

Floods of a warmer climate - Looking at the Last Interglacial -

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I – A future that resembles the past

Climate change affects the hydrological cycle in many regions¹, with potentially strong impacts. Projections are produced with global climate models forced with greenhouse gas concentration scenarios. These results depend on how well models capture the climate system's response to greenhouse forcing. We want to complement this knowledge with lessons from the past climate. The advantage is that past climate simulations can be validated empirically – using 'proxies' (pollen, sediment...)³. **The Last Interglacial (~127,000 years ago)** is fit for this, because it has key resemblances with projected future climate (Fig. 1), and because it is relatively recent. Here we analyze the Last Interglacial hydroclimate through models and proxies. Then **we will simulate Last Interglacial floods**.

	Last Interglacial (~127,000 years ago)	Future (until year 2100)
Global surface air temperature	+ 0.7 ± 0.6°C ⁸ ; + 1.5°C ⁹	+ 0.6 up to + 7°C (CMIP5 ensemble ¹)
Northern Hemisphere temperature	Up to 5-10°C warmer than present ⁸	+ 1 up to 7°C / century ¹⁰
Mean sea level	+ 5-9 m ¹¹	+ 0.5-2 m ¹²
Orbital parameters	Slightly higher northern hemisph. insolation ¹³	As at present
Atmospheric [CO ₂]	~ 290 ppm ¹⁴	From ~400 to >1000 ppm ¹
Ocean circulation	Less vigorous ¹⁵	Less vigorous Atlantic circulation ⁷
Ice sheets	Much reduced polar ice sheets ¹⁶ ; West Antarctica collapse ¹¹	Marked reduction in ice sheet coverage; West Antarctica collapse ¹⁷
Vegetation cover	Poleward expansion ¹³	Poleward expansion, but highly dependent on land-use ¹⁸
Monsoon systems	Stronger ²	Stronger ¹⁹

Fig. 1: Analogies and differences between the Last Interglacial and the expected warmer future

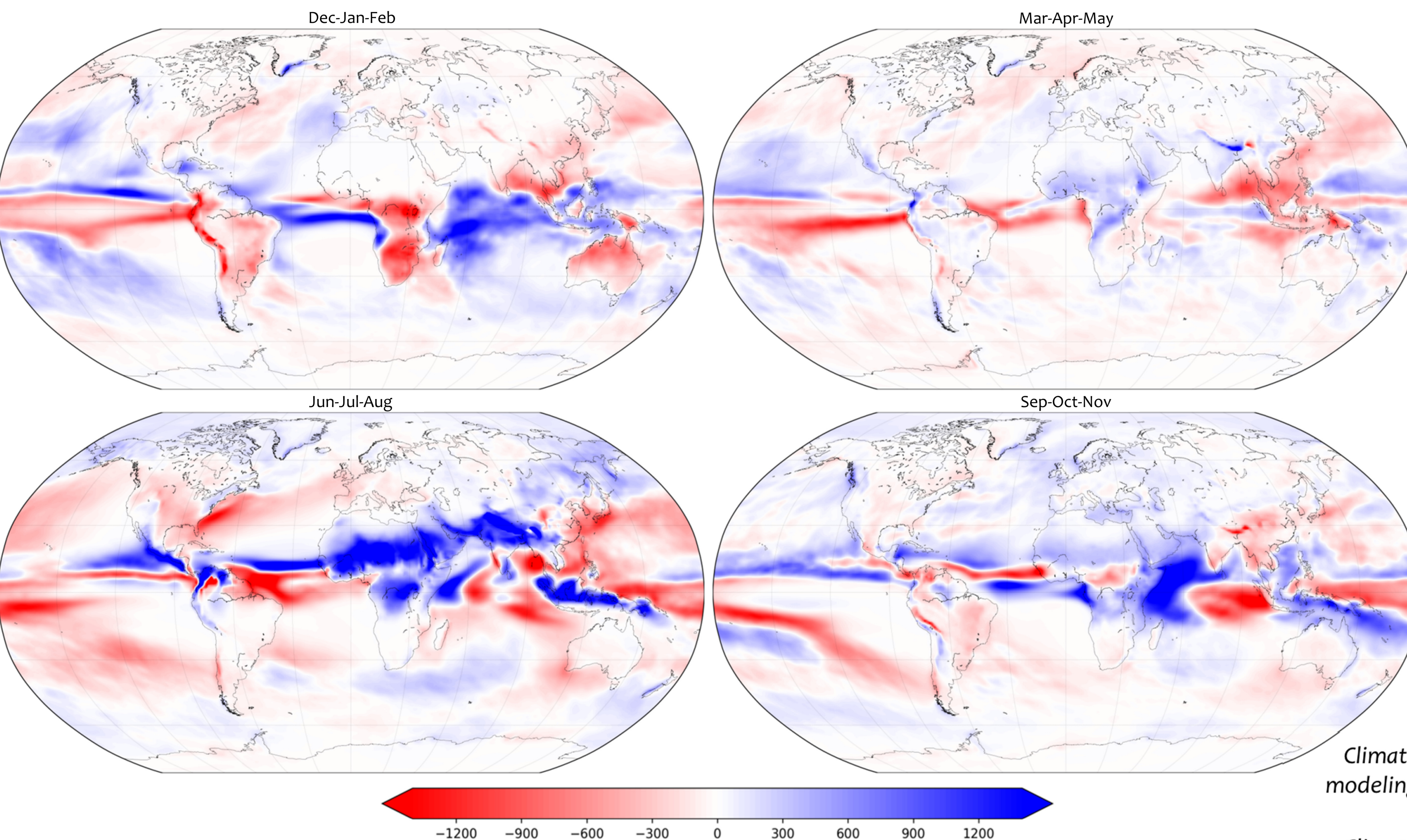


Fig. 2: Precipitation difference between Last Interglacial and Preindustrial (mm/year; blue = wetter Last Interglacial) with CESM1.2

