Atmospheric Chemistry and Physics Discussions
Special Issue: The IASI instrument onboard the METOP satellite: first results
Manuscript Number: acp-2009-65.
Monitoring of atmospheric composition using the thermal infrared IASI/MetOp sounder by Clerbaux et al.

Reply to Anonymous Referee #1

Dear Reviewer 1,
Thank you for the useful and constructive comments. We took them all into account, and a detailed point-by point reply is provided hereafter.

General
This is an introductory paper to a series of more detailed papers and has been reviewed as such. The paper is generally sound, but is somewhat long in places. It would benefit from being shortened before final publication.
As recommended we have shortened the conclusion part (several sentences were removed or moved, see hereafter).

Specific Major Comments
Section 1 – Introduction – As I understand it the AIRS instrument is not "dedicated to operational weather forecasting" - it is a research instrument. It certainly has improved weather forecasting, but it is on a research satellite, not an operational one.
The word 'operational' was removed from the sentence.

The list of tropospheric sounders is limited to the Fourier Transform spectrometer instruments and even then omits significant instruments such as GOSAT, ACE and the like.
The sentence was modified to:
"with that of tropospheric sounders dedicated to atmospheric chemistry and climate (e. g. the Interferometric Monitor for Greenhouse gases, IMG, the Tropospheric Emission Spectrometer, TES, the Atmospheric Chemistry Experiment, ACE-FTS, and the recently launched GOSAT mission)."

In the next sentence (8310-9) reference is made to "compromises" but there are no statements of what these were.
It is a compromise between spatial coverage (meteorology requirement) and spectral resolution (chemistry requirement, to be able to accurately retrieve trace gases + have some vertical information). The sentence was modified to:
"In the case of IASI, the instrument design resulted from compromises between the meteorology requirements (high spatial coverage) and the atmospheric chemistry needs (accuracy and vertical information for trace gases). This led to the development of an advanced instrument based on a Fourier Transform Spectrometer (FTS) that was designed by the Centre National d'Etudes Spatiales (CNES) (Cayla, 1993; Blumstein et al., 2004) and combines good horizontal coverage with a moderate spectral resolution".

Section 2.4 – Figure 2 has two lines on it, but they are not distinguished
We made the figure caption more explicit to distinguish both lines. It is now:
IASI radiometric noise as established from a set of representative spectra, spanning a range of latitude. Values are provided in radiance units ($W/(m^2.sr.m^{-1})$, black line, left scale), and were converted to noise equivalent temperature difference (NEdT, blue line, right scale) for a given reference temperature of 280K.

Section 3.2.1 – The discussion of "FLG_CLDSUM" is confusing. First it is a flag (8317-9), then it is a percentage (8317-11) – but what a percentage of what is not defined. In the next sentence (8317-13) FLG_CLDSUM>0 is the problem condition. I am not sure that introducing what is obviously a program variable name is helpful at this point – but more explanation of the meaning of this indicator would be helpful. Also it would be useful to tie this back to the statement (8316-12) that "only data that are not contaminated by clouds . . .. were selected for further processing. . ."

We put some details on how to interpret the Eumetsat cloud flags as it is not clear how to use these flags when reading the Eumetsat documentation.
We agree that the way it was previously written was confusing. We tried to rephrase and reorganize this paragraph to make it clear what we call "cloud free data" and which flag to use and how.
The end of the paragraph is now: "The summary cloud fraction flag (FLG_CLDSUM), which combines information from the different cloud parameters, was used for the analysis of trace gases reported here. All data corresponding to the cloud flag between 0 and 25% are further analyzed".

The last sentence of 3.2.1 (8317-14) does not fit there and it significance is unclear.
Where do the emissivity data come from and how are they related to the cloud filtering?
We agree that this sentence might not belong to this paragraph. It has been removed.

Section 3.2.3 – 8319-27 indicates that data were validated with GOME-2 products and with a chemistry-transport model – it's probably only my opinion, but in my opinion validation essentially involves the comparison of two measurements and therefore validation cannot be performed using one set of measurements and a model.
We agree with your opinion. The Massart et al. paper (also part of the IASI special issue) is dealing with data assimilation of ozone from other instruments such as MLS and SCIAMACHY. So it is not a direct comparison of IASI O3 data with model data. The sentence has been modified so that it is more explicit. It is now:
Ozone total and tropospheric columns were generated from the NN algorithm, and validation of these products with GOME-2 data and assimilation of other satellite data are discussed in Boynard et al. (this issue) and Massart et al. (this issue), respectively.

Section 3.3.1 – This is where averaging kernels play a significant role. 8321-12 gives the basis for the plots of Figure 7, but fails to specify where the first level of the temperature profile occurs and what the averaging kernel appropriate to that level looks like.
The first level of temperature is provided on a fixed pressure grid and is always in the boundary layer. The averaging kernel is directly linked to the thermal constrast, and we rephrased the sentence accordingly:
This temperature difference (ΔT) is often referred to as the thermal contrast, a critical parameter for analyzing retrieved products from infrared missions as it determines the shape of the averaging kernel function and if the measurement contains information from the boundary layer or not (e. g. Deeter et al., 2007).

Since the entire discussion is about separating the temperature near the surface from the temperature at the surface, this information is important. The essential question is: Are the measurements of temperature at the first atmospheric level independent of the temperature measurements of the surface?
Yes, the temperature at the first atmospheric level is independent of the temperature measurements of the surface. The temperature profile is derived from the analysis of CO2 bands (with the assumption of a known concentration of CO2) whereas the surface temperature is obtained by converting radiance channels free of absorption (window channels) into a BT channel using the BB law.
New sentences are:
Figure 7 shows the ΔT distribution derived from IASI observations in May 2007, where skin temperature is the brightness temperature of the surface derived from IASI surface sensitive radiance channels, and T is the temperature of the first level in the temperature profile (where the latter is derived from the analysis of CO_2 bands). It is worth noting that these two parameters are retrieved independently.

The explanation of Figure 7 is also rather long
We had several feedbacks from people saying that this discussion is useful. Although most of this is well know since a few years and has been well described by e.g. the Mopitt team, it is worth noting that it is the first time that we can draw daily global maps.

4 Conclusions and Discussion – much of this section is a re-iteration of the rationale and characteristics of the instrument. It could be significantly shortened without loss to the paper.
Paragraph 2 of the Conclusion and discussion section was shortened by a few sentences.

There are references to several useful websites, etc. – but these are neither discussion nor conclusions of the paper and should be moved into another section.
Reference to the website for CO daily plots and SO2 alerts were moved to Section 3.2.3

Specific minor comments:
All the minor comments were taken into account and corrections were brought in the paper as asked.