

Interactive comment on “3-D radiative transfer in large-eddy simulations – experiences coupling the TenStream solver to the UCLA–LES” by F. Jakob and B. Mayer

Anonymous Referee #1

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This paper describes the work involved in coupling the TenStream solver to a large eddy model. Much of it is concerned with the efficiency of the scheme, which is fine. I do have a problem with the one "scientific" plot though (Fig. 1). The paper states that the evolution of the model is statistically indistinguishable, yet to me Fig. 1 clearly shows significantly more noise in the *domain mean* liquid water path when spectral sampling is turned on. Compare this to Fig. 1 of Pincus and Stevens (2009) which shows that liquid water mixing ratio exhibits about the *same* noise whether or not spectral sampling is used. This would seem to undermine a key result of the paper, and so needs much more investigation. For example: (1) If the LWP noise is detectable in the domain mean, surely the LWP of individual clouds has much greater noise? (2)

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Can this noise be mitigated, e.g. following my suggestion in item 4 below? In my view this issue needs to be addressed properly for this paper to be fully published.

Specific comments:

1. Page 9022 Line 21: "energy-rich" -> "energetic"
2. Page 9024 Lines 9-10: The references here are only to the LMU group, but other groups are working on the same problem, e.g. Tompkins and Di Giuseppe (JAS 2007) and Hogan and Shonk (JAS 2013) for the shortwave.
3. Page 9025, Equation on line 12: The important factor here is which dimension varies fastest in memory - this depends whether the equation is using the Fortran or C convention - please state.
4. The discussion in section 2.1 considers the case that radiation is run every timestep but just for one g-point. What if N g-points were computed every N timesteps, where N could be 2, 4, or a larger number? Presumably the cost of reordering arrays would be less since it would not be incurred every timestep, and since the clouds only change by a small amount per timestep, very little additional error would be incurred? The heating rates could be applied evenly to a number of timesteps between calls to the radiation scheme, which might even be an improvement in terms of heating-rate noise, highlighted in my main comment at the start of this review.
5. Page 9030 Line 10: please state the length of a timestep and the number of g points, to indicate how long it takes for all g points to be computed.
6. Figure 2: Explain the black/grey bars that form part of the color bar.
7. Figure 4: Explain the legend of the panels with reference to Table 1.
8. Listings 1 and 2: These are meaningless to anyone except a user of this specific model. Please write out what this means in English.

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