COMBINED GROUND-BASED OPTICAL SUPPORT FOR THE AURORA (DELTA) SOUNDING ROCKET CAMPAIGN

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Several optical instruments were operated in support of the Japan Aerospace Exploration Agency (JAXA) DELTA rocket experiment, which was successfully launched from the Andoya Rocket Range at 0033 UT on December 13, 2004. The primary instruments were 2 Fabry-Perot Interferometers (FPIs) located at Skibotn, Norway (69.3oN, 20.4oE) and the Kiruna Esrange Optical Site (KEOPS), Sweden (67.8oN, 20.4oE). Both FPIs sampled the 557.7 nm atomic oxygen emission, originating in the lower thermosphere. The instruments continuously sampled the emission in a sequence including the cardinal azimuthal directions and the vertical. Profiles thus recorded provide a time series that may be analysed to provide neutral temperatures and line-of-sight wind velocities, together with the intensity fluctuations throughout the night. Further analysis allows vector wind patterns over each site to be deduced. At each site all sky cameras (ASCs) were also operated to allow important contextual information to be acquired, including the development and extent of the optical signatures of the auroral activity.

The measured neutral temperatures allow the influence of the auroral activity on the local energetics during this night to be examined. The proximity of the 2 sites also allows an intercomparison of the results from the FPIs from complementary look directions. This provides independent verification of the absolute temperature values during the moderately quiet conditions in the early part of the night. The overlap of the field-of-view of the Skibotn FPI with the DELTA rocket trajectory provides a valuable and unique comparison of in-situ and ground-based measurements, especially given the context provided by EISCAT measurements. This is important as both the rocket and EISCAT measurements produce altitude profiles of ion and neutral temperatures, whereas the FPI is passive and measures the neutral temperature at the peak emission height of 557.7nm. This can be a problem because in the lower thermosphere there is a large height dependence of the temperatures and winds. Although the emission height will change under the influence of active auroral conditions, the experiment uniquely provides coverage of the relevant parameters to investigate these changes. Comparing the intensity data from the FPIs with the ASC images allow the possible changes in emission altitude and the consequent changes in neutral temperatures and winds to be tracked.

In the case of the winds, the extended field of wind velocities can be used to determine the dynamical situation before, during and after launch time. This completes a full set of ion and neutral parameters to allow proper examination of ion-neutral coupling issues such as Joule heating and frictional heating. This combination of parameters provides a rich dataset with which to study the lower thermospheric response to auroral activity from the very smallest structure to the large scale context and hence present a challenge to existing models of the auroral region.