Annales Geophysicae Discussions

Ann. Geophys. Discuss., referee comment RC1
https://doi.org/10.5194/angeo-2020-90-RC1, 2021

Comment on angeo-2020-90

Anonymous Referee #1

Referee comment on "On the semi-annual variation of relativistic electrons in the outer radiation belt" by Christos Katsavrias et al., Ann. Geophys. Discuss., https://doi.org/10.5194/angeo-2020-90-RC1, 2021

Katsavrias et al. in their work "On the semi-annual variation of relativistic electrons in the outer radiation belt" thoroughly investigate the reasons which produce the variations of the electron intensities. The results can be helpful for the adjustment of the future radiation belt models. The manuscript is well written and structured. I would recommend this study for publication after considering the following minor comments/suggestions:

Specific comments:

lines 59-60: How did you derive that background correction rate was less than 75%? Is that specified in the Level-2 data? What do you mean under "only similar to Boyd et al. (2019)"?

line 65, Were both RBSP-A and RBSP-B observations used in this study? How well are the observations from these two spacecraft cross-calibrated?

line 106, please specify the interpretation of values of 0 and 1.

lines 121-122, It is not quite clear what do you mean under "the secondary peaks". Is that the second enhancement after the second islet? And "peaks" mean that those are seen in different energy channels?

lines 157-158, about the presence of the significant semi-annual fluctuations for years 2013-2014 and year 2019 we cannot really judge because they are in the cone of

influence for this period.

Figure 4, why different time spans are used in panels on the left and right sides?

line 189, Could you please clarify what does "90 degrees lead of the first data-set" mean?

lines 200-201, Could you please specify how the phase degrees are transformed in to day's time lag.

line 220, "primarily driven by the theta angle" --> The electron fluxes are not driven by the theta angle. They correlate with the theta angle.

lines 228-241, in study by Smirnov et al., on "Electron Intensity Measurements by the Cluster/RAPID/IES Instrument in Earth's Radiation Belts and Ring Current", JGR, 2019 a clear correlation between AE index, the solar wind dynamic pressure and the electron fluxes at energies of 40 to 400 keV and L-shells 4 to 6 was derived. The enhancement of the solar wind dynamic pressure and AE index occur during the descending phase of the solar cycle. Therefore, these results are also in agreement with those in the manuscript. Namely, they support the scenario of HSS (high speed --> high solar wind dynamic pressure) that drive substorms injections (correlation with AE-index) which populate the radiation belts.

lines 265-272, There is a new model based on the machine learning approach of the electron intensities in the radiation belts at energies 120–600 keV and L-shells ~4 to 7 which is pretty dynamic, depends on the solar wind and geomagnetic conditions and gives high prediction rate: "Medium Energy Electron Flux in Earth's Outer Radiation Belt (MERLIN): A Machine Learning Model", Smirnov et al., 2020, Space Weather. I think it is worse discussing in the outlook. The solar wind electric field does not appear to play highly important role for the electron flux enhancements in this model.

Technical comments:

1. The affiliations 3 and 4 should be added to the affiliation list.

2. Through the manuscript there is a lot of confusion with definition of abbreviations. They are often defined too late, or several times or not defined at all. For example, HSS(ICME) on line 8 are not defined, fully spelled in line 24, 126, 164 and defined in line 165; MagEIS can be defined either in line 2 or line 52; RM is not defined in line 71; EPS should be

defined before line 250.

3. Figure 3, in the horizontal label, "20015"--> "2015"

4. Please add in line 159 at the end of sentence "(not shown)".

5. Please acknowledge the data source of GEO data.