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Impact of Earth's orbit and fresh water fluxes on Holocene climate mean seasonal cycle and ENSO characteristics

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The El-Niño/Southern Oscillation (ENSO) is the major mode of climate variability in the tropical regions. Past climate indicators such as coral records from the Pacific Ocean or laminated lakes deposits in Ecuador show substantial variations in ENSO activity in the past. They suggest that ENSO acquired its modern characteristics about 5000 ky ago. These past periods provide a unique opportunity to test our understanding of ENSO fluctuations and of the linkages between ENSO variability and climate seasonality.

Here we use a set of simulations of the Early and Mid-Holocene with the IPSL_CM4 coupled ocean-atmosphere general circulation model in order to investigate the ENSO response to Holocene insolation changes and to fresh water release in the north Atlantic. We first consider simulations of 9.5 kyr BP (Early Holocene) and 6 kyr BP (mid-Holocene) for which only the changes in the Earth's orbital parameters are accounted for. In two additional simulations of the early and mid-Holocene we also switch on a crude parameterisation of ice-sheet melting, and consider thus the impact of a fresh water flux in the North-Atlantic.

The presentation will discuss the impact of the changes in insolation and in the fresh water release on the characteristics of El-Niño and La-Niña events from composite analyses. The analyses will focus on the relative influence of changes in seasonality and changes in the characteristics of El-Niño and La Niña events on SST and precipitation in different places of the Pacific Ocean. We will then investigate how these results can be used to provide some guidelines to interpret the numerous proxy data used to study ENSO activity and to evaluate the model's ability to properly reproduce it at different time scales.