

# ***Interactive comment on “Seasonal dependence of the Earth’s radiation belt: new insight” by Rajkumar Hajra***

**Anonymous Referee #1**

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This article presents an analysis of the periodicity of electron flux enhancements in the Earth radiation belts, and of its main solar wind drivers. Periodograms are established, showing various periodicities (mainly linked to the solar cycle and the seasonal periodicity), depending on the L-shells and for different solar wind parameters. Focusing on L=3.5, this article then shows that the seasonal dependency can only be seen on multi-year statistics, and a large variability is shown from one year to another in the presence and position of flux peaks. While not surprising, these observations might not have been published earlier, and a careful analysis of the year-wise variability of the electron outer belt is of interest to the community.

The language in this article is clear and concise, and the figures are clear, easily readable and appropriately described.

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However, I have the following remarks concerning this article:

- Why was the L parameter used for this study? The  $L^*$  parameter, which is an invariant of the motion of the particles, would certainly provide a clearer picture of the electron radiation belt dynamics, particularly at high L values.
- On line 20, the explained mechanism mostly applies to the outer radiation belt, and obviously not in or below the slot. This is confirmed by the provided periodograms, but should be noted.
- On line 94, the fact that the VB parameter has a 6 month component that is not shared by Vsw is not surprising, since the seasonal periodicity is due to the magnetic configuration. The absence of of periodic component in Vsw below a period of a few years is of interest, and shows that the solar wind activity is intrinsically aperiodic on these time scales, so that the observed seasonal dependency can only be proper to the geospheric system (which is compatible with the usual explanation of the seasonal effect).
- On line 105, the article seems to imply that the current understanding of the seasonal effects (namely the equinoctial configuration of the magnetic field being linked to increased geoeffectiveness of the storms) does not explain the observations presented here, due to the variability of the observed peaks from one year to another. I think the community is aware that the seasonal effects are statistical in nature, since they act on the geoeffectiveness of the storms, and not on the occurrences of the storms (which are aperiodic on short time scales, and have a solar-cycle period component, as shown in the plots of Vsw). The observed year-wise variability is expected with the classical model, which is not clear at all in this article. A more detailed and rigorous analysis of this variability would be of interest to the community, but the mere existence of this variability seems obvious.

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