COMPARISON OF THE TRUE QUIET ELECTRON DENSITY OF TWO DIFFERENT HIGH LATITUDE SITES

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ABSTRACT

Two data sets consisting of incoherent scatter radar results from Scandinavia (EISCAT) and rocket borne measurements are compared concerning their True Quiet (TQ) electron densities. The locations are Longyearbyen (Spitzbergen), and Tromsø (Norway mainland), respectively.

The former site is located on the edge of the northern polar cap (78.2°N) while the latter is in the auroral oval (69.6°N).

The Spitzbergen TQ results were presented earlier by the authors in 2004 and are the first continuous study of the electron densities at such a high latitude.

The comparison verifies the TQ generation routines, discarding event-based enhancements of the electron density, considering only electron densities due to solar controlled ionisation. The data are processed separately for day and night values and a transition is applied around twilight. For night conditions one constant value at each pressure level is assumed, whereas for daytime an analytical dependence on solar zenith angle is included. As a global parameter the dependence on the solar flux density is obtained and included in the model.

The present model covers the ionosphere from the D-region beyond the F-region peak and is specified as a function of neutral background pressure substituting altitude.

All data - both from VHF and UHF - since the commencement of the operations (1984 for Tromsø, and 1997 for Spitzbergen) of the respective radar installations to the present day are included, namely about 300,000 profiles from Spitzbergen and beyond 100,000 profiles from EISCAT Tromsø. All EISCAT profiles were interactively inspected and obvious erroneous profiles were either limited or completely rejected.

The D-region proper is covered by some 500 Russian rocket borne probe measurements from Molodezhnaya (Antarctica) for the auroral zone, and Heiss Island for the polar cap, respectively.

Despite the relatively low number of rocket profiles their contribution is significant because for quiet conditions electron densities in the D-region are below the threshold of EISCAT.

The behaviour at these two high latitude locations are compared to each other and implications such as pertaining to the neutral atmosphere are discussed.