

Interactive comment on “Lower Thermosphere response to solar activity: an EMD analysis of GOCE 2009–2012 data” by Alberto Bigazzi et al.

Anonymous Referee #2

Received and published: 21 February 2020

General comments

The manuscript contains significant analysis of a big dataset of GOCE mission and geomagnetic and solar flux indices (a long time series spanning more than 3 years). A new method based on EMD analyses to estimate thermosphere response (atmosphere density) to solar activity is suggested and justified. The method can have important practical application but is it not well discussed in the paper.

Specific comments

1. In figure 1 there are significant changes of altitude which are not explained in the text. May they influence data analyses (because one of the main reasons of higher error in the third time zone is the rapid changing of satellite altitude)?

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2. In figure 3 there is a subplot (time 534.4 – 535) which is also not mentioned in the text. And what is the nature of obvious periodic oscillations?
3. In figure 4 I suggest correct numbering (last plot is e) but in alphabetic ordering in should be d)) and to add a) – d) to the plots (it will be easier to understand what is what)
4. It is not commented what data are presented in figure 5 (second and third plot). Here density is averages, but for what time? Daily as in figure 6?
5. First plot of figure 6 shows “correlation” of density and Ap index, but used averaged index. Does it make sense because previously it was shown that Ap correlates with fast variations. I think that in this plot better to show correlation with instantaneous Ap or may be skip this plot. Moreover, it seems strange to fit with line such field of dots.
6. Line 175, it is difficult to understand conclusion and the difference between low and high activity. From data it seems that for all periods Ap is needed to get fast impulsive events and solar flux proxies to get low frequency component of density changing. And from table 1 it is seen that all IMP of Ap are used and low frequency components of F10.7 or MgII are needed for all time intervals.
7. To show efficiency of the method to estimate atmospheric density it would be interesting how the function obtained based on one dataset allows to calculate density in another dates. For example, calculate and optimize function using 2009 or 2010 data and apply it to indices in 2011 to get density and compare with measurements. If error is small it shows that method works, if not this can be explained by different solar activity of other reasons. Now you use the same data to get function and analyze its quality.
8. Another important thing is that it should be mentioned that this works for a definite altitude. For different altitude this model should be modified, may be another

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measurements are needed. And interesting question is what makes a greater contribution to the error in the third time interval: increased solar activity or a change in the height of the apparatus?

Technical corrections

Line 102 typo a a -> a

Line 164 capturedd -> captured

Interactive comment on Ann. Geophys. Discuss., <https://doi.org/10.5194/angeo-2019-167>, 2020.