Four Positions are sought for post-doctorate fellows at the Laboratoire des Sciences du Climat et de l'Environnement (LSCE), located south of Paris (http://www.lsce.ipsl.fr/) on the following topics:

Modelling the effect of droughts on the C balance of terrestrial ecosystems
3 years position.

EU funded CARBO-EXTREME project

A key source of uncertainty in projecting the future response of land ecosystems to climate change is the impact of extreme events, in particular severe droughts. Current terrestrial biosphere models describe CO_2, H_2O and energy fluxes between vegetation and atmosphere in response to variable weather and climate, but the response of ecosystem carbon pools is yet poorly understood. Extreme climate events impact the short-term behaviour of fluxes. For instance, during the extreme summer heat in 2003 over Europe, several forests stopped taking up CO_2 during few weeks. Extreme events also cause lagged effects on carbon pools, in particular for forest ecosystems. On the one hand, a 'bad year' will legate less litter to be decomposed later on, which creates an abnormal C sink. On the other hand, tree damage, mortality, decreased reserves and greater vulnerability to pathogens may diminish durably the capacity of trees to fix CO_2 from the atmosphere and increase soil respiration To gain insights on these effects, long term observations and process studies are needed, that can be combined with improved models.

The candidate will work in the framework of the CARBO-EXTREME project, funded by the EU. In that project, a new dataset of long-term proxies of C fluxes will be compiled, including tree ring growth, regional forest biomass inventories, crop yields, and harmonized long-term satellite data. Three steps are foreseen :

- Participate to the harmonisation and synthesis of long-term time series, in collaboration with other partners in the project.
- Adapt the process based ecosystem model ORCHIDEE to account for some lagged effects (reserves) and run it at the long term observation sites
- Evaluate the model performances, make possible improvements and perform European wide simulations for the last century

For each of these steps, at least one lead-author publication is foreseen. The cross-disciplinary nature of the proposed research will likely generate several collaborative publications as well. Salary is commensurate with experience, and includes full social and health benefits.

The work will be carried out at the LSCE in the biosphere modelling team with Philippe Ciais, Philippe Peylin, Nicolas Viovy, Nicolas Vuichard, Pierre Friedlingstein, Juliette Lathière. Strong collaboration with Markus Reichstein and his group at MPI-Jena, and other partners are planned.

Applications including CV, letter of motivation and the names of two reference persons should be sent to Philippe Ciais (philippe.ciais@cea.fr), and Philippe Peylin (philippe.peylin@lsce.ipsl.fr)

Assimilating carbon cycle data in a terrestrial ecosystem model to improve future prediction of the C cycle. A 3 years position.

EU-funded CARBO-EXTREME project

Process-based models used to simulate the response of the terrestrial ecosystems to environmental changes at the regional/global scales (CO_2, H_2O and energy fluxes) rely on generic hypothesis and empirical parameterizations that are poorly calibrated against observations. These uncertainties hamper the estimation of net ecosystem carbon balance and the prediction of future land carbon uptake and climate change. Currently, an increasing number of long term carbon cycle related observations, with information on very different time and space scales, becomes available for model validation and model optimization. In this context, there is a crucial need for model-data fusion approaches.

The first objective of the proposed position is to optimize the ORCHIDEE land surface model, developed at the IPSL institute, using very diverse data and a Bayesian variational framework, taking advantage of the adjoint code of the model. The approach will allow maximum consistency between theory and data at different scales, from net ecosystem measurements (eddy-covariance data) to time integrated measures of tree growth, remote sensing integrated observations and spatially integrated information (via atmospheric concentrations). It will also result in well-defined uncertainties. The second objective is to drive the optimized model with regional and global climate scenarios to provide spatially explicit sources and sinks scenario of the terrestrial ecosystems, with a special focus on Europe.
The candidate will start to work in the framework of the EU-funded CARBO-EXTREME project and most likely follow with another project, CARBONES. Several steps are foreseen:

- relate ORCHIDEE model outputs to specific observations and prepare the optimization set-up,
- perform model parameter optimizations using observations related to extreme climate events (gathered within the Carbo-Extreme project: fluxnet data, tree ring growth, forest biomass inventories,…)
- perform future scenario simulations with a specific attention on uncertainties propagation; analyse the vulnerability of the terrestrial carbon cycle together with other partner of the project
- continue with a 30-yr reanalysis of the global carbon cycle assimilating available data (the candidate will be responsible of the land component in a team project).

