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The thermospheric auroral red line polarization: comparison between theory and observations.

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The existence of the auroral red line polarization is now an established feature. Several steps still need to be fulfilled in order to make this observable a true space weather proxy. First, we must progress in understanding it theoretically, to know which parameters in the space environment can be derived from its measure. Then, we must increase that number of observations.
We have performed a coordinated EISCAT Svalbard Radar (ESR) and Spectro Photo Polarimeter (SPP) observation campaign in the Arctic (Svalbard archipelago) in February 2012 in order to compare the measurements with the theoretical polarization estimate.
We deduce the theoretical polarization from a multiple steps approach. First, we use an electron transport code to infer the electron precipitations on top of the atmosphere needed to produce the electron density profile measured by ESR. We then deduce the stationary electron flux in the ionosphere. This parameter depends on the angle versus the magnetic line and allows defining the electron anisotropy. The theoretical polarization is computed from this anisotropy and is compared to the totally independent measurement.

The theoretical Degree of linear polarization (DoLP) maximizes around 215 km where its value is in very good agreement with the measurements. This allows to perform a study of the DoLP versus different parameters. We show that the polarization may be used to access a badly known parameter: the scattering function of the electrons through an elastic collision. It also varies significantly with the electron precipitation spectra and with the geomagnetic activity, and could therefore become a very precious proxy for space weather applications.