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

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Present and future potential groundwater recharge from precipitations over France

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GROUNDWATER MANAGEMENT AND GOVERNANCE
COPING WITH WATER SCARCITY

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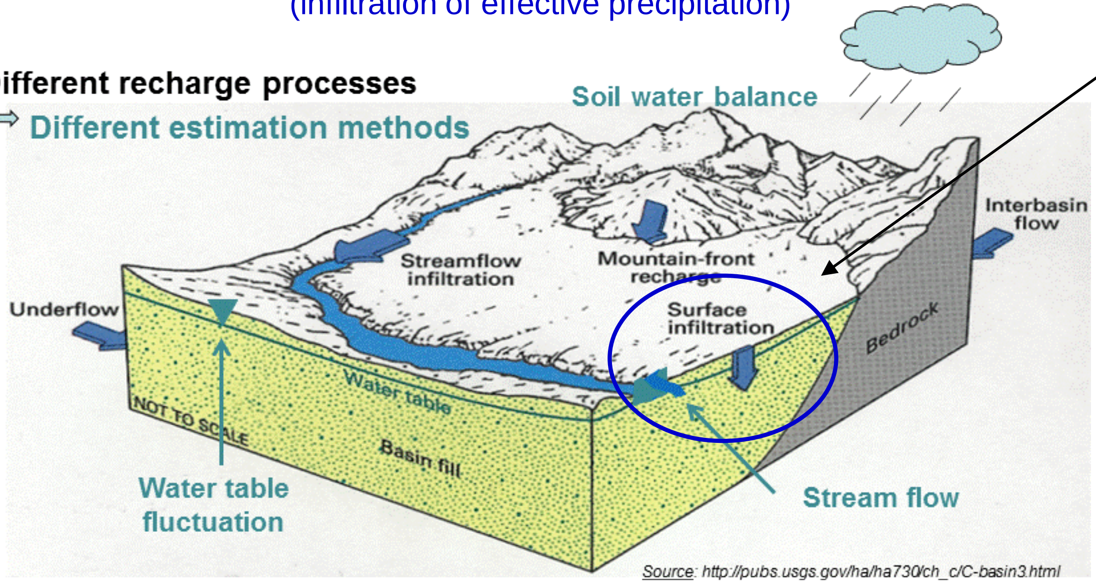
Future groundwater resource?

Renewable groundwater resource: Potential groundwater recharge by precipitation

(infiltration of effective precipitation)