II – What we are doing

In the Last Interglacial Floods project (Fig. 3), we:

- 1) Analyse daily precipitation from the latest Last Interglacial models of CMIP6 generation: CESM1.2, NorESM-L, EC-EARTH3.2, IPSL-CM6-LR, CNMR-CM, NUIST-CSM and potentially more, and compare it to preindustrial (Fig. 2) and future climate. We look at long (~300-year) time series to understand patterns of precipitation extremes.
- 2) Compare and validate precipitation patterns from the models with paleoclimate proxies.
- 3) Input daily variables from the paleo climate models in a hydrological model (PRC-GLOBWB, CWATM⁴), to obtain river discharges, and in turn in a hydrodynamic model (CaMa Flood⁵) to simulate river flood hazard at 30'' resolution.
- 4) Calculate river flood risk, as if the past climate were to replicate in the future. We will use the GLOFRIS framework⁶. We project flood impacts based on datasets of vulnerability and exposure of population and assets from SSP scenarios. We plan to assess risk indicators established in consultation with stakeholders involved in long-term development action, and in investments on climate adaptation.
- 5) Will also study changes in storm surge and coastal flooding, with the GTSM model⁸; plus we will look at changing patterns of meteorological drought. But these are topic for another poster, or for discussing in person.

III – What we can do for you, what you can do with us

Do you also wonder what would happen if our future climate were to look like the Last Interglacial? Let us know what risk and impact indicators are most useful to your work, and we will try to calculate them.

We are interested in collaborations. If you are a modeler of climate impacts, or of regional or global hydrology, we would like to discuss how to expand the scope of our project and investigate other implications of the Last Interglacial climate.

Stay tuned for the first results soon.

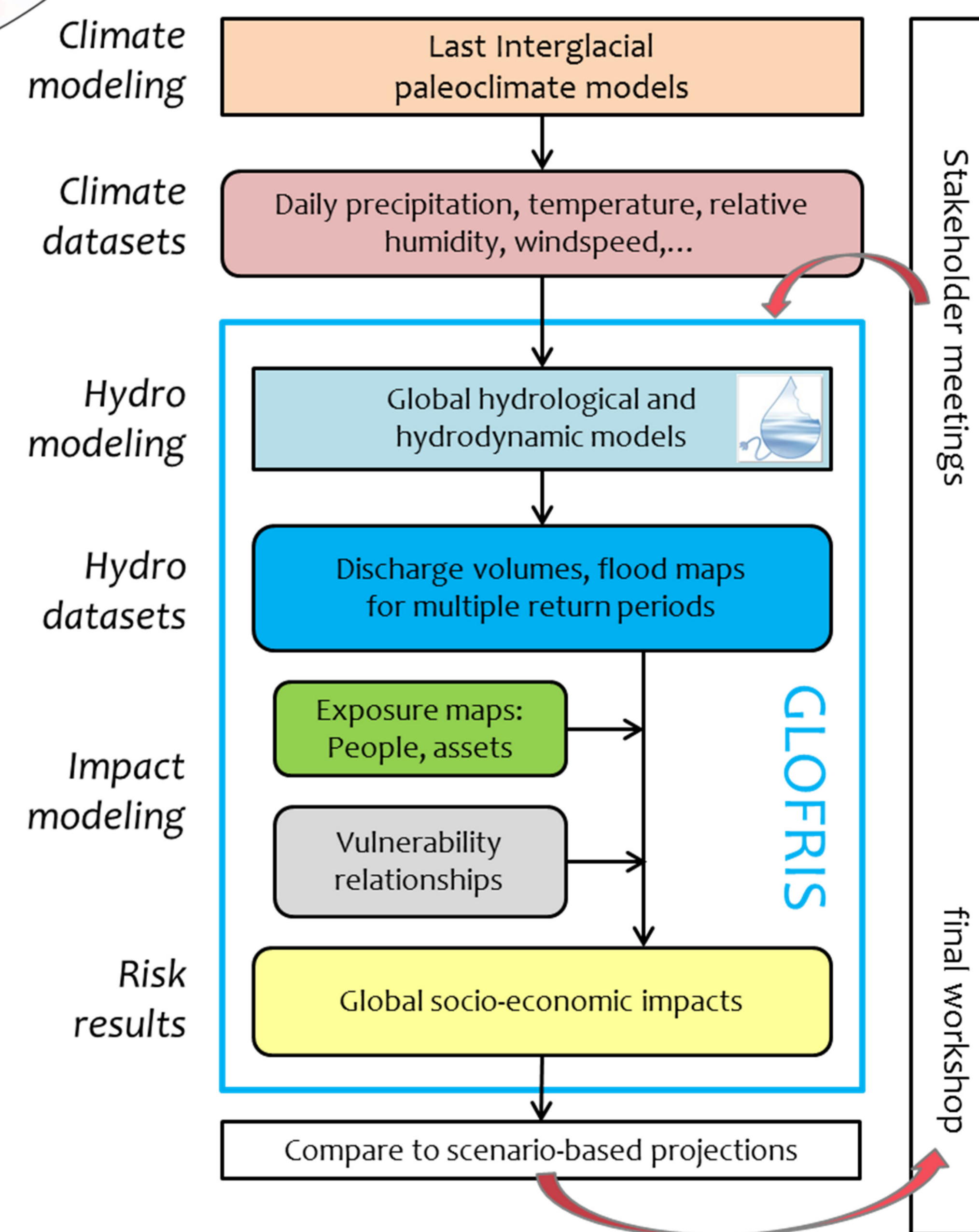


Fig. 3: Structure of the project

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