

Interactive comment on “AMPERE Polar Cap Boundaries” by Angeline G. Burrell et al.

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The authors would like to thank the reviewer for their thoughtful response. These changes will make the manuscript more accessible, improving its clarity and impact. We have addressed the reviewers comments as detailed below.

1 General Comments

With respect to the reviewer’s concerns about the IMF, the confusion seems to arise from the discussion of the CRB detection algorithm. In an attempt to clear up this confusion, we have expanded the discussion in Section 2.2 to better discuss the algorithmic biases and how they affect the validation data set. In Section 4 we added: ‘These local

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times were chosen due to the MLT-dependent variations in the CRB-OCB relationship discussed in Section 2.2. Recall, as well, that no specific selection was made for IMF conditions. All IMF clock angles and magnitudes are considered together, as the AMPERE OCBs will be valid at all IMF conditions when the OCB can be represented (to first order) by an ellipse.’

We decided not to break up the validation by clock angle, IMF steadiness, or IMF magnitude for several reasons. Firstly, at dawn and dusk the CRB-OCB relationship is not strongly dependent on the IMF (though it is at other MLTs). However, any dependence of the CRB-OCB relationship on IMF at this time will confuse the interpretation of the validation. Thus, it is most appropriate to consider all IMF conditions together and not attempt to infer if variations in the distribution are due to an IMF dependence on the part of the CRB or the AMPERE/IMAGE OCBs. Secondly, the number of points available as the data set is further broken down makes the results less statistically significant. However, the reviewer may be interested in seeing the figures that led the authors to come to this decision (Figures 1-5).

With respect to the reviewer’s concerns about the relationship between the OCB and CRB, these concerns were addressed in Section 2.2. Specifically “Near magnetic noon and midnight, the flows tend to be mostly sunward or antisunward, meaning there is no clear reversal in the convection as a function of magnetic latitude”. This, along with the other enumerated points in this section, make it clear that it is impossible for the CRB to be used in any sort of validation apart from the magnetic local times near dawn and dusk. The authors thought it was most appropriate to discuss this in the data selection portion of the paper, since these considerations were used to select an appropriate validation data set. However, to ensure that reader recalls the details of this discussion when the validation is brought up, we have added this sentence to the validation Section: ‘These local times were chosen due to the MLT-dependent variations in the CRB-OCB relationship discussed in Section 2.2.’. In addition, we have expanded the discussion of the CRB in the Introduction.

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2 Technical Comments

These points refer to the numbers of the technical comments made in RC1.

1. We changed the wording in the introduction to be more similar to that used in the abstract.
2. Revised wording in the introduction.
3. Removed the Joule Heating example.
4. Clarified this statement to read: 'Due to these and other differences in MIT coupling processes in the auroral oval and the polar cap, it is desirable to have a coordinate system that indicates in which region measurements were taken.'
5. We disagree with the reviewer that specifics were not provided in this sentence, as this phrase immediately follows and refers to three peer-reviewed journal articles that demonstrate the improvements that can be made in statistical and climatological studies by using OCB oriented coordinates. However, to avoid confusion we have added a specific example from one of these articles: '(for example, Chisham (2017) demonstrated the difference between using magnetic and OCB oriented coordinates when studying the climatological behaviour of the plasma drift vorticity)'
6. Changed the introduction to introduce the OCB by name in the second paragraph.
7. Changed the wording to be more specific and added a reference to the review paper by Coxon et al. (2018). 'Because the location of the Birkeland current system is tied to the expansion and contraction of the polar cap under quiescent and disturbed conditions (Coxon, et al., 2018).'

8. Replaced 'measured by' with 'inferred from particle precipitation measurements made by'
9. The CRB is now introduced in the third paragraph in the introduction, and related to the Dungey cycle (which is used as a reference point for all of the other examples).
10. Clarified text to say: 'Because the direction of convective plasma drifts are strongly tied to the motion and state (i.e., open or closed) of the magnetic field lines'
11. Moved to the introduction.
12. Fixed author name order in bibTeX (here and elsewhere)
13. Removed dash in reference year
14. The statement was revised to be: 'The similarity between the two fits can be quantified by comparing the differences between a_{Median} and $a_{S.G. Peak}$ (0.40°) and the typical difference between the hourly median and S.G. peak values (0.49°); the differences between the eccentricity and angular offset are even less significant.'
15. Fixed as suggested
16. Fixed editor names.
17. Removed the two extra 'and's in the article title.
18. The Jones citation is correct (more correct with the dashed year), as it is obtained from the SciPy.org citation guide available at: <https://www.scipy.org/citing.html>
19. Fixed title in Spiro reference.

