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Interactive comment on “Can IASI be used to simulate the total spectrum of outgoing longwave radiation?” by E. C. Turner et al.

Anonymous Referee #2

Received and published: 11 August 2014

General Comments

This paper is well-written, and presents an interesting technique to construct broadband longwave radiance from IASI data. The literature review is thorough, and most of the scientific content seems sound. There are some places where the paper seems to place too much equivalence between broadband LW radiance and LW flux, and I found some other things that should be revised, listed below. After these revisions are made, I feel that the paper is suitable for publication.

Specific Comments

Page 3, Lines 27-28: I would recommend changing "in a warmer world there will be an increase in water vapour due to its positive feedback" to something like "Because

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the relative humidity is expected to remain constant, the water vapor mixing ratio will increase in a warmer world."

Page 8, Line 28: Citing Loeb et al. (2003) for the ADMs is fine, but I would recommend also citing Loeb et al. (2005), since it describes the ADMs used for the CERES instruments on Terra and Aqua.

Page 11, Lines 6-7: CERES footprints are not generally referred to as pixels in order to differentiate CERES footprints from MODIS pixels. In any case, the footprints are not circular (even at nadir), closer to an extended hexagon (see Fig. 3 of Smith 1994).

Page 12, Lines 1-2: Although flux and radiance are proportional for a given scene, anisotropy varies significantly between different scene types. This is especially true for nadir-viewing scenes such as those in this study.

Page 13, Lines 20-22: It is good to point out that the radiosonde data used for the correlation analysis is based on tropical and mid-latitude soundings, but the sentence (as written) seems to imply that if the algorithm works for polar latitudes (where it isn't "supposed" to work), it will surely work for middle and low latitudes as well. Please rewrite.

Various places in Section 3: Differences between IASI and CERES are expressed as CERES minus IASI. Since CERES (with its measurement of broadband LW radiance) is treated as the truth in this comparison, I would suggest changing to IASI minus CERES.

Section 4.2: The increased proportion of Far-IR energy for cloudy scenes is interesting. Much of this is due to the shift to a lower emitting temperatures (and hence, lower peak wavenumbers according to Planck's Law) for cloudy scenes, as noted earlier in the manuscript. Is there a way to quantify the departures from the expected shift with temperature?

Page 20, Lines 6-10: As noted earlier, the isotropic assumption is not particularly good,

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especially at nadir. However, it could be noted that the error estimate resulting from this assumption is likely high, since the anisotropic factor at nadir is greater than 1.0 for almost all scene types (the coldest nighttime scenes in Antarctica being an exception). Please be more specific with the statement that these flux differences are "comparable in magnitude to those presented in previous studies.."

Technical Comments

Page 4, Lines 12-13: Not sure what is meant by "clear to cloudy instantaneous conditions."

Page 6, Line 3: With Pluto's demotion to dwarf planet status, you can remove the "and Pluto" from the text.

Page 7, Line 16: Should be "principal component analysis".

Figure 9: The "Locations" in the figure panels give two latitudes. I assume that the number followed by S should be followed by an E instead?

Page 17 and Figure 10: "Peak wavelength" is given in terms of wavenumber.

Page 19, Line 7: Change "Interesting" to "Interestingly".

References

Loeb, N. G., S. Kato, K. Loukachine, and N. Manalo-Smith, 2005: Angular distribution models for top-of-atmosphere radiative flux estimation from the Clouds and the Earth's Radiant Energy System instrument on the Terra satellite. Part I: Methodology. *J. Atmos. Oceanic Technol.*, 22, 338-351.

Smith, G. L., 1994: Effects of time response on the point spread function of a scanning radiometer. *Appl. Opt.*, 33, 7031-7037.

Interactive comment on *Atmos. Chem. Phys. Discuss.*, 14, 18421, 2014.