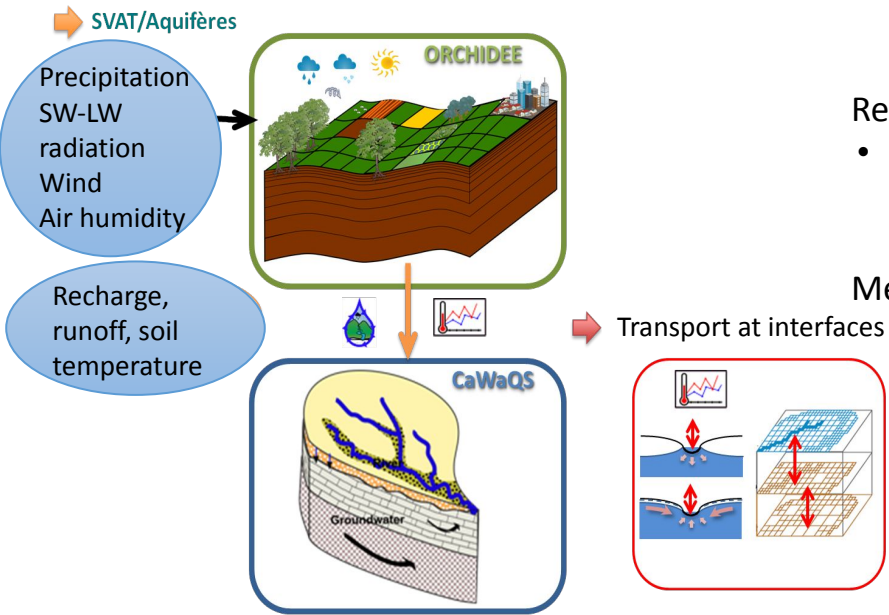


Integrated modeling of water and heat fluxes in the Seine hydrosystem



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Gaps and research questions:

- The impact of climate change on the Seine hydrosystem, especially groundwater resources, requires further research

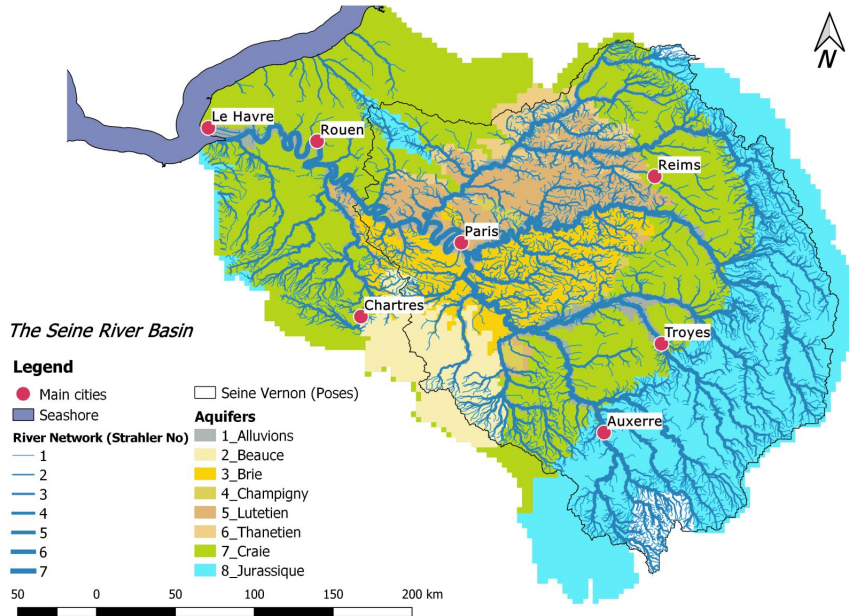
Research goal:

- How do global changes modify water and heat fluxes in the Seine hydrosystem?

Methods: Coupling two process based distributed physical models:

- ORCHIDEE (Krinner et al., 2005; tag2.2):
 - SVAT model
 - Vegetation dynamics (STOMATE activated)
 - Surface water budget and energy balance
 - Meteorological forcing data: SAFRAN (8 km resolution)
 - Daily time step
- CaWaQS (Flipo et al., 2020, Labarthe, 2016):
 - Pseudo-3D distributed groundwater model
 - River dynamics
 - Stream-aquifer exchanges

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Key points:

- 78650 km² surface area
- Yearly rainfall is around 850 mm/y
- Mean discharge at the Poses outlet is 500 m³/s
- Monthly average temperatures range between 2 – 20 °C
- Industrial and agricultural center of France
- 16.7m inhabitants in the region
- 1 Bm³/y groundwater consumption (Labarthe, 2016)

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- Validation data are from Eau France, GLEAM v3.3, GIMMS databases

