



Groundwater resources of the Pyrenees in the global change context -The PIRAGUA Project

Santiago Beguería, Javier Luis, Jorge Lambán, Benoît Dewandel, Jean-François Desprats, Ane Zabaleta, Iñaki Antigüedad, Yvan Caballero, Sandra Lanini, Pierre Le Cointe, et al.

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Present and future potential groundwater recharge from precipitations over France

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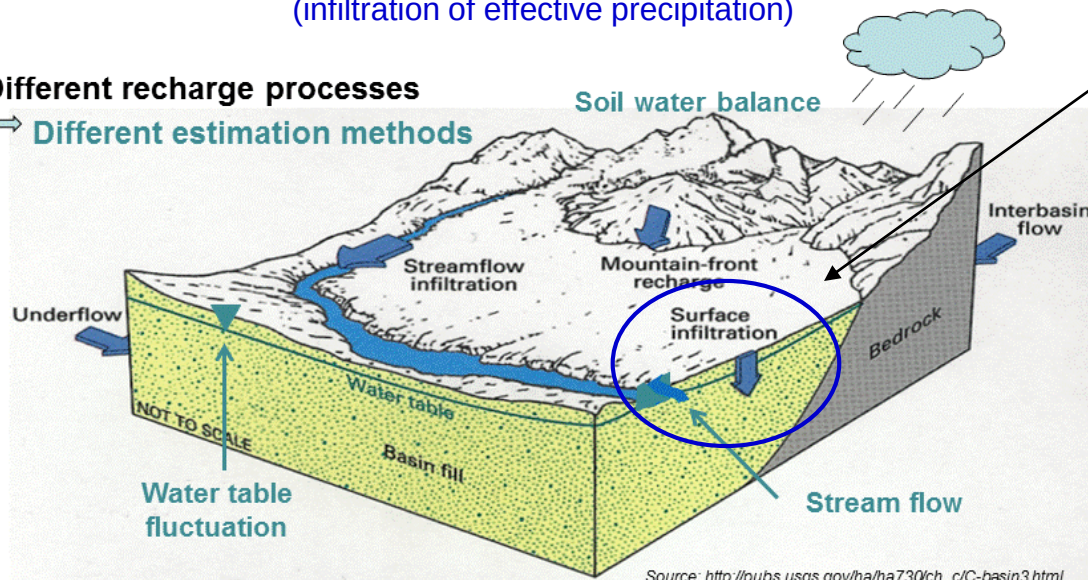
Contact: y.caballero@brgm.fr

Future groundwater resource?

Renewable groundwater resource: Potential groundwater recharge by precipitation

(infiltration of effective precipitation)

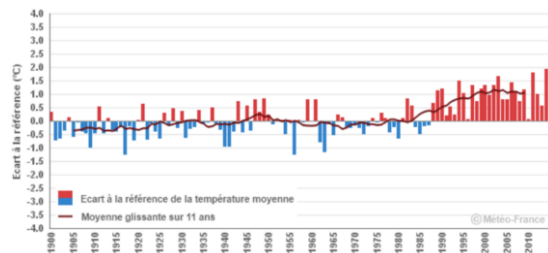
Different recharge processes
Different estimation methods