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20. Updated the Zhu reference.

21. Reviewed all bibTeX entries, removing unneeded fields that may have caused the Copernicus template to create non-standard looking references.

Interactive comment on Ann. Geophys. Discuss., <https://doi.org/10.5194/angeo-2019-113>, 2019.

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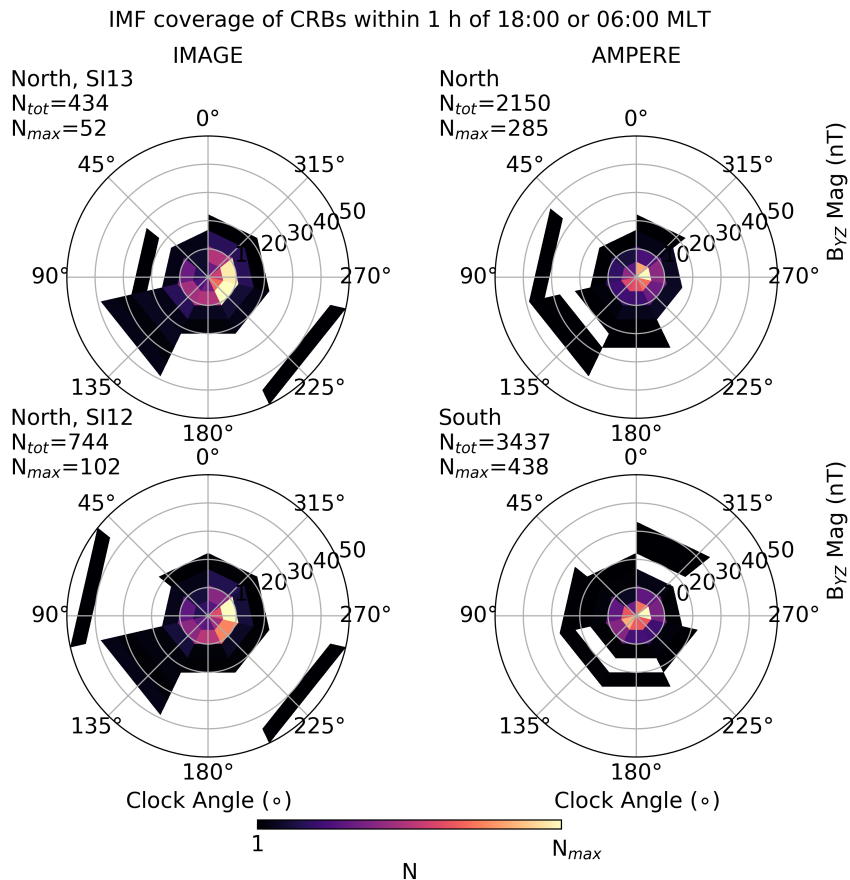


