Assessment of SWOT L2 HR PIXC (pixel cloud) products for riverbed recognition and characterization : case of the Old Rhine, between Kembs (France) and Breisach (Germany).

Ledauphin T., Chardon V. , Azzoni M., Amzil S., Maxant J., Schmitt L., Picot N., and Yésou H.

tledauphin@unistra.fr , herve.yesou@unistra.fr, valentin.chardon@live-cnrs.unistra.fr, nicolas.picot@cnes.fr

Context & objectives: Cal Val over narrow rivers

- Assess SWOT's ability to reflect the river's topography and geomorphological features (sandbanks, ledges, pools, riffles)
- Focus on the "Old Rhine", a 50 km bypassed segment of the Rhine , with a width varying from 80 to 150 m
- The Old Rhine: a legacy of the successive rectifications of the Rhine's course over the last two centuries, including the construction of hydroelectric plants
- It has a guaranteed minimum flow of 52 m^3/s through it, most of which is used to supply the canal's hydroelectric power stations (500m^3/s on the Rhine Canal at low-water periods)

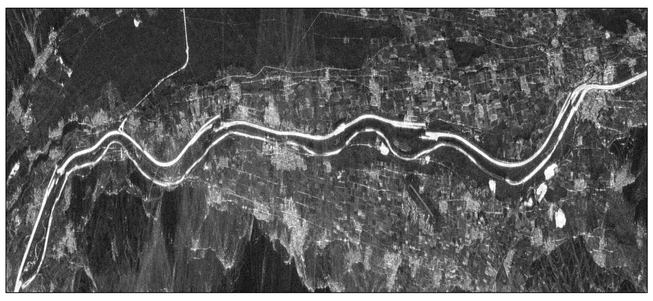

Fig.1: SWOT Coherent power over the Old Rhine (bottom river) and the Grand Canal d'Alsace (upper river with the effects of the sharp drop in water level at dam locations)

Method:

- Using of PGC0 L2 HR PIXC (pixel cloud) products
- Extraction of class 4 PIXC over the Old Rhine
- Generation of daily river profiles over the Cal Val period
- Comparison with flow (flood and low-water conditions)
- Comparison with bathymetric transects spaced every 200m along the watercourse

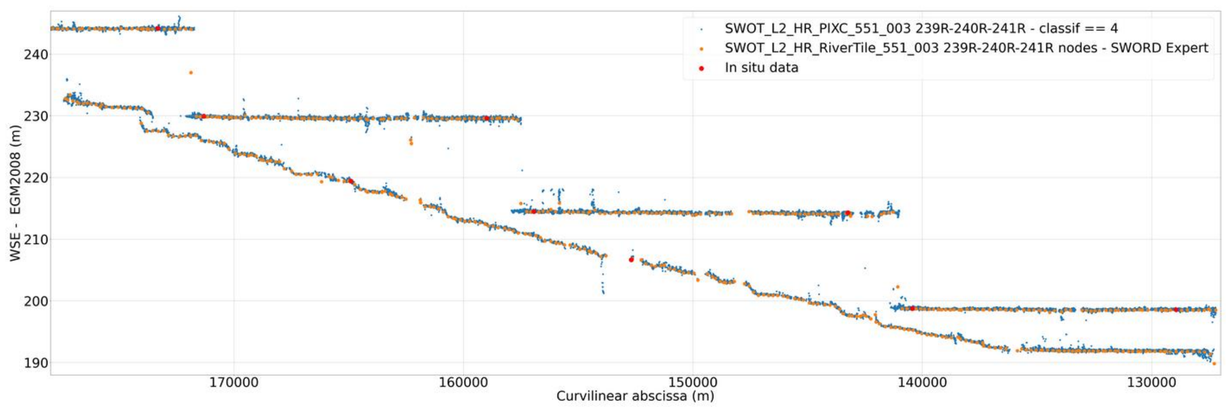

Fig.2: PIXC class 4 visualisation over the Rhine canal with 4 dams and Old Rhine with its gently slope

River topography

- At low levels, i.e. low flows, the topography of the river surface observed by SWOT is a good reflection of the topography of the riverbed:
  - Natural riffles and weirs are marked by slope breaks
  - Pools are identified by flat areas on the SWOT profile

