A joint soil-vegetation-atmospheric modeling procedure of water isotopologues with WRF-Hydro-iso: Implementation and application to present-day climate in Europe and Southern Africa

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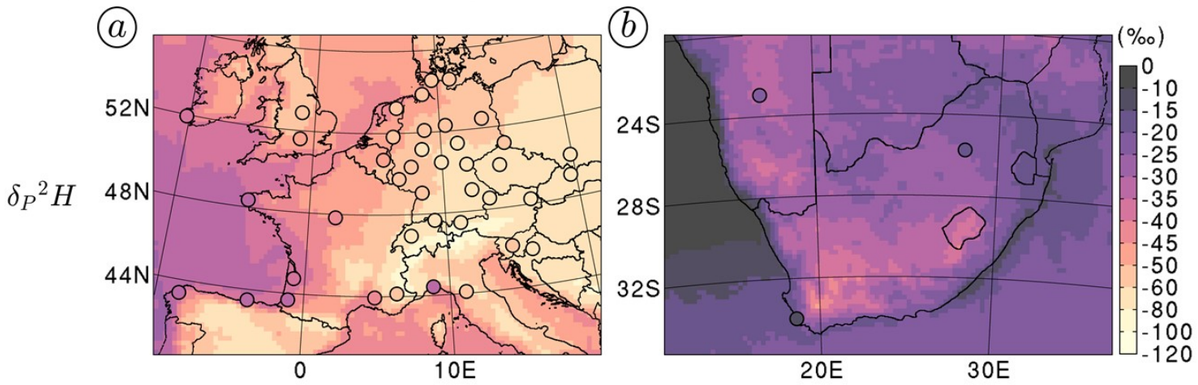
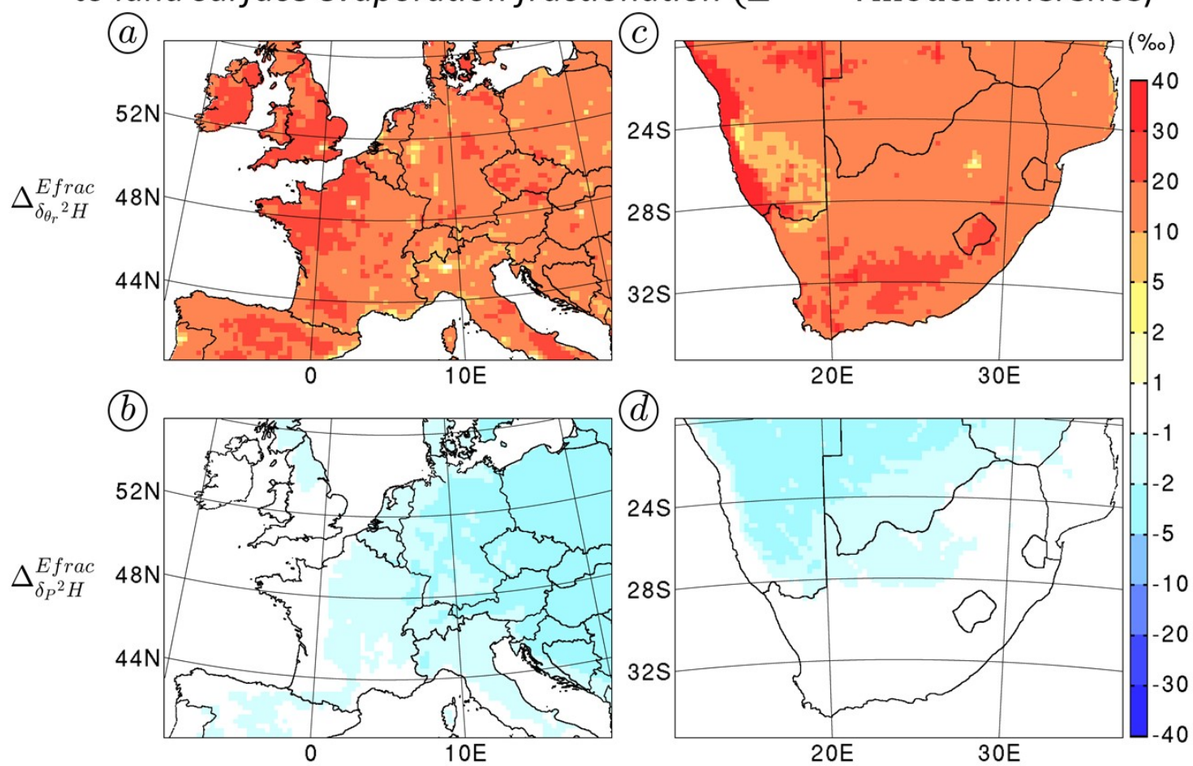
- *Research question:* How does land surface evaporation affect water isotopologues concentration in precipitation and soils (focus on deuterium $\delta\ ^2H$)
- *Research Tool (recently developed in Arnault et al. 2021): C*oupled atmospheric-hydrological model WRF-Hydro-iso enhanced with water isotopologues transport and fractionations, based on the tagging procedure of Arnault et al. (2019)
- *Method:* drive WRF-Hydro-iso with a hybrid ERA5-iCESM dataset, apply to two study regions and conduct sensitivity runs to extract the effect of land surface evaporation fractionation on deuterium concentration

- *Validation:* 10-year-average WRF-Hydro-iso vs GNIP stations data (circles) of precipitation deuterium $\delta_P\ ^2H$ for Europe (left) and Southern Africa (right)



- *Results Summary:*
  - Spatial variability of modeled $\delta_P\ ^2H$ close to GNIP stations data
  - Land surface evaporation fractionation enriches soils and slightly depletes precipitation in deuterium
  - The depletion effect on precipitation is larger inlands where the contribution of land surface evaporation to precipitation is highest.

- *Sensitivity of soil deuterium $\delta_{\theta_r}\ ^2H$ and precipitation deuterium $\delta_P\ ^2H$ to land surface evaporation fractionation* (Δ^{Efrac}: model difference)



ERA5: Global reanalysis product from the European Center for Medium-Range Weather Forecasts
iCESM: isotope-enabled version of the Community Earth System Model
GNIP: Global Network of Isotopes in Precipitation

Arnault et al. (2019). A joint soil-vegetation-atmospheric water tagging procedure with WRF-Hydro: Implementation and application to the case of precipitation partitioning in the upper Danube river basin, Water Resources Research
Arnault et al. (2021). A joint soil-vegetation-atmospheric modeling procedure of water isotopologues: Implementation and application to different climate zones with WRF-Hydro-iso, submitted to Journal of Advances in Modeling Earth Systems