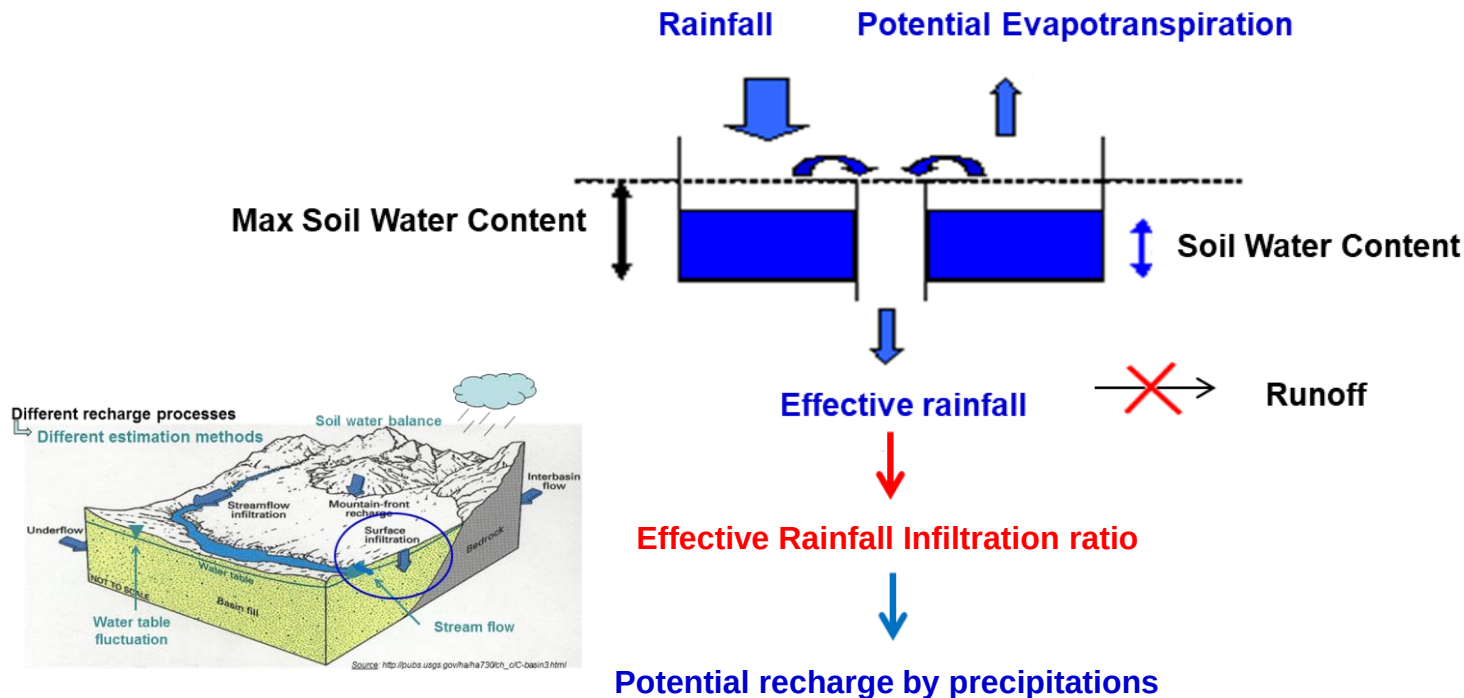
Source: http://pubs.usgs.gov/ha/ha730/ch_c/C-basin3.html

Using several recharge estimation methods provides more robust results with associated uncertainty (Scanlon et al., 2006)

