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Relative brightness of the $O^+(^2D–^2P)$ doublets in low energy aurora

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The ratio of the emission line doublets from O^+ at 732.0 nm (I_{732}) and 733.0 nm (I_{733}) has been measured in auroral conditions of low energy electron precipitation from Svalbard (78.20° north, 15.83° east) during two winters between 2003 and 2006. The value obtained for $R = I_{732}/I_{733}$ for the 2003–2004 season is 1.38 ± 0.02. This result is slightly higher than theoretical values, and values obtained in airglow, but is lower than earlier measurements in similar auroral conditions. Most of the data from 2003–2004 were from 06 UT to 13 UT, which straddles the time when Svalbard is under the magnetospheric cusp region. The value obtained for the 2005–2006 season is $R = 1.45 \pm 0.08$. The data from this season have lower spectral resolution, and contain much more scatter than those from the earlier season. Higher ratio values mostly occur between 14 UT and 17 UT, when Svalbard is outside the cusp, and when more energetic precipitation may dominate. One of the motivations of the work is the need for accurate modelling of the emission doublet at 732.0 nm. It is one of the emissions measured by the Auroral Structure and Kinetics (ASK) instrument, which is also located at Svalbard. Accurate determination of $R = I_{732}/I_{733}$ provides a powerful method for separating the density of the upper ^2P states, information which is needed for ionospheric modelling of emissions. This work is especially relevant for studies of plasma flows in the ionosphere utilising the long lifetime of the O^+ emission. Although the present work is a statistical study, the work shows that it is necessary to determine whether there are significant variations in the ratio resulting from auroral energy deposition, large electric fields, and changes in composition.