Research and Development position on surface model SURFEX improvement for Destination Earth On-Demand Extremes Digital Twin

Applicants are invited for a 16-month engineer position starting on 1st January 2023

The deadline for application is 1st December 2022.

Context :

Destination Earth (DestinE) is an ambitious initiative of the European Union (EU) to create a digital twin – an interactive computer simulation – of our planet. DestinE will be used to better understand the effects of climate change and environmental disasters and to permit policy makers more effectively respond to these issues. The European Centre for Medium-range Weather Forecasts (ECMWF), the European Space Agency (ESA) and the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT) are the three organisations entrusted by the EU to achieve this unprecedented endeavour for climate, weather and computing sciences.

A key milestone is the launch of the first two digital twins by December 2023. One of these will be the Digital Twin on Weather-Induced and Geophysical Extremes. Managed by ECMWF, this digital twin will provide capabilities and services for the assessment and prediction of environmental extremes.

Météo-France, contractor and leading partner of a European team composed of 28 environmental institutes and national meteorological/hydrological services, took part in the procurement procedure, launched by ECMWF for the provision of the On-demand Extremes Digital Twin in March 2022. The proposed solution is to make on-demand configurable digital twin engines for forecasting of environmental extremes at sub-km scale. The DE_330 tender was successfully evaluated, negotiated and signed. The 20-month DE_330 contract between ECMWF and Météo-France started on 1st September 2022.

Missions

The AROME model is a kilometer Numerical Weather Prediction (NWP) model used operationally in the whole Europe. It was first designed by the CNRM (Centre National de Recherches Météorologiques, UMR 3589) to improve short-range forecasting of dangerous phenomena such as heavy Mediterranean rains, violent storms, fog or urban heat islands during heat waves. AROME will see its resolution increase to reach sub-kilometer scales. The AROME model is coupled to a surface module platform, SURFEX, that can also be used in offline mode, and that includes many of the state-of-the-art features necessary to a modern model like AROME.
This position offers the opportunity for a scientist to help improving the modeling of the surface through the platform SURFEX in the future LAM-DT. SURFEX hosts different models adapted to each surface type (vegetation, ocean, town ..,). For each model, different parametrizations are available and those used in the operational setup are not, from far, the most advanced. There will be three versions of the LAM-DT (AROME, HARMONIE-AROME and ALARO) that currently use three different versions of SURFEX. One goal will be to converge between the different LAM-DT SURFEX versions, especially with Harmonie-Arome. Also it must be decided how to initialize the surface fields from the global DT. The global DT uses another surface scheme, the HTESSEL

scheme, and a direct interpolation from HTESSEL to SURFEX is one possibility. If that interpolation causes too much spin-up, an offline SURFEX configuration will have to be set up to initialize the surface fields of the LAM-DT.

Methods :

The objectives of the position are to:
- Setup a configuration with an offline SURFEX initialized with the global IFS model.
- Compare the results in terms of spin-up and scores to a configuration with a direct interpolation with HTESSEL
- Define a strategy for converging with HARMONIE-AROME in term of SURFEX configuration.
- Setup and test new options available in SURFEX notably in the soil vegetation model ISBA. The use of a diffusion scheme for soil and snow representation are particularly targeted. Assess the relative performance of those new options.
- Perform some optimizations to speed-up some SURFEX-related configurations.

Required qualifications :

Masters Degree in atmospheric sciences/computer sciences processing or civil engineer diploma, obtained before the date of the application.

Experience and skill required :
- Good experience in numerical weather prediction models, preferably in surface modeling.
- Good experience in scientific programming
- Good experience with scripting languages like python.
- Experience in using scripts and UNIX-related tools.
- Knowledge of FORTRAN language.
- Candidates must be fluent in spoken and written English. The interviews will be conducted in English

Following criteria will be taken into account for the evaluation of candidates:
- Analytical and problem-solving skills
- Initiative and ability to work collaboratively with teams at Météo-France and beyond
- Good interpersonal and communication skills
- Dedication, passion, and enthusiasm to succeed individually and across teams of developers

Practical information :

The successful applicant will be based at the Météopole in Toulouse and will be welcomed by the GMAP (Groupe de Modélisation et d'Assimilation pour le Prévision) of the CNRM . The position will be funded by Météo-France, and will start preferentially on the 1st January 2023 for 16 months. Depending on professional background and experience, the gross monthly salary shall amount from 2552€ to 3280 €.

For full consideration, an application letter shall include a detailed statement of research interest, along with a curriculum vitae (including research experience, publications and conferences, computing skills and different language practice) and the names, telephone and email address of 2 referees. The package should be sent by email before the 1st December 2022 to adrien.napoly@meteo.fr. Same email can be used for any scientific question. Due to spam filters applied in Météo-France, without rapid acknowledgment of receipt by email
from one of the two addressees, it is recommended to verify the correct receipt of the candidate's email with a phone call (Adrien Napoly: +33 (0)5 61 07 93 84).