

Extraction of ground magnetic signatures from solar quiet (Sq) current systems in sub-auroral regions

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Extraction of Sq Information

Is achieved directly by applying signal filtering for periods of 24h, 12h, 8h and 6h on horizontal components X and Y of geomagnetic field measurements from magnetic observatories

Visualisation of Filter output

Is done via statistical analysis during magnetically quiet periods between 1991-2019 in dependence of local time **LT** and season **Ls**

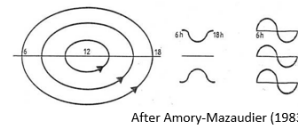
Geomagnetic Baselines

The Sq variations as directly extracted by the filters, together with long-term variations, may be used to determine magnetic quiet variation curves during magnetically quiet periods

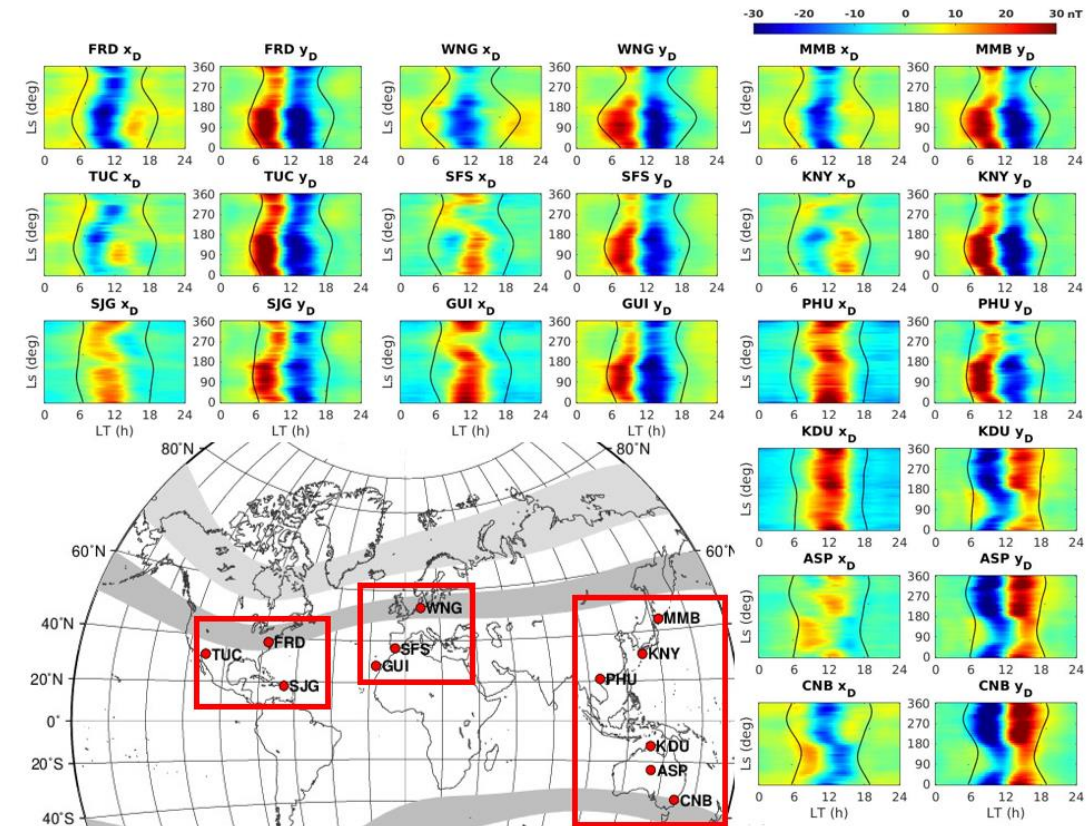
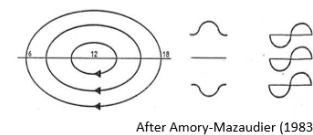
Sq Current Cell Footprints

The statistical analysis reveals that the filter output captures the Sq variations well.