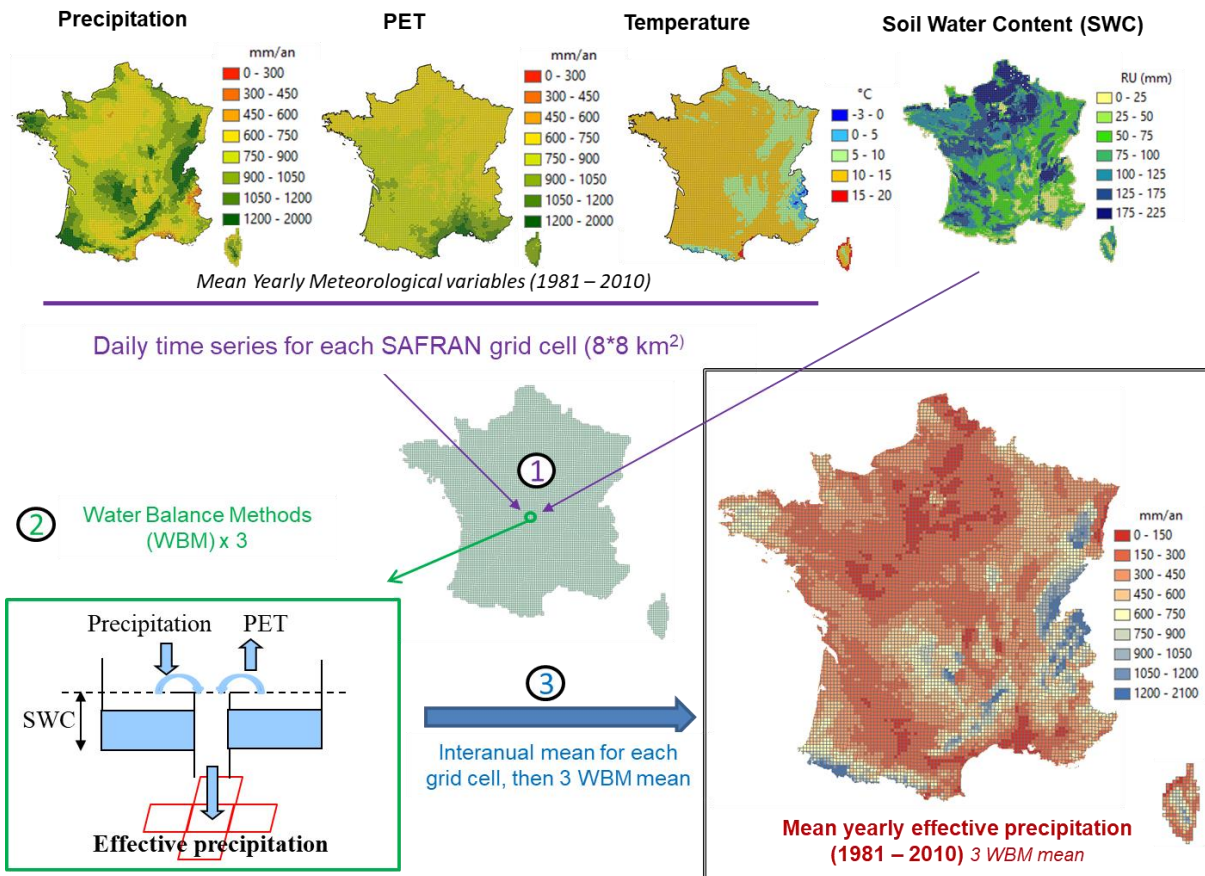
Projected impacts of
Climate Change?
Future T° and Precip°
→ Adaptation



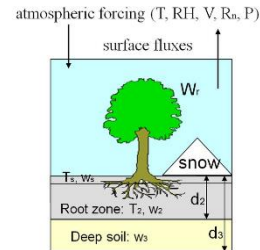
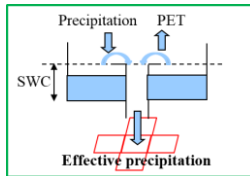
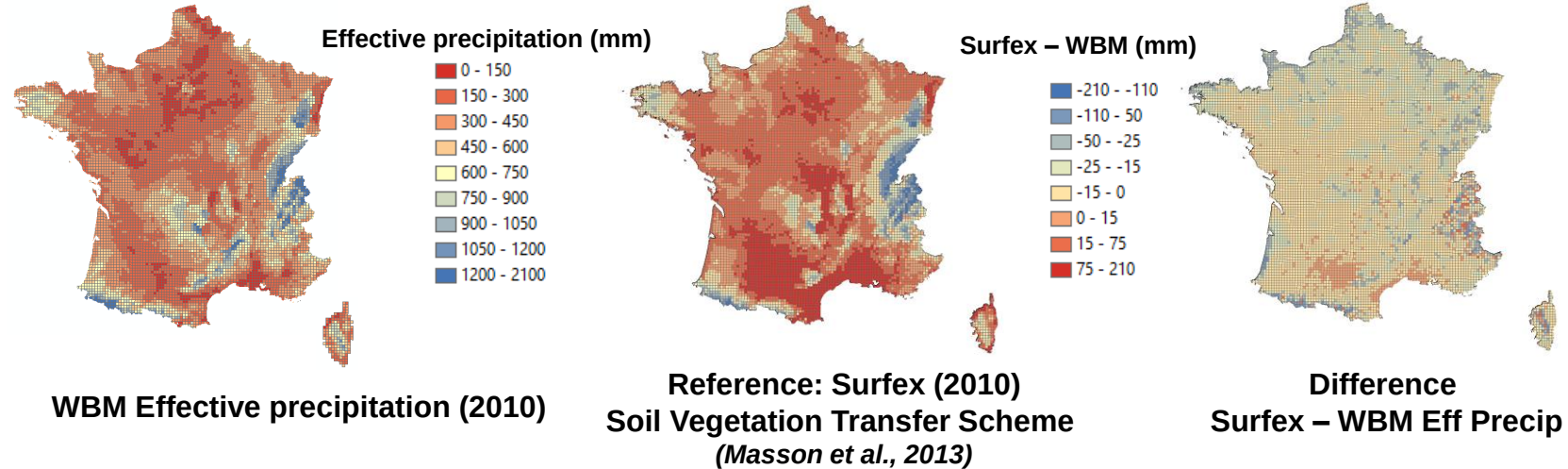
From effective precipitation → Potential recharge



