Geophysical Research Abstracts
Vol. 20, EGU2018-8185, 2018
EGU General Assembly 2018

Precision Reduction for Grid-point Models

Jan Ackmann (1), Peter Düben (2), and Piotr Smolarkiewicz (2)

(1) University of Oxford, AOPP, Oxford, United Kingdom (jan.ackmann@physics.ox.ac.uk), (2) ECMWF, Reading, United Kingdom

In this work, we explore the potential computational gains from precision reduction—reducing the number of bits in the representation of floating point numbers—for grid-point models. Compared to previous work, we go beyond the scope of fully explicit models and move towards semi-implicit model formulations. The key new elements we study in terms of precision reduction are thus the required solve of an elliptic problem and the impact of its associated preconditioner.
As a testbed for our precision reduction experiments we use a shallow-water model on the sphere, which was discretized using the MPDATA approach and then linked to a reduced-precision emulator. The model is either used without preconditioning or with an ADI-type preconditioner. We study the impact of precision reduction on this model using standard dynamical core testcases such as the zonal flow over a mountain, and the Rossby-Haurwitz wave testcase.
Given this setup, we show that, for the unpreconditioned model, we can go far below the threshold of single precision for most of the model computations without degrading the model solution. The so-called co-designed approach, in which model tendencies are computed in low precision while their respective prognostic variables are stored in high precision, is extended to our framework and is shown to again have a positive effect on model performance. Additionally, the model performance when employing the preconditioner will be discussed.