Different recharge processes

Different estimation methods

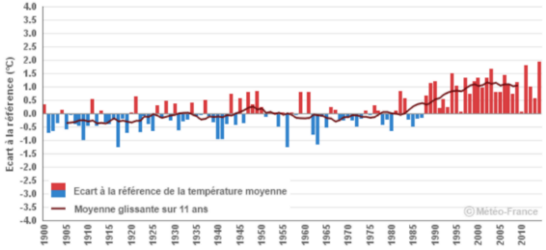


Source: http://pubs.usgs.gov/ha/ha730/ch_c/C-basin3.html

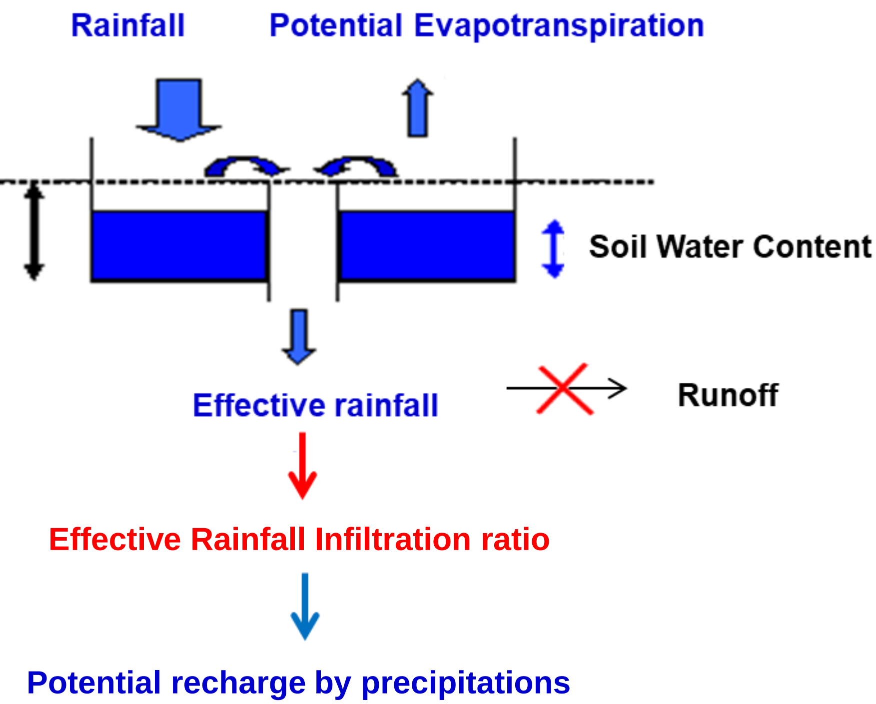
Using several recharge estimation methods provides more robust results with associated uncertainty (Scanlon et al., 2006)

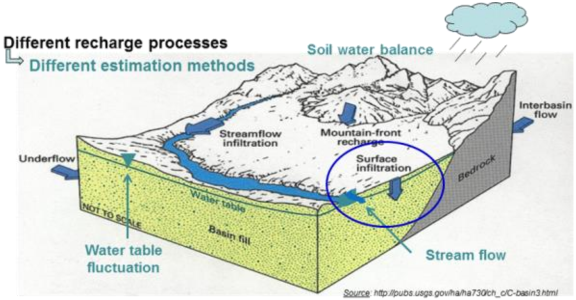
Projected impacts of Climate Change? Future T° and Precip°

