ÉCOLE DOCTORALE
SCIENCES DE LA TERRE ET DE L'ENVIRONNEMENT
ET PHYSIQUE DE L'UNIVERS, PARIS

Subject offered for a contract starting october 2015

SUBJECT TITTLE: Response of the Earth to seasonal loads

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Second Advisor: **FLEITOUT, Luce, DR, fleitout@geologie.ens.fr**
Host lab/ Team : ***Géodynamique ; Géodésie et Sismologie, ENS;***
Collaboration: Tonie VAN DAM, Luxembourg

Financing: Doctoral contract from CNES and Luxembourg University

For more information go to http://ed560.ipgp.fr*, section: Offres de these (PhD offer), You must apply on the Doctoral School website*

Presentation of the subject:

Context. The GRACE space gravity mission has largely demonstrated that spatial and temporal variations of mass caused in particular by continental water (liquid or ice) were measurable. A number of studies have hence compared the deformation of the Earth surface caused by loads derived from GRACE to direct observations from precise GNSS positioning. Such deformation calculations assume an elastic Earth model, with a half-space or a spherically geometry using for instance the PREM elastic stratification. The agreement between models and observations is generally good for the vertical component. It is not the case for the horizontal component, which shows significant disagreements both in phase and amplitude between observations and models and is therefore rarely considered in publications. Recents studies in our group indicate that this disagreement probably results from the fact that the PREM model, constrained by seismological observables with periods < 100 seconds, is not adequate at the annual time scale.

Methodology. The student will process GRACE and GNSS data to compare global deformation models derived from GRACE to observations measured by GNSS, with a focus on the horizontal component. He/she will develop new algorithms to compare observations and models of Earth deformation caused by loads using a spectral method that has been throughly validated. The student will test an ensemble of Earth models in order to determine the parameters that best explain both the vertical and horizontal components of GNSS positioning forced by seasonal loads. He/she will attempt to explain these parameters in terms of viscous relaxation or kinematics of mantle phase transitions.

Expected results. The combination of positoning and gravity data from space will allows us to improve both our knowledge of the inner Earth and our understanding of the signal contained in GNSS measurements. This work will have broad implications across space geodesy and geophysics, two scientific domains often considered separately but tightly connected. The expected results will improve our ability to extract pertinent information from geodetic data, with direct implications on the definition of global geodetic reference frames, seismic hazard on major active faults, continental hydrological balance, postgacial rebound, sea level changes, and therefore the global climate system.

The project will be cofunded by CNES (French Space Agency) and Luxembourg University. The PHD student will interact mainly with E. Calais and L. Fleitout in Paris and with T. Van Dam in Luxembourg. Successful candidates must have a strong background in geophysics and/or physics, and a solid background in computing. Applicants should send a vitae, a motivation statement, and a list of 3 references to Eric Calais (eric.calais@ens.fr), Luce Fleitout (fleitout@geologie.ens.fr), and Tonie Van Dam (tonie.vandam@uni.lu).