

## **Parameter regionalisation methods for a semi-distributed rainfall-runoff model: application to a Northern Apennine region**

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The study presents the implementation of different regionalisation approaches for the transfer of model parameters from similar and/or neighbouring gauged basin to an ungauged catchment, and in particular it uses a semi-distributed continuously-simulating conceptual rainfall-runoff model for simulating daily streamflows.

The case study refers to a set of Apennine catchments (in the Emilia-Romagna region, Italy), that, given the spatial proximity, are assumed to belong to the same hydrologically homogeneous region and are used, alternatively, as donors and regionalised basins. The model is a semi-distributed version of the HBV model (TUWien model) in which the catchment is divided in zones of different altitude that contribute separately to the total outlet flow. The model includes a snow module, whose application in the Apennine area has been, so far, very limited, even if snow accumulation and melting phenomena do have an important role in the study basins.

Two methods, both widely applied in the recent literature, are applied for regionalising the model: i) “parameters averaging”, where each parameter is obtained as a weighted mean of the parameters obtained, through calibration, on the donor catchments ii) “output averaging”, where the model is run over the ungauged basin using the entire set of parameters of each donor basin and the simulated outputs are then averaged.

In the first approach, the parameters are regionalised independently from each other, in the second one, instead, the correlation among the parameters is maintained.

Since the model is a semi-distributed one, where each elevation zone contributes separately, the study proposes to test also a modified version of the second approach (“output averaging”), where each zone is considered as an autonomous entity, whose parameters are transposed to the ungauged sub-basin corresponding to the same elevation zone.

The study explores also the choice of the weights to be used for averaging the parameters (in the “parameters averaging” approach) or for averaging the simulated streamflow (in the “output averaging” approach): in particular, weights are estimated as a function of the similarity/distance of the ungauged basin/zone to the donors, on the basis of a set of geo-morphological catchment descriptors.

The predictive accuracy of the different regionalisation methods is finally assessed by jack-knife cross-validation against the observed daily runoff for all the study catchments.