➔ Adaptation

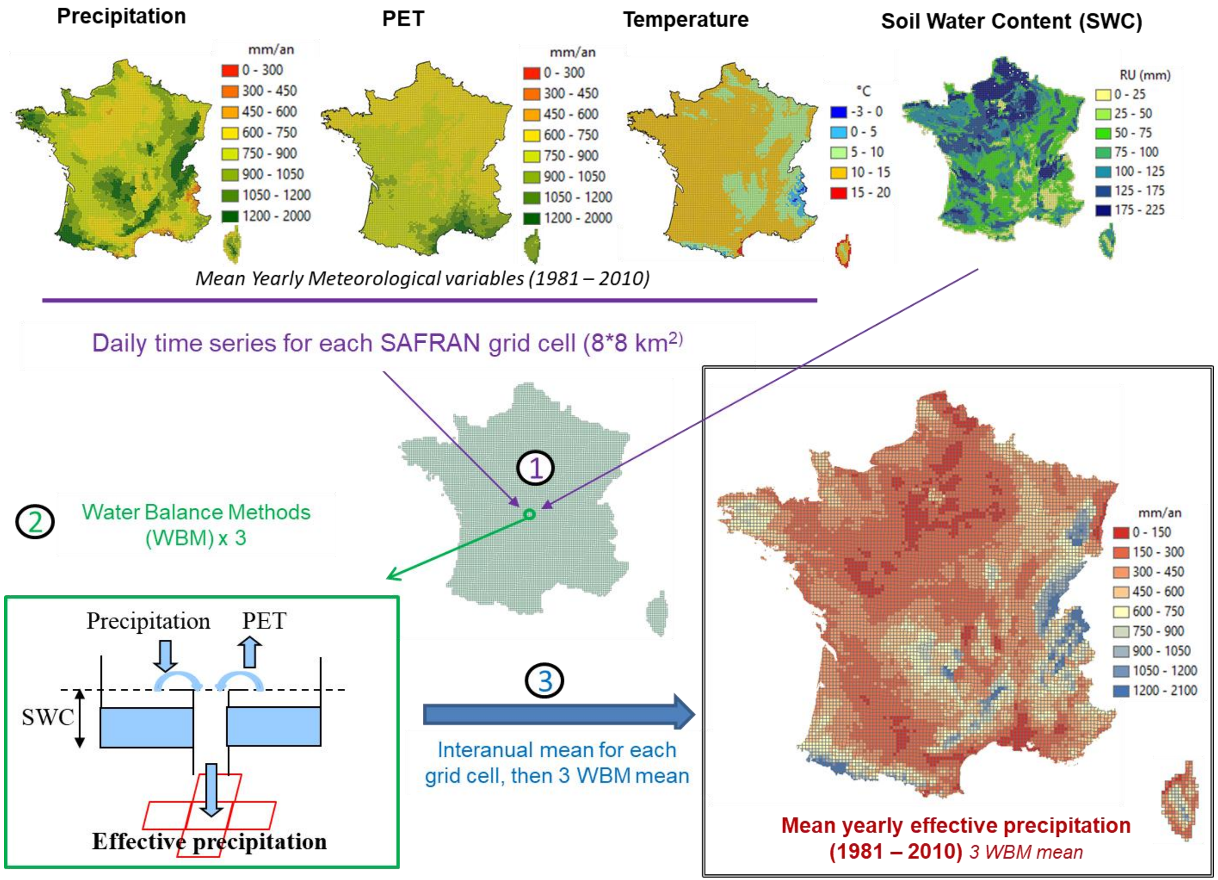


From effective precipitation ➔ Potential recharge

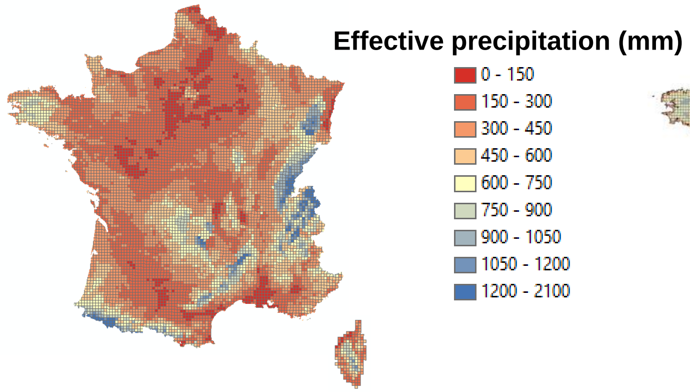




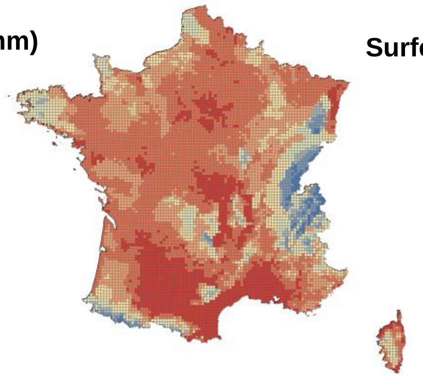
Effective precipitation computation



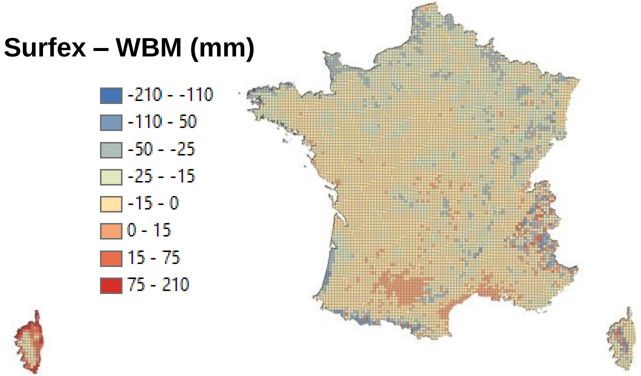
Effective precipitation computation quality



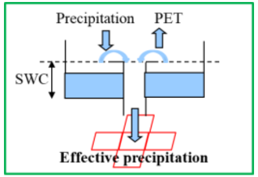
WBM Effective precipitation (2010)

