

The Gravimetry and Seismology Operational Directorate and Reference Frames and Planetology Operational Directorate of the Royal Observatory of Belgium and the Earth and Life Institute of the UCLouvain recruit a postdoctoral researcher in hydrogeodesy (Prf-2022-041_SEPARATOR).

Background

In the frame of the FED-tWIN programme of the Belgian Science Policy Office *BELSPO*, which aims at promoting research cooperation between Federal Research Institutes and Universities in Belgium, the Royal Observatory of Belgium (ROB) and the Earth and Life Institute (ELI) of the Université catholique de Louvain (UCLouvain) are recruiting a postdoctoral researcher in hydrology and geodesy. The person will be recruited with a contract of undetermined duration and we expect that the project will last at least 10 (ten) years.

Geodynamics at local (Belgium), regional (Europe) and global (world) scales unravels contributions from different processes: hydrological processes, Earth interior dynamics, climatic and anthropic processes contribute to the observed deformations. In order to elucidate elusive vertical crustal motion, we benefit now from nearly two decades of continuous GNSS measurements, terrestrial and spatial gravity measurements, and PSInSAR (Persistent Scatterer Interferometric Synthetic Aperture Radar) observations. Altogether these observations provide ever-increasing accuracy and spatial resolution of surface deformation.

The research project that the candidate will have to lead requires two lines of expertise, in which the ROB and ELI research groups have built a strong tradition. ROB has developed significant expertise in geodesy, which involves identifying crustal deformation at the sub-mm/yr level and in gravimetry, measuring mass change effects on gravity. The ELI group is an expert in remote sensing, hydrogeophysics, and modelling the critical zone.

The candidate will launch new promising hydro-geodetic research at the interface of 20 year-long collaboration between the Geodesy-Seismology-Gravimetry departments of the ROB and ELI-UCLouvain. The question will be to find the most effective combination of investigation methods among the wealth of available geodetic, geophysical, geologic and hydrologic information, and to prioritize the right cutting-edge approaches, with the objective to better disentangle and understand the deformations coming from geophysical or anthropological origins at local, regional and global scales.

Project

Geodetic signals are strongly influenced by hydrological effects, and their correction remains challenging. This is especially true for decadal or centennial oscillations and possible trends caused by the variations in the mass distribution associated with climate change or anthropological contributions. This masks geodynamic processes and separation techniques are needed to distinguish the hydrological signal from the solid-Earth signal or from anthropological signal contributions in geodetic observables.

Hydrological data and models are often too uncertain to cope with the highly variable terrestrial water mass distribution. One of the challenges consists in assessing the efficiency of hydrological data and models. Another challenge in hydrology is to build on the huge amount of geodetic information to improve the understanding of water mass distribution at different spatial and temporal scales. The lack of a consensual framework to correct hydrological effects in geodetic observables leads to significant uncertainties in the characterization of vertical land movements and associated seismic, volcanic, and flood hazards, as well as in Earth rotation.

The ROB will provide its comprehensive knowledge in geodynamics, geodesy, geophysics and metrology, while UCLouvain will bring its proficiency in hydrological observation and modelling. Both expertises are needed to resolve the hydrological and geodynamic signals.

Function

In the short term, the project aims at expanding research at the interface of geodesy and hydrology. The first two years of the FED-tWIN researcher's activity will be dedicated to:

1. Separation of the hydrological signal from man-induced and geodynamic land movements;
2. Estimation of the long-term climate and hydrometeorological alteration effects on geodetic time series (gravity, GNSS, InSAR);
3. Improving or developing local, regional and global hydrological models.

In parallel, we expect the FED-tWIN researcher will establish collaborations with international teams in the studies of uncertainties of geodetic observables. These efforts will lead to a better understanding of vertical land movements in and around Belgium. The candidate will also contribute to the practical work, such as the processing of geodetic measurements. He/she will further develop advanced hydrological modelling and advanced data mining techniques applicable to highly dimensional geophysical data.

At ELI, the candidate will contribute to the practical work and exercises of courses related to data mining and statistical hydrological modelling, taught to students in the Faculty of biosciences engineering, master of environmental sciences and engineering. For instance in courses with the option "analysis and management of information", "soil and water", "SMART technologies for environmental engineering", "Advanced hydrology for Engineers", "Data Mining", and "Data science in bioscience engineering". We also expect that he/she proposes in 2024 optional advanced courses related to his/her research and contributes to the organization of courses for thematic graduate schools (e.g. the FNRS-funded graduate school of Environmental Sciences, Technologies and Management).

All planned tasks will be performed in close interaction with the ROB and ELI teams, to both of which the researcher will be affiliated (as SW2 work leader at ROB; as a postdoctoral researcher at UCLouvain) and between which he/she will distribute his/her work time according to a bilateral agreement associated with the research profile. She/he will be expected to participate in the operational and administrative aspects of these departments, in particular in the fundraising of projects directly related to the research profile. This includes to embed her/his research activities within the broader research and outreach strategies of the institutions. With a 50% appointment in each institution, the FED-tWIN would however have limited administrative responsibilities at the department or faculty level.

Competences

The FED-tWIN project requires that applicants have obtained their PhD no more than 12 years before the job application submission date. This period is extended with 1 year for each long-term leave for a child or illness. The candidate will hold a PhD degree in Earth Sciences, civil engineering, physics, mathematics, or bio-engineering and ideally will have expertise in data analysis, advanced statistics, numerical computing, data processing, management of databases, and geosciences. A PhD in a different field might be acceptable if the candidate can demonstrate equivalent experience in one or more of those fields. General knowledge of remote sensing, geodesy, signal processing and data

mining is an asset. Another advantage is an experience in hydrological modelling, geodetic and data statistical analysis.

Experience in teaching at the bachelor and master levels is also valuable. In principle, teaching at the bachelor level at UCLouvain is in French. The candidate will also take part in operational activities at ROB.

If the master's and/or PhD degree were awarded outside of Belgium, the Netherlands and the Grand-Duchy of Luxembourg, a certificate to demonstrate the diploma equivalence will be needed during the procedure of the contract elaboration (see https://www.belgium.be/en/education/equivalence_of_diplomas).

The candidate could carry out missions in the field, in Belgium and abroad.

Practical information

Applications have to be sent to Veronique Dehant (v.dehant@oma.be) with a copy to hrrob@oma.be at the latest on July 31, 2023, 11:59 pm (CET - UTC+2).

The application must include

1. A detailed CV, with a publication list;
2. A motivation letter;
3. The candidate must provide two recommendation letters.

Candidates who take part in the interview will be asked to make a 20-minute presentation to the jury on their career and on the research that they have carried out, followed by a 10-minute presentation on their vision of research in the field of hydrogeology/hydrogeophysics/hydrogeodesy.

The time window for the signature of the employment contracts (one part-time at ROB, one part-time at UCLouvain): September 1st, 2023 – October 31th, 2023

Workplaces: **At ROB:** Gravimetry and Seismology Operational Directorate, Royal Observatory of Belgium – Ringlaan/Avenue Circulaire, 3, B-1180 Brussels, Belgium

At UCLouvain: Earth and Life Institute, Environmental sciences, Croix du Sud 2 bte L7.05.02 (Mendel C.079.30), 1348 Louvain-la-Neuve, Belgium

Contact persons:

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UCLouvain: Prof Marnik Vanclooster (marnik.vanclooster@uclouvain.be, +32-10-473710)

Website ROB: <http://observatoire.be> and <http://seismologie.oma.be/en>

Website ELI: <https://uclouvain.be/en/research-institutes/eli>