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Action 2 - Flood forecasting, HYDROM A1 (“Dynamic rating curves”) and HYDROM A2 (“Analysis of morphodynamic rating shifts”)

Hydrological modelling, drought assessments and flood sizing, all need reliable discharge data from rivers to be quantified. Discharges and their data, albeit a physical quantity, are not easily measurable in rivers in a continuous manner. Typically, gauge heights are measured at gauging stations and through a rating curve transformed in discharge. Thus, the later need reliable rating curves.

However gauge heights and rating curves can be impacted by several factors and their validity altered. Two very common example of this are:
1) The presence of vegetation in Rivers which report higher gauge heights compared to when vegetation is absent (e.g. Perret et al., 2022).
2) Rating shifts can be due to variety of factor, from section control modifications to sediments deposit filling/changing the bed, all while including extreme events (e.g. Mansanarez et al., 2019).

With regards to to the first point, the goal of my work as a Post-Doc at INRAE is to develop a regional approach for vegetation, so as to help hydrometric technicians in their correction of gauge heights due to vegetation. At this point (September 2025), work is very preliminary and the focus is on harmonizing data, prior to the development and implementation of the approach.

Regarding the second point, during my PhD, I had the opportunity to perform an extensive Hydrological modelling of the Adige River in the North East of Italy (Morlot et al., 2024). Part of this modelling contained the Avisio River (a tribuatary of the previously mentioned Adige) which had a strong rating shift due to the Vaia storm in 2019 (Menegatto et al., 2024) This means that I am doubly aware as a hydrologist of this. The BarantinAGE software (Le Coz et al., 2014) now includes the methodology RatingShiftHappens (Mansanarez et al., 2019; Mendez-Rios et al., 2024). Both the software and methodology developed at INRAE allow to automatically adjust rating shifts. The second part of my work is to help with the implementation, testing and development of RatingShiftHappens methodology in BaratinAGE.

References:

Le Coz, J., Renard, B., Bonnifait, L., Branger, F., and Le Boursicaud, R.: Combining hydraulic knowledge and uncertain gaugings in the estimation of hydrometric rating curves: A Bayesian approach, Journal of Hydrology, 509, 573–587, https://doi.org/10.1016/j.jhydrol.2013.11.016, 2014.

Mansanarez, V., Renard, B., Coz, J. L., Lang, M., and Darienzo, M.: Shift Happens! Adjusting Stage-Discharge Rating Curves to Morphological Changes at Known Times, Water Resources Research, 55, 2876–2899, https://doi.org/10.1029/2018WR023389, 2019.

Mendez-Rios, F., Renard, B., Coz, J. L., and Lang, M.: Action 2 - Prévision des inondations, 2024.

Menegatto, M., Freschi, G., Bulfon, M., and Zamperini, A.: Collectively Remembering Environmental Disasters: The Vaia Storm as a Case Study, Sustainability, 16, 8418, https://doi.org/10.3390/su16198418, 2024.

Morlot, M., Rigon, R., and Formetta, G.: Hydrological digital twin model of a large anthropized italian alpine catchment: The Adige river basin, Journal of Hydrology, 629, 130587, https://doi.org/10.1016/j.jhydrol.2023.130587, 2024.

Perret, E., Le Coz, J., and Renard, B.: Courbes de tarage dynamiques pour la végétation aquatique saisonnière, LHB, 108, 2082339, https://doi.org/10.1080/27678490.2022.2082339, 2022.