Fig. 1. IMF coverage by clock angle and magnitude

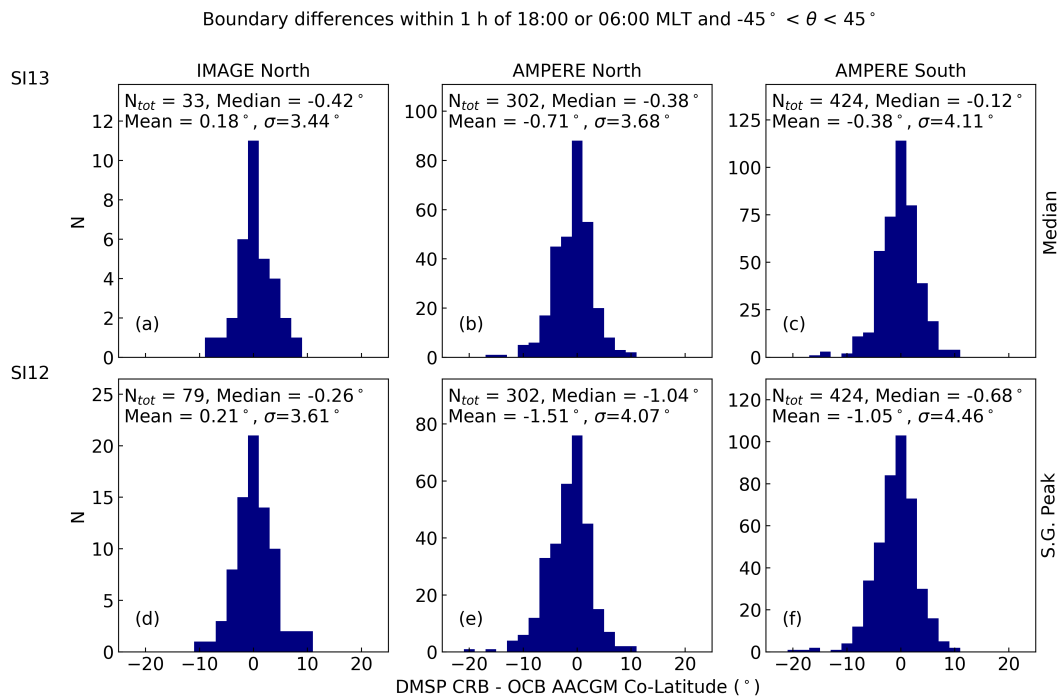


Fig. 2. +Bz Validation

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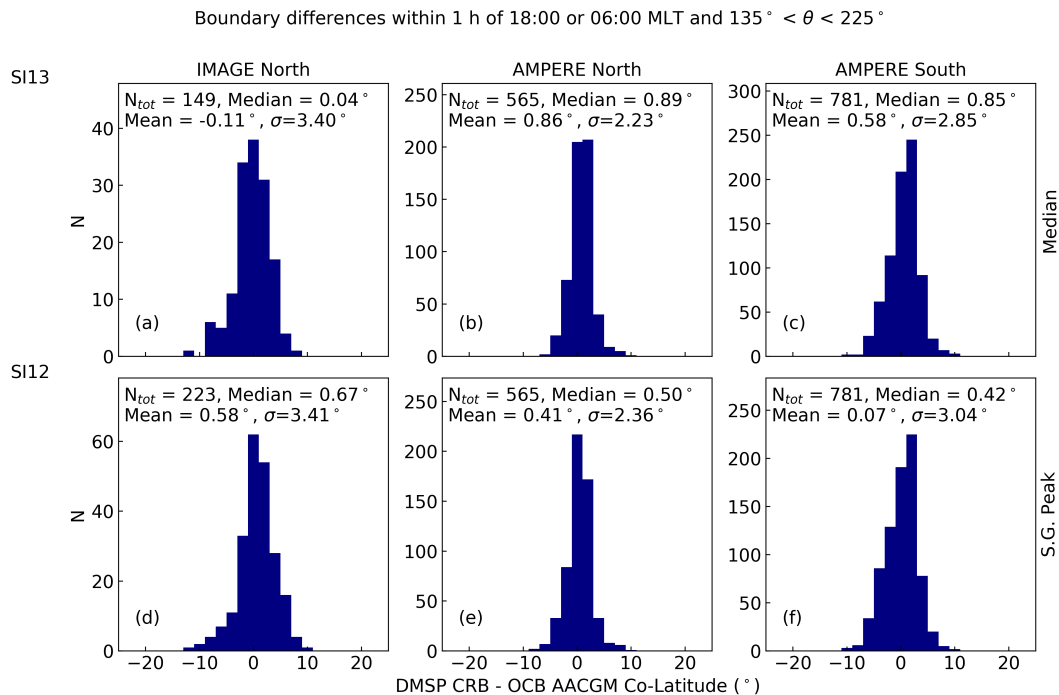


