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Interactive Comment

Interactive comment on "Pan-spectral observing system simulation experiments of shortwave reflectance and longwave radiance for climate model evaluation" *by* D. R. Feldman and W. D. Collins

Anonymous Referee #4

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This manuscript presents a set of "observing system simulation experiments" (OSSEs) for hyper spectral observations in the longwave and shortwave (as would be obtained e.g. from CLARREO). Detailed simulations of high-resolution spectra are made from atmospheric states sampled during climate-change runs with the NCAR CCSM 3 and from monthly averages with two other climate models (MIROC5 and HadGAM2-ES) chosen because they have low and high climate sensitivity respectively. The spectral features of changes in atmospheric composition and state are identified in the differences between spectra at the beginning, middle, and end of the 21st century and the

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differences between high- and low-sensitivity models are contrasted.

The main concerns with the manuscript are a lack of focus and what appears to significant repetition of previously-reported results.

The authors would benefit from making their goals for the manuscript more explicit. Much of what's published in GMD deals with technical advances but this manuscript doesn't fit the bill: the combination of radiative transfer modeling with MODTRAN and the simulation of changing climate with CCSM has been previously reported and is, in any event, straightforward if computationally ambitious. The introduction suggests that the goal is to demonstrate the value of hyper-spectral observations, perhaps as a way to contain the climate sensitivity of the real world, but the manuscript doesn't follow this argument very far. Without a sense of what the authors hope to achieve it's hard to provide feedback to help them get there.

Of larger concern is the fact that the CCSM/MODTRAN calculations appear to be have been described by the authors in previous papers (the Feldman papers from 2011 and 2013). The calculations made for MIROC5 and HadGAM2-ES appear to be novel (though one would like stronger assurances that using monthly-mean fields in place of instantaneous snapshots does not introduce important artifacts). The manuscript makes a number of interesting points regarding the ability of spectrally-resolved observations to distinguish among process in ways that broadband observations can not, but the authors and others have made these points before.

Though the work described here may well be a useful contribution it would be difficult to recommend publication of the manuscript in its present form. The authors should clarify the goals of the manuscript for themselves and for readers and focus revisions to support those goals, presenting previously-reported results briefly and stressing the new contributions.

As a minor point, the decision to continue to use CCSM 3.0, a model that's now two generations old, is perplexing and deserves some elaboration.

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