

CAMELS-FR: A large sample, hydroclimatic dataset for France, to support model testing and evaluation

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Vazken Andréassian, Olivier Delaigue, Charles Perrin, Bruno Janet, Nans Addor. CAMELS-FR: A large sample, hydroclimatic dataset for France, to support model testing and evaluation. EGU General Assembly 2021, Apr 2021, Vienna, Austria. 10.5194/egusphere-egu21-13349 . hal-03370674

HAL Id: hal-03370674
https://hal.inrae.fr/hal-03370674

Submitted on 8 Oct 2021

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CAMELS-FR

A large sample hydroclimatic dataset for France to support model testing and evaluation

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Context

Large sample hydrology

- Over the last decades, development of large sample hydrology (Andréassian et al., 2006; Gupta et al. 2014)
- Generalization of sound model evaluation and testing practices based on various types of split-sample tests
- CAMELS international initiative (Addor et al., 2017): facilitate reproducible hydrological research by the use of large sample catchment datasets

  Several CAMELS datasets already published:
  - USA
  - Chili
  - Great-Britain

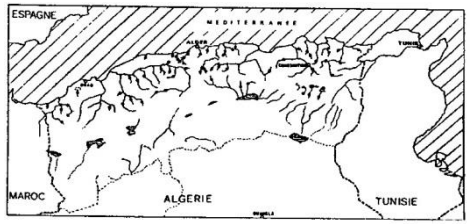
  Other datasets are being finalized:
  - Australia
  - France

Andréassian, V., Hall, A., Chahinian, N., Schaake, J. (2006). Introduction and Synthesis: Why should hydrologists work on a large number of basin data sets? IAHS Publication, 307, 1-5, https://hal.inrae.fr/hal-02588687.
Gupta, H.V., Perrin, C., Blöschl, G., Montanari, A., Kumar, R., Clark, M., Andréassian, V. (2014). Large-sample hydrology: A need to balance depth with breadth. Hydrology and Earth System Sciences, 18(2), 463–477, doi: https://doi.org/10.5194/hess-18-463-2
Addor, N., A. J. Newman, N. Mizukami and M. P. Clark (2017). "The CAMELS data set: catchment attributes and meteorology for large-sample studies." Hydrol. Earth Syst. Sci. 21(10): 5293-5313.

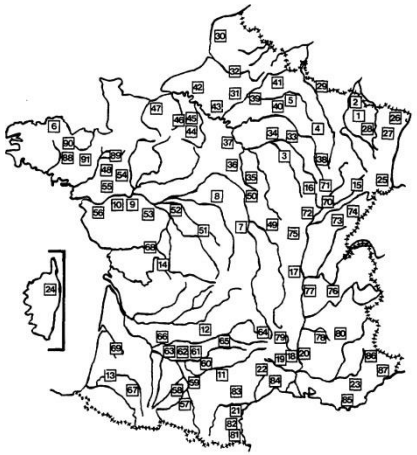
Context

Large sample hydrology expertise at INRAE (France)

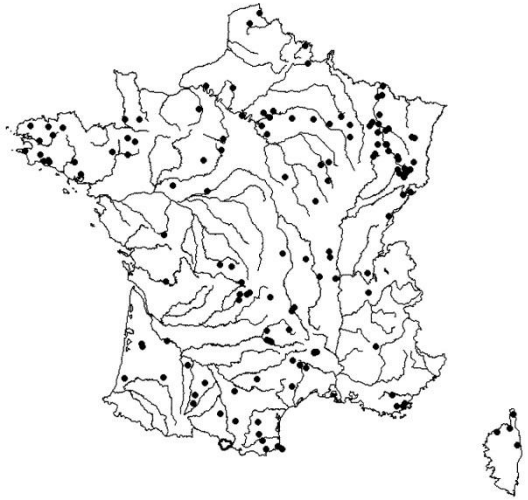
Increasing number of studies conducted on large datasets over the last three decades



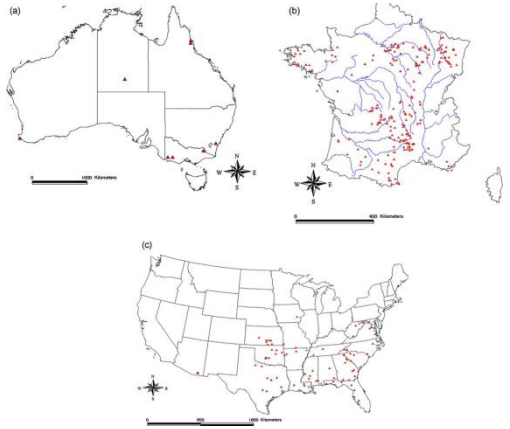
63 catchments in Algeria
(Kabouya et al., 1991)



91 catchments in France
(Makhlouf et al., 1994)



140 catchments in France
(Edijatno et al., 1999)



308 catchments in Australia, France & USA
(Oudin et al., 2005)

Kabouya, M. and C. Michel (1991). Monthly water resources assessment, application to a semi-arid country." Revue des Sciences de l'Eau 4(4): 569-587.
Makhlouf, Z. and C. Michel (1994). "A two-parameter monthly water balance model for French watersheds." Journal of Hydrology 162(3-4): 299-318.
Edijatno, N. O. Nascimento, X. Yang, Z. Makhlouf and C. Michel (1999). "GR3J: a daily watershed model with three free parameters." Hydrological Sciences Journal 44(2): 263-277, DOI: 210.1080/02626669909492221.
Andréassian, V., C. Perrin and C. Michel (2004). "Impact of imperfect potential evapotranspiration knowledge on the efficiency and parameters of watershed models." Journal of Hydrology 286(1–4): 19-35.
Oudin, L., C. Michel and F. Anctil (2005). "Which potential evapotranspiration input for a rainfall-runoff model? Part 1 - Can rainfall-runoff models effectively handle detailed potential evapotranspiration inputs?" Journal of Hydrology 303(1-4): 275-289, DOI: 210.1016/j.jhydrol.2003.1009.1030.

