Using the R package airGRteaching for teaching hydrology with lumped hydrological models

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Applying hydrological models during tutorial classes is a way of making hydrology students use on concrete examples the knowledge they acquired during lectures. Most of the time, this is done through the application of either single components of a hydrological model (e.g. a unit hydrograph) or of more complex models, which suffer from difficult understanding and limited application due to the need of large datasets or low computational time.

To overcome this issue, Irstea has also developed an R-package, airGRteaching (Delaigue et al., 2017), based on a suite of daily rainfall-runoff models (i.e. catchment scale representations of the precipitation-discharge relationship) already included in the airGR R-package (Coron et al., 2017a,b) (see abstract EGU2018-13049). This package includes the following features:
- three very simple functions to prepare data, calibrate a model and run a simulation,
- additional static and dynamic graphical functions,
- a Shiny (Chang et al., 2016) interface that connects this R package to a browser-based visualization tool

This PICO will focus on how the interface can be used by students to apply what they learnt.

The airGRteaching graphical user interface presents a sidebar panel, which allows to select the basin and model and also to modify the model parameters with a slider widget. It is also possible to automatically calibrate the model (choosing objective function and flows transformation). The students can see the results on different time series reactive graphics or model scheme, and as a table presenting efficiency criteria values. The previous simulations can be viewed in order to better understand the role of the changed parameter(s). Static charts and model outputs can be exported respectively in the PNG and the CSV formats, and can be used by students for reporting.

One exercise that can be given is to ask students to calibrate manually the model on a snowy basin, without telling them it is a snowy basin and without activating the snow model. By analyzing the fact that it is not possible to manually calibrate the model in such conditions and by analyzing the hydrological regime of the river, the students should be able to identify that the snow model should be activated. Other exercises include the calibration of a hydrological model on subperiods and wet or dry year and application on a validation period, which highlights the importance of the calibration conditions.

References

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