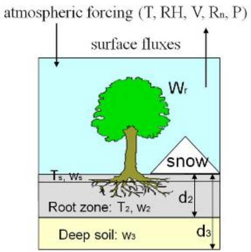


Reference: Surfex (2010)
Soil Vegetation Transfer Scheme
(Masson et al., 2013)



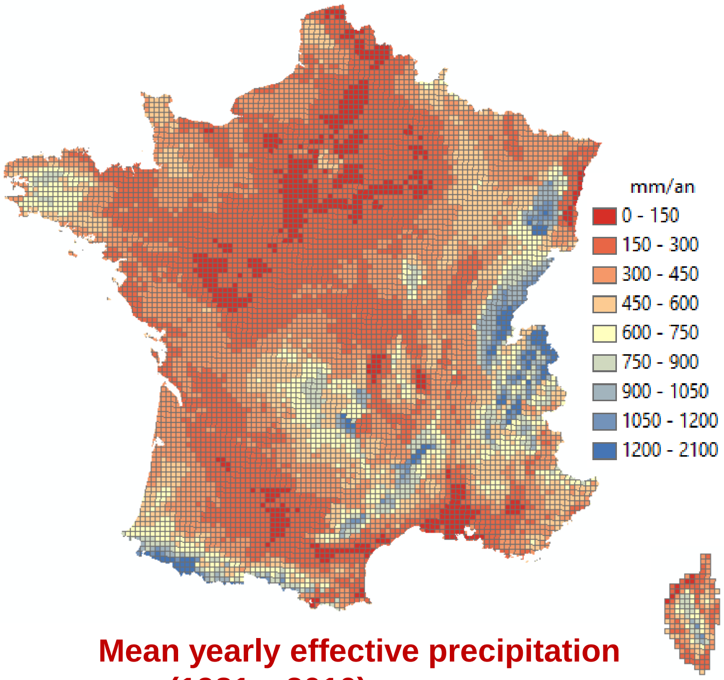
Difference
Surfex – WBM Eff Precip





From effective precipitation ➔ Potential recharge

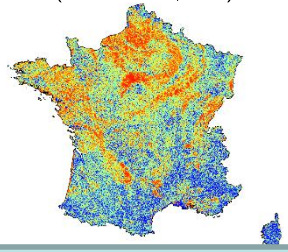
> **Effective precipitation infiltration ratio? (EPIR)**



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

IDPR V2017 Map

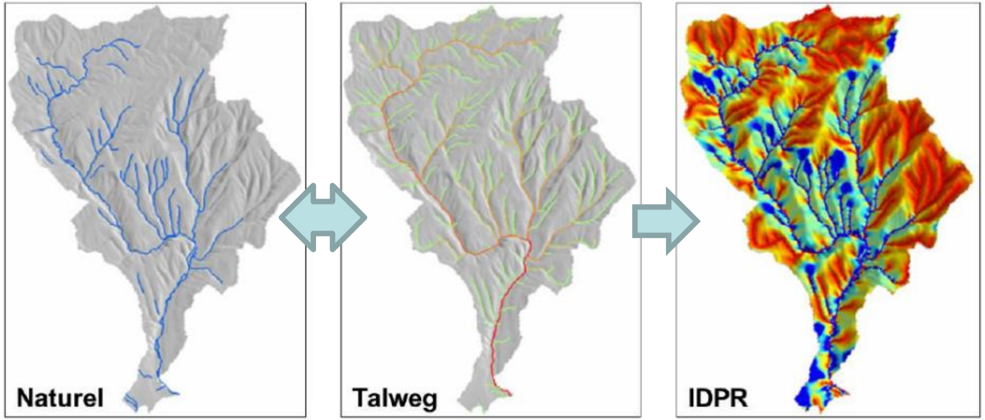
(Mardhel et al., 2004)

