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Geoscientific
Model Development
Discussions

Interactive comment on "Porting marine ecosystem model spin-up using transport matrices to GPUs" *by* E. Siewertsen et al.

E. Siewertsen et al.

ts@informatik.uni-kiel.de

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Comments to referee #2: Thank you for your comments. *** We will make the following changes:

pg2180, line 17: "...that a consumer CPU can beat a significant number..." pg2181, line 17 "(if there is any)" pg2194, line 22 "...which basically looks like this:" *** will all be changed

- pg2181 line: 17. There must be a better reference for MITGCM than a webpage - *** we will add: Marshall, J., A. Adcroft, C. Hill, L. Perelman, and C. Heisey (1997): A finite-volume, incompressible Navier Stokes model for studies of the ocean on parallel computers. J. Geophysical Res., 102(C3), pp 5753-5766, doi: 10.1029/96JC02775

line 25: conform to, not with ** will be changed

- use of the word "predestined". *** will be omitted, see below

As per the first reviewers comments, please explain /why/ GPGUs are suitable for such operations. References for this? *** We will change pg 2181 lines 28 - pg. 2182 line 2 to: "The motivation for this is to check how fast GPUs with their nowadays hundreds of cores are compared to a single CPU, and whether they thus may be a cheap alternative to CPU clusters. Compared to a single CPU, we expect a performance gain, at least when porting just the transport and neglecting the spatially and . . ."

- "..big performance gain" -> "...performance gain" *** will be changed

- pg 2182, line 5-10. Hard to make sense of this sentence - *** We will make clearer what we want to say in the next version.

line 19 - sentence is not complete - *** yes, should be: ". . . using more than one GPU".

line 27 - "three space dimensions" -> "three spatial dimensions" *** ok, will be changed

- pg2182-2183 line 27-line 2 - Not sure what this sentence means - pg2185, line 21 - Better reference for MPI - line 23, same for PETSc. THere are better references than the websites! *** Will be added: for MPI: Message Passing Interface Forum (2009): MPI: A Message-Passing Interface Standard, Version 2.2, High Performance Computing Center Stuttgart (HLRS) Germany for PETSc: @TechReport{petsc-user-ref, Author = "Satish Balay and Jed Brown and and Kris Buschelman and Victor Eijkhout and William D. Gropp and Dinesh Kaushik and Matthew G. Knepley and Lois Curfman McInnes and Barry F. Smith and Hong Zhang", Title = "{PETS}c Users Manual", Number = "ANL-95/11 - Revision 3.3", Institution = "Argonne National Laboratory", Year = "2012" } @InProceedings{petsc-efficient, Author = "Satish Balay and William D. Gropp and Lois Curfman McInnes and Barry F. Smith", Title = "Efficient Management of Parallelism in Object Oriented Numerical Software Libraries", Booktitle = "Modern Software Tools in Scientific Computing", Editor = "E. Arge and A. M. Bruaset and H. P. Langtan-

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gen", Pages = "163–202", Publisher = "Birkh{\"{a}}user Press", Year = "1997" }

- pg2186. A description of CSR format is not required. *** We are not sure if this is common knowledge for all GMD readers, but we can omit it.

- pg2191. Might be worth mentioning if the GPGPU can handle double floats, or just floats. *** It can handle doubles, will be added.

- pg2192. I don't think the file extensions are necessary - *** will be omitted

line 12. Again, better refer- ence than the website, please *** reference for Thrust: Nathan Bell and Jared Hoberock (2011): Thrust: A Productivity-Oriented Library for CUDA: in: Wen-Mei W. Hwu (Ed.): GPU Computing Gems Jade Edition (Applications of Gpu Computing), Morgan Kaufmann

- pg2193. Reference for CUSP *** This is the official site of the CUSP project. There is no (!) other reference than this website. @MISC{Cusp, author = "Nathan Bell and Michael Garland", title = "Cusp: Generic Parallel Algorithms for Sparse Matrix and Graph Computations", year = "2012", url = "http://cusp-library.googlecode.com", note = "Version 0.3.0" }

- pg2194. line 7-9. If this paragraph/sentence required? If you are going to say you didn't use an "official" release, then say why and which features were missing at the time this work was done *** This sentence can be omitted. the necessary extensions to PETSc are described anyway in section 4.1.

- pg2197. Does the description of the hardware really need a table? *** no, will be put in the text

- pg 2198. Worth noting that 1 degree resolution is now fairly low resolution and that this might well be an issue for using GPGPUs in this way - *** Yes, we add a remark. We also will add that more recent GPUs have more memory such that higher resolutions may be used.

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line: 12. "Somehow 'fair'". Is it fair? THe CPU compiler performs multiple optimisations? - *** The CPU compilers (mpicc, mpif90) were both run with option "-O", the GPU C compiler nvcc with option "–with-debugging=0", for pgfortran no optimization was used.

line 10-12. If you have 100 runs, then report the fastest, not the mean - that is the top speed the code runs at Also, please report the mean, and std dev too - why not? Most speed-up comparisons consist of 2-5 runs only, so this it's very good to have so much data available here. *** We will provide more details on peak performances and standard deviations. On the other hand, since a spin-up needs about 3000 years/cycles, we think the mean is the relevant quantity to estimate the overall performance gain.

- Pg2200, line 5-8. Remove the (!). *** ok

- Comparing speed only is not fair, despite the comment comment two pages ago. GPGUs have thousands of cores, compared to the 8 of a CPU. *** The aim of the paper was not (!) to compare the performance of one CPU core to one GPU core, but to study the performance of the whole GPU (with all its cores) compared to one and several CPU.

- Whilst, I agree it is very hard to compare performance directly, I think this deserves more attention than simply raw wallclock time. What about comparing cost or watts? % of peak FLOP performance? *** What we want to do in the end is to speed up the spin-up, for example to perform parameter optimization runs for model calibration etc. Then, besides cost or watts, wall-clock time is that what matters. Again, we did not want to compare peak performance of one GPU core with one CPU core.

- Do the times include tha data transfer to/from the GPGPU - the paper isn't clear on this. *** There is no data transfer from or onto the GPU in one year, the data are transferred before the spin-up is started. The spin-up takes about 3000 years/cycles, then the data are transferred back.

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Interactive Comment

- Pg2206. Table 3. "totally 480 CUDA" -> "a total of 480 CUDA" *** ok

- Pg 2207. Table 4 - this table could contain more info, like the max, min and std dev. *** ok, see above

- Pg 2210. Fig 2. Can the names be made more generic? e.g. metos3d.exe -> executable. I think this would make the figure clearer. *** can be done

- Pg 2211-12. Fig 3, 4. Can't tell the difference between colours when printed in greyscale. Please alter accordingly. *** will be done, will use different line styles

- Pg 2213. Fig 5. Why a block size 166. I got to this figure and realised the block size had been mentioned, but the reason for 166 was not explained. Is there an explaination? *** the block size was 160, not 166. The reason was that this was the fastest, as can be seen in Fig. 5

- Pg2214. Fig 6. It took me a while to understand this figure. The vertical dashed lines look just like the GeForce line. The other processors look identical in greyscale *** we will omit the vertical lines and use different line styles.

Interactive comment on Geosci. Model Dev. Discuss., 5, 2179, 2012.