Ideal patterns in the Northern Hemisphere



Ideal patterns in the Southern Hemisphere



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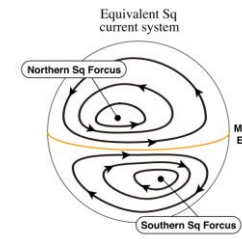
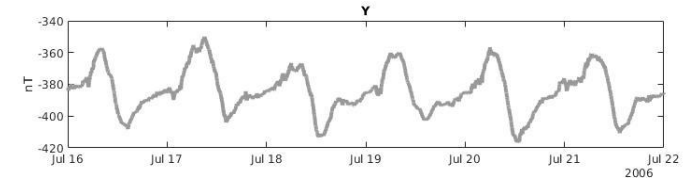
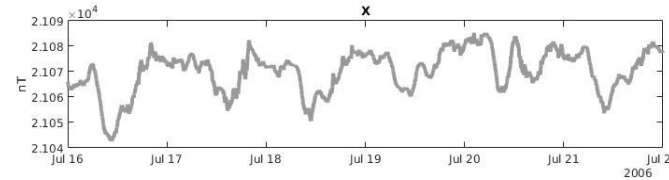
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Haberle et al. 2022
(under review)



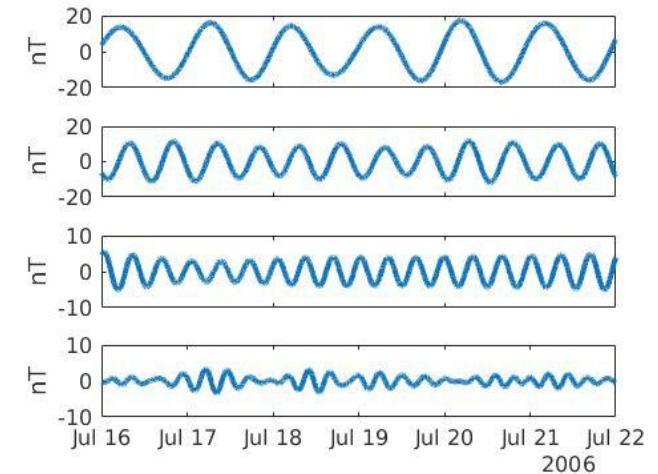
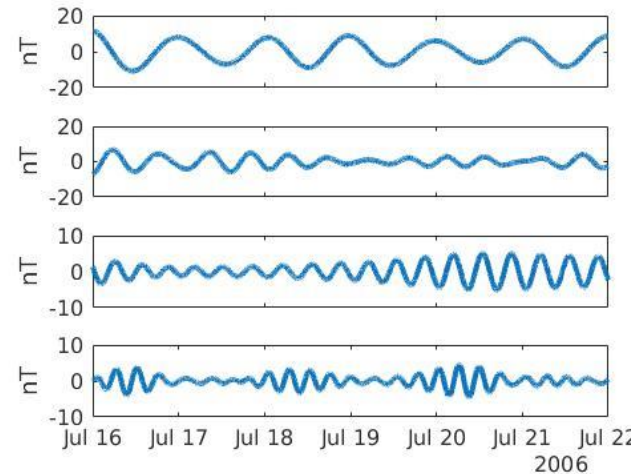
Extraction of Sq information

Viewing the horizontal components X and Y of the geomagnetic field data as a discrete time signal ...

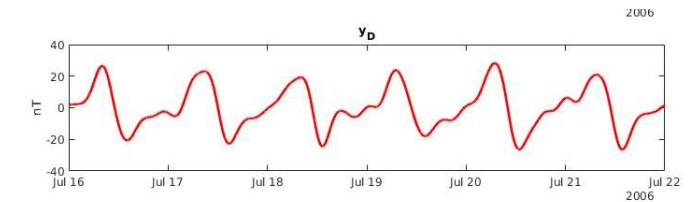
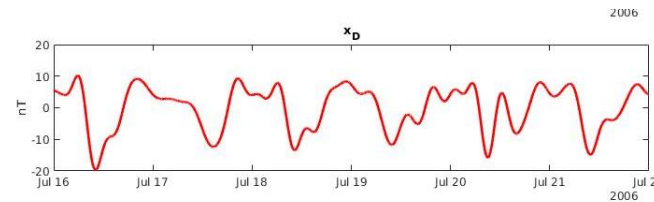


... allows us to apply filtering techniques ...

