Research engineer in data assimilation for the inversion of greenhouse gas emissions fluxes

Publication date: 15th of October, 2018
Reference : CDD VERIFY INGE
Location : LSCE-Orme, sur le Plateau de Saclay, à 25 km au sud-ouest de Paris
Contract type : CDD
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Description:

Using atmospheric data to improve our knowledge of biogeochemical cycles, and particularly of the sources and sinks of greenhouse gases (GHGs) and their precursors is a major challenge for the next decade at the local to regional scales.

There are various scientific and society-related issues which require better separating natural and anthropogenic fluxes, quantifying and spatializing carbon dioxyde (CO_2) sinks, estimating and reducing uncertainties on methane (CH_4) and nitrous oxide (N_2O) fluxes and verifying the emissions reported by countries or groups of countries, which have ratified international treaties.

The numerical tools which are used for the atmospheric monitoring of GHG fluxes combine atmospheric transport models at various scales together with statistical methods in the domain of data assimilation and inverse problems to convert the atmospheric observations into GHG fluxes. Data assimilation methods are a powerful tool that makes it possible to obtain a synergy between numerical models and observations of the chemical composition of the atmosphere in order to estimate the fluxes of various species together with their related uncertainties. They may be used to deal with research issues as well as with problems which require an operational approach, necessary to deal with large data fluxes (domain of the "big data").

In Europe, atmospheric surface stations have been providing data for a number of years and the ICOS (Integrated Carbon Observing System) network should reach 50 sites in nominal state. For a few years, satellite carbon monoxide (CO), CH_4, CO_2 and NO_2 data have also been available and an ensemble of satellite missions for GHGs is planned at short and middle-term (Sentinel 5P, GOSAT2, MERLIN, MICROCARB, GeoCARB). These new large data sets are challenging to treat and explore.

In this context, the H2020 VERIFY project (funded by the European Union) includes activites on the use of satellite data for inverting CH_4, CO_2 and N_2O fluxes in Europe, by making use of atmospheric measurements of these species as well as other species linked to them, such as NO_2 or CO.

Work description:

The person in this position will participate in the developments of the LSCE inverse system required to assimilate both satellite data and surface data in order to provide estimates of CH_4, CO_2 and N_2O fluxes in Europe from 2005 to 2016 at a weekly scale.

The LSCE inversion system has been set-up and used for numerous studies dealing with CO_2 fluxes and reactive species. An update is currently being finalized, the most recent version will have to be used for CH_4, CO_2 and N_2O.

The expected work includes:

- formating all required data: surface measurements, satellite data, emission inventories, boundary conditions
- retrieving meteorological data (grib files from ECMWF, some are already available at LSCE)
- creating input data for the simulations: this involves adapting already existing scripts and, if possible, optimizing them
- implementing in the inverse code itself the developments which will be made and tested in a first stage by the researchers involved in the project, if possible, optimizing them and validating the new sections of code
- providing the outputs in the format required by the VERIFY protocol
- participating in the exploitation and interpretation of the results with the researchers involved in the project, including writing reports and presenting the work in conferences.

Technical requirements:

- fortran
- python (particularly numpy, pandas, gdal)
- various shells, Linux, parallel computing cluster
- English, writing skills for documentation and tutorials, particularly on a wiki,
- some knowledge in linear and bi-linear algebra

Other information :

Salary will depend on the applicant's degrees and experience.

Beginning: October 2018. End: December 2019.

To apply, please send cover letter and detailed CV by e-mail to the contact person with the reference in the subject.

This position is open to persons with disabilities.