Effective precipitation computation

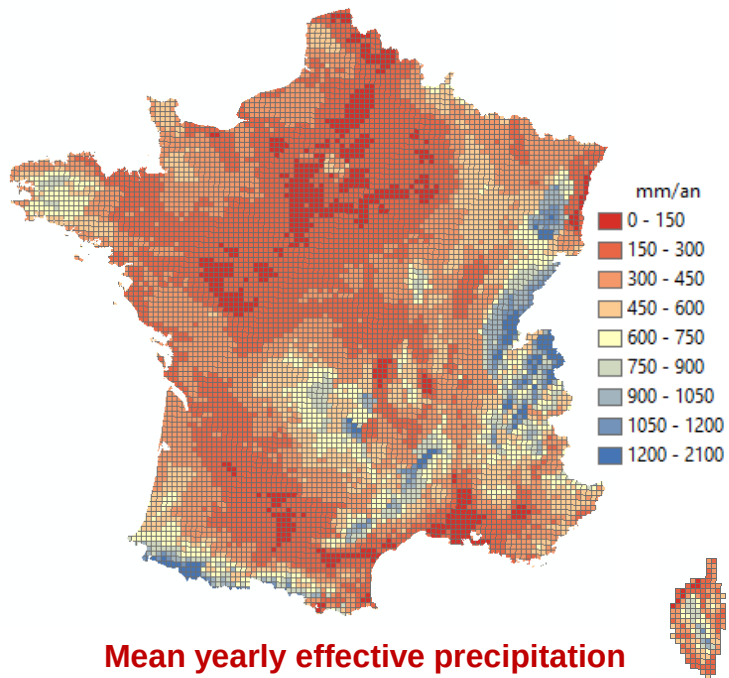


Effective precipitation computation quality



From effective precipitation → Potential recharge

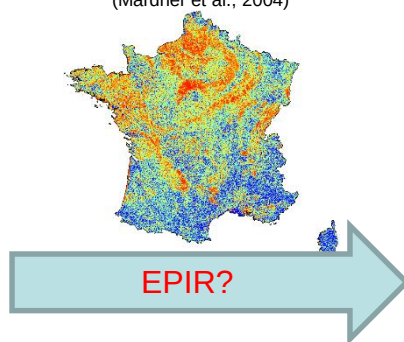
> Effective precipitation infiltration ratio? (EPIR)



