Related articles

Volume 6, issue 1 | Copyright

Special issue: The Transport Matrix Method (TMM) for ocean biogeochemical...

Development and technical paper | 08 Jan 2013

Porting marine ecosystem model spin-up using transport matrices to GPUs

E. Siewertsen et al.

Received: 19 Jul 2012 – Discussion started: 31 Jul 2012 – Revised: 07 Nov 2012 – Accepted: 05 Dec 2012 – Published: 08 Jan 2013

Abstract. We have ported an implementation of the spin-up for marine ecosystem models based on transport matrices to graphics processing units (GPUs). The original implementation was designed for distributed-memory architectures and uses the Portable, Extensible Toolkit for Scientific Computation (PETSc) library that is based on the Message Passing Interface (MPI) standard. The spin-up computes a steady seasonal cycle of ecosystem tracers with climatological ocean circulation data as forcing. Since the transport is linear with respect to the tracers, the resulting operator is represented by matrices. Each iteration of the spin-up involves two matrix-vector multiplications and the evaluation of the used biogeochemical model. The original code was written in C and Fortran. On the GPU, we use the Compute Unified Device Architecture (CUDA) standard, a customized version of PETSc and a commercial CUDA Fortran compiler. We describe the extensions to PETSc and the modifications of the original C and Fortran codes that had to be done. Here we make use of freely available libraries for the GPU. We analyze the computational effort of the main parts of the spin-up for two exemplar ecosystem models and compare the overall computational time to those necessary on different CPUs. The results show that a consumer GPU can compete with a significant number of cluster CPUs without further code optimization.

Download & links

- Article (PDF, 2036 KB)

How to cite: Siewertsen, E., Piwonski, J., and Slawig, T.: Porting marine ecosystem model spin-up using transport matrices to GPUs, Geosci. Model Dev., 6, 17-28, https://doi.org/10.5194/gmd-6-17-2013, 2013.