

## ***Interactive comment on “A thermal infrared instrument onboard a geostationary platform for CO and O<sub>3</sub> measurements in the lowermost troposphere: observing system simulation experiments” by M. Claeymaen et al.***

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A thermal infrared instrument onboard a geostationary platform for CO and O<sub>3</sub> measurements in the lowermost troposphere: observing system simulation experiments.

Answer to the referee 1 :

First of all the authors thank the reviewer for the reports he has provided. His remarks and comments have been taken into account in the revised paper. Below, we answer point by point the different comments from the reviewer:

C952

"This OSSE study by Claeymaen et al. demonstrates the added information in data assimilations using ozone and carbon monoxide measurements from a TIR instrument in GEO with spectral resolution and NESR that allow sensitivity in the lowermost troposphere (LmT) as compared to O<sub>3</sub> and CO measurements from a TIR instrument in GEO with (degraded) spectral resolution and NESR designed more for T, H<sub>2</sub>O measurements and to the control run. The paper provides interesting results in the skill of these instruments to aid in forecasting of ozone pollution events."

We thank the referee for these positive comments.

"However, the results comparing the two instruments are not very surprising given that the GEO-TIR2 has both worse spectral resolution and NESR compared to GEO-TIR. A more interesting study would be to examine whether spectral resolution or NESR is more important for the LMT information added in data assimilation. Furthermore, the study did not cover trade-offs of temporal/spatial sampling/resolution."

This study is the first step in a comprehensive programme to evaluate air quality measurements from a GEO platform. In this context it is important to quantify the benefit of particular satellite configurations. This is the focus of the paper. We agree with the referee that testing various configurations is valuable and involves investigating the technical specifications associated with each configuration; this is key to our approach. In particular, we will test other GEO configurations (e.g. TIR vs TIR+VIS) in future papers. These tests will also look at trade-offs between the various instrument parameters, and, naturally, will take into account model resolution.

"Nonetheless, this paper represents a positive development in the use of OSSEs to define the measurement requirements needed for improving AQ forecasting. The paper is well organized, but somewhat difficult to follow in terms of the definitions of experiments, instruments and statistical metrics. I have tried to make suggestions below to improve this."

We have addressed the suggestions from the referee as indicated below.

C953

"Specific comments Abstract :

Line 4. "instruments to monitor ozone (O3) and carbon monoxide (CO) for air quality purposes over Europe" could be changed to "instruments to measure ozone (O3) and carbon monoxide (CO) for monitoring air quality over Europe" "

done

"Line 5. "The originality of this study could be changed to: "The primary motivation of this study""

done

"Line 10. The abstract should state the main differences (i.e., spectral resolution and NESR) in the instruments, after "Both instruments measure radiances in the same spectral TIR band.""

done

"Line 13: " The value of the measurements" could be changed to "The information added by the measurements""

done

"Line 18: " but lower than" could be changed to "although still lower than""

done

"Line 19: " dedicated to monitoring " could change to "with a capability for monitoring""

done

"Introduction: p. 818: 2 citations of (Jacob, 2000) and 1 citation of (Turquety et al., 2009) should be (e.g., Jacob, 2000) and (e.g, Turquety et al., 2009)."

done

"p. 819 Line 21: Korea is also developing an AQ monitoring instrument in GEO –  
C954

Korean GEMS on MP-GEO from NIER – you could cite S. Lee et al, EGU2010-7595-1."

done

"p. 821 Line 2: Do you mean Clerbaux et al., 2008a? (you have 2008b). Also, you should include the Stuhmann et al. reference here."

done

"Section 2.3: p. 824 Lines 5-10: - IR spectral range should be specified - A table with instrument specs would be useful - Is the NESR defined for a common spectral sampling or the sampling corresponding to each instrument ?"

We add a Table with this information. The NESR is defined for the sampling corresponding to each instrument.

"Section 2.5: It would be useful if Table 3 was expanded to include the correlation, bias and RMS for the nature runs vs. assimilated runs with GEO-TIR and GEO-TIR2 for the 4 experiments."

This is an oversight on our part. We add this information in Table 3 and amend the text accordingly.

"Section 3.2: p. 832 Line 19: "the implications of this are discussed later" Where? Figure 4 is hard to follow – it would be easier if you compared GEO-TIR2 to the CR (as in Eq. 2) instead of to GEO-TIR. More descriptive row and column titles would help. Also, for the plots that show statistical differences almost everywhere, what does this difference mean ?"

We remove the sentence.

The point of Fig. 4 is to assess the added value of GEO-TIR compared to the control experiment (CR) and GEO-TIR2 (which is reasonably similar to MTG-IRS), hence we keep the panels. However, we improve the figure layout as indicated by the referee.

The reason for comparing GEO-TIR2 to the GEO-TIR in Fig. 4 is to demonstrate that the differences between these experiments are significant, i.e., the use of a different set up has a significant impact. Significant differences in Fig. 4 indicate that for the use of different set ups, the impact is significant. Alternatively, if the differences were not significant, this would indicate that one set up was not better than the other (by this objective measure).

Statistical differences almost everywhere indicate that the set ups are very different. We add this comment to the text.

"Section 3.2.1 p. 833 Line 5: reference to Figure ??"

This is Figure 5. Done.

"Sections 3.2.1-3.2.4 Figures 5-12 might also be easier to interpret if both b & c cases are compared to the a case (CR) and then to each other – i.e. have 4 columns for the bias & RMS rows.

The point of Figs. 5-12 is to assess the added value of GEO-TIR compared to the control experiment (CR) and GEO-TIR2. We improve the figure layouts as for Fig. 4.

"Section 3.3 Vertical scale is very hard to read on Figs 13-14"

The vertical scale is improved.

"Section 3.4 p. 841 Line 22 – spelling: "treshold""

done

"Section 4 : p. 842 Line 26: Include both Clerbaux and Stuhlmann references ?"

We include both.

"p. 843 Line 16: "if the control run error is very small and the observation error is bigger." Bigger than the control run error or is the observation error variable ?"

This is a typo ; it should be "big". This is corrected.

C956

"p. 844 Line 1: "brings bigger improvement" could be "provides significantly more improvement""

done

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Interactive comment on Atmos. Meas. Tech. Discuss., 4, 815, 2011.