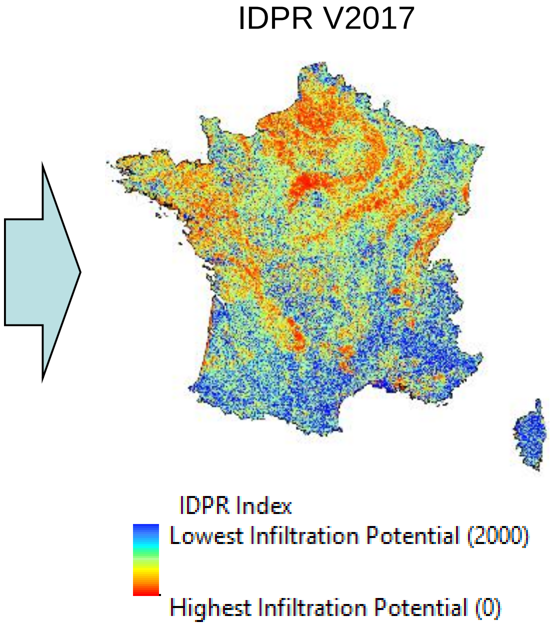


EPIR?

Potential recharge by precipitation

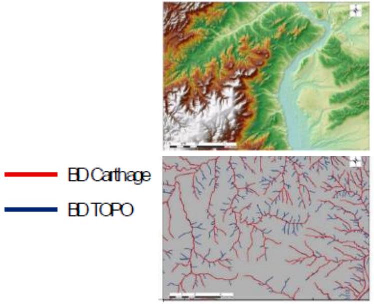
IDPR V2017 concept





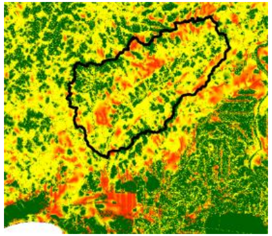
> **V2017: New data:**

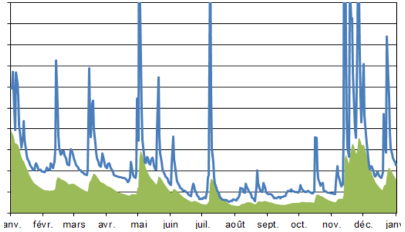
- DEM 20 m (BD ALTI V2 IGN©)
- Hydrographic Network (BD TOPO IGN©)



From effective precipitation ➔ Potential recharge

> **IDPR / Base Flow Index (BFI) ➔ EPIR**





At yearly scale:

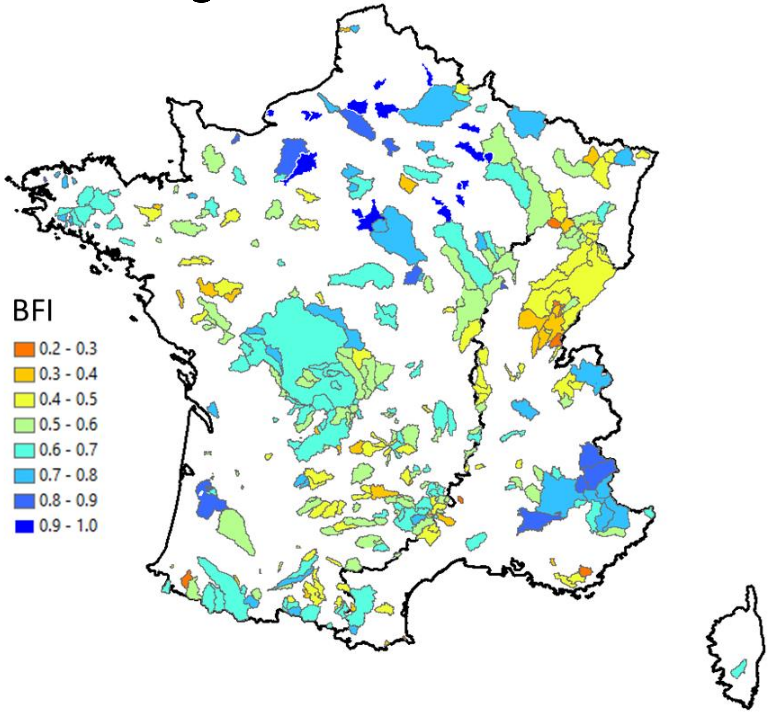
- « Natural » river basin
- No lateral nor vertical groundwater flux
- Negligible stock variation

