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# Streamflow velocity estimation in GIUH-type approach: what can neighbouring basins tell us?

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In geomorphology-based rainfall-runoff models, the transfer function is mainly determined from the input of geomorphometric features which are easily observable for gauged or ungauged basin. But these approaches generally also involve an estimate of flow velocity as a parameter, which is less robust in un- and poorly-gauged basins. Its estimation still remains one of the main issue on geomorphology-based model in ungauged basins. The velocity estimate can: i) be inferred from a flow equation where parameters are based on empirical relations; or ii) be assessed from a regionalisation approach, generally based on regression relationships between the basin structure and model parameters.

We propose a regional approach, physically based, from the study of 102 gauged basins, from 5 to 2468km$^2$, distributed all over Brittany peninsula, France. The velocity is assessed through the calculation of the basin rise time for a set of rainfall-runoff events between 2000 and 2010. Spatio-temporal variability is one of the main difficulty to estimate this parameter: this is verified firstly between rainfall-runoff events for a given basin, and secondly between basins for a common rainfall-runoff event. However, an interesting stability of the annual median velocity is brought to light. Each basin can therefore be characterized by its specific annual median streamflow velocity. A statistical analysis is then performed to relate those characteristic streamflow velocities to basin descriptors such as landform, geomorphology, topography, land use, soil and climate. Results enable to relate this stability of streamflow velocity to geomorphologic features, which implies that can be assessed for ungauged basins.

In the second part of the work, the aim is to transpose streamflow velocity knowledge built on gauged basins to ungauged one. In this context, velocities are considered in space and time through temporally dynamic maps. Based on the previous evidence of a characteristic velocity for each basin, velocities of each rainfall-runoff events are put into perspective with the characteristic velocity of the studied basin. Results show similarities of basins behaviour which allows to transpose information from neighbouring gauged basins to an ungauged one. To sum up the methodology, velocity is estimated, on the first hand from basin geomorphological characteristics which identified its order of magnitude, and on the other hand from neighbouring basins which bring information on temporal variability.

Finally, those velocity estimations are implemented in a geomorphology-based rainfall-runoff models which need it as a parameter. The model is based on hydrograph transposition from a gauged basin to ungauged one. Efficiency of the runoff simulation using this velocity estimation is particularly improved when transposing between basins of larger scale difference.