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# ***Interactive comment on “Development of a numerical system to improve particulate matter forecasts in South Korea using geostationary satellite-retrieved aerosol optical data over Northeast Asia” by S. Lee et al.***

## **Anonymous Referee #1**

Received and published: 29 July 2015

The manuscript shows the development and application of a technique to improve aerosol forecasts by using geostationary satellite data enhanced with a kriging technique which is then used to modify initial conditions for a chemical transport model simulation. The results show encouraging improvements in model skill. The study is of great novelty, advances science on the use of geostationary satellite data, is well written, and is in the scope of the journal. I recommend publication after some changes/additions related mainly to including additional analysis to get a more complete picture of the method presented.

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## Main comments

One additional CMAQ simulation and analysis that I would like to see is a comparison between using initial conditions from GOCl but without using kriging (single frame on the time of initialization without filling any gap) vs using kriging. This would help show how valuable is to enhance the GOCl data with kriging, which is one of the main novelties of this study. You could add some of these results to Fig 6.

The results are shown for specific air pollution episodes. However, since the system is planned to be used operationally, it would also be useful to see some performance statistics for the less polluted conditions. That way it can be stated if this is a tool for episodes only or for any condition.

Since MODIS AOD is also an operational product and shows slightly better performance than GOCl, it would be nice to see additional sensitivity experiment where MODIS AOD is included into the kriging stage along with GOCl. Since the MODIS bias is very low, this could help with the systematic bias you get in your CMAQ results.

When comparing GOCl vs MODIS (Fig 3) you are comparing a 6km vs a 10km retrieval, so resolution might play a role in the differences seen in performance and spatial coverage. MODIS collection 6 provides 3km AOD, so it would be interesting to include this product as well to “bound” in some way the GOCl resolution.

In several places of the text the authors state that kriging is used instead of data assimilation (e.g., beginning of section 3.1 and section 2.3). However, the kriging is a data processing stage to enhance the GOCl data and is not related to data assimilation (i.e., combine model and observation). Actually, one could use the output from the kriging into a data assimilation system. What you are replacing by data assimilation is the way you change the model concentrations (e.g. assumption of a perfect observation, choice of observation operator and control variable). Please correct this throughout the text.

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## Other comments

Page 5319, Line 11. SeaWIFS is no longer operations since 2010 so I wouldn't include as a product that can be used

Page 5322, Line 18. It is not clear what the numbers mean, hours? Configuration index? Please rephrase

Section 2.2.1. Please clarify that the GOCl vs MODIS comparison is done before kriging

Fig. 3. How is spatial coverage from GOCl computed? Do you use a single GOCl time for a similar time of the Terra overpass? Or you average several GOCl frames? Please explain this in the text to better understand where the differences in spatial coverage come from.

Section 2.3 . The kriging fill the gaps of the GOCl data. Is the kriging able to fill all of the gaps? If not, how do you determine if there is enough data to fill a gap. If you don't fill a gap, then this column in the CMAQ is not modified, right?

Page 5329, Lines 21-23. I'm having problems understanding this CV choice. You assume SO<sub>4</sub> and OA is the same only for the increment? Or you make SO<sub>4</sub> and OA be the same in the final model concentrations? You also mention something about the surface, so you don't do anything aloft? Please clarify

Page 5329, Lines 27. CV #4 balances SO<sub>4</sub>, NO<sub>3</sub> and NH<sub>4</sub>, but do you do anything with OA? Table 3 says you do change it.

Page 5336, line 26-27. It can greatly influence composition but you show that for PM<sub>10</sub> and AOD differences between CVs are not large. Please rephrase this sentence.

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Interactive comment on Geosci. Model Dev. Discuss., 8, 5315, 2015.

**GMDD**

8, C1548–C1550, 2015

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