Context

Hydrological tourism?

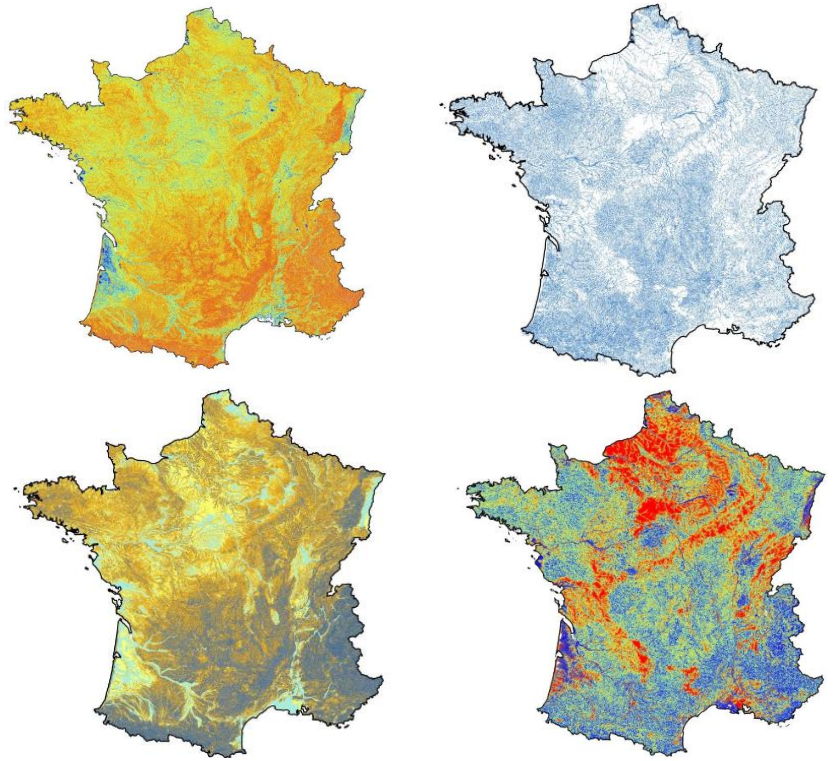
According to the United Nations (UNWTO agency):

France is on the top of the world tourism rankings not only because of the beauty of Paris
or the Mont-Saint-Michel or because of the quality of wines but also because of the diversity of the landscapes

Indeed, France is a very diverse territory:

- climates
- soils
- relief
- etc.

An ideal playground for hydrologists!



MEDDE, GIS Sol. 2014. Enveloppes des milieux potentiellement humides de la France métropolitaine. Notice d'accompagnement. Programme de modélisation des milieux potentiellement humides de France, Ministère de l'Ecologie, du Développement Durable et de l'Energie, Groupement d'Intérêt Scientifique Sol, 50 pages

The CAMELS-FR dataset

Data sources

Dataset assembled by an automated chain fed by national data products (Delaigue et al., 2020)

CAMELS-FR dataset on several hundreds of watersheds over the 1958-2021 period:

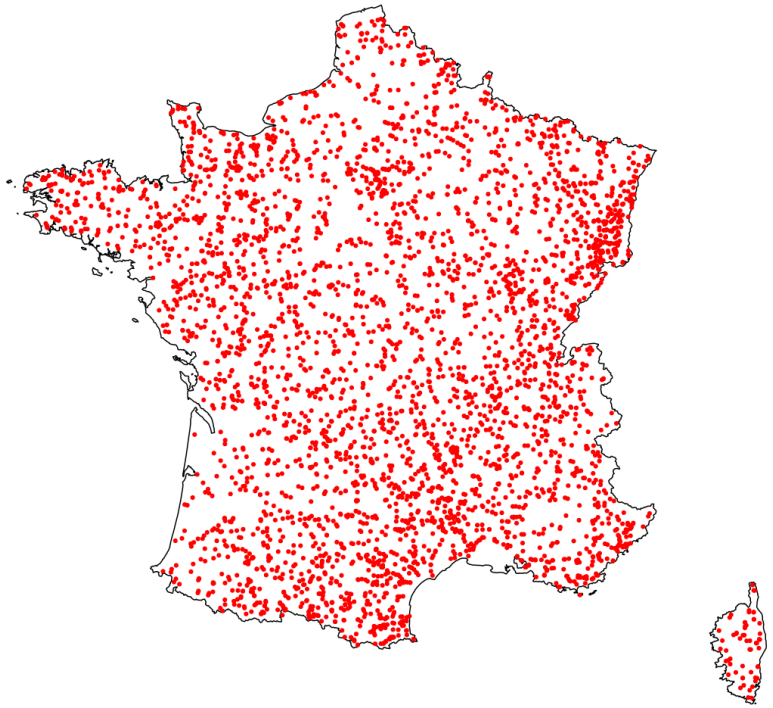
- Hydrological data (from French national Banque hydro)
  - Streamflow time series
  - Qualitative indices time series
  - Information about possible regulations upstream
- Climatic data (from Météo-France SAFRAN product)
  - Solid and liquid precipitation time series
  - Potential evapotranspiration time series
  - Temperature time series
  - Other time series
- Land cover (from Corinne Land Cover)
- Topography indices (from the SRTM DEM)
  - Elevation and slope distributions
  - Drainage density
  - Topographic index
  - etc.