Signal Contribution	Notation	
Long-Term	$x_{>24}$	$y_{>24}$
Diurnal	x_{24}	y_{24}
Semi-Diurnal	x_{12}	y_{12}
8 hours	x_8	y_8
6 hours	x_6	y_6



... to extract major contributions that are induced by the Sq current



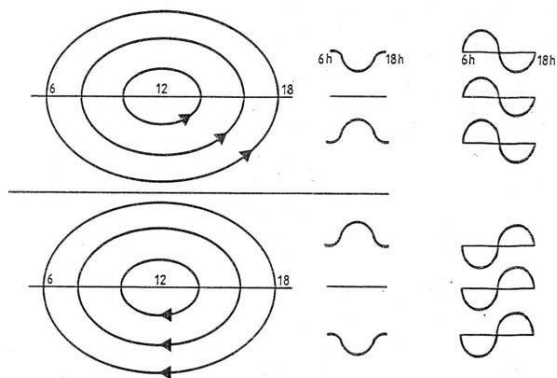
Visualisation of Sq information

Analysis of the filter output during magnetically quiet periods
in dependence of

- local time **LT**
- season **Ls**

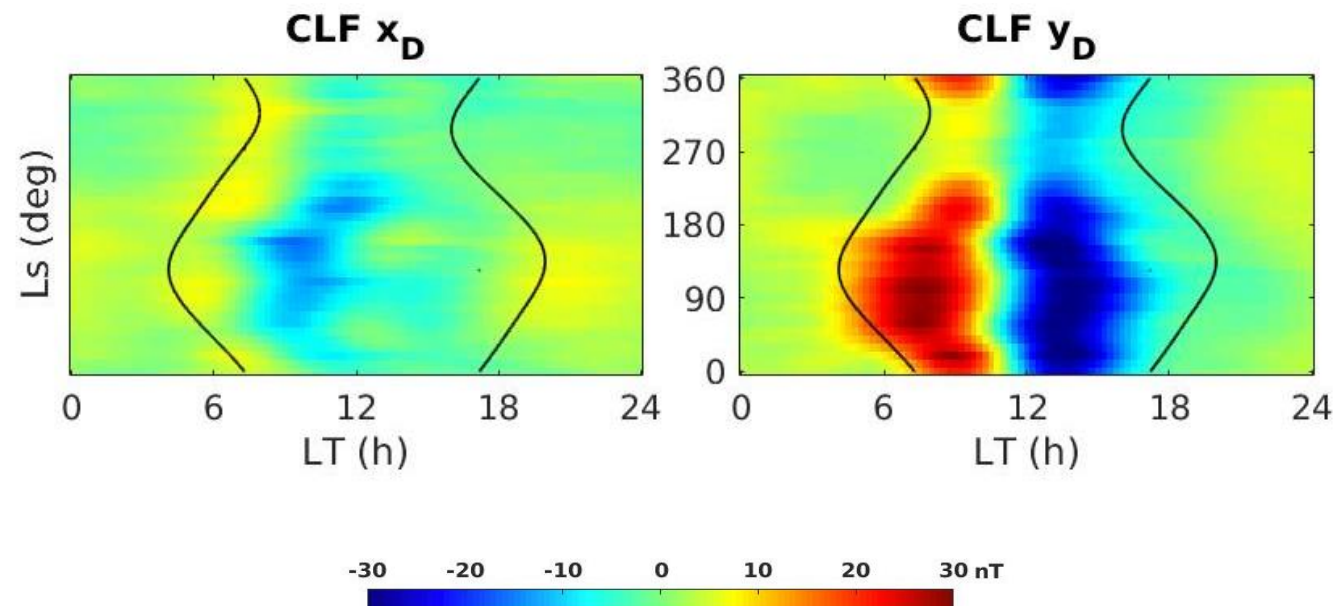
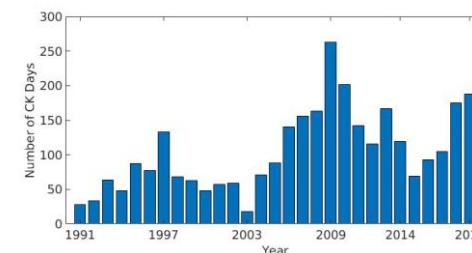
... in order to identify Sq footprints

