

L-IPSL post-doctoral fellow offer in decadal variability

Title: Coupled reconstructions of the climate variability since the early 20th century.

The excellence laboratory L-IPSL of the *Institut Pierre-Simon Laplace* offers a post-doctoral position of 2 years to perform and analyze ocean-atmosphere coupled reconstructions of the recent climate variability.

Context: The understanding and perception of climate change due to human activities is complicated by internal variability that occurs over a wide range of time scales (from days to several decades). This internal variability arises from the chaotic nature of fluid motions and from the interactions between the components of the climate system (atmosphere, ocean, cryosphere, continents and biosphere). It comes in addition to externally forced variability from both natural (solar activity and volcanism) and anthropogenic sources (emissions of greenhouse gases –GHG, sulfate aerosols, land-use, *etc.*).

This project aims to understand the role of the ocean in the 20th century climate variability to better understand and anticipate future climate evolution in the context of climate change. For this purpose, we propose to perform reconstructions of the climate over the historical period (from around 1850) in which internal variability to observations is constrained to observations. This is achieved through nudging techniques in a coupled climate model. Each external forcing can then be considered alternatively in order to advance on the attribution of the past observed variations. The project will benefit from the unprecedented amount of high quality observations during the last decades, notably in the ocean.

Description of work: Given the central role of the ocean in the global scale variability, reconstructions of the global climate variability have to be performed in ocean-atmosphere-cryosphere coupled mode. Building on extensive expertise and recent results in the IPSL decadal group, we will investigate new methods to constrain climate simulations to the observed variability. We propose to focus initially on perfect model configurations in order to understand the mechanisms governing the adjustment of the model to the observations. The methods that show potential in the perfect model set up will be then tested in historical conditions. This will eventually contribute to the realisation of coupled reconstructions of the climate variability over the 20th century based on the IPSL model, to be use as a shared resource for a number of IPSL projects.

In a first step, we will pursue the methodology developed at IPSL where the ocean is only constrained from the surface. The objective is both to avoid tampering with the oceanic internal dynamical and to benefit from multi-decadal surface observations. A recent test in a perfect model framework has shown that combining a physical understanding of the variability mechanisms and a simple nudging with a variable physically-based restoring coefficient is quite successful at reproducing extreme events of the large scale oceanic circulation. This exciting new approach will be tested in historical conditions, addressing challenges related to data availability and model biases

In a second step, the coupled model could be constrained in specific regions/domains or using specific forcings to explore the mechanisms of the reconstruction and teleconnections, including over land. The use of a dynamical atmosphere nudging could also be tested. Supposing that atmospheric circulation is weakly sensitive to external forcing, this set up will indeed allow performing conditional attribution experiments, where external forcings are only applied separately and successively, in order to understand the causality of the different fluctuations observed in the climate system and their link with anthropogenic forcing or natural variations.

Supervision and working environment: The work will be conducted under the main supervision of J. Mignot (LOCEAN), E. Guilyardi (LOCEAN) and D. Swingedouw (EPOC). It will be performed within the project “understanding and attributing climate variability since the early 20th century, funded by the Labex L-IPSL and involving 6 laboratories of the IPSL federation. The candidate will thus benefit from rich interactions with ocean, atmosphere and climate dynamics experts as well as external forcings, climate modelling, data reanalysis and reconstructions experts, all present at IPSL. This work will also contribute to the recently funded H2020-Blue Action proposal, in which inter-comparisons of climate reconstructions over the recent decades are proposed as well as decadal hindcasts based on improved reconstructions of initial conditions. The work will be mainly conducted at LOCEAN, with regular trips to EPOC (Bordeaux)

Duration and salary: The post-doctorate will be recruited for 24 months with a net monthly salary around 2000 euros, commensurate with experience. This includes social services and health insurance.

Contact for applications: Applications should include a vita, a statement of research interests and the names of at least two references including e-mail addresses and phone numbers. Applications should be submitted by e-mail to Juliette Mignot (juliette.mignot@locean-ipsl.upmc.fr) and Eric Guilyardi (eric.guilyardi@locean-ipsl.upmc.fr).