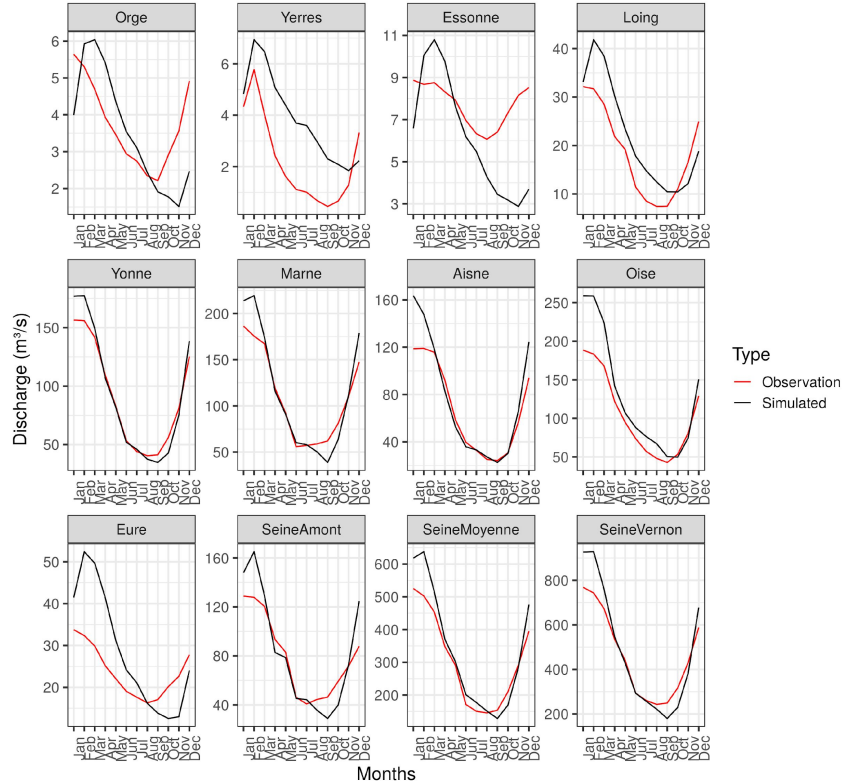
Variable	Description	Spatial resolution	Period	Uncertainty	Source
Q(daily)	Streamflow	Point	1995-2018		Eau France
ETref(daily)	Actual evapotranspiration	25 km	2003-2018	-0.41 - 0.65 mm/d mean absolute difference	GLEAM v3.3*
LAI (mean)	Reference LAI	25 km	1981-2015	RMSE = 0.676	GIMMS v3**

Sources: *Martens et al 2017, GMD; **Mao et al. 2019.

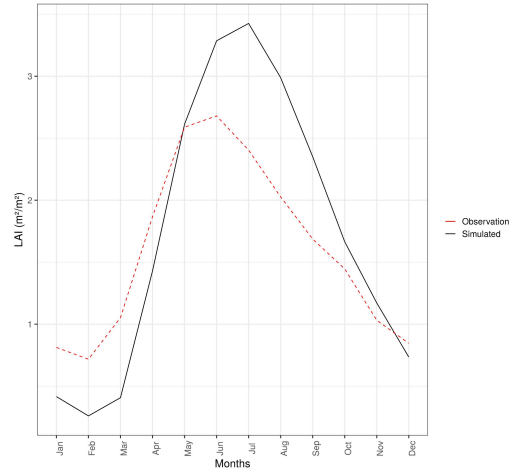
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Preliminary results

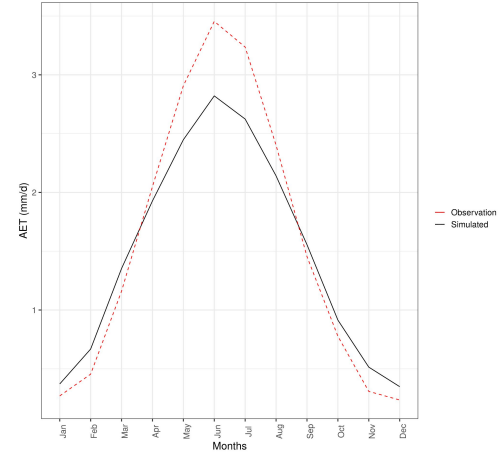
Seasonalities of the total surface runoff vs discharge
Observations vs simulation



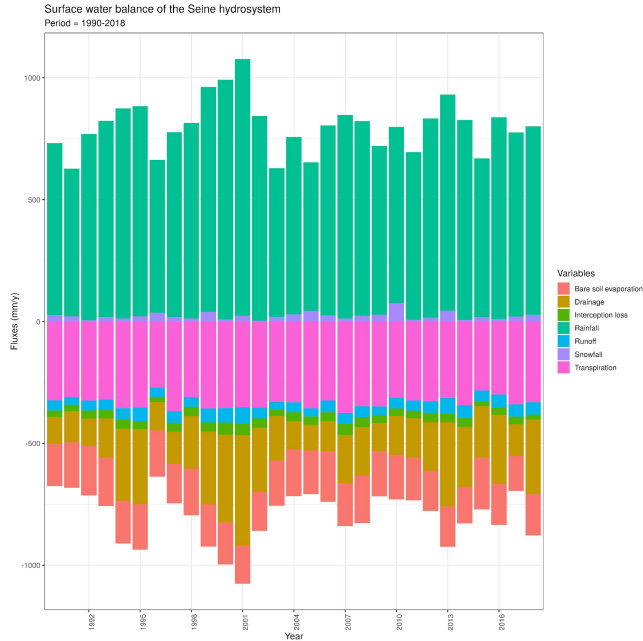
Monthly variation of mean LAI vs Observations
Observations vs Simulation, period = 1982-2010



Monthly variation of actual evapotranspiration
Observations vs Simulation, period = 2003-2018, dataset: GLEAM v3.3b



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Results:

- Seasonal dynamics and multi-year mean discharge are captured
- Regional assessment of AET datasets show underestimation during summer
- Vegetation module underestimates during winter & overestimates during summer
- Distributed recharge, runoff and soil temperature maps are obtained to force the groundwater model CaWaQs

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