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Higher-level geophysical modelling

Roman Nuterman, **Dion Häfner**, and Markus Jochum

Niels Bohr Institute, University of Copenhagen, Copenhagen, Denmark (nuterman@nbi.ku.dk)

Until recently, our pure Python, primitive equation ocean model Veros has been about 1.5x slower than a corresponding Fortran implementation. But thanks to a thriving scientific and machine learning library ecosystem, tremendous speed-ups on GPU, and to a lesser degree CPU, are within reach. Leveraging Google's JAX library, we find that our Python model code can reach a 2-5 times higher energy efficiency on GPU compared to a traditional Fortran model.

Therefore, we propose a new generation of geophysical models: One that combines high-level abstractions and user friendliness on one hand, and that leverages modern developments in high-performance computing and machine learning research on the other hand.

We discuss what there is to gain from building models in high-level programming languages, what we have achieved in Veros, and where we see the modelling community heading in the future.