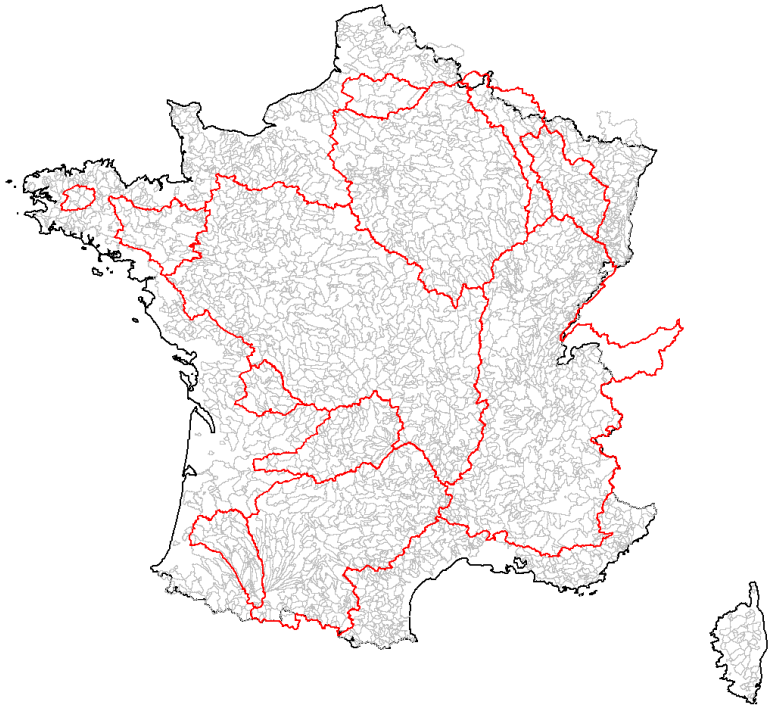
Delaigue, O., Génot, B., Lebecherel, L., Brigode, P., Bourgin, P.Y. (2020). Database of watershed-scale hydroclimatic observations in France. Université Paris-Saclay, INRAE, HYCAR Research Unit, Hydrology group, Antony. URL: https://webgr.inrae.fr/base-de-donnees.

The CAMELS-FR dataset

Hydrological data

- More than 4000 hydrological stations in Banque Hydro
- Station snapped on INRAE theoretical hydrographic network
- Catchments automatically computed by INRAE and checked visually





The CAMELS-FR dataset

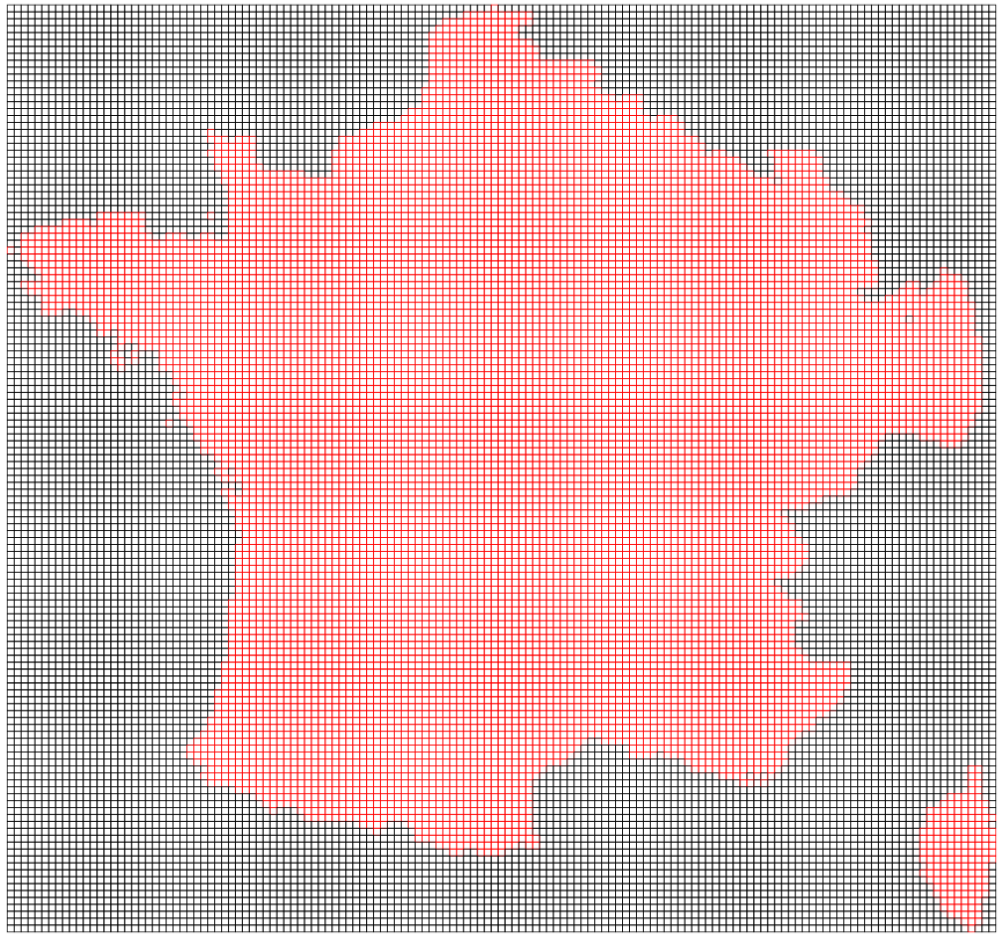
Climatic data

SAFRAN atmospheric reanalysis produced provided by Météo-France at daily time step (Vidal et al., 2010)

- Mesoscale analysis system of near-surface atmospheric variables
- Use of ground observations, combined with data from meteorological models

Parameters interpolated on a regular grid (8 × 8 km²):

- solid and liquid precipitation
- temperature
- potential evaporation
- humidity
- wind
- water equivalent of snow
- solar radiation
- infrared radiation

