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airGR: a suite of lumped hydrological models in an R-package

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Lumped hydrological models are useful and convenient tools for research, engineering and educational purposes. They propose catchment-scale representations of the precipitation-discharge relationship. Thanks to their limited data requirements, they can be easily implemented and run. With such models, it is possible to simulate a number of hydrological key processes over the catchment with limited structural and parametric complexity, typically evapotranspiration, runoff, underground losses, etc.
The Hydrology Group at Irstea (Antony) has been developing a suite of rainfall-runoff models over the past 30 years with the main objectives of designing models as efficient as possible in terms of streamflow simulation, applicable to a wide range of catchments and having low data requirements. This resulted in a suite of models running at different time steps (from hourly to annual) applicable for various issues including water balance estimation, forecasting, simulation of impacts and scenario testing.
Recently, Irstea has developed an easy-to-use R-package (R Core Team, 2015), called airGR, to make these models widely available. It includes:
- the water balance annual GR1A (Mouehli et al., 2006),
- the monthly GR2M (Mouehli, 2003) models,
- three versions of the daily model, namely GR4J (Perrin et al., 2003), GR5J (Le Moine, 2008) and GR6J (Pushpalatha et al., 2011),
- the hourly GR4H model (Mathevet, 2005),
- a degree-day snow module CemaNeige (Valéry et al., 2014).
The airGR package has been designed to facilitate the use by non-expert users and allow the addition of evaluation criteria, models or calibration algorithms selected by the end-user. Each model core is coded in FORTRAN to ensure low computational time. The other package functions (i.e. mainly the calibration algorithm and the efficiency criteria) are coded in R.
The package is already used for educational purposes. The presentation will detail the main functionalities of the package and present a case study application.

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