

Position in code adaptation to GPU at Météo-France research centre (CNRM), Toulouse (France)

Short description

A 2-year position is available for the following topic "Code adaptation to GPU" in Météo-France research centre (CNRM).

Expected starting date is 01/04/2023.

Closing date for application is 31/02/2023.

Monthly gross salary ranges from 2552€ et 3280€ depending on experience, with full social benefits (French social security and health insurance).

Applicants should send to philippe.marguinaud@meteo.fr :

- a curriculum vitae (including programming experience, computing skills and different language practice, etc.)
- a brief statement of programming interests
- names and contact details (email + telephone number) of places where they have already worked

General context

GPGPU (general purpose graphical computing units) have been available for more than 10 years, and their integration in the HPC (high performance computing) framework has become acceptable during the last few years. Météo-France NWP (numerical weather prediction) models are today well suited for traditional scalar processors (AMD/Intel x86, ARM, etc.) or vector platforms (NEC Aurora), but adapting them for the GPGPU architecture is still an on-going effort which requires expertise on the code itself and on this new computing environment.

Objectives

The selected applicant shall participate to the code refactoring and testing required for satisfying to the new architecture constraints :

- wrapping existing data structures into high-level classes, allowing for synchronization between the CPU and the accelerator
- rewriting computation code (physics, dynamics) in order to meet new constraints for automatic pre-processing of the code for adaptation to GPU

This refactoring will be performed manually or semi-manually (possibly using scripts developed by the selected applicant).

The selected applicant shall also help to port and test the physics and grid-point code to GPU accelerators. This involves:

- Creating new tests taken from ARPEGE/AROME physics
- Validating, profiling and optimizing these test cases

The selected applicant will, in particular, be responsible of the adaptation of the ECRAD radiation scheme (<https://github.com/ecmwf-ifs/ecrad>) software and of its integration in the ARPEGE/AROME physics. This effort of adapting ECRAD is shared among many Météo-France partners (ECMWF, members of the ACCORD consortium).

Required qualifications

Some experience on ARPEGE/AROME development is highly desirable. Knowledge of modern Fortran (OOP with the 2003 standard), C, C++ is required. Expertise on OpenMP, MPI and parallelization are also required. OpenACC is also highly desirable.

Scripting with bash and Python and/or Perl, and a good experience with x86 and Linux (debugging and optimizing complex programs) are required.

Hosting institution

The Centre National de Recherches Météorologiques (CNRM) is the research department of Météo-France (<http://www.cnrm.meteo.fr>). It is responsible for conducting the largest part of the research activities in weather forecasting, climate modelling, atmospheric chemistry, land-surface processes including snow related processes, oceanography.

Within CNRM, the Groupe de Modélisation et d'Assimilation pour la Prévision (GMAP) is in charge of the development of Météo-France numerical weather prediction models (ARPEGE and AROME). This development is performed jointly with other institutions : ECMWF, the ACCORD consortium (ex HIRLAM and ALADIN), and the Laboratoire d'Aérodynamique (Université Paul Sabatier).

Funding

The first year of this position is funded by the Destination Earth On-Demand Extremes project; the second year will be funded by the TRACCS project (<https://www.insu.cnrs.fr/fr/PEPR-TRACCS>).

About the Destination Earth and the Destination Earth On-Demand Extremes projects

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.