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)

```r
OptimGR4J <- function(Param_Optim) {
  Param_Optim_Vre <- airGR::TransfoParam_GR4J(ParamIn = Param_Optim,
                                             Direction = "Y")
  OutputModel <- airGR::RunModel_GR4J(InputModel = InputModel,
                                    Multiphase = MultiOptions,
                                    Param = Param_Optim_Vre)
  OutputCrit <- airGR::ErrorCrit_RMSE(InputModel = InputModel,
                                     OutputModel = OutputModel)
  return(OutputCrit$hCritValue)
}
```

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

```r
lowerGR4J <- rep(-9.99, times = 4)
upperGR4J <- rep(+9.99, times = 4)
```

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

```r
optPORT <- Rmalschains::malschains(fn = OptimGR4J,
                                   maxEvals = 2000,
                                   control = DEoptim::DEoptim.control(NP = 40, trace = 10))
```

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

```r
optDE <- DEoptim::DEoptim(fn = OptimGR4J,
                           lower = lowerGR4J, upper = upperGR4J,
                           control = DEoptim::DEoptim.control(op = 40, trace = 10))
```

### References


### Future developments

- New version of CemaNeige that allows to use satellite snow cover area for calibration (Riboulet et al., accepted)
- Parameters maps on France for GR4J, GR5J & GR6J models for ungauged basins (Poncelet et al., submitted)