SWOT Science Team Meeting 2022 – River Science Working Group session
Wednesday, June 29th, 2022

Tools4swothr : a Python tool dedicated to the generation of inputs for SWOT simulators from river hydrodynamics model outputs

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OUTLINE

WHY TOOLS4SWOTHR ?
PRINCIPLE
HOW TO GET TOOLS4SWOTHR
APPLICATIONS

WHY TOOLS4SWOTHR ?

Objective : Generate SWOT-like data from hydrodynamics model outputs

- Provide inputs for SWOT-HR (and recently) SWOT-GE simulators

- Post-treat 1D/2D model outputs
  - Map 1D info to 2D
  - Map 2D meshed info to 2D gridded

- Gather information for known and unknown catchments
- Propose methods and algorithms

Technically : Implement an automatic solution in Python

WHY TOOLS4SWOTHR ?

Developments : In the framework of the SWOT project@CNES

- SWOT-DAHM (PI H. Oubanas, INRAE) on discharge estimation
- SWOT-M3C (PI B. Laignel, Univ. Rouen) on estuaries

Funding by CNES and TOSCA

- CERFACS (S. Ricci, A. Piacentini)
- CS GROUP-France (C. Emery)

Collaboration with other institutes and collegues for various needs related to hydrodynamic models and catchments of interest (INRAE, INSA-IMT, CEREMA, EDF)

Today's focus :

- Make these developments available for users in the SWOT community
- Make the resulting SWOT-like data available for users in the SWOT community

WORKFLOW FOR TOOLS4SWOTHR

INPUTS

HYDRAULIC SIMULATIONS

- 1D model with or without georeferencing,
- 2D model defined over unstructured mesh

MAPPING
1D to 2D
2D to 2D
time sampling

WSE 2D maps

OUTPUTS

2D maps georeferenced over a regular 10 m resolution regular grid of:

- Water Surface Elevation (DSM)
- Water/land classification

Tools4swothr

SWOT simulators

SWOT-HR
SWOT-GE

SWOT products

- Pixel clouds,
- Reach/Node aggregated products

Use of SWOT-like data

SWOT-like DATA

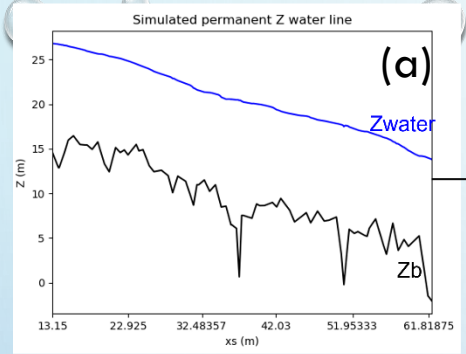
SWOT DISCHARGE ALGORITHMS

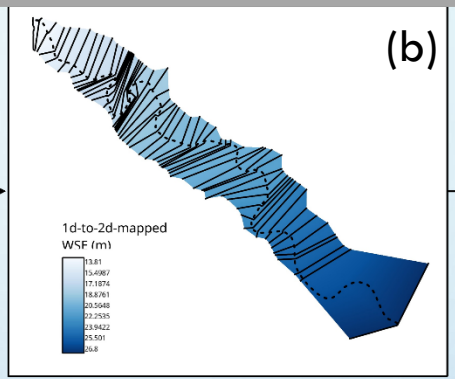
DATA ASSIMILATION PLATFORM

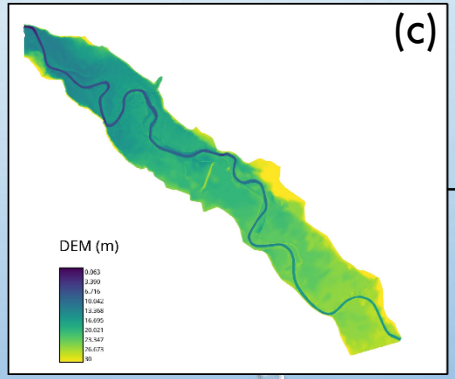
APPLICATIONS: (1) FULLY-KNOWN 1D MODEL

Garonne river in France, 1D Mascatet model @EDF

INPUTS



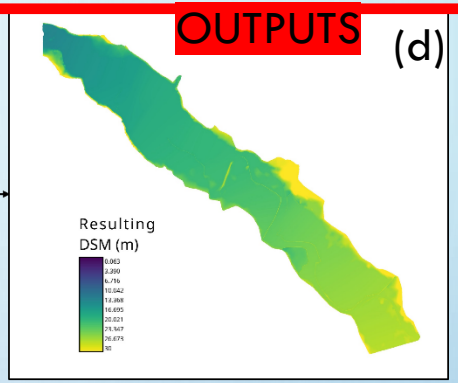


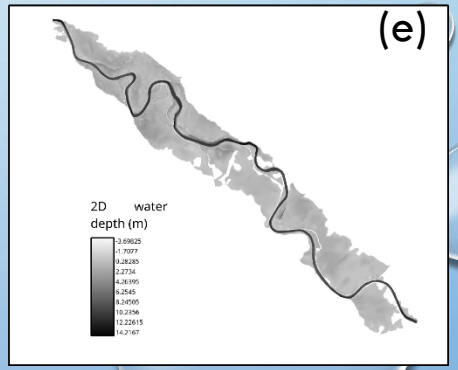


Fully-controlled study domain and modeling:

