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Comment

***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. Claeysman et al.***

**Anonymous Referee #1**

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This OSSE study by Claeysman 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. However, the results comparing the two instruments are not very surprising given that the GEO-TIR2 has

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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. 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.

### Specific comments

#### Abstract:

Line 4. “. . .instruments to monitor ozone (O<sub>3</sub>) and carbon monoxide (CO) for air quality purposes over Europe” could be changed to: “. . .instruments to measure ozone (O<sub>3</sub>) and carbon monoxide (CO) for monitoring air quality over Europe”

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

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.”

Line 13: “ The value of the measurements. . .” could be changed to “The information added by the measurements. . .”

Line 18: “ (but lower than. . . ” could be changed to (although still lower than. . .”

Line 19: “ dedicated to monitoring . . . “ could change to “with a capability for monitoring. . .”

#### 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).

p. 819 Line 21: Korea is also developing an AQ monitoring instrument in GEO – Korean GEMS on MP-GEO from NIER – you could cite S. Lee et al, EGU2010-7595-1.

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

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?

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.

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?

Section 3.2.1

p. 833 Line 5: reference to Figure ??

Sections 3.2.1-3.2.4

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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.

### Section 3.3

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

### Section 3.4

p. 841 Line 22 – spelling: “treshold”

### Section 4 :

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

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?

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

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