Determining neutral temperatures in the high-latitude upper atmosphere

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The neutral temperature plays an important part in determining the dynamics and chemical composition of the upper atmosphere. In the thermosphere, heating occurs mainly through the absorption of solar ultraviolet photons, however, at high latitudes, there is also significant heating from precipitating energetic particles. Using observations from the High Throughput Imaging Echelle Spectrograph (HiTIES) located on Svalbard, we determine neutral temperatures at three different altitudes of the upper polar atmosphere. This is achieved for the F region, at an altitude of around 250 km, using the new finding that the neutral temperature in this region can be related to the ratio of the two auroral O+ doublets at 732 nm and 733 nm (Whiter et al., 2014). From the same spectral observations, we obtain neutral temperatures at the mesopause, by measuring the intensity of OH airglow emission lines. In order to separate the various auroral and airglow emissions seen in HiTIES (O+, N2 1P, OH), which overlap in wavelength, we have developed a novel spectral fitting method that includes a theoretical model for N2 1P emission. A fit to the N2 model allows a final temperature estimate of the neutral atmosphere in the E region. In the study presented here, we compare the temperatures obtained using HiTIES with electron and ion temperatures measured during a recent campaign with the EISCAT Svalbard Radar.