EGU22-12282
https://doi.org/10.5194/egusphere-egu22-12282
EGU General Assembly 2022

Optical observations of thermospheric neutral temperature in aurora

Daniel Whiter and David Price
School of Physics & Astronomy, University of Southampton, Southampton, United Kingdom (d.whiter@soton.ac.uk)

The aurora can have strong electric fields and currents associated with it, which deposit a significant amount of energy in the neutral upper atmosphere through heating. Such heating must be included in global atmospheric models used to study thermospheric dynamics, coupling between the atmospheric layers, climate, and drag on spacecraft and space debris in low Earth orbit. However, the heating rate is poorly quantified, and often spatial structure is not well represented. Heating is typically estimated by measuring the ionospheric electric field using radar, which is then combined with measurements or estimates of the neutral wind velocity and Pedersen conductivity to calculate a Joule heating rate. However, such measurements of the electric field necessarily neglect small scale spatial and temporal variability through their relatively coarse resolution and averaging. The Joule heating rate is proportional to the square of the electric field, and therefore the spatial and temporal averaging can lead to a significant underestimate of the Joule heating rate. As a step towards improving estimates of neutral heating, we have developed a technique to invert spectrographic measurements of aurora to observe the thermospheric neutral temperature altitude profile at high temporal resolution. Application of the technique to an auroral event shows substantial Joule heating adjacent to an arc where the E-field must be strong, as well as heating embedded within an auroral curl, which we associate with an intense field-aligned current.