

Combined response to the referees:

First; I wish to thank the referees both for critical comments and some unexpected questions regarding conjugate auroras and plasma physics in my manuscript on the results of the 120 yrs old conjugate, polar cap auroral data recorded during the Gjøa and Discovery expeditions!! I have – to the best of my knowledge, answered your questions and comments rg. the content. I have even pointed out – what I believe are some mistakes/misunderstand in your referees. I agree that my English is far from excellent, but should be understandable. I don't agree that Fig. 1 is not illustrative and shows some interesting effects. Simultaneous geographic and magnetic coordinates plotted on a sphere, is difficult to plot. Have looked around and not found a better figure to illustrate that the two stations are at opposite end of the same field line which connect to the Earth near 78° magnetic latitude.

Second: My main aim with this work was to check if also polar cap auroras are mainly a geomagnetic phenomenon or if solar e-m radiation is an important source for auroras at polar latitudes. In addition, if it is possible from magnetic signatures to conclude that there are auroras overhead, even if you don't see them.

I have tried hard in my last version to change and update the language, but without changing the physical results from this investigation. The text in chapters 6 & 7 is updated and adjusted, but the conclusions are not changed. Chapter 7.1 have been cut out.

Thanks for pointing out I had forgot a reference. The final reference list has been checked and updated.

An auroral observer get suspicious if auroras are not observed a couple of hours around magnetic midnight, or when the daily variations of auroras follow the daily magnetic Sq variation.

To your information, I have not changed the lay out of the paper and even kept the figures. However, to update my English, I have made a lot of small changes in the original text, both a few new sentences and changed several words. By these changes I hope the quality has increased.

March 2024, Alv Egeland.

Changes in my last version of the updated manuscript on “conjugate auroras”.

My main aim with this work was to check if also polar cap auroras are mainly a geomagnetic phenomenon or if solar e-m radiation is an important source. In addition, if it is possible from magnetic signatures to conclude that there are auroras overhead, even if you don't see them.

The Science results are not changed in the last version, but I have tried hard to update my English so the reader clearly understand what I try to point out.

1. Rg. The lay out: Have cut out Ch. 7.1, but kept the other chapters and the figures.
2. Chs. 6 & 7. The physical characteristics, particular the test rg. the form called SAA have been rewritten – not changing the physics, in a more modern form, which I hope is more clear English. I conclude stronger that this polar cap auroral form is likely generated by photoelectrons because they show a daily variation similar to the Sq curve of the daily magnetic records.
3. I have added 3 new references in the final list and in the test.
4. In the other chapters + Abstract, several small – a few sentences, but mainly several words, and language changes have been made to improve the English. As I have not stored the earlier version, I can unfortunately not be more detailed/accurate.

5. Still the main conclusion – the characteristics of polar cap auroras are different from those observed in the oval, as pointed out in the first version.

I certainly hope this is what you need. If you have proposals and questions, I will try to answer quickly.

Best regards Alv.