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Geoscientific
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Discussions

Interactive comment on "FAMOUS, faster: using parallel computing techniques to accelerate the FAMOUS/HadCM3 climate model with a focus on the radiative transfer algorithm" *by* P. Hanappe et al.

Anonymous Referee #2

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General comments

This paper is a very good contribution to the growing body of literature investigating the potential of emerging computing technologies for weather and climate simulation. The findings, in line with those of others, are encouraging but the amount of effort required to adapt existing codes is confirmed to be a concern, particularly given the rapidity of developments in the hardware sector (the CELL architecture, a main feature of the work reported, is already dead, though this does not reduce the validity of the results reported). The structure of the paper is excellent and it is very well written.

Specific comments

The abstract should point out that the optimisation work reported was carried out in the context of a version of FAMOUS that did not exploit any MPI-based domain decomposition parallelism (i.e. the base code was sequential).

The time taken to undertake the porting of the algorithm is a key result being reported in this paper (authors should always be encouraged to publish such data!). I would like to see the effort mentioned in the abstract, rather than just being buried in the depths of the paper.

The paper should point out that the CELL architecture was dropped by IBM in 2009. This could be done in a footnote added to the first paragraph on p.1276.

4.2:

- Add motivation for the translation to C. At the time, this 'choice' would have been forced on the authors in order to exploit the hardware technologies (it is not such a forced choice today).

- For the column entry, please state that Sect. 4.4 provides motivation for this reorganisation.

- In the final para. on validation, please point to section 5.2 which provides some explanation. A definition of quasi-identical is required!

- Ideally, I would like to see some evidence that a FAMOUS that doesn't provide bit reproducible results to the original version of the code is useful to scientists. Bit reproducibility is a major issue for the Met Office, especially in climate work. Perhaps a reference to a paper discussing this issue (in the context of FAMOUS) could be added here.

4.3: The first line states that it was 'decided' to translate the code. Please clarify whether this choice was forced. If not, please motivate the decision.

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4.4: Para. 1, Add a sentence to the end of the para. stating that the motivation for the column-based reorganisation, and the benefits associated with it, are discussed in the rest of this section. (Otherwise the reader is left wondering why at this point.)

Section 4.6 and 4.7:

- I am slightly confused by the story of 'deciding' to develop a distributed version of the code (using a thread pool) and the subsequent, apparently independent decision to 'extend' this version to exploit the SPEs.

- It seems to me that the decision to implement a thread-pool version was required to enable the execution on multiple SPEs (having ruled out 'most of the higher-level library-based approaches').

- The point is that FAMOUS already supports MPI-based distribution of work - and MPI decomposition can obviously be used on a shared memory, multi-core machine, so why wasn't this explored instead, or as well as, the thread-pool approach? Please clarify the story here. Was it actually the case that the thread-pool approach was taken _because_ it supported the exploitation of the SPEs in a more straightforward manner?

p.1286, para. with line 15 in it. It would be worth stressing the point that the performance of the radiation calculations are not limited by the transfer of data between the CPU and the device. This is a very positive point for weather and climate computations, particularly if this property turns out to be true of other physics computations. (Although the issue of data transfer will probably disappear in the future as 'devices' become integrated on chips.)

Technical corrections

P.1280, line 8. By 'quite fast' you probably mean 'at an acceptable fraction of peak performance'... better to be quantitative if possible but 'quite' is not useful.

p.1282: A reference to the technique to handle conditional expressions would be useful.

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Interactive Comment

5.1: I would like to see (a reference to) some discussion about the scientific acceptability of computing at single precision. A pointer to a paper confirming this is standard for the scientific uses of FAMOUS.

p.1288, para. including line 20. The claim about energy reduction is out of place here, particularly given the early motivation that faster models are required to enable higher resolution and bigger ensembles! The energy case should be added to the statements in the introduction.

Fig. 5. Caption should read ‘radiation as a function’ rather than ‘radiation in function’.

Interactive comment on Geosci. Model Dev. Discuss., 4, 1273, 2011.

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