

Interactive comment on “Intercomparison of stratospheric gravity wave observations with AIRS and IASI” by L. Hoffmann et al.

Anonymous Referee #2

Received and published: 23 September 2014

In this study, L. Hoffmann et al. have compared the retrieval of stratospheric gravity waves with two infrared hyperspectral limb-sounding instruments: AIRS and IASI. While AIRS data have already been extensively used to provide characteristics of gravity waves in the stratosphere, it is the first time that the IASI instrument, which shares many similarities with AIRS, is used in this respect. The approach used by the authors to derive gravity-wave disturbances in brightness temperatures from the raw spectrally-resolved radiances is described in a very rigorous way, as is the detailed comparisons between the instrument performances and sensitivities. The authors then illustrate their results with 3 case studies of orographic and convective gravity waves that enable the reader to get a feeling of the similarities and differences between AIRS and IASI gravity-wave retrievals. A first global climatology of gravity-wave brightness tempera-

C2844

ture variances is provided at the end of the article. The article is well written, and the authors' method and results are clearly stated and discussed. It provides solid foundations for the future use of IASI observations to extend our knowledge of gravity waves in the stratosphere. The article perfectly fits with AMT, and I thus recommend to publish it with only minor revisions.

1 Minor comments

p8422, l26: you have chosen here to convolve the IASI spectra with a Gaussian window to mimic AIRS spectral resolution. Although such treatment is perfectly justified in this comparison, I wonder how it might degrade gravity-wave retrievals from IASI raw measurements? Can you tell us how you expect the IASI results would be modified if such treatment were not performed?

p8424, l8-9 and 21-24: I have the impression that the detrending procedure you are using to subtract the variance associated with large scale processes might remove signals due to gravity waves if the gravity-wave packet phase lines are (nearly) aligned with the cross-track scan direction (i.e. if the wave propagates along the satellite track). Is this correct? If yes, the sensitivity to horizontal wavelengths shown in Figure 5 represents actually a maximum sensitivity, and this sensitivity might be degraded depending on the wave direction of propagation. I encourage the authors to discuss this point, and to indicate how this directional sensitivity might influence the gravity-wave climatology provided at the end of the paper.

p8425, l9-11: This point should at least be clearly stated in the caption of Figure 5, or even better, Figure 5 (right) should be redone with this finite resolution effect (and the x-axis going down to 0). Right now, this figure gives the erroneous feeling that the AIRS and IASI sensitivities are perfect down to infinitely small wavelengths.

p8429, l20-24 and Figure 8: I have found these lines quite confusing. Especially, I am

C2845

not sure of what is meant by "wave amplitudes" here. Is this brightness temperature amplitudes, or sensible temperature amplitudes? Similarly, the color bar of Figure 8 left panel refers to "4.3 BT perturbation (K)" (which is perfectly clear), while that of the middle panel refers to "amplitude (K)" (which is confusing)? It would furthermore be very helpful if only one wording were used (either perturbation or amplitude). Last, I wonder whether the "horizontal wavelength" on Figure 8 right panel actually refers to the horizontal wavelength along the cross-track direction. Is this right or are you using a 2D S-transform?

p8431, l12-13 and Figure 9: It might be worth stating how the local variances are obtained in the caption of Figure 9.

p8432, l23: "westerly"? Summer stratospheric winds are easterly winds...

p8434, l5-11: I did not succeed to follow this discussion. "IASI daytime temperatures are warm biased by up to 10K"... "AIRS and IASI background temperatures compare very well" (night-time temperatures then?)... "Daytime AIRS temperature are 2-3K larger than IASI" (so they are even more biased?)

p8435, l2-3 and l7-8: On the one hand, you seem to suggest that the high-latitude gravity-wave cycle is mainly due to source effects, while on the other hand you argue that it is mainly due to wind-induced satellite visibility. My feeling is that the latter definitely makes sense given your sensitivity analysis and Figure 11 (ECMWF winds), while you do not have strong arguments here to support the former.

p8436, l17: Is it "K" here or "K²"? Your correlation coefficients apply to gravity-wave variances, and Figure 13 and 14 also display variances.

Figure 11-13: I would encourage the authors to be more specific on the axis/colorbar title: "4.3 μm BT variances" rather than simply "variances".

Interactive comment on Atmos. Meas. Tech. Discuss., 7, 8415, 2014.