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Preparing the IFS for HPC accelerator architectures

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The need to fully exploit the advantages of accelerators in modern HPC systems plays a vital role in achieving the next step change in predictive skills for weather and climate models. However, the diversification of HPC hardware continues and the use of heterogeneous computing architectures is becoming more widespread in the scientific modelling community. This incurs a recurring need to adapt and transform existing model software to new programming models, which is becoming increasingly impractical using a single code base.

In this talk we highlight the key elements of the ECMWF roadmap for adapting the Integrated Forecasting System (IFS) to HPC accelerators. We discuss how a combination of flexible data structures, an extended use of library interfaces and the use of source-to-source translation tools is envisaged to allow the incremental adaptation of the code base to multiple HPC architectures alongside scientific development.

We also demonstrate Loki, an in-house developed tool that allows bespoke source-to-source transformations to be devised to adapt individual model components to novel programming paradigms or community-driven DSLs. In addition to GPU-driven efforts we will also highlight preliminary results using FPGAs and showcase the potential for utilising HPC systems based on a dataflow programming paradigm in weather and climate models.

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