

## ***Interactive comment on “IASI-METOP and MIPAS-ENVISAT data fusion” by S. Ceccherini et al.***

### **Anonymous Referee #1**

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#### General comments

This paper deals with the very important problem of exploiting at best the information coming from different sensors that sound common air masses. The task is tackled using the measurement space solution (MSS) approach that some of the authors have proposed in a recent paper where data fusion was identified as a possible application. As an example the authors combine the MSS solution of a MIPAS ozone profile retrieval with the one of a coincident IASI retrieval. The case study is exhaustive because, although the information content is seemingly unbalanced in favor of MIPAS, the two experiments are complementary with respect to the sounded altitude regions. The scientific content and the presentation quality of this paper are high. However I have a few specific remarks that the authors should address before publication in ACP.

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#### Specific comments

\* The MSS method and the data fusion procedure that follows are described in Sect. 2 with an appropriate and simple language; reference is made to Ceccherini et al., 2009a for the full descriptions. In my opinion it would be wise to include in this paper a short section reporting the basic algebraic formulas that have been applied throughout the steps of the reported application. These formulas could be helpful to refer in several parts of the text (see e.g. L. 149-150).

\* The authors report a sample application of data fusion and use it to highlight the advantages and the potentiality of their approach. However, in my understanding, this is not only an academic study but there is an indication that the method is suitable to be routinely used for operational applications. Since only random errors (matrix  $S_y$ ) are considered in the MSS calculation (and therefore in the fusion process) I see the problem of combining the systematic errors to derive the total error budget of the fusion results. The authors should indicate how to handle this problem that is likely to be encountered in operational applications.

\* Sect.s 3.2 and 3.3. It would be wise to specify the strategy that has been adopted to define the initial guess in the retrieval simulations.

\* I find that figure 1 is rather superfluous; the plotted lines are not resolved and all the necessary information can be found in Fig. 2 except for the shape of an ozone profile that, however, can be assumed as known.

\* Figure 5 shows that, at 5 km, the vertical resolution of MIPAS profile has been degraded by the fusion. This negative aspect should be noticed in the text.

\* The proposed method provides comparative merit indicators (such as information gain, number of degrees of freedom, AK) relative to the two (or more) considered experiments. This outcome suggests to me that the method could represent a powerful tool to compare the performance of different experiments with respect to specific tar-

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gets of interest. I understand that many variables would enter in this kind of exercise that however could provide useful indications about the selection of observation strategies for future experiments. The choice about whether to touch this aspect in the paper is left to the authors, however I leave this point as a possible hint for the open discussion.

#### Technical corrections

L. 75 and throughout the text: “collocated” should be changed with “co-located”. L. 257: the “significant quality improvement” applies to only the IASI case and not to a generic “only one” case. Table 2: specify UTC (if this is the case) when reporting time.

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Interactive comment on Atmos. Chem. Phys. Discuss., 10, 183, 2010.