Recharge ~ base flow / Eff. Precip° ~ total discharge

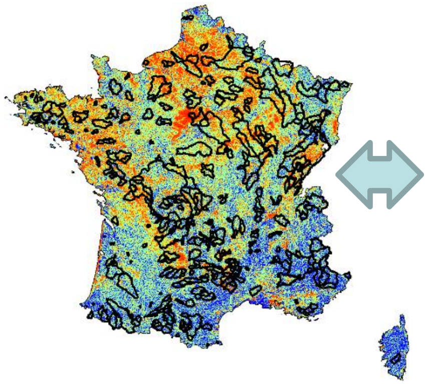
➔ EPIR = BFI

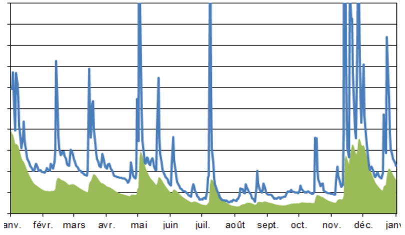
BFI computation over 350 river basins

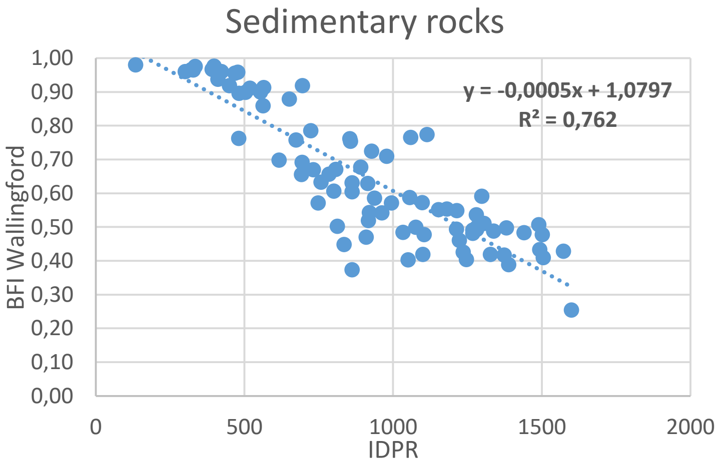
Wallingford method (Gustard et al., 1992)

