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1 PhD Fellow Position (3-year) available in the field of Earth System Modelling at the Faculty of Physics, Complutense University of Madrid, Spain.

Positions are part of the [CriticalEarth](#) project – a Horizon 2020 Marie Skłodowska-Curie Actions, Innovative Training Network (ITN).

We would like to encourage applications from *[candidates worldwide](#)* wishing to pursue a PhD degree in the field of [Earth System Modelling](#) with an interest in [ocean-atmosphere-cryosphere processes and tipping point behaviour](#).

The Complutense University of Madrid (UCM), Faculty of Physics, Department of Earth Physics and Astrophysics, is **offering one PhD Fellowship**, referred to as early-stage researchers (ESR) in Earth System Modelling, **starting between 01.03.2021 and 30.09.2021**. Our department studies the elements of the Earth and climate system – the atmosphere, oceans, ice sheets, sea ice, solid Earth, and the interactions between them.

The positions are posted as part of the exciting **CriticalEarth** project - “Multiscale Critical Transitions in the Earth System - funded through the Horizon 2020 Marie Skłodowska-Curie Actions programme under Grant number 956170.

You will join a network of 15 PhD Fellows (ESRs), trained to research new methods for assessing the mechanisms and associated risks of critical transitions in the climate. The focus will be on investigating how numerical simulations and complex mathematics can be used to predict and avoid irreversible climate change. The position will offer you an excellent background, working within a strong, cross-disciplinary network among leading universities and research institutions across Europe and with contacts to industry, governmental- and non-governmental institutions.

Project Description:

ESR Project Title: [Tipping in the past and future climate](#)

Principal supervisor: **Professor Marisa Montoya, UCM, Madrid, Spain.**

When the concept of tipping elements of the Earth System was introduced more than a decade ago, tipping was considered likely only under extreme global warming levels. However, this view is

changing and evidence is mounting that crossing of critical conditions could take place at lower global warming levels than initially thought. For instance, several studies suggest that on millennial timescales the Greenland and Antarctic ice sheets could have tipping points close to the 1.5–2.0°C threshold of the Paris agreement. For the Greenland ice sheet, this could lead to irreversible mass loss due to the surface mass balance–elevation feedback; for the Antarctic ice sheet, it could result in a collapse of major drainage basins due to ice-shelf weakening. Furthermore, tipping elements interact with each other and with the whole Earth System. Tipping can trigger positive feedbacks that could accelerate global warming, in particular bio-geophysical feedbacks. For instance, loss of the northern summer sea-ice at relatively low warming levels could accelerate Arctic amplification with implications for thawing of Siberian permafrost and melting of the Greenland ice sheet. Thus, exceeding tipping points in one system can increase the risk of crossing them in others. Such interaction can lead to tipping cascades that further increase the warming and impacts. However, these thresholds are based on a limited number of model studies. Because abrupt events might be found in the tails of statistical distributions, ensembles or long climate model runs may be required, which are generally not feasible with the most comprehensive models. This project aims at determining the critical forcing levels at which tipping of individual tipping elements can take place in high-dimensional Earth System Models (ESMs). Of particular interest is the rate at which the transition takes place and the degree of irreversibility implied, as well as how the interaction between tipping elements modifies the former critical levels, and whether it can lead to tipping cascades. To this end we will use ESMs of different complexity, aided by mathematical tools developed in the frame of the network. The use of an intermediate complexity, computationally efficient ESM will allow the performance of such long-term runs in ensemble mode. In this way structural (model-related) uncertainty can be assessed through ensembles of simulations for a range of uncertain model parameters. In addition, it will pave the way for the subsequent realisation of climate simulations with state-of-the-art ESMs.

Secondments for at least 6 months at the Potsdam Institute for Climate Impact Research (Potsdam, Germany) and KNMI (Utrecht, The Netherlands) will provide training in the use and interpretation of the Earth System Model results.

Job descriptions

The position is available for a 3-year period and your key tasks as a PhD student are:

- To work independently, develop and carry through your research project;
- Attend PhD courses to learn additional skills;
- Write scientific articles and your PhD thesis with support from your supervisors;
- Teach and disseminate your research, participate in network related and international conferences and workshops;
- To stay at a partner research institution for at least six months to develop new skills;
- Contribute to the everyday activities at the department.

Formal requirements for ESR

Applicants should hold an MSc degree in **Physics** with good results and good English skills. It is not an essential requirement, but any relevant work experience you may have or publications (if any) can also be considered in the assessment.

Eligibility: Because the aim of EU ITN projects is to attract candidates from worldwide locations, **applicants cannot** have resided and not have carried out their main activity (work, studies, etc.) in the country of the recruiting beneficiary for more than 12 months in the 3 years immediately before the recruitment date — unless as part of a procedure for obtaining refugee status under the Geneva Convention. *If you are applying from a location that requires a visa or permit, then we will be able to provide support and advice throughout the process of relocation for you and your family. Feel free to ask us questions in advance if you need more information and reassurance.*

The applicant must be an Early Stage Researcher (ESR) i.e. at the time of recruitment she/he must be in the first 4 years (full-time equivalent research experience) of her/his research careers and must not have been awarded a doctoral degree.

Further requirements: CriticalEarth will create an exciting environment for you to learn as PhD Fellows, and candidates should be able to demonstrate enthusiasm for research and a desire to learn new skills. You should also enjoy working independently and as part of a wider network of other students. All fellows must be willing to travel and will be required to complete international secondments.

Application Procedure:

The application, *in English*, must be submitted electronically by March 15th 2021.

Please send to principal supervisor Marisa Montoya (mmontoya@ucm.es) **a single pdf file containing the following:**

- Cover Letter, detailing your enthusiasm and background for applying for the PhD project.
- CV with relevant work experience (if any)
- Diploma and transcripts of records (BSc and MSc)
- Other information for consideration, e.g. list of publications (if any)
- 2 reference letters (if any)

The University wishes our staff to reflect the diversity of society and we welcome applications from all qualified candidates regardless of personal background. The selection will be exclusively based on qualification without regard to gender identity, sexual orientation religion, national origin or age. The main criterion for selection will be the research potential of the applicant and the above mentioned skills. The successful candidate will then be requested to formally apply for enrolment as a PhD student at the PhD school of Science.

Question

For specific information about the PhD scholarship, principal supervisor Marisa Montoya will be happy to answer your questions and provide advice (mmontoya@ucm.es). For further information about Critical Earth please consult the project website www.criticalearth.eu. General information about the Physics PhD program at UCM is available at <https://www.ucm.es/doctorado/doctoradofisica>.