- [in] 1D-model output file (a),
- [in] Geolocalized cross-sectional profiles along 1D centerline (b)
- [in] 2D bathymetry+topography CONSISTENT with 1D-model (c)
- [out] 2D DSM (d)
- [out] 2D maps of water depths (e)

OUTPUTS

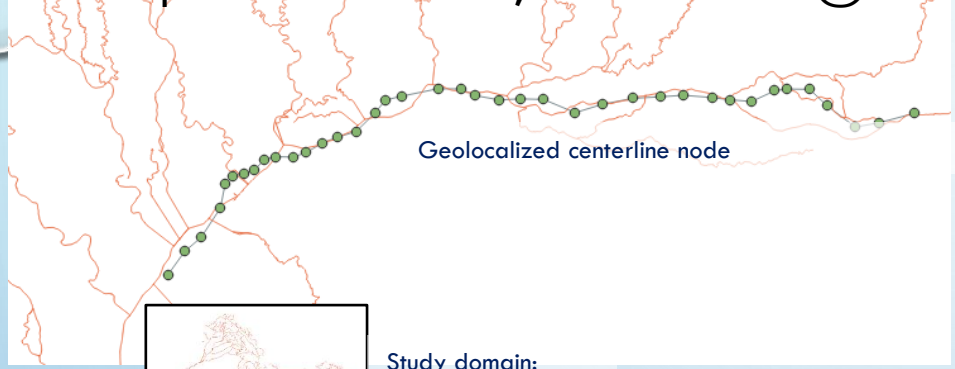




APPLICATIONS: (2) « UNKNOWN » 1D MODEL

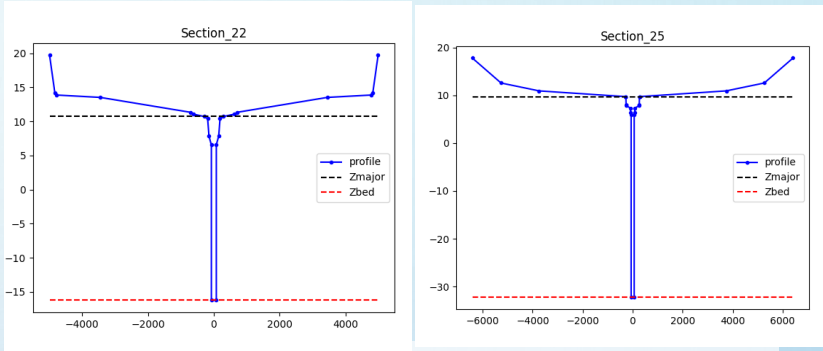
INRAE

Brahmaputra river in India, 1D SIC model @INRAE

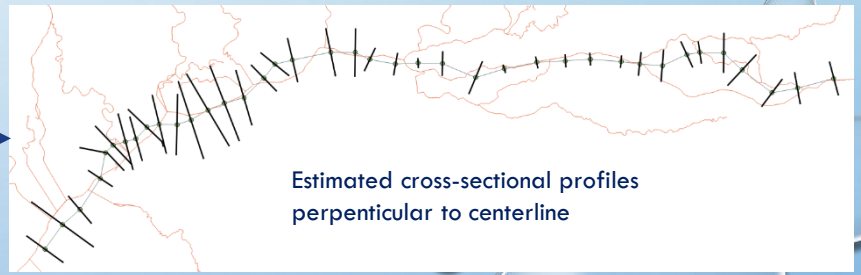


Study domain: PEPSI Brahmaputra domain (orange) SWORD reach

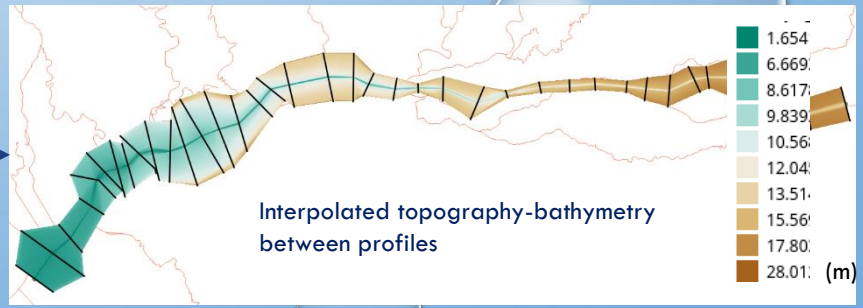
+



Shape of cross-sectional profiles



Estimated cross-sectional profiles perpenticular to centerline



Interpolated topography-bathymetry between profiles

⇒1D model with limited georeferenced info:

- [in]1D-model output file,
- [in]1D-model geometry file with limited geolocalization
- NO cross-sectional profiles
- NO 2D bathymetry+topography

SUMMARY

- **Tools4swothr is a Python tool that manipulates hydrodynamic model outputs into inputs for SWOT-HR and generate SWOT-like data**

- It is **open source**
https://gitlab.com/cerfacs/globc/tools4swothr

- For friendly use, it runs on a **container**
https://gitlab.com/cerfacs/globc/tools4swothr-singularity

- Applied for 1D/2D outputs from MASCARET, SIC, DASSFLOW, TELEMAC2D

- It relies on several hypothesis and knowledge that may vary **for known and unknown cathments**

- Applied for Garonne-upstream (**DassFlow-1D**), Garonne-downstream (**Mascaret**), Bramaputra (simplified Pepsi river, **SIC**), Seine (**Telemac2D**), Gironde (**Telemac2D**)

THANK YOU FOR YOUR ATTENTION