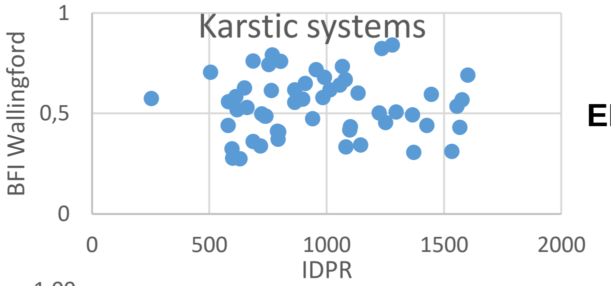


From effective precipitation ➔ Potential recharge

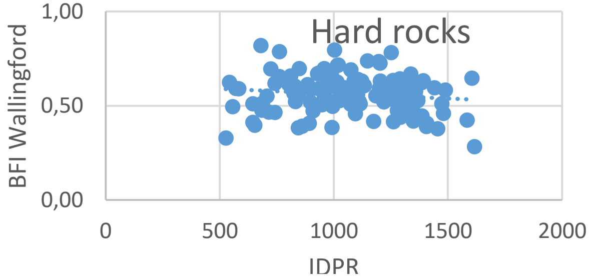




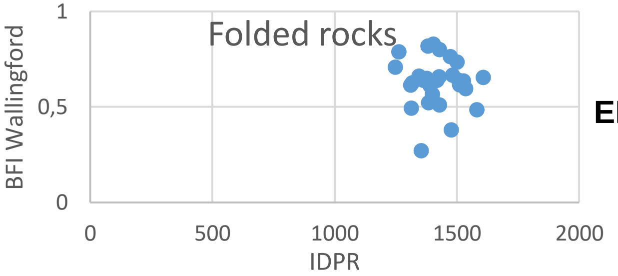




EPIR = 55%

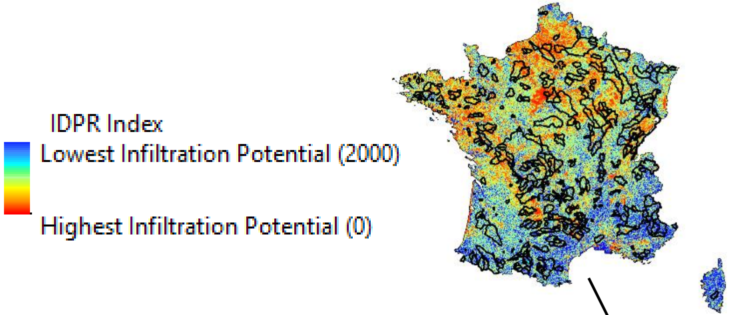


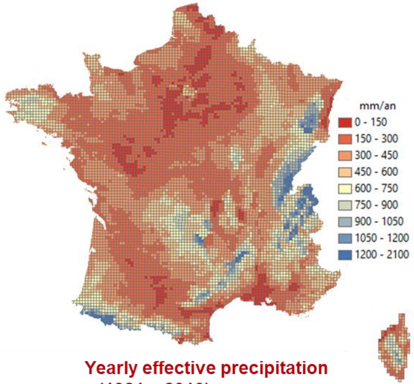
EPIR = 55%



EPIR = 65%

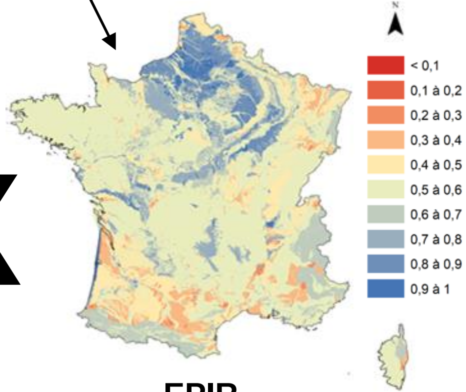
From effective precipitation ➔ Potential recharge





Yearly effective precipitation (1981 – 2010) ***3 WBM mean***

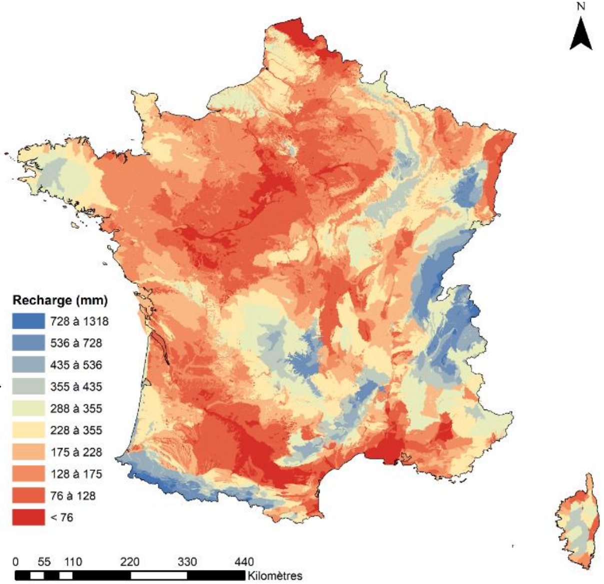
X



EPIR

➔

Mean yearly potential recharge (1981-2010)



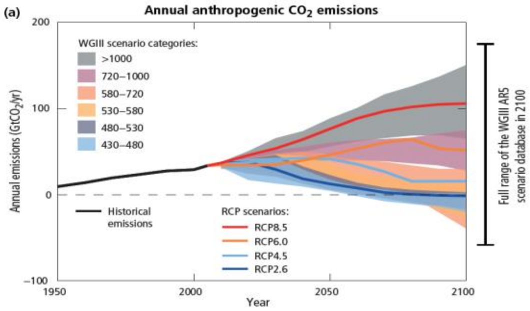
Future potential recharge?