The work will be carried out at the LSCE in the "inversion-assimilation" modelling team with Philippe Peylin, Philippe Ciais, Peter Rayner, Frederic Chevallier, Nicolas Viovy, and other partners. It involves cross-disciplinary skills (optimization, biophysics) and will most likely lead to several high profile publications. Salary is commensurate with experience, and includes full social and health benefits.

Applications including CV, letter of motivation and the names of two reference persons should be sent to Philippe Peylin (peylin@lsce.ipsl.fr) and Philippe Ciais (philippe.ciais@cea.fr)

Modelling the interaction between climate change and carbon cycle under mitigation scenarios economy. A 2 years position.

 French GIS-DECLIC project

Future scenarios of greenhouse gases emissions are based on assumptions on the future evolution of the main drivers, such as energy use, land use and carbon sequestration strategies. Models that couple the physical climate system are now coupled to models of the terrestrial (and ocean) carbon cycle. In the context of the next IPCC report, such coupled models will be used in order to project the 21st century climate change as well as the anthropogenic CO2 emissions that could be sustained.

The candidate will work in the framework of DECLIC, a project funded by the French GIS Climat-Environnement-Société trans-disciplinary programme (http://www.gisclimat.fr/). Within the project, the objective is to investigate the effect of climate mitigation strategies, based on land carbon cycle management, on climate change and the global carbon cycle. Using a coupled climate-carbon cycle model, the candidate will estimate for a given set of future atmospheric CO2 stabilization targets what are the permissible emissions that are consistent with such target. Then the candidate will evaluate the different potential economical pathways that could lead to such decreasing emissions. In particular, strategies making use of land resources such as afforestation, or intensive use of biofuels will be quantified. Indirect climate effect of such mitigation strategies (due to change in physical or biogeochemical properties) will be also evaluated.

Part of the work will consist of development of model component, and coupling between the biogeochemical and economical aspects of the land use component. Specific modules describing mitigation strategies such as biofuels or Carbon Storage and Sequestration may be needed to be introduced in the model. This work could lead to several high profile publications and make a contribution to the IPCC 5th Assessment Report. Salary is commensurate with experience, and includes full social and health benefits.

Thee work will be carried out at the LSCE institute, in the biosphere modelling team with Pierre Friedlingstein, Philippe Ciais and Patricia Cadule together with Renaud Crassous and Thierry Brunelle at the CIRED economics laboratory in Paris.

Applications including CV, letter of motivation and the names of two reference persons should be sent to Pierre Friedlingstein (pierre.friedlingstein@lsce.ipsl.fr) and Philippe Ciais (philippe.ciais@cea.fr)

Inverse modelling of CO2 fluxes using atmospheric data to improve the carbon balance of the Northern Hemisphere. A 2.5 years position.

EU-funded COCOS project

In the framework of the EU-funded COCOS project (http://www.cocos-carbon.org/), the Laboratoire des Sciences du Climat et de l'Environnement (LSCE) is seeking a postdoctoral fellow for a 2.5-year fellowship on inverse modelling of CO2 fluxes in the context of the Northern Hemispheric carbon sink. The project will involve the application of state-of-the-art atmospheric transport models coupled to a variational inversion system. Focus will be on understanding the processes that are controlling the variability of surface CO2 fluxes in linkage with fires, land use and forestry practice, and the response of land ecosystems and ocean biogeochemistry to modes of climate variability.

The objectives of the project can be divided into two parts:
1) The candidate will first valorize an existing "inversion system" based on the global transport model, LMDz. Particular attention will be given to the quantification and analysis of errors in inverse modelling, using new data and information collected worldwide within the COCOS project.
2) He/She will then improve the system with the use of a meso-scale transport model, CHIMERE, and focus on Western Europe and the North Atlantic, two regions of particular interest where dense observation networks are available in the ocean, atmosphere and at the land surface.

We expect the project to produce an increasingly detailed and robust picture of the Northern Hemisphere and European carbon cycle. The LSCE's position in European carbon cycle research will also give the fellow immediate access to the range of high-quality data, leaving them ideally placed for rapid and high-profile publications. A strong involvement is expected in the international workshops that will organized by COCOS in the framework of developing a global, coordinated carbon cycle observing system.

The research will take place within the Inversion and Satellite team (INVSAT) at LSCE, one of the world's leading groups on trace gas inversion and related problems (F. Chevallier, P. Ciais, P. Rayner, P. Peylin, M. Ramonet). Salary is commensurate with experience, and includes full social and health benefits.

Applications including CV, letter of motivation and the names of two reference persons should be sent to Philippe Ciais (philippe.ciais@cea.fr) and Frederic Chevallier (frederic.chevallier@lsce.ipsl.fr)