Idealised Current Cell



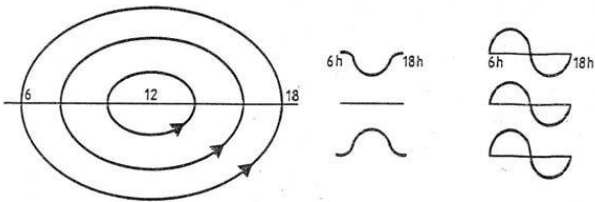
After Amory-Mazaudier (1983)

CK48 days between 1991-2019



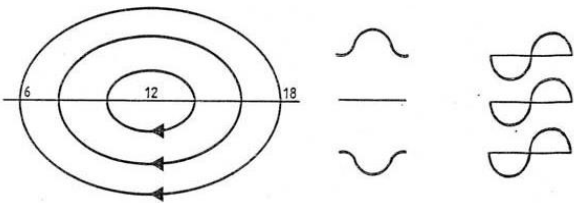
Sq Footprints

Ideal patterns in the Northern Hemisphere

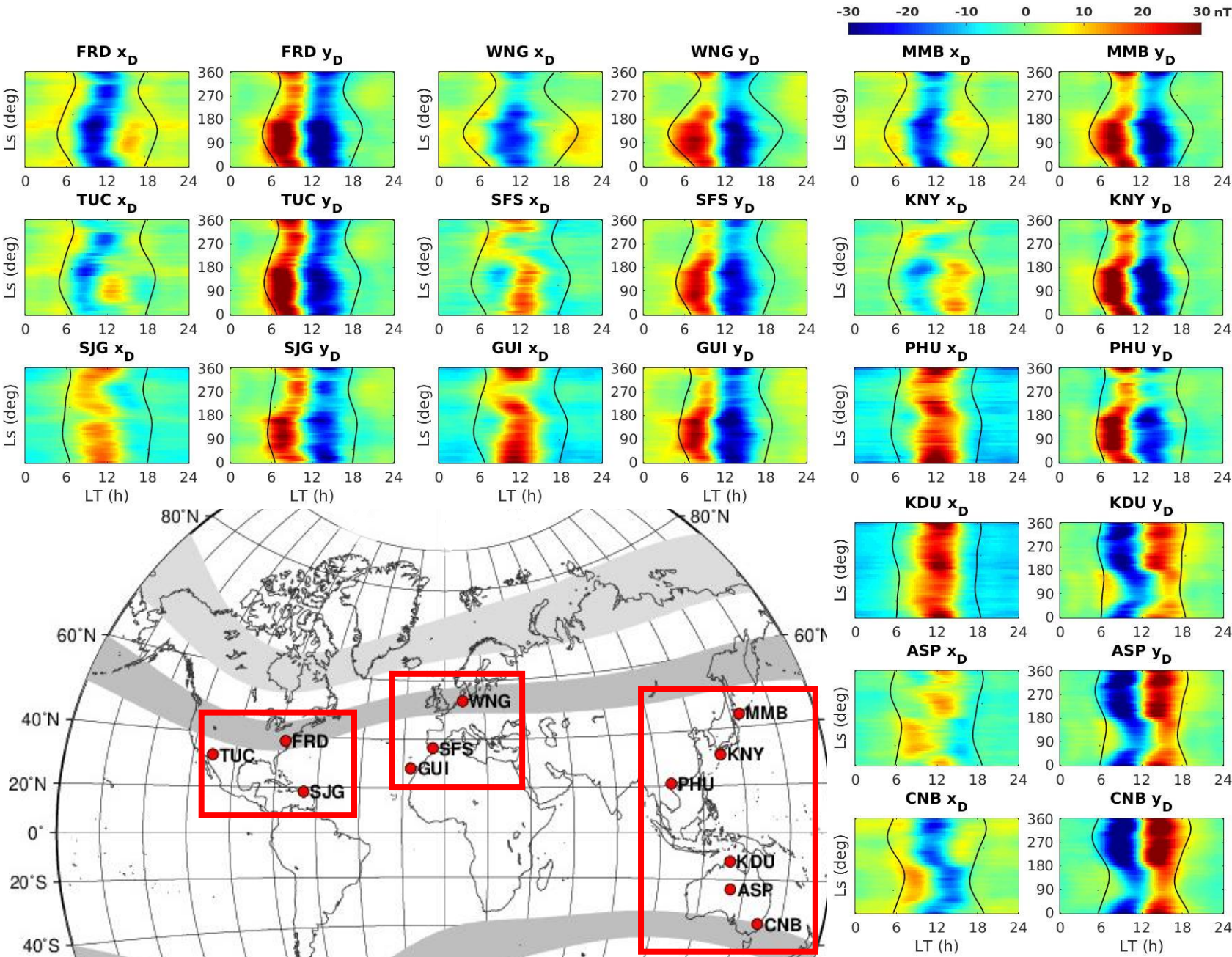


After Amory-Mazaudier (1983)