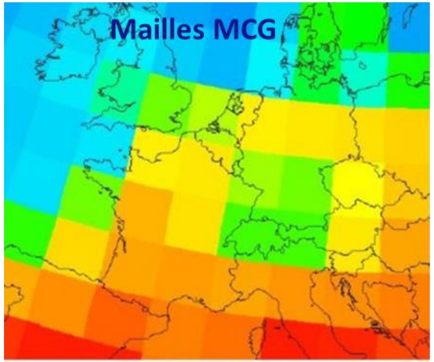
Climate projections ➔ Future effective precipitation

RCP Scenarios 2.6 (optimist) and 8.5 (pessimist)

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

2 downscaling methods: (DSCLIM / DAYON)



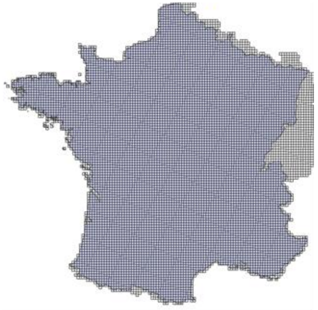


downscaling

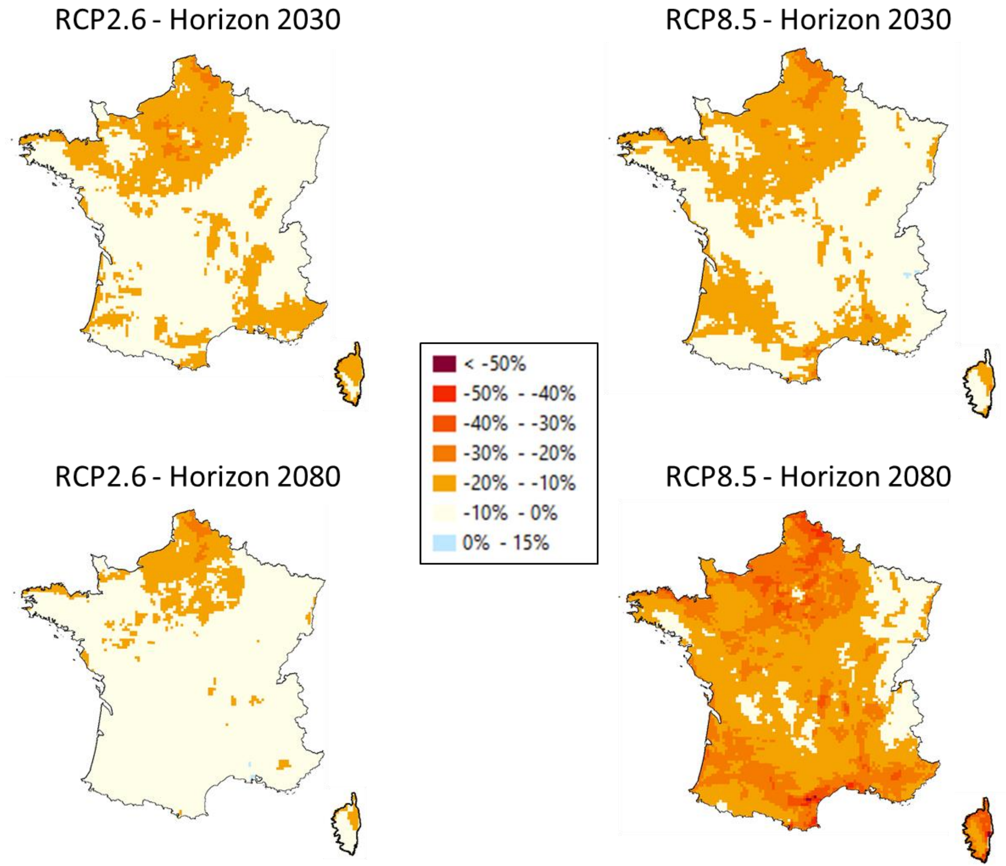
DESCLIM
(Pagé et al., 2010)

Analogs
(Dayon, 2016)

SAFRAN grid (8x8 km)



Future potential recharge?



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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