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Detailed spatial and temporal structure in high latitude thermospheric winds and temperatures

E. Griffin (1), A. Aruliah (1), I. McWhirter (1), E. Ford (1) and A. Aylward (1)

(1) Atmospheric Physics Laboratory, University College London (email: eoghan@apl.ucl.ac.uk; fax: +44 20 76799024)

In recent years advances in CCD technology have allowed greater time resolution to be achieved in a number of optical applications. In the area of upper atmospheric remote sensing the Fabry-Perot Interferometer (FPI) has been used for many years to observe the upper thermospheric 630 nm atomic oxygen emission. In early 2002 an electron multiplied CCD (EMCCD) was installed in an FPI located at the KEOPS site, Esrange near Kiruna, Northern Sweden (67.8 N, 20.4 E). The instrument has been operated in a standard FPI cycle using 20 second integrations for much of the observing seasons following the EMCCD installation, producing high quality data and revealing new structure in both neutral winds and temperatures. In late March and early April 2004 the instrument was operated in a cycle in which most of the observations were made in a fixed direction, with a full cycle of directions performed once every 15 minutes to provide context. The integration time was also lowered to 10 seconds to increase time resolution. The resulting dataset produced several nights with highly detailed temporal structure in both winds and temperatures down to scale sizes of just a few minutes. This structure is at odds with the more accepted view of the thermosphere as a slowly changing, highly viscous, background sink of energy. The consequences of these results, in terms of the thermospheric representation within GCMs, are profound. Output and developments are discussed from the CTIP model indicating the need to address the issue of small scale thermospheric structure within this class of numerical model.