Ideal patterns in the Southern Hemisphere



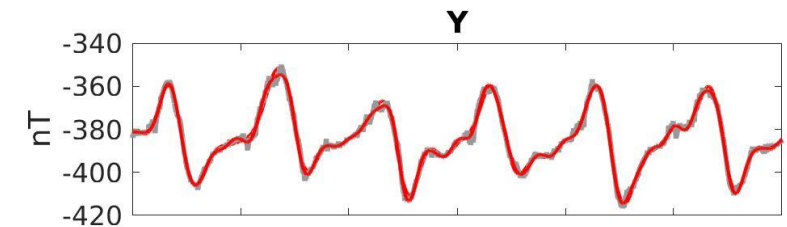
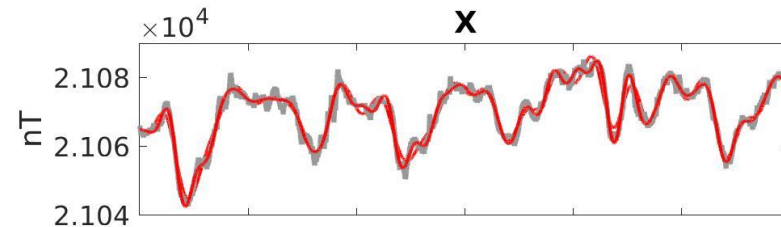
After Amory-Mazaudier (1983)



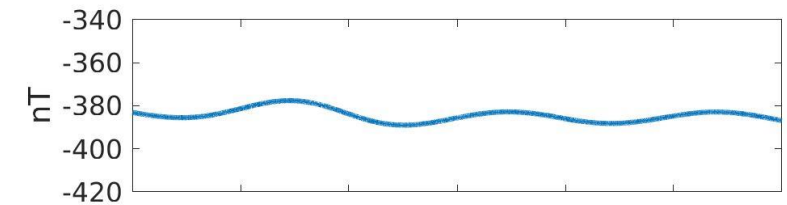
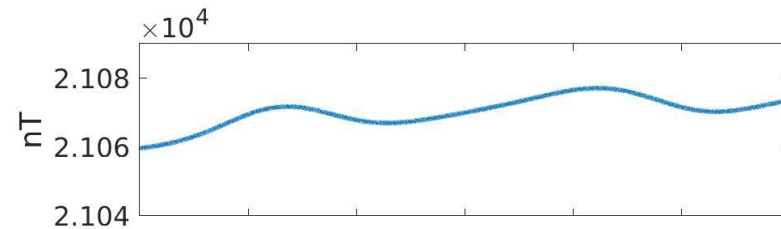
Sq as part of Geomagnetic Baselines