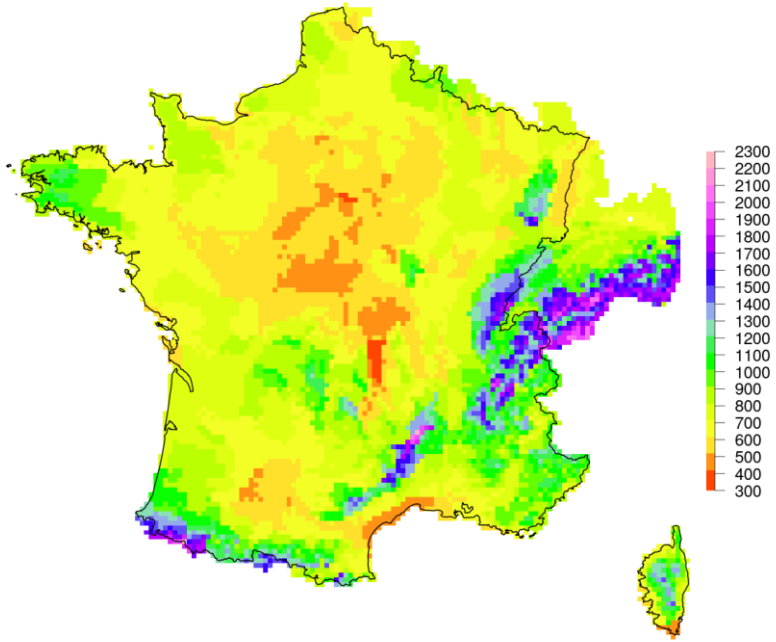


Vidal, J. P., E. Martin, L. Franchisteguy, F. Habets, J. M. Soubeyroux, M. Blanchard and M. Baillon (2010). "Multilevel and multiscale drought reanalysis over France with the Safran-Isba-Modcou hydrometeorological suite." Hydrology and Earth System Sciences 14(3): 459-478.

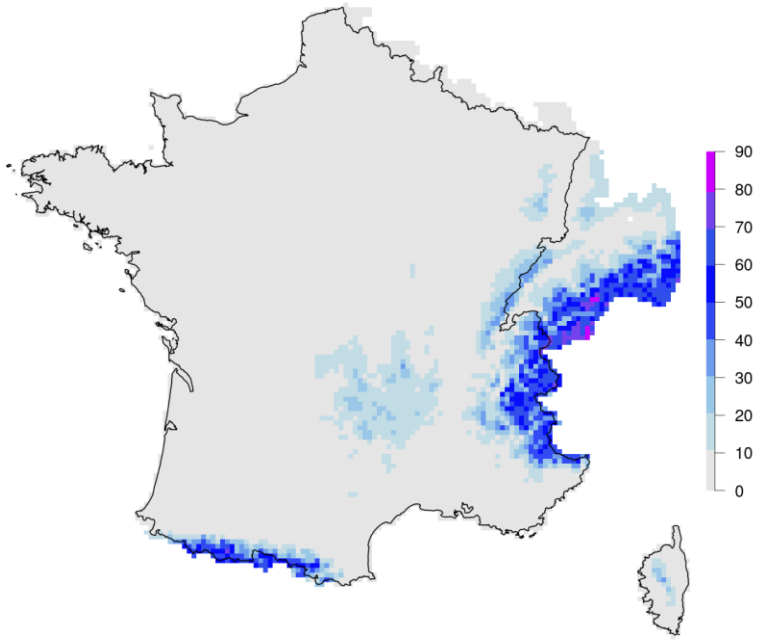
The CAMELS-FR dataset

Examples of variables

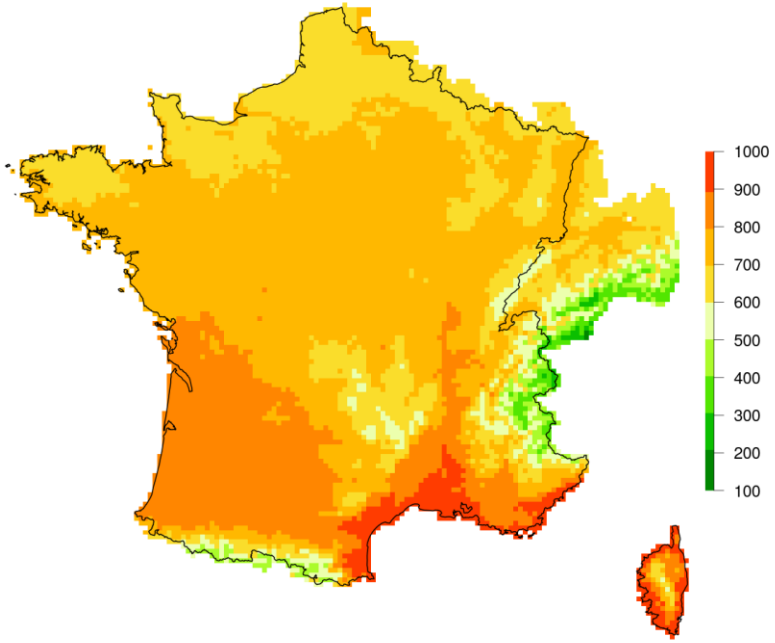
Precipitation (mm)



Solid precip. fraction (%)



