

Review

This manuscript describes the theoretical foundations of EarthCARE's radiative flux and heating rates product, ACM-RT, that derives from applying a radiative transfer model to aerosol and cloud profiles retrieved from the cloud profiling radar, lidar, and multi-spectral imager. The primary focus is to document the details of the radiative transfer calculations with an emphasis on establishing the value of the unique use of 3D radiative transfer modeling. The subject is appropriate for *Atmospheric Measurement Techniques*, the methods are thoroughly described, and the results are compelling. My only concerns are that (a) in places the paper reads too much like a technical report or theoretical basis document and (b) the paper assumes too much 'insider knowledge' of the EarthCARE products and nomenclature to be fully understood by the general reader. I recommend the paper be published in AMT after the following minor revisions to address these concerns.

Specific Comments

1. The paper reads too much like a report or technical document in some places. The abstract refers to the study as a "report" on at least 3 occasions and the compositing process in Section 3 reads very much like a technical document as opposed to a paper. As opposed to strictly describing a recipe, are there any elements of the thought process or motivating physics that could be described? Similarly, the lists of wavenumber ranges for RRTMG's LW and SW bands in Section 4.1.1 seem out of place in a paper, perhaps they could be converted to a table at least to avoid devoting two paragraphs to lists of numbers. Another example concerns the detailed description of the Lorenz-Mie calculations starting on Line 221 that includes the increments used to step through particle radii. I suggest adopting a more narrative approach throughout the paper to improve readability.
2. While the paper is part of a special issue that likely fills in several additional mission details, I believe this paper should largely stand alone. At a minimum all acronyms should be spelled-out but it would be useful to add a few additional details regarding the ACM-CAP, A-ICE, C-CLD, etc. products. I also didn't see clear definitions of "Hawaii frame" and "Halifax frame".
3. Line 158: it seems one or more words is missing after "ACM-COM's ..."
4. While the accuracy of the radiative transfer model and, in particular, the 3D Monte Carlo calculations are discussed at length, a broader discussion of the anticipated sources of error in the ACM-RT product itself owing to retrieval uncertainties and errors in the supplemental meteorological variables and surface albedo is lacking. To what extent do these uncertainties offset the value of modeling 3D effects? I realize the point of the closure studies after launch is to answer this very question, but have any sensitivity studies been conducted to assess the relative magnitudes of geophysical parameter errors vs. radiative transfer errors?
5. What does the black rectangle in Figure 7 represent? It is not described in the caption or in the narrative.