Mean yearly effective precipitation
(1981 – 2010) 3 WBM mean

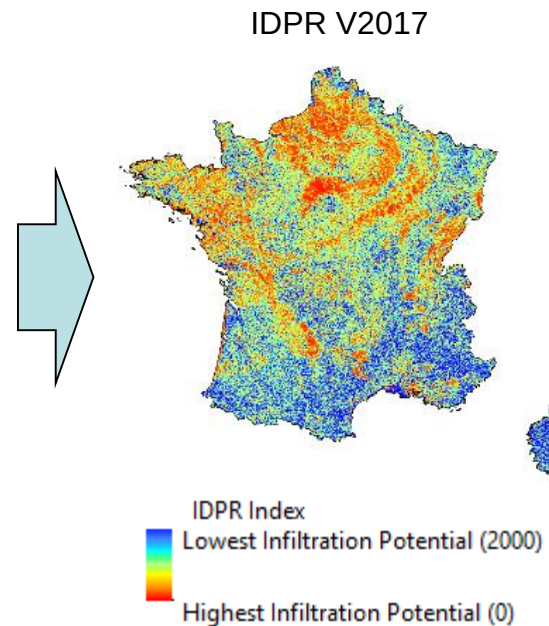
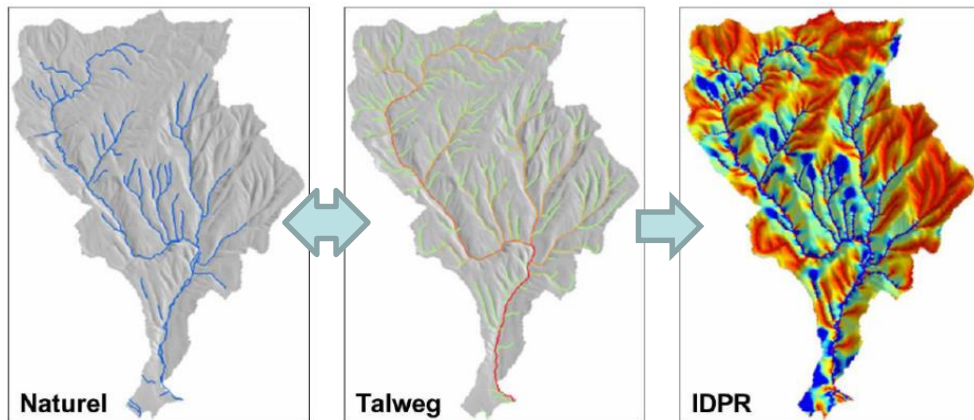
IDPR V2017 Map

(Mardhel et al., 2004)



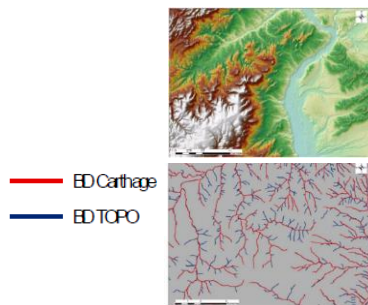
Potential recharge
by precipitation

IDPR V2017 concept



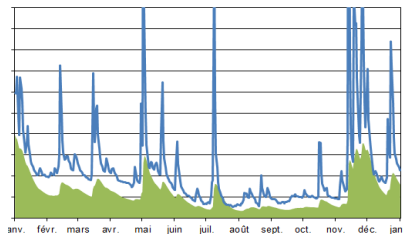
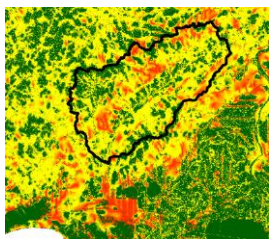
> V2017: New data:

- DEM 20 m (BD ALTI V2 IGN©)
- Hydrographic Network (BD TOPO IGN©)



From effective precipitation → Potential recharge

> IDPR / Base Flow Index (BFI) → EPIR



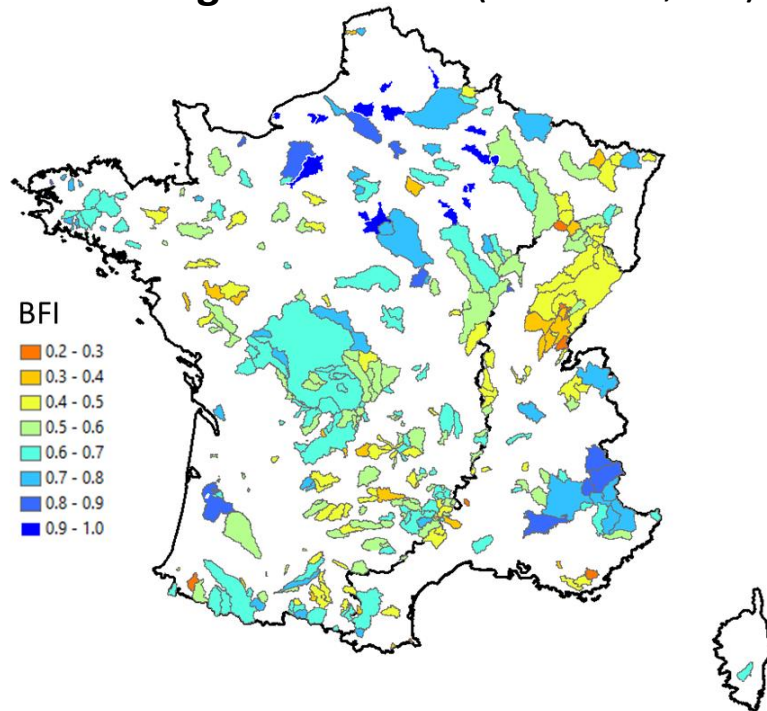
At yearly scale:

