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Geoscientific Model Development Discussions

Interactive comment on "Single precision arithmetic in ECHAM radiation reduces runtime and energy consumption" *by* Alessandro Cotronei and Thomas Slawig

Anonymous Referee #1

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Since the memory access became the most important bottleneck to a numerical simulation efficiency the use of reduced precision becomes an attractive way to gain a speed-up.

Authors very clearly and in good level of detail describe their attempt to use this optimization method for the ECHAM model radiation scheme in this paper. The text is well written, easy to follow and the argumentation behind the subsequent steps is very clear. Finally the achieved speed-up is consistent to what has been already published while the results are impressively comparable across the two compared numerical precisions. Certainly, this is the description of another success story and documentation

of a hard work when getting there.

My main concerns are twofold: First, by their incremental method authors identified routine(s) being problematic with respect to the reduced precision (like for example srtm_reftra_ec). Those were then kept entirely in the double precision. Authors apparently didn't dare to introduce any alternative method mathematically quasi-equivalent but possessing higher robustness with respect to the numerical precision. Similarly they did no attempt to modify the exponentials (inv_expon, expon) evidently performing computation outside the representativeness of 32bits arithmetic. Although those are probably minor issues a curious reader would like to see some discussion about possible entirely singe precision alternative and its eventual cost with respect to the proposed solution to keep it in double precision. Having that discussed the paper would substantially improve its scientific content for a reader outside the ECHAM community. The presented work looks rather like a mechanical task suitable for graduate students. This however is also being of a scientific value as it gives some guidelines for other applications. Still the presented method leaves some impression that when the ECHAM model is partitioned differently into different number of subroutines the resulting code ready for single precision execution might be different.

Second, having some experience from converting few double precision radiation schemes to single precision, it is bit hard to digest the author's claim about being it relatively a straightforward task. Our experience was entirely different. This implies some question-marks about the evaluation method used. Did authors ever evaluated the single precision radiation code separately? It would be for example very interesting to see some single column model simulations targetted to radiation scheme comparing outputs from double and single precision radiations schemes.

Despite those two above comments I still consider the paper to be bringing an interesting material worth for being published.

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