airGRteaching: How an interactive visualization tool can help students evaluate the performance of a hydrological model and understand the role of its parameters

Pierre Brigode (1), Olivier Delaigue (2), Guillaume Thirel (2), and Laurent Coron (3)

(1) Université Côte d'Azur, CNRS, OCA, IRD, Géoazur, Nice, France (pierre.brigode@unice.fr), (2) IRSTEA, Hydrology Research Group, Antony, France (airGR@irstea.fr), (3) EDF DTG, Toulouse, France

Teaching hydrological modeling can be slowed down by the difficulty for students to implement or dispose of an efficient visualization of data. Therefore, helping students to dig deeper into their data through smart visualization tools enables a quicker understanding of the different concepts involved and a proper analysis of their results.

In addition, the use of hydrological models on concrete examples allows students to directly use the knowledge they have acquired during the courses. Most of the time, this is done either by applying a single component of a hydrological model (e. g. a unit hydrograph) or more complex models, which suffer from difficult understanding and limited application due to the need for large data sets or short computation time.

To solve these problems, the Hydrology Group at Irstea (Antony) has developed an open source tool using the R software and proposes a package called airGRteaching (Delaigue et al., 2018) based on a series of global rainfall-runoff models (i.e. watershed scale representations of the precipitation-discharge relationship) that are already included in the R-package airGR (Coron et al, 2017, 2018). airGRteaching includes the following features:
- three very simple functions to prepare data, calibrate a model and run a simulation,
- functions producing static and dynamic graphs (in HTML/Javascript),
- a Shiny interface that links this R package to a browser-based visualization tool

This PICO will focus on how the graphical user interface (GUI) can be used by students to apply what they learnt.

The airGRteaching GUI presents different visualization panels to analyze model simulations using synthetic performance graphs or observed and simulated flow time series graphs. It is also possible to visualize the variations of the internal states of the model over time, or at a given time step.

In addition, previous simulations can be visualized to better understand the role of the modification of parameter value(s) (e.g. comparison of the results of a manual calibration performed by students with those of an automatic calibration).

The visualization panels contain clickable dynamics graphics and are accompanied by a table presenting the values of the efficiency criteria, allowing the student to criticize the results by combining visual and numerical criteria.

Static graphs and model outputs can be exported to PNG and CSV formats respectively, and can be used by students for reports.

Of course, students can use their own data. Several models are proposed in order to understand different hydrological modeling issues on their basin (presence of snow, intercatchment groundwater exchange).

References
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