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## The airGR galaxy: Hydrological tools around GR models

Olivier Delaigue, David Dorchie, Guillaume Thirel

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# The airGR galaxy

## Hydrological tools around GR models



Olivier Delaigue<sup>1</sup>, David Dorchie<sup>2</sup>, Guillaume Thirel<sup>1</sup>

1: Université Paris-Saclay, INRAE, HYCAR – Antony, France

2: G-EAU, Univ. Montpellier, AgroParisTech, BRGM, CIRAD, IRD, INRAE, Institut Agro – Montpellier, France

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 (<https://hydrogr.github.io/airGR>). airGR goes along with other R packages which allow performing data assimilation, modelling integrated water resources management, and teaching hydrological modelling.

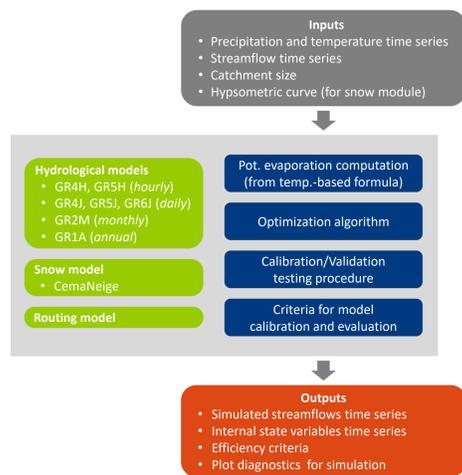
### GR hydrological models

- ▶ Designed with the objective to be as efficient as possible for flow simulation at various time steps (from hourly to annual)
- ▶ Warranted complexity structures and limited data requirements
- ▶ Can be applied to a wide range of conditions, including snowy catchments (CemaNeige snow routine included)

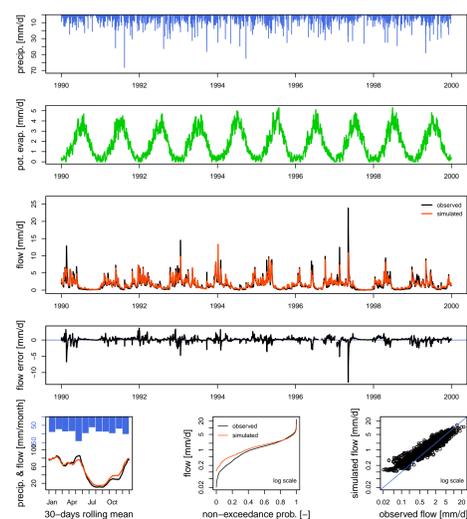
### airGR galaxy tools



### Main components of the airGR R-package



### airGR R-package plot diagnostics example

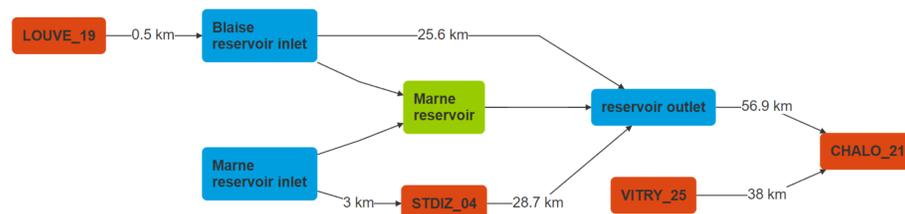


### airGRiwm R-package

IAHS2022-105 | S4

- ▶ Simplifies the semi-distribution mode of the airGR package
- ▶ Integrates human influences and their managements