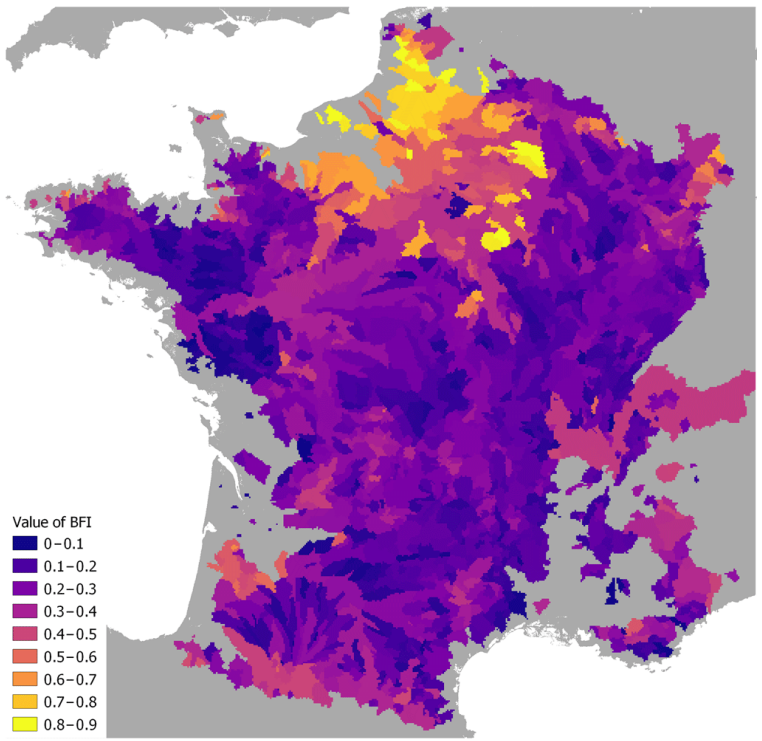
Evapotranspiration (mm)



