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Performance Portability for Existing Weather and Climate Models using PSyclone: Application to the NEMO Ocean Model.

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The high-performance computing landscape today is varied and complex with a wide range of both hardware and software technologies available. Given the size, longevity and performance requirements of weather and climate models, this landscape and its continuing evolution presents a problem: it is simply not feasible to repeatedly re-write a model every time a new supercomputer or programming model comes along. Domain Specific Languages (DSLs) are a potential solution to this problem since they permit a Separation of Concerns for the scientific and performance aspects of a code. Consequently, it becomes possible to have single-source science code that can be translated/transformed into code that performs well on a variety of architectures.

PSyclone is a code-generation and transformation tool that has been developed to support the DSL being used by the UK Met Office's LFRic Model. One of the drawbacks of DSLs is that they require a revolution: the whole model must be re-written in the new language. This represents a very significant investment and brings with it concerns about the sustainability of the associated tool chain. For this reason, some communities are rightly cautious about adopting DSLs. Therefore, PSyclone has also been developed to support an evolutionary approach to DSL adoption by working with existing Fortran code. In this presentation we will describe the approach taken and present results for the application of PSyclone to the NEMO ocean model, allowing it to be run at scale on both GPUs and in hybrid MPI/OpenMP mode.

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