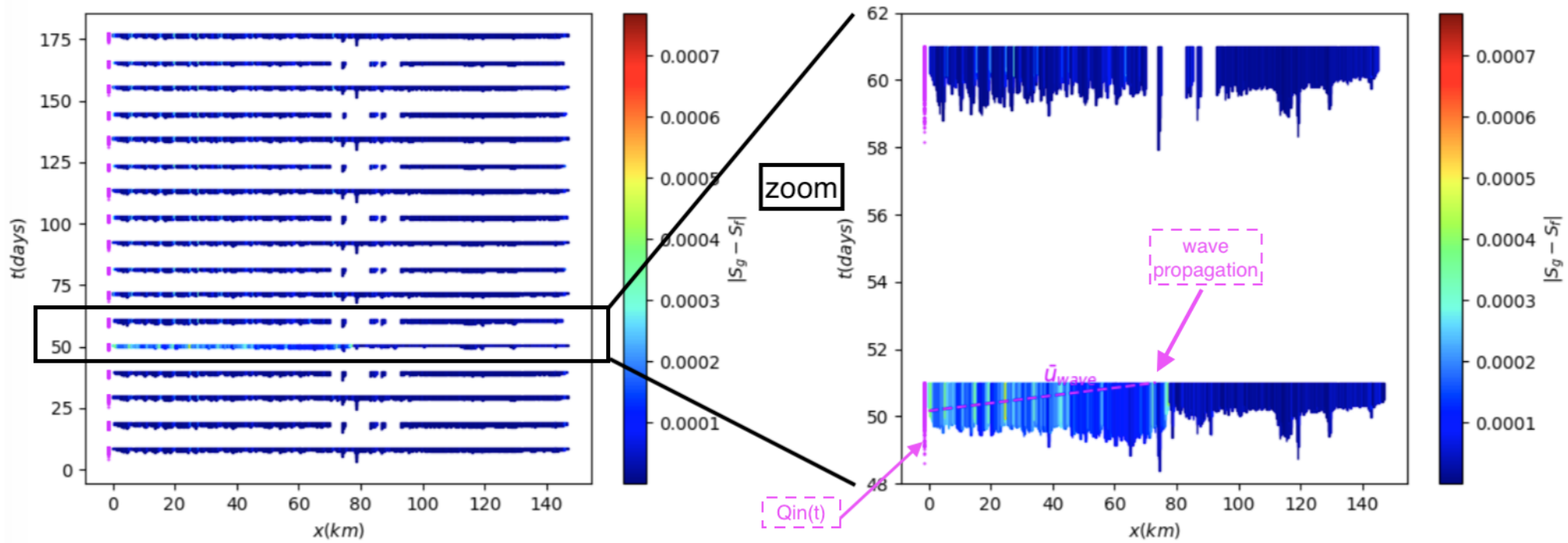
Scientific goals and motivation

- Inference of discharge and algorithm parameters from surface observations only
  - Good priors using ancillary data

