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Understanding variability in atmospheric electricity measurements at Sodankyla, Finland

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High latitude measurements of the atmospheric Potential Gradient (PG) can provide valuable information on understanding sources of variability in the Global Electric Circuit (GEC). The influence of solar activity on electrical processes (such as ionisation) is much greater at high latitudes, allowing the mechanisms by which space weather affects atmospheric electricity to be studied. The often cleaner environment, which means that PG measurements are not dominated by variations in local aerosol concentrations, also means that processes related to changes in near surface ionisation (e.g. from radon) can be studied.

Measurements of PG have been made at a high latitude site in Sodankyla, Finland (67°22' N, 26°38' E) since 2017 using a Campbell Scientific CS110 Electric Field Mill. Sodankyla is a heavily instrumented site for meteorological, geophysical and auroral research and so a wealth of additional observations are available to support PG analysis. This research provides an overview of 7 years of PG measurements at Sodankyla, including analysis of the typical fair weather diurnal variation, which demonstrates clear evidence of the GEC signal, with a morning minimum and evening maximum, with significantly larger PG values during summer months than winter. This work will also analyse the diurnal and seasonal variability in PG at Sodankyla alongside the variability in co-located ionisation measurements, comprising observations of Radon222, as well as “external” radiation from a gamma ray spectrometer which is sensitive to gamma emission from natural radioactivity as well as galactic cosmic rays. This work will contribute to understanding around how conductivity variations resulting from changes in local ionisation rate contribute to diurnal and seasonal variability in PG at clean air sites.