La Rochelle Université

D R P I
Direction Recherche
Partenariats Innovation

PhD Opportunity- Full Grant (37 months)	
Research Unit : LIENSs	**Graduation Institution : EUCLIDE**

Title:

Role of sediment redistributions on coastal subsidence and Relative Sea Level rise at present and in the near future

Advising team:

Celine Grall (Researcher,CNRS, **Pi**) and **Eric Chaumillon** (Professor, La Rochelle University, **co-Pi**).

Summary and Broad Impact :

The **relative sea level** (**RSL**) is the resulting elevation changes in between the moving sea and land. RSL is critical on explaining shoreline trajectory, land lost and gain in coastal areas, and in turn is essential regarding **sea level hazards**. RSL predictions by 2100 are highly variable over the different **coastal territories**. At high latitude (>45°), RSL rises at a significantly lower rate than in regions closer to the Equator. This difference is, at the first order, explained by **land displacements** and in particular, land displacements induced by mass redistributions at the earth surface. Such gravity-induced displacements by the redistribution of water (in between ocean and ice sheets) and sediments (erosion/sedimentation) name **isostatic adjustments**. At high latitude, the ice sheet retreat that occurs since the beginning of the present interglacial/warming period (18 500 years ago) and that have significantly accelerated since the industrial times, induces a regional (near-field) rate of land uplift (names post-glacial rebound). In contrast, territories at lower latitude are far field from the ice sheets, and instead of uplift, coastal subsidence, i.e. land burial of coastal territories, often occurs in these territories.

Coastal subsidence can reach very critical (1 or several cm/yr at present) rates in lots of territories. This is particularly true in large **delta plains**, where, **massive sediment redistributions through the ocean-land continuum induce significant regional sediment isostasy and in turn coastal subsidence. In such environment, RSL is rising at a fast rate and associated sea level hazard predictions are extremely alarming.**

In Sea Level sciences, Glacio-hydro-Isostatic Adjustments (namely GIA) are broadly considered on Sea Level predictions as well as on analyzing sea level indexes (such as tide gauges for instance). Global modelling parameters (such as Ice and Water history) are available to the community for considering such processes. Among others, an example is the ICE models (https://www.atmosp.physics.utoronto.ca/~peltier/data.php) that are free accessible for computing GIA and the RSL at present. **Similar grid describing changes of sediment redistribution are missing and thus, up to date, no global model considering the effect of such redistribution on RSL prediction is available. The main target of this PhD program is to build up such model. We will produce a gridded that describing the sediment redistribution since the Last Glacial Maximum (LGM, 18 500 yrs ago) in order to consider this effect on estimating RSL today and in the near future.**

A particular attention will be given to solve regional sediment redistribution over large delta plains, as they are a priority for managing global environmental changes.

This PhD program, fully funded by La Rochelle University and CNRS (37 months), will help on better considering coastal subsidence on RSL at present and in the near future.

PhD working plan :

This 37 months PhD program includes **3 different working packages (WPs)**:

- WP1, ~8 months, the student will work on integrating in a **world GIS database** all observed information about **sedimentation** that can be find on open scientific databases as well as scientific publications. We will define regional morphodynamic units over the earth according to these observations and the morphotectonic context.

- WP2, ~ 16 months, the student will build up **regional 2D stratigraphic models** for reconstruction the sediment fluxes since the LGM. Each morphodynamic unit will be resolve by few 2D stratigraphic sections. We will use the python based program Sequence 2d, implemented in the Landlab library. This modelling approach allows to couple deep and shallow processes on stratigraphic reconstructions. The overall target will be to determine the shoreline trajectory since the LGM. Models will be developed first at a resolution of 20 km, but they will be build up with the target of improving the resolution. The student will work in more detailed, on few well-documented morphodynamic units, in order to test the sensitivity of the models to the parameters.

- WP3, ~ 12 months, the student will **couple Sequence 2D with a python based program that enable to solve the Sea Level Equation**. This program is based on the mass conservative formulation of the Sea Level Equations, which allows to solve the RSL by considering isostatic adjustments associated with surface load redistributions. A systematic exploration of the effects of different parameters on the RSL will be carry out, in order to identify the role of each parameter on it, globally and regionally.

All models will be published in Rank-A publications and made publically available online.

Candidate profile and required skills:

The expected candidate needs to have a **solid background in numerical modelling and Earth Sciences** (Master degree on one of this field at least). This is a required criterion. A preference will be given to a candidate with a **previous experience** (internship and/or working position**) in academic research**. A fluency in English is preferable, international applications are welcome, and the scholarship is not under any restriction on age nor nationality.

A person with a **strong intellectual curiosity and deductive skills, as well as a taste for communication** should find themselves comfortable in this PhD program and in our research team.

The student will be mainly located in LIENSs (LIttoral, ENvironment and Societies, https://lienss.univ-larochelle.fr/?lang=en) at La Rochelle University, France (West Coast). The student will also do a long stay at the LDEO of Columbia University (USA). This PhD program is **fully funded by La Rochelle University and CNRS (37 months). The preferred starting date is September 1st 2021. This PhD program will evolve through the following research program**: NSF EAR 19 25974 (2019-2023) and the DELTA ANR (2018-2021, ANR-17-CE03-0001).

We care about the target of doing educational opportunities at University fully inclusive and fighting against all discriminations. The working space is adaptable to reduce mobility, deafness and hearing loss (basics on sign language).

How to apply?

For applying to this PhD program, you need first to contact Celine Grall by email (celine.grall@univ-lr.fr or cgrall@ldeo.columbia.edu). Please attached to your email in a **unique pdf**, the following documents and information:
1. A curriculum vitae

2. A letter of intention where you introduce yourself, your interest to do a PhD and your interest for this PhD program
3. The name of 2 referees, working in research (either academic or private) with who you have worked or who has been your advisor in the frame of an internship.

Once you have contact Celine Grall, you may finalize your application here:
https://www.univ-larochelle.fr/wp-content/uploads/misc/CandidatureFinancementED-2021.rtf

Do not consider the deadline indicated in La Rochelle University website as the final deadline. The offer will be closed once the position full.