Results for the PEPSI2 challenge using this method are available (see post on the DAWG blog)
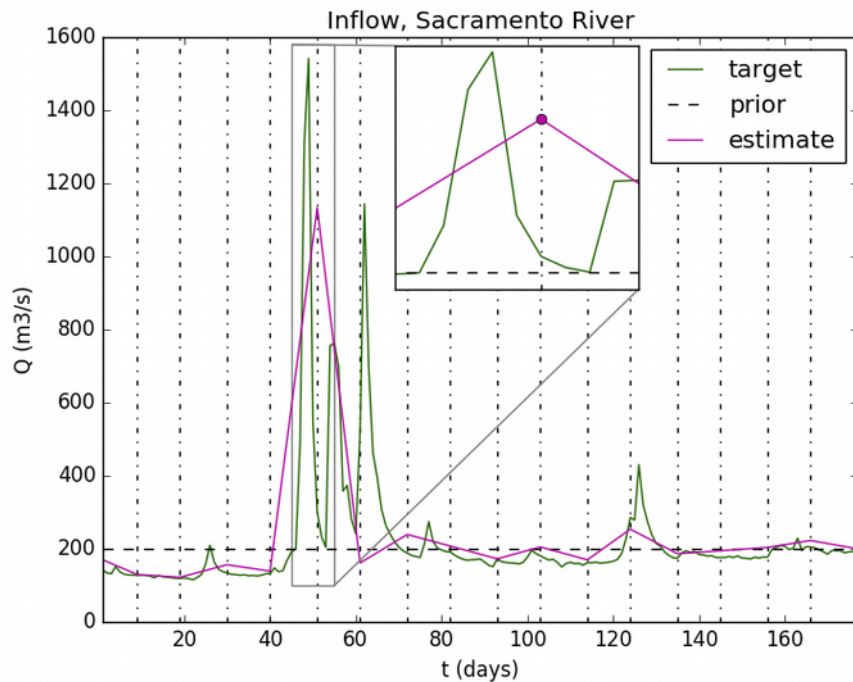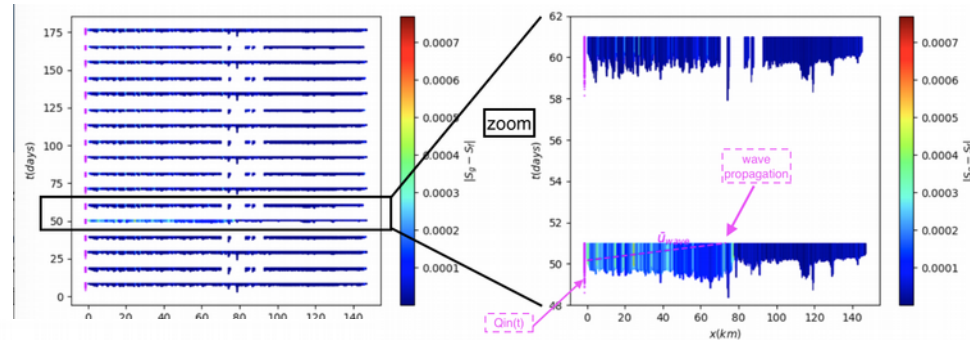
Scientific goals and motivation

- Impact of the temporal sampling

(INSA-IMT, Brisset et al, 2018, Larnier et al, *submitted*)

