

PhD Studentship

Development of new homogenisation methods for atmospheric GNSS data. Application to the study of climate variability.

Supervisors:

Dr. Habil. Olivier BOCK (IGN)

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Hosting institution: IGN - LAREG, University Paris Diderot, 35 rue Hélène Brion, 75013 Paris, France

Application deadline: November 30th, 2016

Project description:

Long records of observational data are essential to climate research. Space geodetic techniques such as GNSS (Global Navigation Satellite Systems) provide observations of tropospheric delays and integrated water vapour for more than 20 years. However, similar to every observing system, the global GNSS data are affected by temporal inhomogeneities due to changes in the instruments (sensors, processing software, measurement practice, etc.) or in measurement conditions (relocations of instrument, change in the electromagnetic environment of the antenna, etc.). The inhomogeneities manifest usually as artificial shifts in the time series which can lead to erroneous interpretation as a climate signal. It is crucial to detect and correct the inhomogeneities in long GNSS time series before they can be used faithfully to assess climate change and variability. The detection of artificial shift in time series is complex because not all instrumental changes are actually documented in logsheets, some shifts are not due to instrumental changes but to changes in measurement conditions, and the number of stations is continuously increasing. As a consequence, only automatic statistical homogenisation methods can be reasonably be used. New homogenisation methods need to be developed to account for the statistical properties of GNSS data.

The goals of this PhD are: (1) to comprehensively characterize the GNSS tropospheric data (zenith delays, gradients, and integrated water vapour) available for different domains and periods (from regional to global); (2) model the data by proper stochastic models and infer the optimal detection and estimation procedures (e.g. using maximum likelihood) and implement rapid and exact algorithms. Therefore, the methodology used by AgroParisTech for molecular biology will be applied to develop new, innovative, homogenisation methods for GNSS tropospheric data. The model and methods will be tested on the basis of simulation benchmarks and compared to more traditional approaches. (3) Apply the algorithms on real GNSS data and use the homogenized data to analyse the water vapour trends and variability and to validate regional and global climate model simulations (e.g. CORDEX, CMIP5).

Collaborative framework:

This work will take place in a broad collaborative framework developed in France between IGN and AgroParisTech and in Europe in the framework of the COST Action ES1206 (GNSS4SWEC).

Contact for informal enquiries: Dr Olivier Bock (Olivier.Bock@ign.fr)

Eligibility:

Applicants for a studentship must have obtained, or be about to obtain, a Master 2 degree or higher in sciences (mathematics, physics), if possible specialized in geodesy and/or climatology, and with good skills in statistics and computer programming. Good communication skills are essential too as the candidate will join a collaborative project between several research institutions in France and in Europe.

The three-year studentship is expected to start as soon as 1st December 2016. The monthly stipend is 1680 € during three years. The contract can include an additional mission of teaching, dissemination of scientific and technical information, valuation, or expertise. In that case the monthly stipend is raised to 2020 €.

Application procedures:

Please send your application to Olivier.bock@ign.fr and emilie.lebarbier@agroparistech.fr

The applications should clearly identify the title of the project and include the following documents:

- CV (including any publications)
- Covering letter (outlining your academic interests, prior research experience and reasons for wishing to undertake this project)
- Transcript (this should be an interim transcript if you are still studying)
- Reference letter from Master study manager.
- References from recognized personalities in the scientific field are welcome (the references can be emailed direct to Olivier.Bock@ign.fr)

After a first selection based on these documents, the admissible candidates will be invited for an interview either on-site or remotely (e.g. by Skype). The admission will be stated after the interview.