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Interactive comment on "Semimonthly oscillation observed in the start time of equatorial Spread-F" *by* Igo Paulino et al.

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REVIEWER:"**This paper describes day-to-day changes in the onset time of the equatorial spread-F, as observed by an all sky imager and coherent back scatter radar in Brazil. It is found that the onset time occasionally shows a semimonthly (14.5d) variation. The authors present argument that the observed semimonthly variation could be due to the lunar semimonthly tide or 16d planetary wave.**"

AUTHORS: We appreciate the revision and the contributions from the reviewer # 2. We have done our best to address all concerns pointed out by the reviewer.

REVIEWER:"**I have two major concerns about this manuscript. Firstly, the in-**

troduction does not include sufficient information for the reader to understand which part of the results are new. It is stated in Page 6 Line 15, "Lunar semidiurnal tides have been pointed out as important factor to the appearance and the start time of EPBs" but there is no reference to it. If there are already such relevant studies, they must be properly cited, and more importantly, the authors should clarify what are the new results obtained in the present study.

AUTHORS: The reviewer is right. We have improved the introduction emphasising that this is the first time that kind of study was done using airglow images and corroborating with backscatter radar measurements. We have added the citation (Page 7, line 11) and some works have been cited though the manuscript.

REVIEWER:"**My second point is about the significance of the results. The authors fit a semimonthly (14.5d) curve to data segments that are sometimes shorter than one lunar cycle (Figure 2). I do not believe that it is appropriate to perform fitting to such sparse data unless the existence of the semimonthly variation is already known or highly expected. As the authors mentioned, the spread-F shows considerable day-to-day variability, and the authors' method could easily misinterpret random variability as a semimonthly oscillation. In my view there is no convincing evidence in this paper that supports the lunar semimonthly variation of the spread-F. "**

AUTHORS: According to the reviewer suggestion. We have included statistical analysis for the start time of EPB and the results showed that the influence of the semimonthly oscillation if frequent. It helps us to improve our discussion as well (Page 8 line 11 - page 9 line 11). We appreciate this comment from the reviewer.

REVIEWER:"**September 2003 (Figure 2a) There are only six data points. It is**

possible to fit "any" curve to such data. Thus the good fit does not necessarily suggest the semimonthly variation of the spread-F. The results actually seem to suggest that the start time of spread-F did not change much with time during this event.'

AUTHORS: In part, we agree with the reviewer. Any curve can be fitted to any data set. However, it fits very well and there is scientific reasons to set this kind of fit in the data. Please, see as following, another example, in which, the 14.5 days does not fit very well. Moreover, the statistical analysis can support those case studies showed in Figure 2 of the manuscript.

REVIEWER:**"October 2005 (Figure 2b) This is the most interesting event among those investi- gated in this paper. There is a shift in the start time of spread-F to later local times by almost two hours during 22-26 October and a shift to earlier local times during 29 October-3 November. Although it is not clear at this point whether these variations have anything to do with the lunar tide or 16d PW, this event deserves more detailed investigation. For instance, the authors could check whether the PRE plasma drift velocity shows consistent behavior. The authors should also examine whether source wave (lunar tide or 16d PW) existed in the middle atmosphere during this event."**

AUTHORS: We thank the suggestions from the reviewer. We have checked the time of maximum vertical drift of the F layer from the digisonde data of São Luís. The results does not matched to the October, however in early November there was a clear oscillation. As explanined to the Reviewer #1, the temporal resolution of the measurements could not be enough to observed this kind os variation.

REVIEWER:**"November 2005 (Figure 2c) This has the same issue as the Septem-**

ber 2003 event. The data are too few, so that the fitting is not reliable."

AUTHORS: Same comment for Figure 2a.

REVIEWER: **"January 2008 (Figure 2d) The same as 1 and 3."**

AUTHORS: Same comment for Figure 2a.

REVIEWER:**"November 2005 (Figure 3) This is the same event as 3 (Figure 2c) but there is a discrepancy in the phase of the semimonthly variation between Figure 2c and Figure 3. That is, the extension of the fitting curve in Figure 3 does not match the one in Figure 2c. This demonstrates the fitting technique used in this study is not reliable for extracting the semimonthly variation of spread-F." "November 2008 (Figure 4) The observed variation is very small (<30 min). The radar data is not able to resolve such a small variation as the authors mentioned."**

AUTHORS: We agree with the reviewer that the technique used to analysed the data from the backscatter radar is not well resolved. We have decided to exclude this analysis from the paper and focus on the results from the airglow as suggested by the reviewer. We are working in the data of the radar to improve our analysis and results and we will present it in a future paper.

REVIEWER:**"As a summary, fitting a semidiurnal curve to small data segments is not a justifiable method to evaluate the influence of the lunar tide or 16d PW. This needs to be fixed before the paper is considered for publication."**

AUTHORS: We appreciate all the comments form the Reviewer # 2 and we are presenting a new version of the manuscript considered the main suggestions presented

here.

REVIEWER:**"What the authors could do instead is to take a statistical approach. Since the authors have long-term observations (September 2000 to December 2010), they could simply sort the data according to the lunar phase at the time of the observations, just like earlier researchers did to extract lunar tidal variations in other ionospheric parameters (e.g., Matsushita, 1967). Matsushita, S., Lunar tides in the ionosphere, Handb. Phys., 49/2, 547, 1967"**

AUTHORS: We have done it for the airglow data. Thank you for the suggestion.

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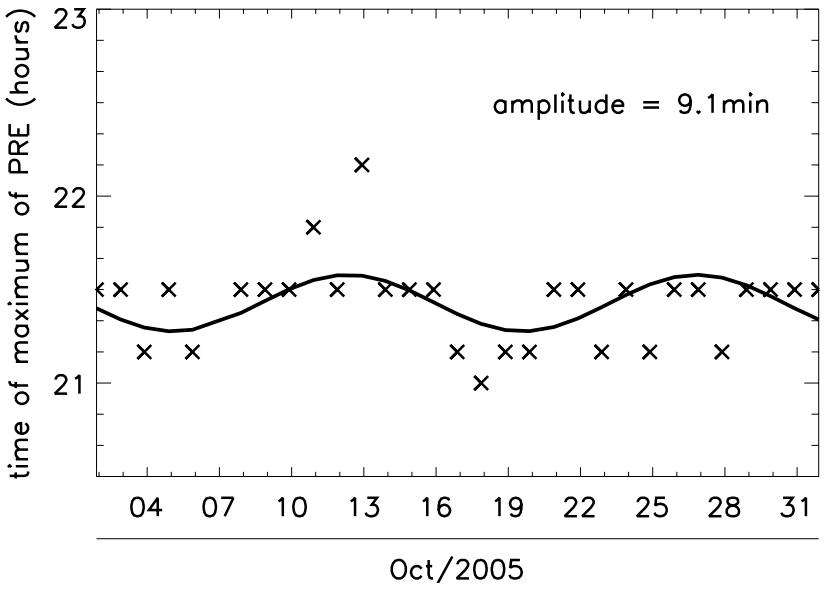
Fig. 1. Same as Figure 3 of the manuscript, but for October 2005.


time of maximum of PRE (hours)
23
22
21
amplitude = 9.1min
04
07
10
13
16
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25
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31
Oct/2005

Fig. 2.