- Impact of the temporal sampling

Inflow, Sacramento River

(INSA-IMT, Brisset et al, 2018, Larnier et al, *submitted*)
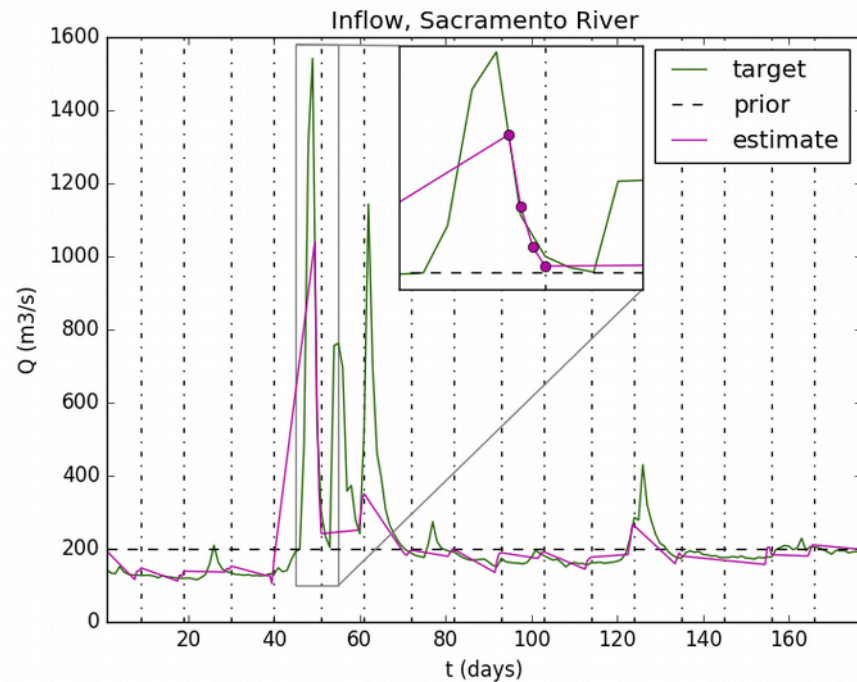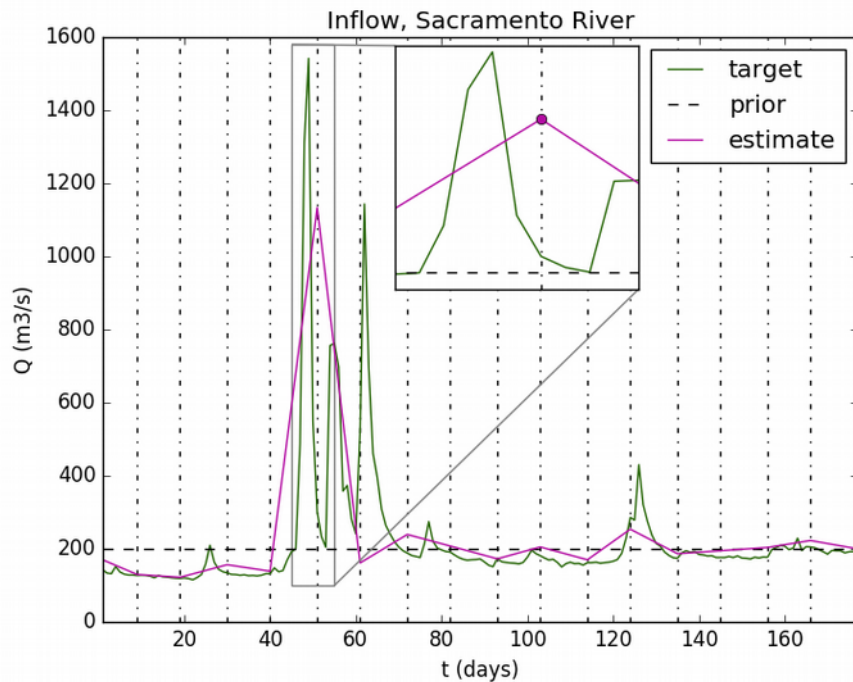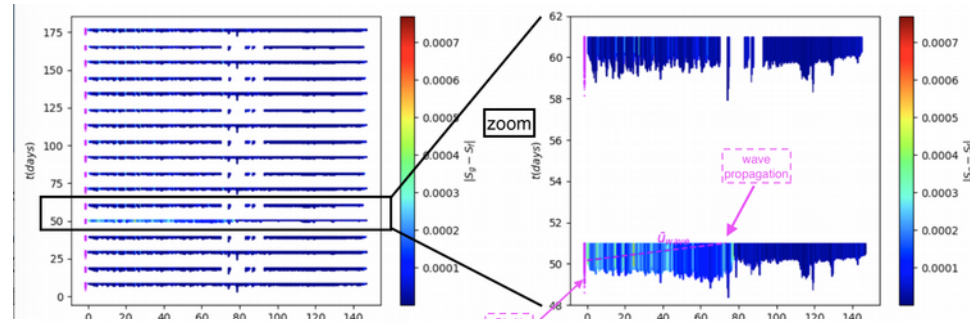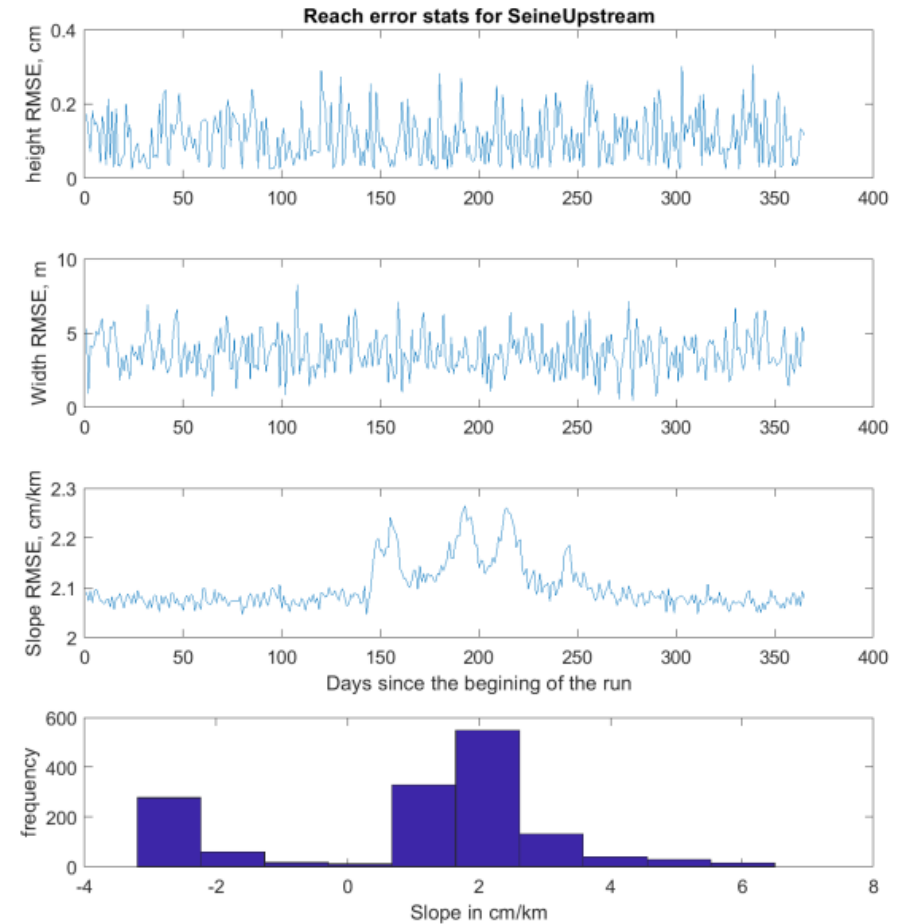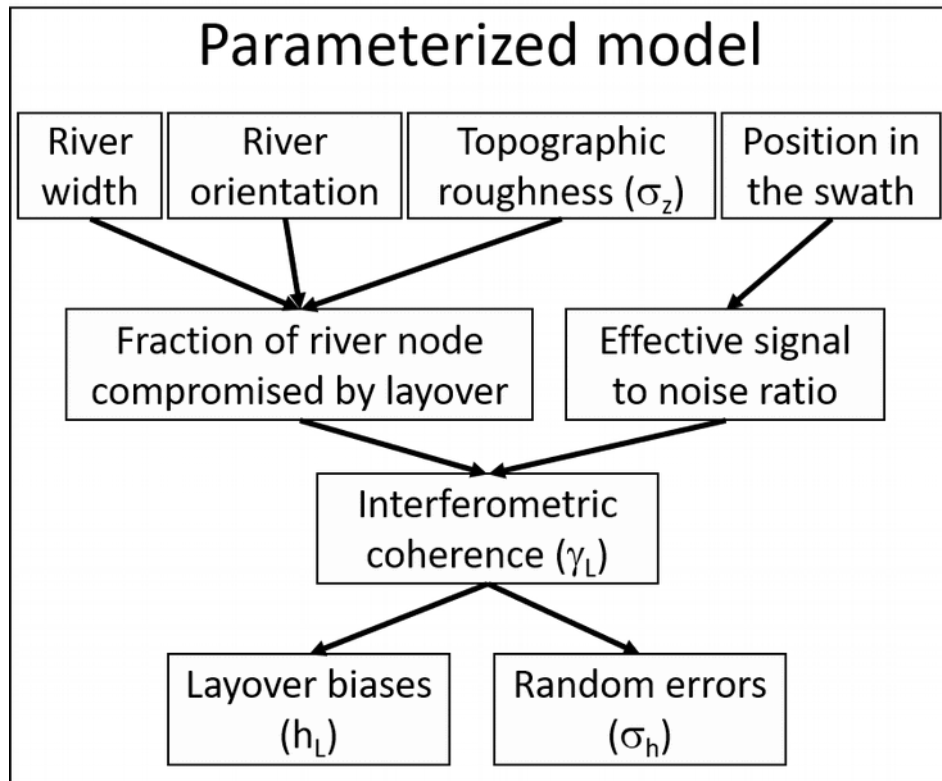
- Impact of the temporal sampling

(INSA-IMT, Brisset et al, 2018, Larnier et al, *submitted*)

Scientific goals and motivation

- Impact of measurements error

(*Courtesy Renato Frasson, DAWG blog post*)

Algorithms

- 5 algorithms have been proposed (see DAWG blog)
  - BAM (Massachussets University)
  - HiVDI (INSA-IMT-ICUBE)
  - MetroMan (Ohio State University)
  - MOMMA (USGS)
  - SADS (Massachussets University)
- Few more to come
  - See third part by Hind Oubanas

The intercomparison challenge PEPSI-2

- Methodology
  - Use calibrated models to compute SWOT-like data
  - Different phases
    - Phase 1: daily sampling with perfect data (no noise added)
    - Phase 2: assessment of the impact of temporal sampling and measurement errors
      - Phase 2a: various sampling (from 2 days to 21 days) with perfect data
      - Phase 2b: daily sampling with multiple level of errors
      - Phase 2c: SWOT-like sampling and errors and visibility (true swaths)
    - What's next ?