POST-DOCTORAL POSITION IN
ARCTIC SNOW-VEGETATION-CLIMATE INTERACTIONS
at the National Centre for Meteorological Research (CNRM)
Météo-France, Toulouse, France

Context

Météo-France is offering a postdoctoral research position in land-surface-climate interactions as part of the EU-funded Horizon 2020 project ESM2025 – Earth System Models (ESM) for the future. This position is available for 24 to 36 months, depending on the candidate's experience. The position will be based in Toulouse at CNRM, the National Centre for Meteorological Research, a joint research unit of Météo-France and CNRS.

About the project

ESM2025 (01/06/2021 – 31/05/2025) is a multidisciplinary project that will develop the next generation of European Earth System Models and include improved representations of climate response to biophysical processes, anthropogenic emissions and land use.

Work environment

The position will be based at CNRM (42 avenue Gaspard Coriolis, Toulouse, France). The successful candidate will join the climate group of CNRM, focusing on understanding scale interactions, interactions between the various components of the climate system, the response of the climate system to anthropogenic forcing, and sources of variability and long-term predictability.

Salary

Salary will be provided according to Météo-France salary rates. Depending on the experience of the selected candidate, the gross monthly salary shall amount from 3280 to 4025€.

Science

Permafrost soils store about twice as much carbon as the atmosphere. The climate-induced thawing of the permafrost has the potential to release huge amounts of greenhouse gases to the atmosphere, representing one of the strongest positive climate feedbacks. Current ESM cannot predict the strength of this feedback with confidence because the rate of thawing of permafrost involves complex processes and feedbacks that are not or poorly described. During the APT – Acceleration of Permafrost Thaw – project, the team of Florent Domine at the UMI-Takuvik (Quebec) has identified two important shortcomings of current ESMs.

First, the snow models used in current ESMs are not able to reproduce the properties of Arctic snow because they were mainly developed for Alpine snow where the dominant processes are different (Barrere et al. 2017; Domine et al. 2019). In Arctic snow the very high temperature gradient between the soil and the atmosphere generates an upward transport of water vapor through the snowpack that results in low density layers at the base of the snowpack. This process affects the insulating properties of the snowpack in a way that could limit winter cooling of the ground more effectively than alpine snow. Without this process, ESMs might overestimate winter cooling of the soil in the Arctic and underestimate the future permafrost thaw.

Secondly, there are strong positive feedbacks between snow and vegetation in the Arctic that are likely to accelerate permafrost thaw. This is because the already observed increasing shrub cover tends to enhance the thermal insulation properties of the snow cover. These effects could lead to an increase and/or an acceleration of CO_2 and CH_4 releases to the atmosphere. However, as identified by the same team, this feedback may be counteracted by the occurrence of melting events at the beginning of the snow season. These events are likely to become more frequent under warming conditions (Barrere et al. 2018).

The impacts of these observed processes will be investigated during this post-doctoral work.

Tasks

The successful candidate will contribute to ongoing developments in ISBA-CTRIP (Decharme et al. 2019; Delire et al. 2020), the land surface model of CNRM-ESM-2 (Séférian et al. 2019) in order to (1) improve the representation of arctic snow; (2) propose simple parametrizations to represent snow-vegetation interactions that control permafrost thaw; and (3) realize new future scenarios with CNRM-ESM-2 to analyse the evolution of arctic snow and permafrost characteristics. All developments will be tested on fully instrumented sites (e.g.: Domine et al. 2021).

Requirements and qualification

A PhD in snow sciences is required, preferably including both field and modelling experience. Preference will be given to candidates with a A proven ability in land-surface numerical modelling. Demonstrated familiarity with the physical properties of the Arctic snowpack, and with snow vegetation interactions acquired through field work will be appreciated. A good practice of written and spoken English required. The ability to communicate in French will be considered a definite plus. All the tasks require good skills in Fortran, Python and Unix, as well as scientific writing.

Application and timeline

For full consideration, an application letter including a detailed statement of research interests, along with a curriculum vitae – Including research experience, publications and conferences and computing skills – and the names, telephones and email addresses of 2 referees should be sent by email before 11th July 2021 to:

bertrand.decharme[at]meteo.fr, christine.delire[at]meteo.fr and florent.domine[at]gmail.com

After examination of the applications, a shortlist of candidates will be auditioned in early July, making it possible to start between October, 1st and December, 1st 2021.

References

Barrere, M., Domine, F., Decharme, B., Morin, S., Vionnet, V., & Lafaysse, M. (2017). Evaluating the performance of coupled snow-soil models in SURFEXv8 to simulate the permafrost thermal regime at a high Arctic site. Geoscientific Model Development, 10(9). https://doi.org/10.5194/gmd-10-3461-2017

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Domine, F., Picard, G., Morin, S., Barrere, M., Madore, J.-B., & Langlois, A. (2019). Major Issues in Simulating Some Arctic Snowpack Properties Using Current Detailed Snow Physics Models: Consequences for the Thermal Regime and Water Budget of Permafrost. Journal of Advances in Modeling Earth Systems. https://doi.org/10.1029/2018MS001445

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