- « Natural » river basin
- No lateral nor vertical groundwater flux
- Negligible stock variation

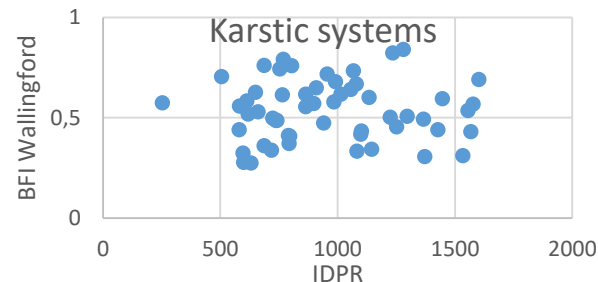
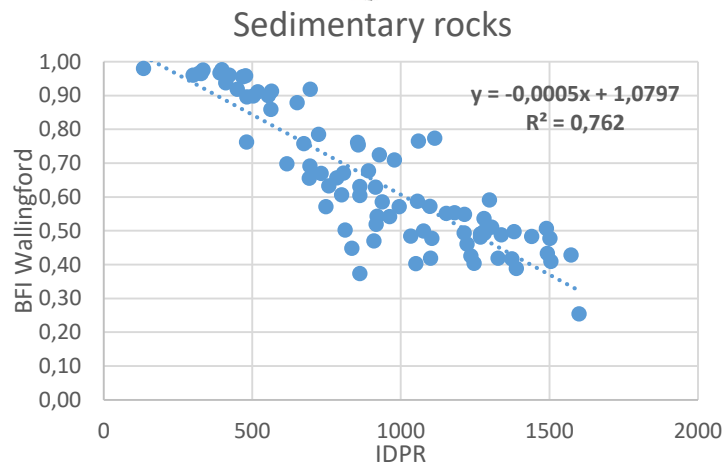
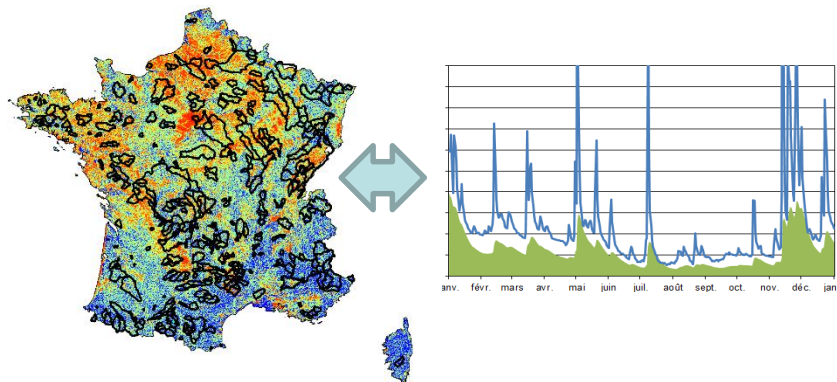
Recharge ~ base flow / Eff. Precip° ~ total discharge
→ EPIR = BFI

BFI computation over 350 river basins

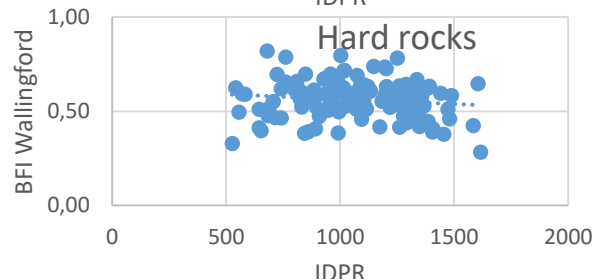
Wallingford method (Gustard et al., 1992)