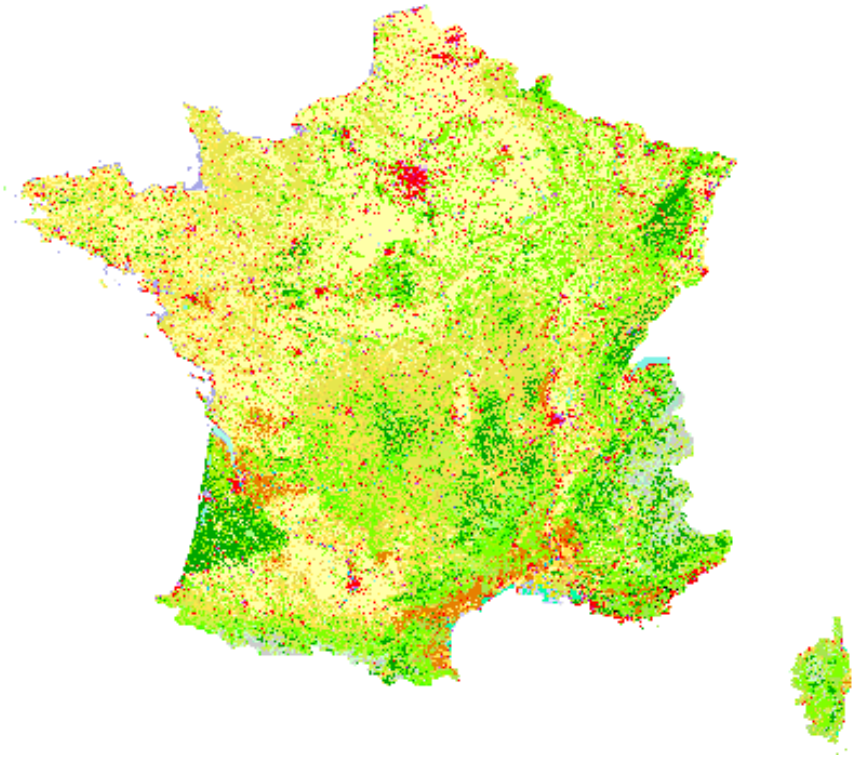
The CAMELS-FR dataset

Examples of variables

Base flow index



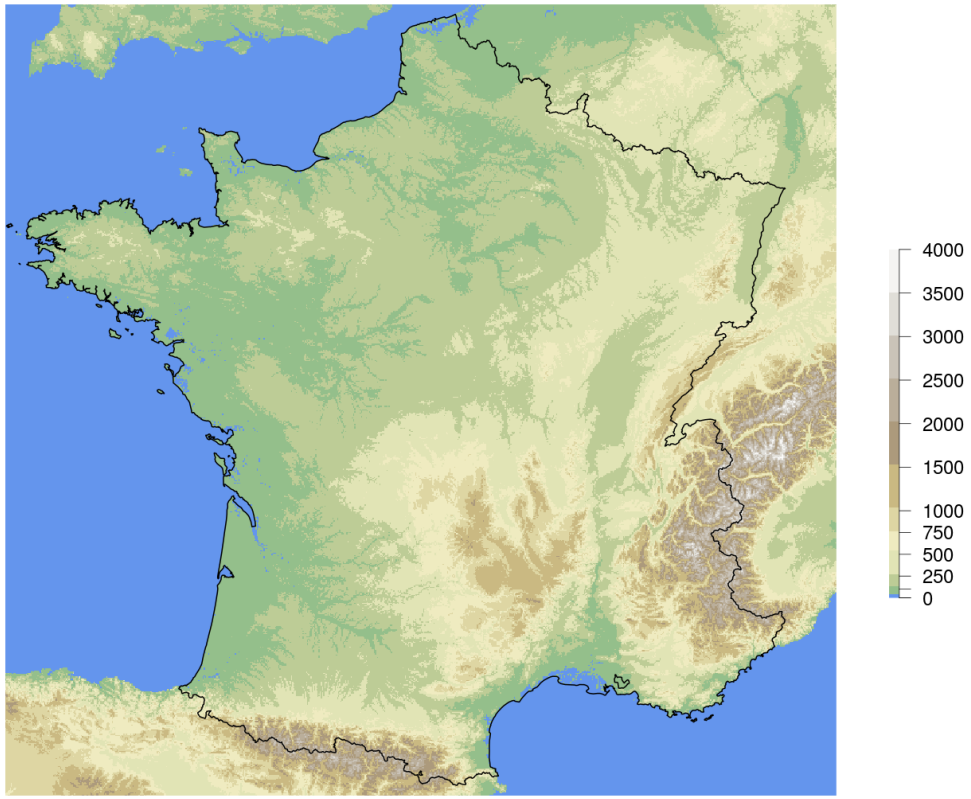
Land cover



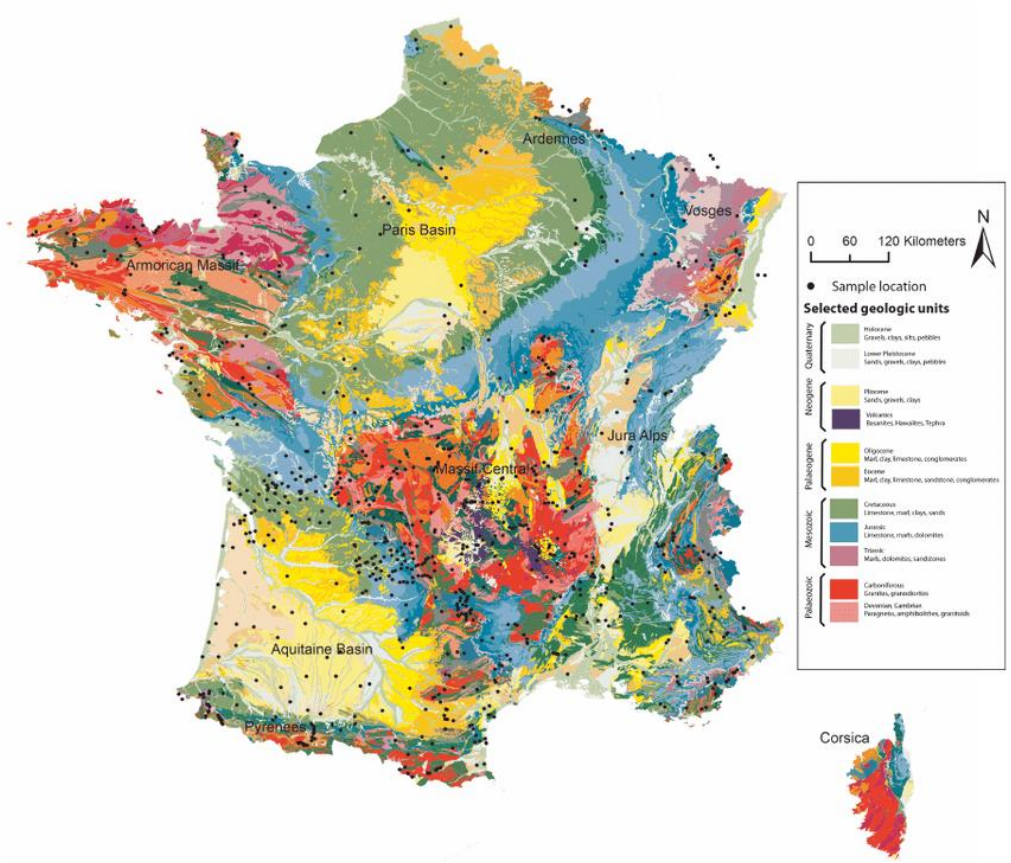
The CAMELS-FR dataset

Examples of variables

Elevation (m)