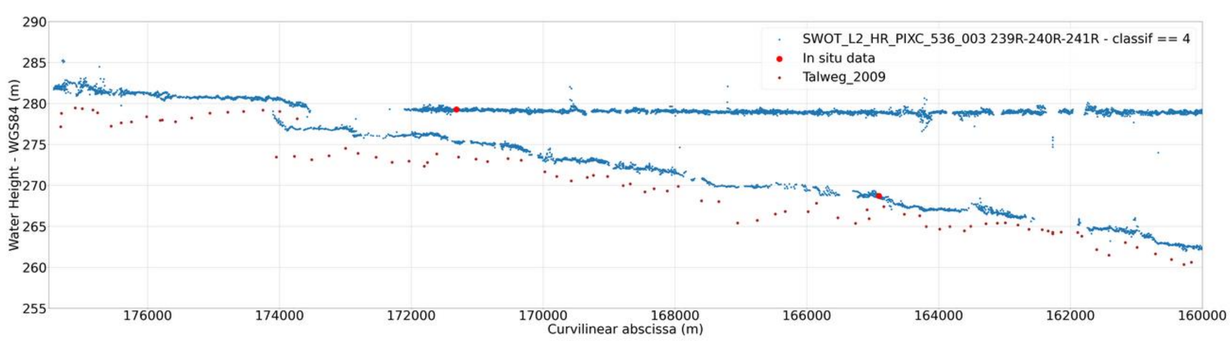

Fig.3: Comparison of PIXC class 4 river profile at low level with bathymetry points from an in situ talweg measurments.

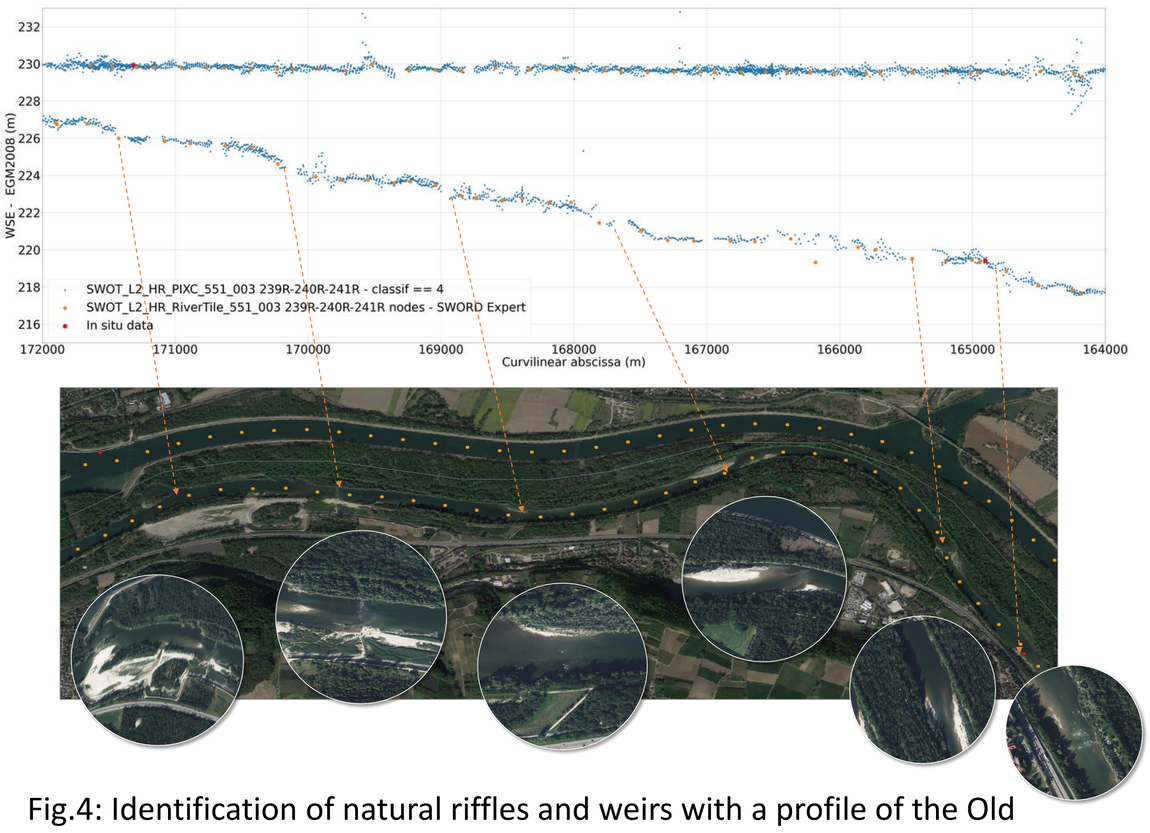

Fig.4: Identification of natural riffles and weirs with a profile of the Old Rhine derived from PIXC class 4