### airGRiwm R-package network diagram

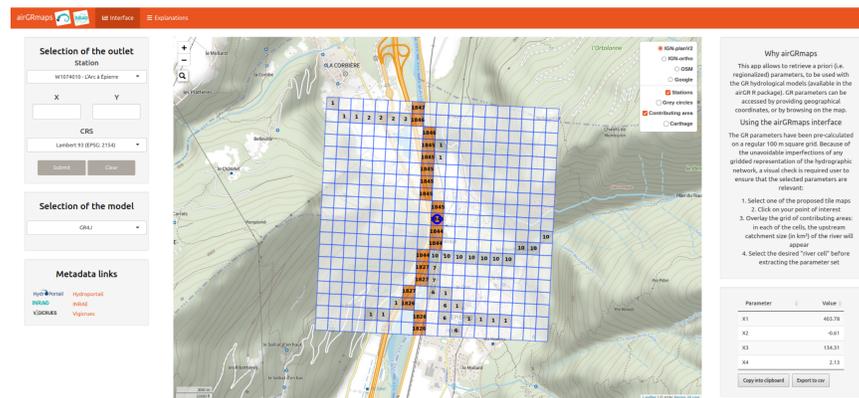


### airGRmaps GUI

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- ▶ Parameter maps over France for GR4J & GR5J models for ungauged basins available soon through a Shiny interface

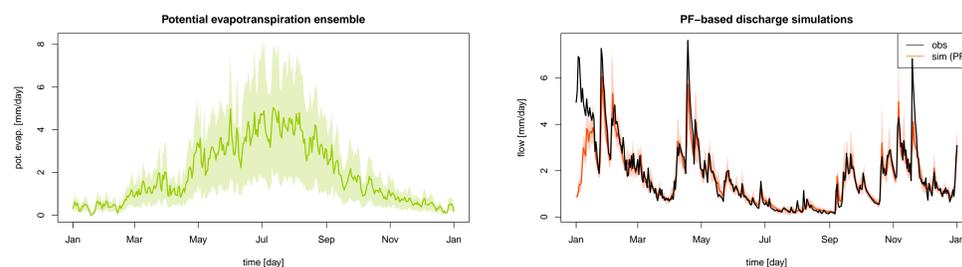
### airGRmaps GUI to get parameter values of GR4J or GR5J all over France



### airGRdatassim R-package

- ▶ Models:
  - ▷ only daily hydrological models (GR4J, GR5J & GR6J)
- ▶ Methods:
  - ▷ Ensemble Kalman Filter (EnKF)
  - ▷ Particle Filter (PF)
- ▶ Assimilated variable:
  - ▷ streamflow
- ▶ Specific perturbation procedures:
  - ▷ meteorological forcing uncertainties
  - ▷ model states

### Perturbed PET & data assimilation simulation using the Particle Filter via airGRdatassim



### baseflow R-package

- ▶ Computes hydrograph separation

### airGRteaching GUI

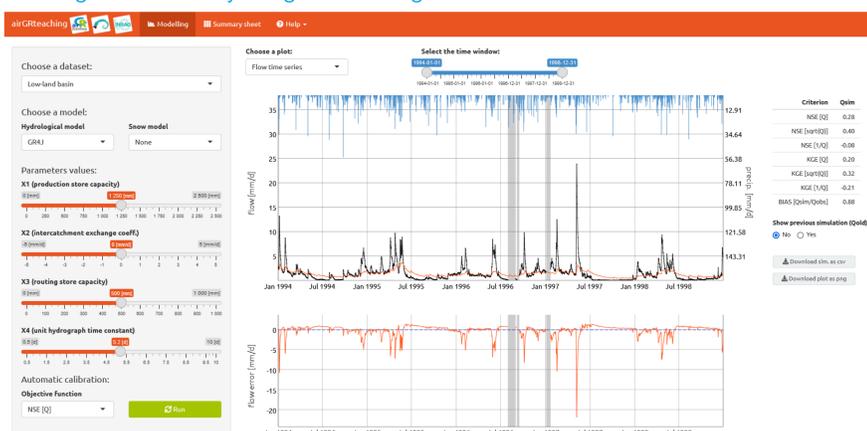
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- ▶ Manual parameter setting and interactive graphs
- ▶ Automatic setting of parameters
- ▶ Visualization of the internal states of the models

### airGRteaching R-package

- ▶ Simplified functions for hydrological modelling
- ▶ Static and interactive graphs
- ▶ GUI running on user time series

### airGRteaching GUI to learn hydrological modelling



### References

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