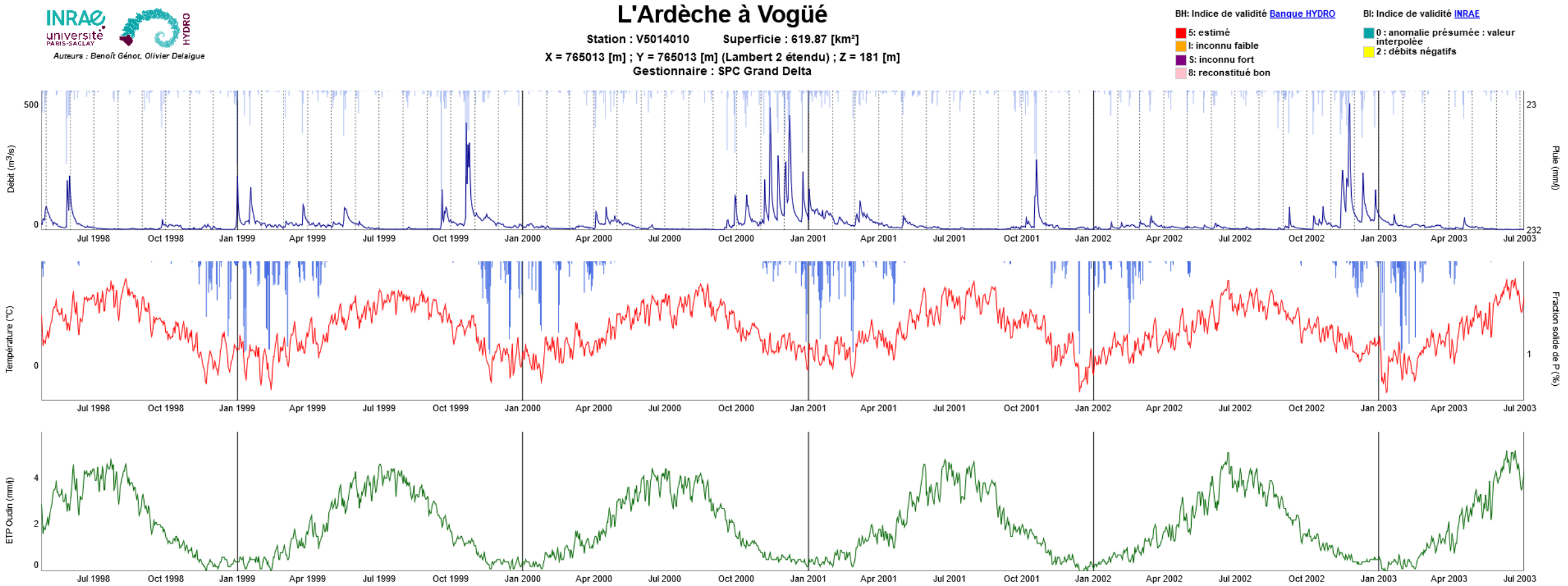


Geology



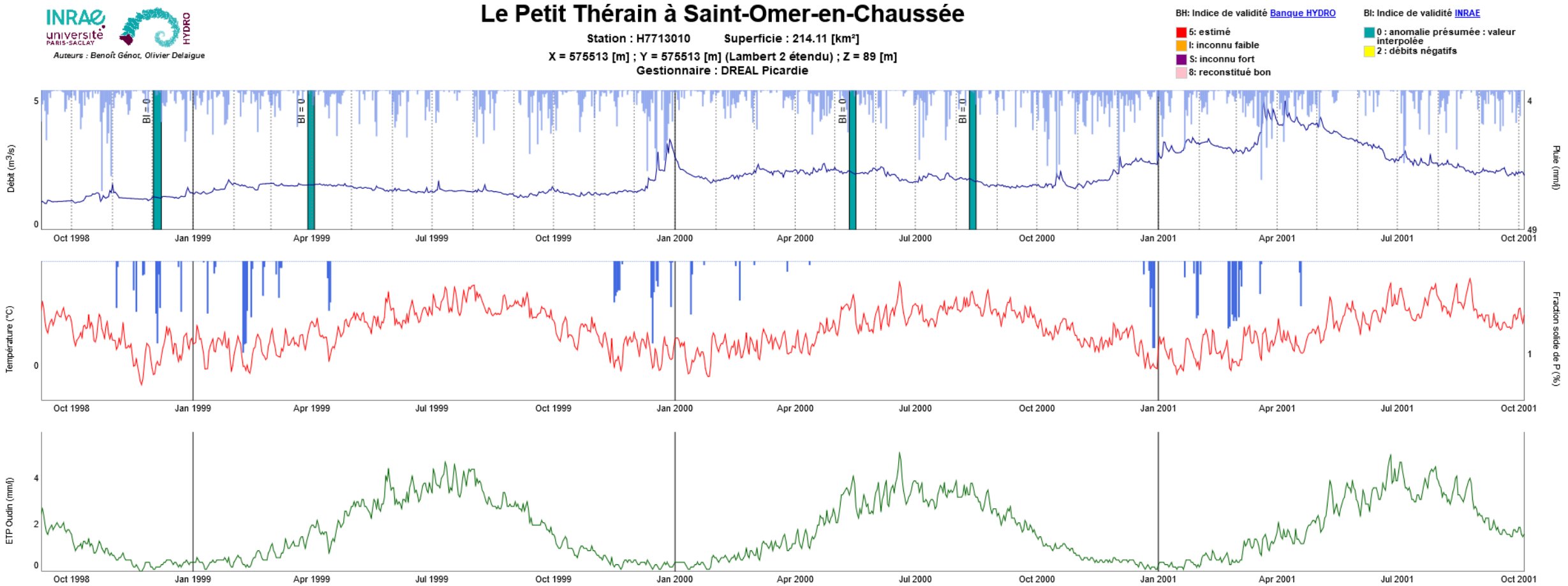
The CAMELS-FR dataset

Example of time series



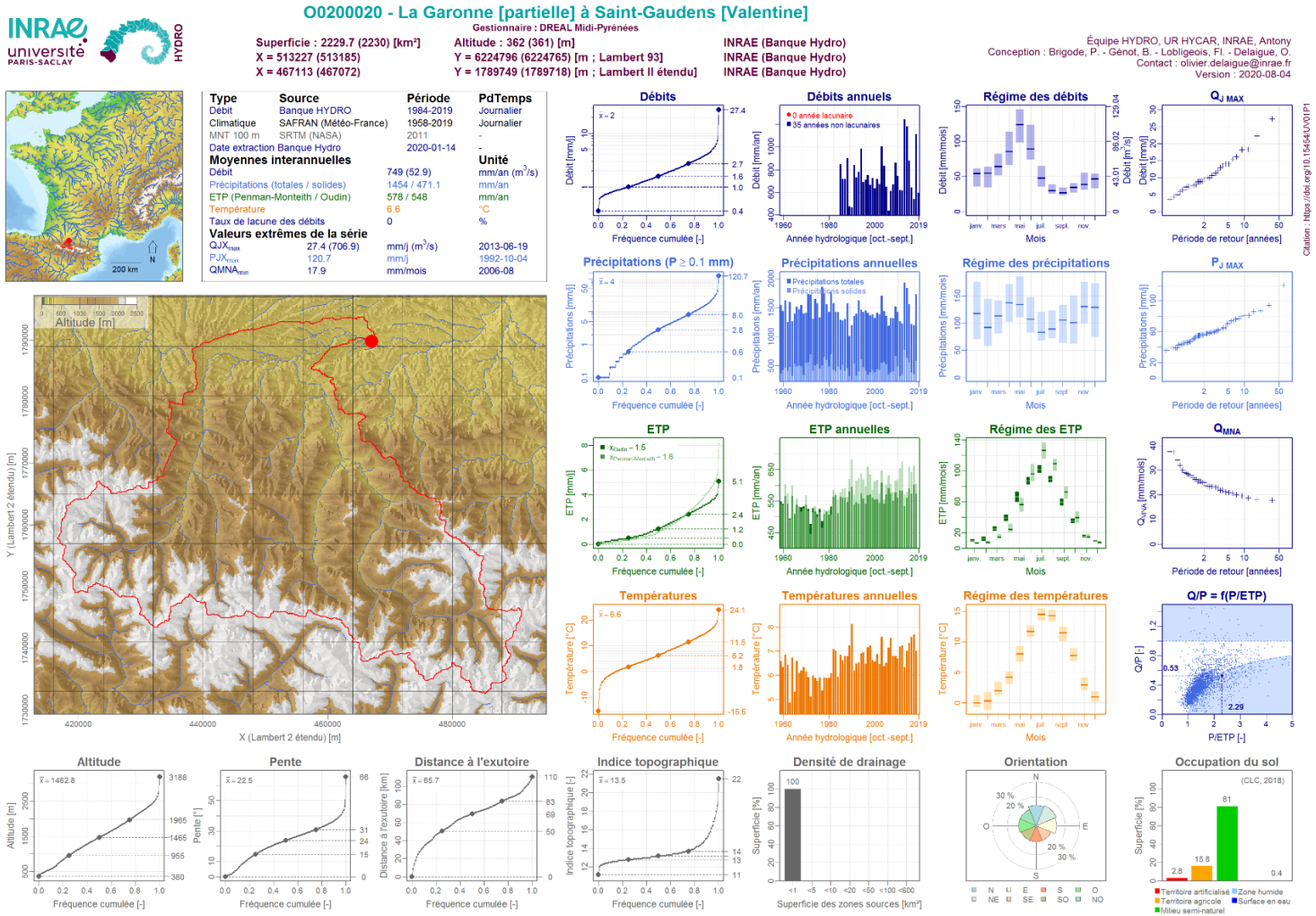
The CAMELS-FR dataset

Example of time series



The CAMELS-FR dataset

Example graphical summary sheet on CAMELS-FR catchments

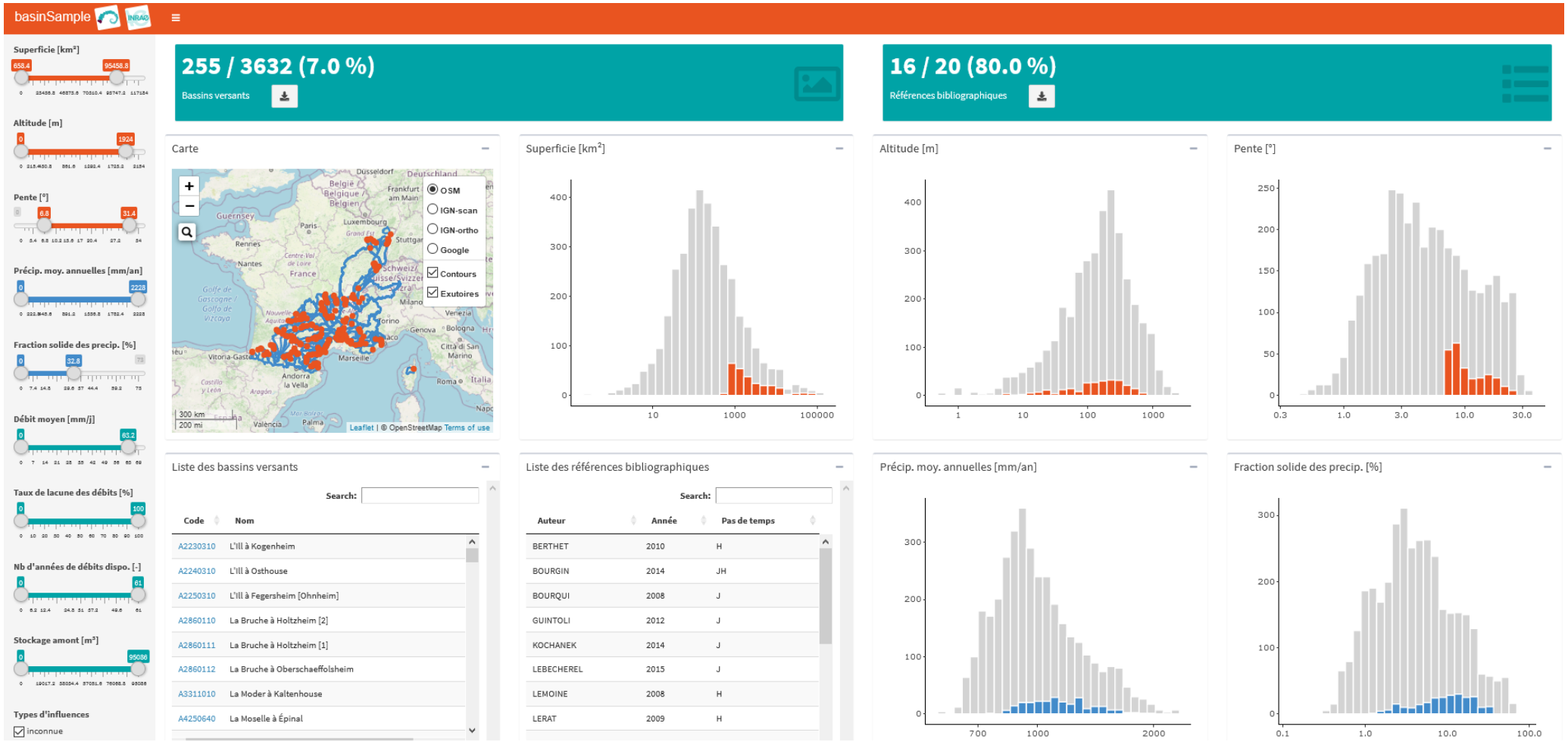


Source: Brigode et al., 2020

Brigode, Pierre; Génot, Benoît; Lobligeois, Florent; Delaigue, Olivier, 2020, "Summary sheets of watershed-scale hydroclimatic observed data for France", https://doi.org/10.15454/UV01P1, Portail Data INRAE, V1

The CAMELS-FR dataset

A graphical user interface to help users to select catchments



Available on sunshine.irstea.fr

The CAMELS-FR dataset

How to retrieve the data?

The CAMELS-FR dataset will be available in the second half of 2021 on the following websites:

- The HYMEX web portal
  - https://www.hymex.org/



- The webGR webiste
  - https://webgr.inrae.fr/

