CALL FOR APPLICATION
18-MONTH POSTDOCTORAL FELLOWSHIP AT CNRM
(TOULOUSE, FRANCE)

Applications are invited for an ***18-month postdoctoral position (with possible extension) starting as soon as 1 January 2024,*** *in the climate research group of the CNRM in Toulouse, France to work on the following subject:*

Harnessing global storm-resolving simulation to quantify parametric uncertainties and structural errors in the CNRM atmospheric model

The deadline for application is ***10 November 2023****.*

Context and objectives:

General circulation models of the atmosphere are used to make predictions spanning from a few days to several decades. These predictions have wide-ranging uses from publicly disseminated weather forecasts through to climate projections for policy development. However, weather and climate predictions are not perfect: there is uncertainty associated with the forecast. A dominant source of uncertainty are the simplifications made when developing the atmospheric model itself, in particular for representing the impact of subgrid-scale processes on the resolved scales (i.e. the physical parameterizations of an atmospheric model). This uncertainty, or this model error as it is sometimes called, lies both in the physically-based formulations used in the parameterizations of atmospheric processes (the structural error), and in the under-constraint parameters that they introduce (the parametric uncertainty). Diagnosing and quantifying these model uncertainties at the most basic level remains a challenge for atmospheric modellers.

Global storm-resolving atmospheric models (GSRM – resolution of a few kilometres) able to be run over a few weeks to a few months have recently emerged in the scientific community (Stevens et al. 2019), providing an unprecedented source of data to assess the detailed representation of deep convective processes in coarser atmospheric. Concurrently, new approaches, harnessing machine-learning techniques, have been developed to address more comprehensively the problem of model calibration (i.e. choosing a value for the model under-constraint parameters), possibly starting at the process level (Couvreux et al. 2021, Hourdin et al. 2021). These two advances are at the heart of the proposed research project, which aims at quantifying the parametric uncertainties and structural errors of the CNRM atmospheric model (ARPEGE-Climat – Roehrig et al. 2020) in representing convective processes over the tropics.

The successful applicant will compare the ARPEGE-Climat model to GSRM output using the 1D framework proposed in Christensen (2020). Atmospheric forcing derived from the GSRM data will serve to build a wide dataset of short-term (a few hours) 1D simulations performed with ARPEGE-Climat. These simulations will be compared to the reference GSRM output to characterize ARPEGE-Climat model errors at the process level over an unprecedented wide range of atmospheric conditions. The sensitivity of these model errors to the large-scale environmental conditions will be quantified. Their sensitivity to model parameters will also be assessed using the "history matching with iterative refocussing approach" advocated in Couvreux et al. (2020), thereby developing a more rigorous assessment of the model structural errors. The analysis will then provide guidance for future improvements of the model. The balance between process analysis, machine learning and possibly parameterization improvement will depend on the expertise and the motivations of the successful applicant.

The present research activity is part of the project "Exposing the nature of model error in weather and climate models", coordinated by Hannah Christensen, Oxford University, UK, and funded by the Leverhulme Trust. The 1D simulation dataset will serve as a basis for other research activities led by the other project partners, in particular to assess the suitability of stochastic scheme currently used in several operational weather and climate models. Strong interactions with the project collaborators, in particular other project fellows at University of Oxford and University of Exeter, will provide a stimulating environment. On a broader scale, these research activities contribute to the Model Uncertainty Model Intercomparison Project (MU-MIP – https://mumip.web.ox.ac.uk/), supported by the World Climate Research Programme (WCRP) Working Group on Numerical Experiment (WGNE), and including research collaborators from Germany, the USA, and Australia.

Required qualifications:

1) Ph.D. in physics, atmospheric sciences, or related fields obtained before the starting date of the contract;
2) Expertise in climate modelling, especially parameterizations and/or atmospheric processes will be appreciated;
3) Strong computing skills, including knowledge of UNIX/Linux, Fortran, Python, or other high-level languages;
4) Excellent communication skills, including the ability to write for publication and present research results;

Practical information:

The successful applicant will be contracted by Météo-France and will be based at the "Centre National de Recherches Météorologiques", Toulouse, France (http://www.umr-cnrm.fr/) within the climate research group. The opened position will start as soon as possible, possibly as early 1 January 2024 for an 18-month duration. Extension may be possible on the wider subject of convection parameterization. The gross salary is commensurate with qualifications and experience, ranging from 3445 € and 4228 €. This includes the French "Sécurité Sociale" (health insurance).

For full consideration, applicants are asked to submit:

- *a curriculum vitae (including research experience, publications and conferences, and computing skills);*
- *an application letter including a detailed statement of research interests;*
- *contact information for 2 referees.*

Applications should be sent by email before 10 November 2023 to romain.roehrig@meteo.fr. Please note that attachments larger than ~5 Mo are not supported by our e-mail server.

For more details about this call, please contact:
Romain Roehrig, romain.roehrig@meteo.fr

Bibliography:

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