Geophysical Research Abstracts
Vol. 20, EGU2018-4108-2, 2018
EGU General Assembly 2018
© Author(s) 2018. CC Attribution 4.0 license.

How long would we have to wait before (re)filling the Malpasset dam reservoir? An example of a teaching project done using R and airGR modeling packages

Quentin Roux (1) and Pierre Brigode (1,2)

(1) Polytech Nice Sophia, Université de Nice Sophia Antipolis, France, (2) University Côte d'Azur, CNRS, OCA, IRD, Géoazur, Nice, France

The Malpasset dam – located in Fréjus, South of France, on the Reyran river – gave way on December 2nd 1959, causing great damage and hundreds of casualties. The dam is now a ruin and a must-see for young hydrologists studying in the region. Last semester, the Polytech Nice Sophia engineering students were given a hydrological project aiming at answering the following question: if the dam were rebuilt identically, how long would we have to wait before filling its reservoir?
First, several basic estimations of the reservoir filling time were made, considering that the dam would be rebuilt during the 2018 summer. A statistical analysis of the historical incoming flows was made using R, based on the observed local climate series and the measured flows of the Reyran river over the last decades. Nevertheless, rebuilding the dam would probably take a while… What would be the reservoir filling time if the dam were completed in 2050, in a potentially different climate? Estimations of the Reyran catchment incoming flows in a future climate were therefore computed. To do so, a monthly rainfall-runoff model called GR2M (Mouelhi et al., 2006) was used. This model, developed by the Hydrology Group at Irstea (Antony), is easy to use since it only requires two input variables (rainfall and potential evapotranspiration) and has two parameters to calibrate. Moreover, this model is available in R through the airGR package (Coron et al., 2017a,b) and its add-on package, airGRteaching, newly developed for education applications (Delaigue et al., 2017). These packages were used to calibrate the GR2M model on the observed data available for the Reyran catchment. A basic downscaling method was also applied in order to have several future climate scenarios, then used as inputs of the calibrated rainfall-runoff model. The use of these different modeling tools enables the simulation of numerous scenarios of future inflows, and thus, the estimation of a distribution of potential filling times of the reservoir in 2050. Both packages happened to be rather intuitive and helpful to efficiently carry out such a project, by performing an easy-to-understand rainfall-runoff modeling within the R environment.
Quentin Roux is currently postgraduate student at Polytech Nice Sophia engineering school.

References:
Coron, L., Perrin, C. and Michel, C. (2017a). airGR: Suite of GR hydrological models for precipitation-runoff modelling. R package version 1.0.9.64. https://webgr.irstea.fr/en/airGR/.
Coron, L., Thirel, G., Delaigue, O., Perrin, C., & Andréassian, V. (2017b). The suite of lumped GR hydrological models in an R package. Environmental Modelling & Software, 94, 166–171.
Delaigue, O., Coron L., & Brigode, P. (2017). airGRteaching: tools to simplify the use of the airGR hydrological package for education (including a Shiny interface). R package version 0.1.8.5. https://webgr.irstea.fr/en/airGR/.
Mouelhi, S., Michel, C., Perrin, C. & Andréassian, V. (2006) Stepwise development of a two-parameter monthly water balance model. Journal of Hydrology, 318 (1-4), 200-214.