Monitoring of water slope break controled by Breiscach dam

- The natural flowing reach of the Old Rhine ends at the Breisach dam, which creates an hydraulic control upstream
- SWOT allow to detect the displacement of the water slope break located at the upstream end of the Breisach dam

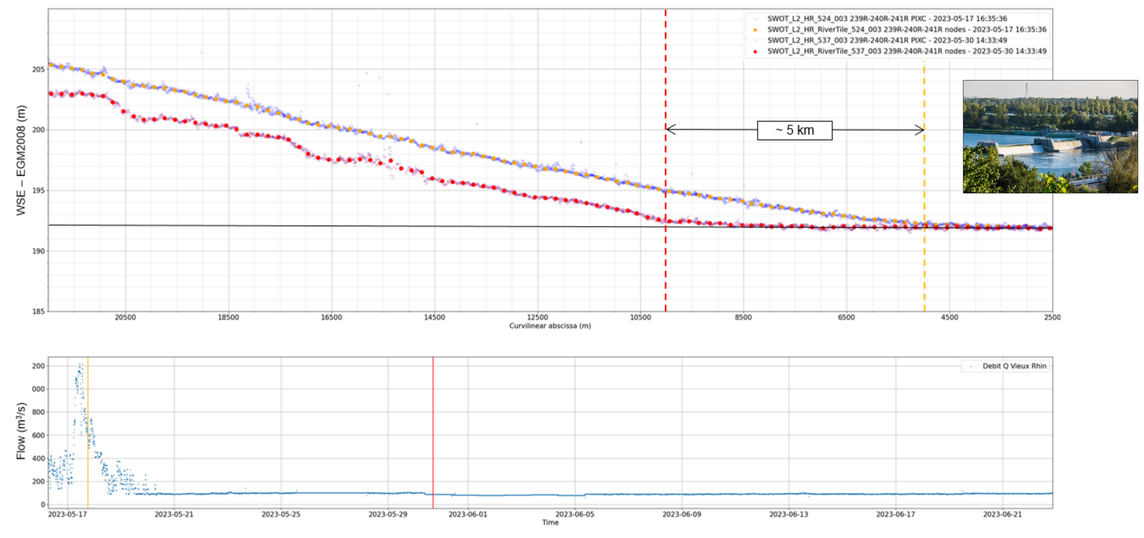

Fig. 5: Displacement of the water slope break located at the upstream end of the Breisach dam backwater, over a distance of 5 km between flood flow and low-water flow.

Conclusion & Perspectives

- The results obtained over the Rhine Tier 1 Cal Val site confirm the quality SWOT measurements in terms of absolute water level
- SWOT signal allows to identify:
  - Series of small riffles, about one meters high, and successive pools
  - Alluvial deposits, sandbanks, and recharge areas
  - Changes in the river profile over time, as a function of flow and river level

- Consolidation of results using data from the Science phase
- Comparison with an HR lidar topo-bathymetric DEM
- Annual analysis of the SWOT profile to see if changes in the river surface profile can reflect changes in the riverbed topography
- All these very promising results highlight the SWOT data for calibrating large-scale hydraulic models on rivers, in the near future

TL, HY, JM, RB, AC: ICUBE SERTIT, University of Strasbourg , Pole API, bv Sébastien Brant, 67412 Illkirch Graffenstaden, France

NP: CNES, 4 Av. Edouard Belin, 31400 Toulouse, France ; LS, VC: LIVE, CNRS, ENGEES, Strasbourg University, Strasbourg, France

Acknolewdgements : Thanks to the CNES team for their constant support; especially to Nicolas, Roger and Claire.