Latest developments of the airGR rainfall-runoff modelling R package: new calibration procedures and other features

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GR is a family of lumped hydrological models designed for flow simulation at various time steps. The models are freely available in an R package called airGR (Coron et al., 2017a, 2017b). The models can easily be implemented on a set of catchments with limited data requirements.

How to use other R packages to perform parameters estimation

- Definition of the necessary function:
  - transformation of parameters to real space (available in airGR)
  - computation of the value of the performance criterion (e.g. RMSE)

\[
\text{OptimGR4J} \leftarrow \text{function(Param\_Optim)}
\]

\[
\text{Param\_Optim\_Vre} \leftarrow \text{airGR::TransfoParam\_GR4J(ParamIn = Param\_Optim, Direction = "TR")}
\]

\[
\text{OutputsModel} \leftarrow \text{airGR::RunModel\_GR4J(InputsModel = InputsModel, RunOptions = RunOptions, Param = Param\_Optim\_Vre)}
\]

\[
\text{return(OuputsCrit$CritValue)}
\]

- Definition of the lower and upper bounds of the four GR4J parameters in the transformed parameter space

\[
\text{lowerGR4J} \leftarrow \text{rep(-9.99, times = 4)}
\]

\[
\text{upperGR4J} \leftarrow \text{rep(+9.99, times = 4)}
\]

- Local optimisation:
  - Single-start (here) or multi-start approach to test the consistency of the local optimisation

\[
\text{optPORT} \leftarrow \text{stats::nlminb(start = startGR4J, objective = OptimGR4J, lower = lowerGR4J, upper = upperGR4J, control = list(trace = 10))}
\]

- Global optimisation:
  - Most often used when facing a complex response surface, with multiple local minima

\[
\text{optDE} \leftarrow \text{DEoptim::DEoptim( fn = OptimGR4J, lower = lowerGR4J, upper = upperGR4J, control = DEoptim::DEoptim.control(CR = 0.4, trace = 10))}
\]

- Particle Swarm Calibration algorithm

\[
\text{optPSO} \leftarrow \text{hydroPSO::hydroPSO(fn = OptimGR4J, lower = lowerGR4J, upper = upperGR4J, control = DEoptim::DEoptim.control(CR = 0.4, trace = 10))}
\]

- MA-LS-Chains calibration algorithm

\[
\text{optMA} \leftarrow \text{Rmiscchains::rmiscchains(fn = OptimGR4J, maxEval = 20000, lower = lowerGR4J, upper = upperGR4J)}
\]

Results

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<th></th>
<th>Age</th>
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<th>X3</th>
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References


Download the airGR package

The airGR package is available on the Comprehensive Archive Network: https://CRAN.R-project.org/package=airGR/.