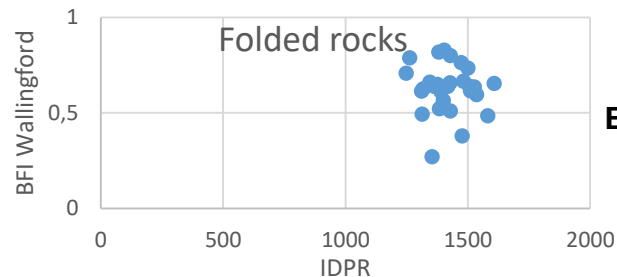
From effective precipitation → Potential recharge



EPIR = 55%

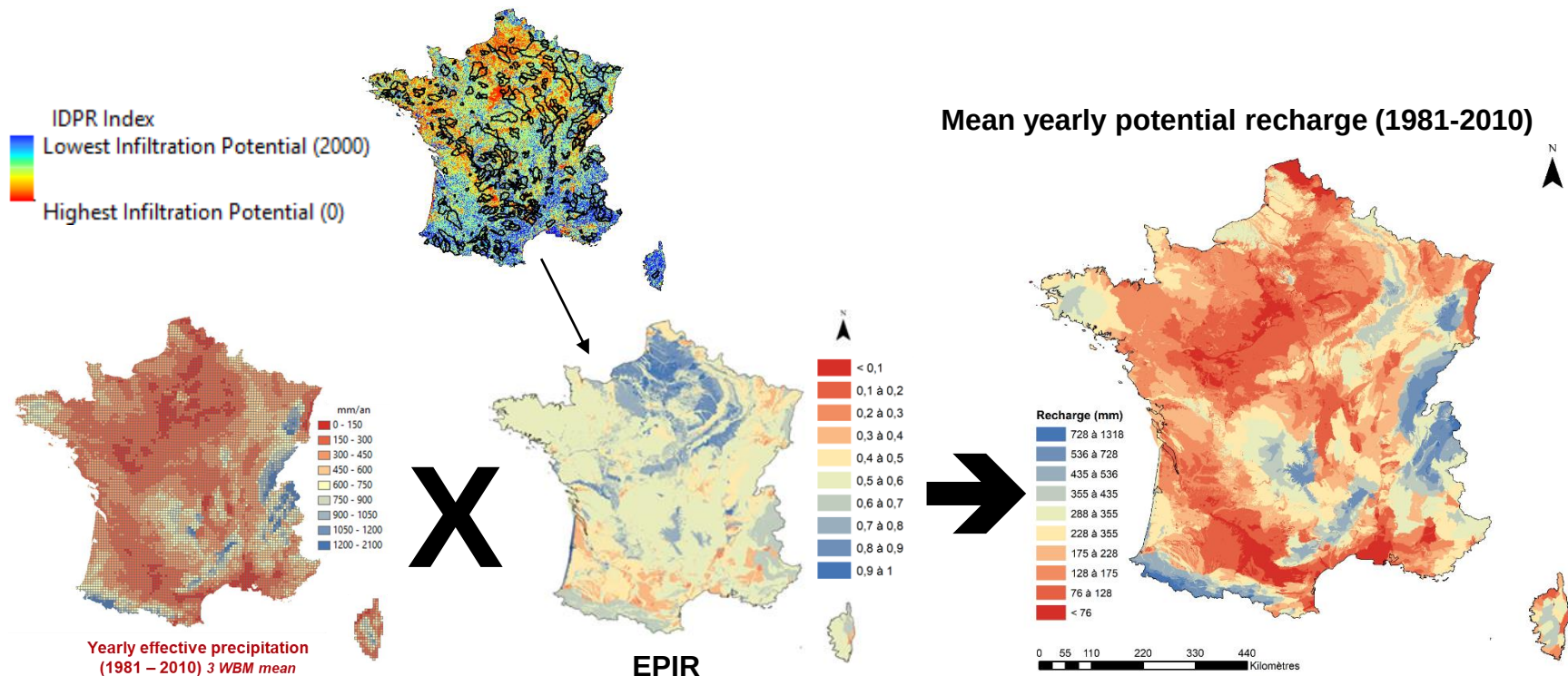


EPIR = 55%



EPIR = 65%

From effective precipitation → Potential recharge



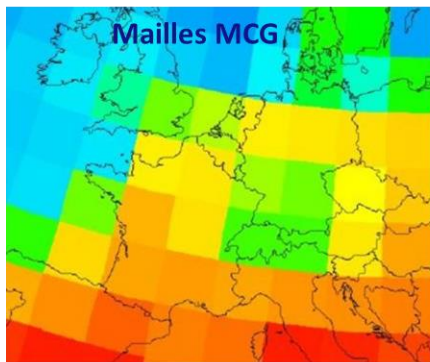
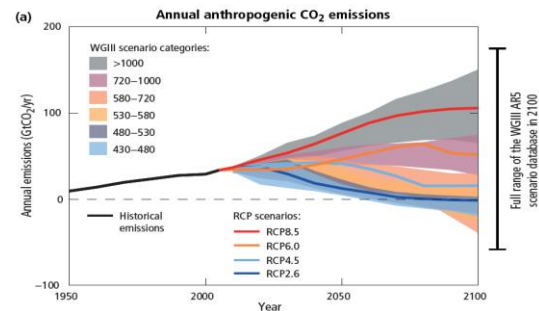
Future potential recharge?

Climate projections → Future effective precipitation

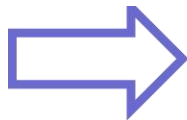
RCP Scenarios 2.6 (optimist) and 8.5 (pessimist)

5 GCMs: (NCAR CSM1, CanESM2, NorESM1, IPSL, CNRM-CM3)

2 downscaling methods: (DSCLIM / DAYON)



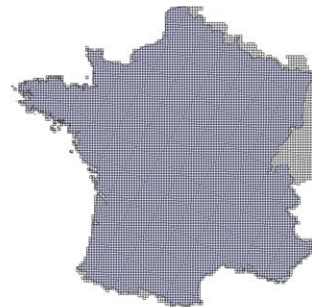
downscaling



DESCLIM
(Pagé et al., 2010)

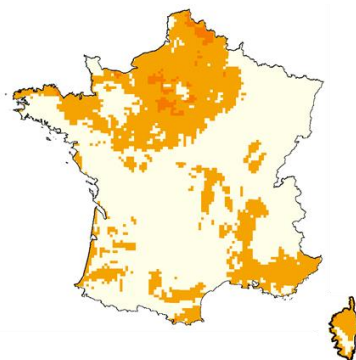
Analogs
(Dayon, 2016)

SAFRAN grid (8x8 km)

