



## **Latest developments of the airGR rainfall-runoff modelling R-package: composite calibration/evaluation criterion and improved snow model to take into account satellite products**

Olivier Delaigue (1), Guillaume Thirel (1), Philippe Riboust (1,2)

(1) IRSTEA, HYCAR, ANTONY, France (olivier.delaigue@irstea.fr), (2) Conseil Général des Hauts-de-Seine, Nanterre, France

Parsimonious and simple lumped rainfall-runoff models are useful tools for research and engineering. From years of experience, the Hydrology Group at Irstea (Antony) developed the GR models suite. Aiming at providing an open source tool, the team started to develop an R package (R Core Team, 2018), named airGR (Coron et al., 2017, 2018), that contains these simulation models (including the GR4J model). The airGR package permits to run six hydrological models dedicated to different time steps (hourly to annual), one snow accumulation and melt model (CemaNeige), one automatic calibration procedure, pre-defined graphical plots and a set of efficiency criteria.

It is now possible in airGR to use a composite calibration/evaluation criterion that combines several criteria as a single criterion. The choice of the different criteria and the weight applied to each one can be adjusted according to needs. This possibility can improve the calibration performance of models by considering several objectives.

Furthermore, several studies have shown that the use of snow cover area (SCA) observations from satellites, such as MODIS SCA, can improve snow model calibration. The airGR package now proposes an improved version of the semi-distributed CemaNeige degree-day model that better represents the hysteretic relationship between SCA and snow water equivalent (SWE). This modification coupled with the combined calibration of the CemaNeige and GR models on SCA data and on river runoff data significantly improve the simulation of the snow cover area by the model and give more robust calibrated parameters (Riboust et al., 2019).

Thanks to its success (about 15,000 downloads so far), the airGR development team carries on its efforts to improve the code, offer new features and improve the documentation. Recently, the development team also released a new package, airGRteaching (Delaigue et al., 2018), which depends on airGR and has expressly been developed for educational purposes, in order to avoid the difficulties that students may have with R programming. The airGRteaching graphical user interface will be demonstrated.

### References

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