



## A descent of the aurora over Lapland

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A very large statistical study ( $\simeq 4 \times 10^5$  measurements) into the peak emission height of the aurora has shown that the aurora over Lapland descended significantly between 1996 and 2007. The study was performed using images from a network of ground-based all-sky cameras which form part of the MIRACLE (Magnetometers–Ionospheric Radar–All-sky Cameras Large Experiment) network, and are located at various observation stations across northern Finland and Sweden. The height of the aurora was first measured about a century ago. Since then, it has generally been assumed that the peak emission height of any particular auroral emission is constant for similar geomagnetic conditions. The present work was motivated by the need to improve estimates of the height of the aurora used to calculate other ionospheric and auroral properties, such as optical flow velocities and auroral arc widths. In recent years MIRACLE has produced approximately  $10^5$  images of the aurora per station per year. In order to analyse such a large number of images, a novel fast and automatic method was developed for finding the peak emission height of an auroral structure from a pair of all-sky camera images with overlapping fields of view. This method has been applied to all auroral images recorded by the MIRACLE intensified CCD cameras in operation between 1996 and 2007. Such a large data set allows the study of variations in the height of the aurora with time (yearly, monthly, hourly) and with solar and geomagnetic indices such as F10.7 and Kp. Results from the statistical study show that the peak emission height of green (557.7 nm,  $O^1S - O^1D$  transition) aurora over Lapland descended by about 10 km between 1996 and 2007. This descent occurred independently of the solar cycle, and is thought to be due to a cooling and contraction of the mesosphere and lower thermosphere.