Fig. 3. -Bz Validation

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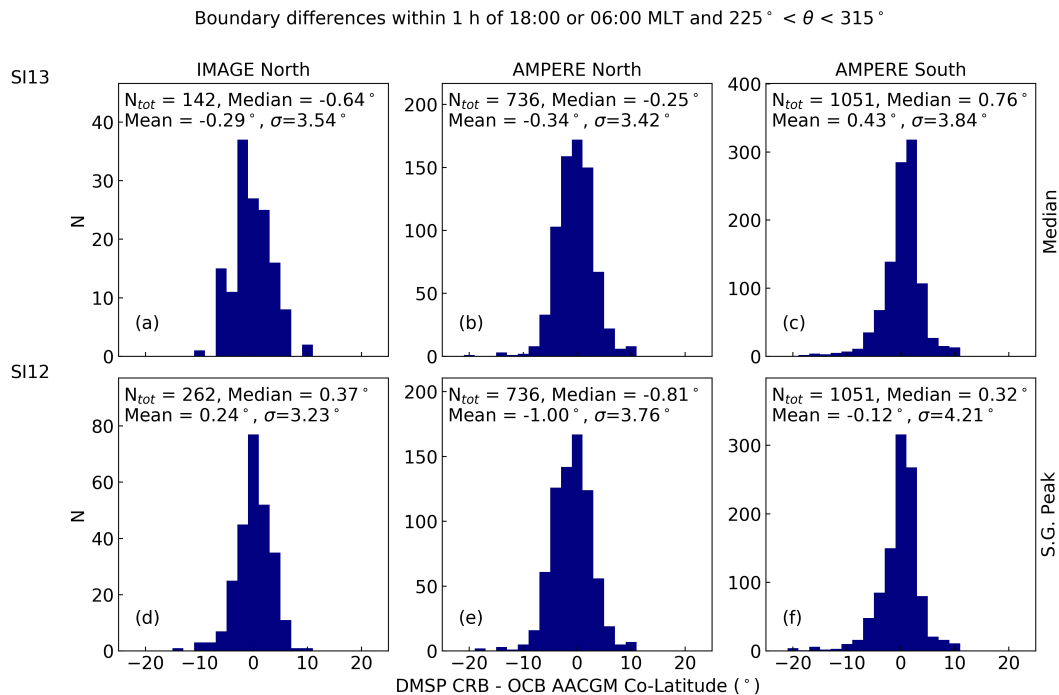


Fig. 4. -By Validation

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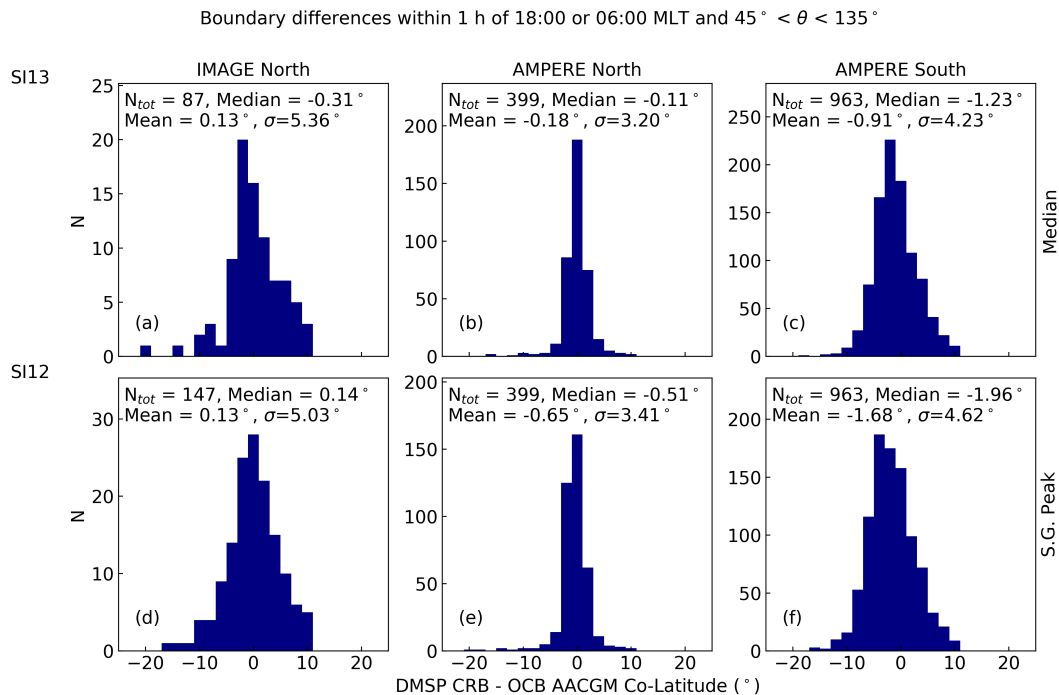


Fig. 5. +By Validation

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