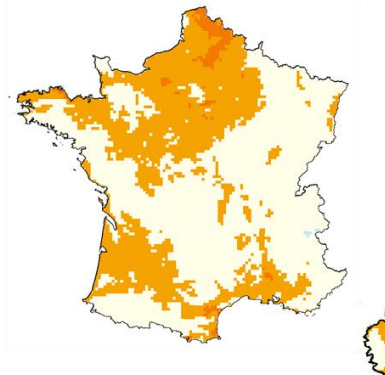


Future potential recharge?

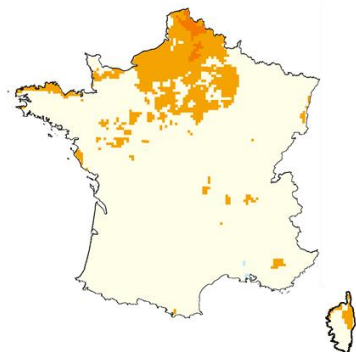
RCP2.6 - Horizon 2030



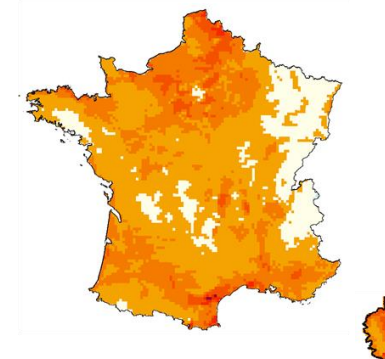
RCP8.5 - Horizon 2030



RCP2.6 - Horizon 2080



RCP8.5 - Horizon 2080



Conclusions



Towards a decreasing of the potential recharge by precipitations over France

- Method for large scale potential recharge estimation → to be assessed
- Probable decrease of the effective precipitations over France, with regional differences to be assessed (higher impacts in the northern regions at short term...)
- Necessary uncertainties assessment at the different levels of the computation and comparison of future / present variability

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