Applicants are invited for a 10-month post-doctoral or civil engineer position starting on 1st June 2023 on the following subject: "Evaluating the gain in efficiency of a new dynamical core FVM compared to the Arome dynamical core"
The deadline for application is 15th of March 2023.

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 Organization for the Exploitation of Meteorological Satellites (EUMETSAT) are the three organizations entrusted by the EU to achieve this unprecedented endeavor 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.

For very high resolution, the representation of the orography becomes more realistic leading to more steeper slopes. Because of the vertical coordinate that follows terrain, the occurrence of steeper slopes leads to stronger winds gradients and consequently less stability. Besides our model spends a significant amount of time performing spectral transforms. It is then relevant so to explore new dynamical solutions for AROME. One possibility would be to use the Finite Volume Module (FVM), a new dynamical core that has been developed by ECMWF. FVM has been developed using a Domain Specific Language (DSL) in a Local Area Model (LAM) version without any physical

parameterization (except turbulence). This new core is only using grid computations, it might be more stable in alpine regions and is potentially more efficient since it does not require spectral transform.

Methods :

The latest version of FVM is working only with idealized cases. We would like to compare it in terms of stability and efficiency with the current AROME core. Since FVM only works with idealized cases, in order to perform a more relevant comparison, it will be necessary first to implement more realistic functionalities to FVM such as coupling capacities. The post-doctoral fellow will help with this task and
Then a fair comparison of AROME and FVM will be realized first in terms of stability. The computational efficiency must also be estimated, though the version of FVM used must not be considered as fully optimized one.

Required qualifications :

Masters Degree in atmospheric sciences/computer sciences processing or civil engineer diploma, obtained before the date of the application. Following criteria will be taken into account for the evaluation of candidates:

- expertise in Fortran, Unix/Linux, Python,
- experience in atmospheric science with emphasis on dynamical core,
- experience in numerical computation,
- fluency in English,
- human and relational qualities necessary for teamwork.

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 June 2023 for 10 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 15th of March 2023 to fabrice.voitus@meteo.fr and ludovic.auger@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 (Fabrice Voitus: +33 (0)5 61 07 85 77).