Response to Referee #1

General comments:

Fast radiative transfer (RT) models are a crucial component of NWP assimilation systems and as clearly stated in the introduction of the manuscript, it is of paramount importance that errors associated with fast RT models are properly addressed and fully understood and, consequently, documented. To date, we are not aware of any paper in the peer-reviewed literature where an assessment of the performance of a fast RT model used in satellite data assimilation has been performed on the scale and the level of detail attempted in this work using IASI, or indeed any other instrument, data. In addition to the relevance for NWP assimilation, the study of RT model errors are also valuable for the spectroscopy community in that they can reveal deficiencies in the molecular databases or in the line-by-line models themselves. In the paper we have highlighted a number of issues related to LBL models errors and it would be surprising (at least in our opinion) that any expert in these fields would dismiss them as not scientifically relevant. Regarding the novelty of the approach, it should be noted that the use of an NWP environment to assess RT model errors is not quite considered as a standard approach. We are aware that this approach can have its limitations. Nevertheless, what we have tried to demonstrate in the paper is that an NWP system be used effectively and there are clear merits in doing that.

The objective of the paper is to asses the accuracy of fast model computations (and consequently the accuracy of the underlying LBL computations). The impact of forward model errors on atmospheric constituent profiles is outside the scope of the paper.

Specific comments:

Section 1 and 2:

I will try to address the pointy made by the reviewer and clarify in the text the meaning of LBL and radiative transfer model.

The RTTOV predictors are described in many papers referenced in the text.

The observation geometry of IASI is fully taken into account (i.e. all scan positions have been considered in the computation of error statistics). The zenith angle at the surface is converted into the viewing angle at nadir by performing a ray-tracing across the atmosphere.

The error covariance is discussed in the reference to Rabier et al. in the introduction. The observation-error covariance matrix is indeed the sum of the instrumental-error covariance matrix and the forward-model-error covariance matrix.

Section3: I have kept the description of the LBL models very short indeed. Only the most basic feature are described in the text. Their description is essential for the interpretation of the results.

I agree with the reviewer that an additional section should be introduced after section 3.3.

Section 4 (I think the reviewer refers to section 5): I do not agree that there is a continuous jump between micron and wave numbers. In fact wave numbers are used throughout the paper. The only place where micron is used is at the beginning of section 5.1.1 to denote the absorption bands of CO_2. This is common practice in spectroscopy.

I will locate the ozone band explicitly in the text.

The coverage of the IASI spectrum (i.e. the whole near infrared) allows the unique opportunity to study all features of the spectra. This is why I have gone to great lengths to discuss results in any relevant spectral region.

The objective of the paper is to asses the accuracy of fast model computations (and consequently the accuracy of the underlying LBL computations). The impact of forward model errors on atmospheric constituent profiles is outside the scope of the paper.

Table 1: I agree with the reviewer that the caption of Table 1 should be changed.