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Interactive comment on "A statistical study of spatial distribution and source region size of chorus waves using Van Allen Probes data" *by* Shangchun Teng et al.

Anonymous Referee #2

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This paper performs a statistical study of the spatial distribution and source region size of both rising tone and falling tone chorus waves based upon a Van Allen Probes data survey. They find that rising tone chorus waves have a higher occurrence rate near the geomagnetic equator, while the falling tone chorus waves have a higher possibility to be observed at lower L-shells and higher magnetic latitudes. They also conclude that both rising tone and falling tone chorus waves are generated near the equatorial plane, roughly consistent with previous theoretical estimates.

This study brings statistically new information about naturally discrete chorus emissions, in terms of exploration of the unprecedented Van Allen Probes data sets. Since

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whistler mode chorus is a key contributor to the acceleration and loss of magnetospheric electrons and its generation mechanism remains not fully understood, the presented results act as a valuable and timely addition to the current knowledge about magnetospheric chorus and arouse further efforts to look into its drivers and associated quasi-linear / nonlinear wave-particle interactions as well.

Below are some specific comments for the authors to consider and address:

Specific:

1. A number of studies have adopted AE* (the maximum or average value of AE in previous hour) to investigate the geomagnetic activity dependence. Please justify or discuss the adoption of AE for such an analysis.

2. Figure 5 shows very interesting results of the chorus wave source region size and the good agreement between observations and theories. What is the error bar associated with the average observational results? Please clarify. By the way, for L = 4.5 on the bottom panel, is one blue line on the right missing (or overlapping)?

3. Also about the source region sizes of rising tone and falling tone chorus. The presented results show a clear dependence on the chorus spectral shape. Say, at L = 4.5 and 5, the former is statistically larger than the latter; and vice versa at L = 5.5 and 6. Is there any explanation for this feature? Please give some discussions.

4. Lines 19 – 20: Please add the following references about chorus-driven diffuse auroral precipitation Ni, B., R. M. Thorne, Y. Y. Shprits, and J. Bortnik (2008), Resonant scattering of plasma sheet electrons by whistler-mode chorus: Contribution to diffuse auroral precipitation, Geophys. Res. Lett., 35, L11106, doi:10.1029/2008GL034032. Ni, B., R. M. Thorne, X. Zhang, J. Bortnik, Z. Pu, L. Xie, Z.-J. Hu, D. Han, R. Shi, C. Zhou, and X. Gu (2016), Origins of the Earth's diffuse auroral precipitation, Space Sci. Rev., 200(1), 205-259, doi:10.1007/s11214-016-0234-7.

Minor: Page 1: Lines 6-7: better read as "at lower L-shells and higher magnetic lati-

tudes” Line 10: the observations

Page 3: Line 12: better remove “conditions”

Page 4: Line 4: using the quasilinear theory

Page 9: Line 23: better read “during periods of different geomagnetic activities” and “at the dayside sector” Line 27: at higher geomagnetic latitudes Line 28: between the equator and higher latitudes (< 10ˆo)

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