In low- and mid-latitudes (including sub-auroral) the Sq current is one of the major contributor to the geomagnetic quiet variations

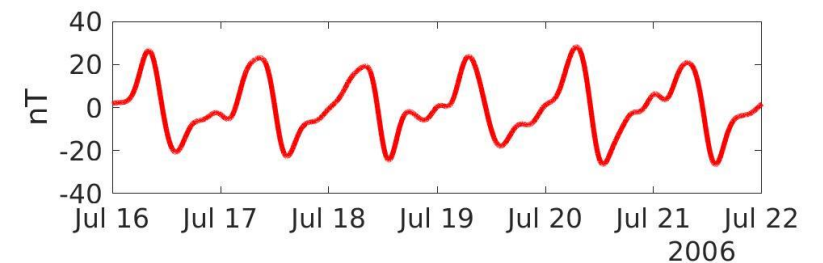
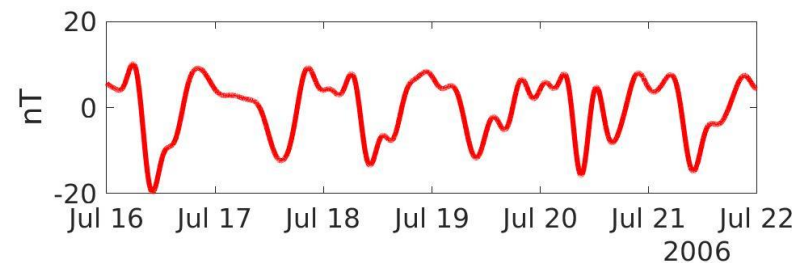
Geomagnetic signal
Long-term + Sq



Long-term contributions



Sq contributions



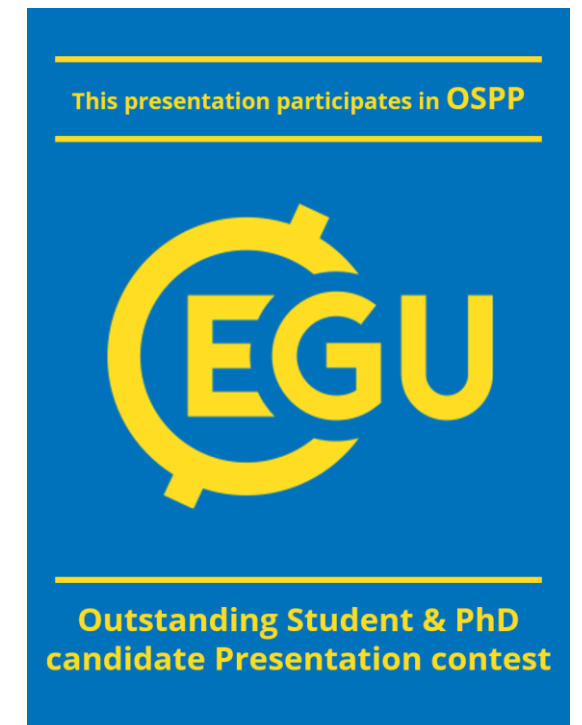
Thank you!

Thank you for your interest in our research and taking your time to follow our progress.

**If you have any further comments, questions or feedback
feel free to approach me directly during the conference**

Or send a message to veronika.haberle@irap.omp.eu

**Watch out for
Haberle et al. 2022
(under review)**



References

Amory-Mazaudier, C. (1983) Contribution à l'étude des courants électriques de moyennes latitudes en relation avec les observations du champ géomagnétique terrestre. Thèse de Doctorat d'Etat, Université Pierre et Marie Curie, Paris.

Yamazaki Y. (2011) Study on energy transfer of solar radiation and solar wind into equatorial ionosphere. PhD dissertation, Kyushu University, Fukuoka, Japan

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