

# ROCKET-BASED MEASUREMENTS OF ION VELOCITY, NEUTRAL WIND IN THE COLLISIONAL TRANSITION REGION OF THE AURORAL IONOSPHERE

LAURELINE SANGALLI<sup>1,2</sup>, D. Knudsen<sup>2</sup>, M. Larsen<sup>3</sup>, T. Zhan<sup>3,4</sup>, R. Pfaff<sup>5</sup>, D. Rowland<sup>5</sup>

<sup>1</sup> Finnish Meteorological Institute, Helsinki, Finland. Email: Laureline.Sangalli@fmi.fi

<sup>2</sup> University of Calgary, Calgary, Alberta, Canada. Email: knudsen@phys.ucalgary.ca

<sup>3</sup> Clemson University, Clemson, South Carolina, USA. Email: mlarsen@clemson.edu

<sup>4</sup> Currently at Conseco Inc., Carmel, Indiana, USA.

<sup>5</sup> NASA Goddard Spaceflight Centre, Greenbelt, Maryland, USA.

Emails: Robert.F.Pfa @nasa.gov and Douglas.E.Rowland@nasa.gov

The JOULE II sounding rocket salvo was launched from Poker Flat Rocket Range into weak pulsating aurora following a moderate substorm at 03:45 LT on January 19, 2007. We present in-situ measurements of ion flow velocity and electric and magnetic fields combined with neutral wind observations derived from ground observations of in-situ chemical tracers. Measured ion drifts in the 150-198 km and 92-105 km altitude ranges are consistent with ***ExB*** motion to within 15 m/s r.m.s and with neutral wind velocity to within 20 m/s respectively. From these measurements we have calculated the ratio  $\kappa$  of the ion cyclotron and ion collision frequencies, finding  $\kappa = 1$  at an altitude of  $118 \pm 0.3$  km. Using direct measurements of ion current we calculate the Joule heating rate and Pedersen and Hall conductivity profiles for this moderately active event and find height-integrated values of  $390 \text{ W/km}^2$  and 0.59 and 2.22 S, respectively. We also find that these values would have errors of up to tens of percent without coincident neutral wind measurements, and presumably more so during more active conditions. Ion flow vectors were measured at a rate of 125 /s , however, no significant fluctuations were observed at spatial/temporal scales below  $\sim 350$  m and 0.5 s and our observational limits of 5.5 m and 0.016 s.

Polar transition region, Joule heating, ion-neutral interaction

Laureline Sangalli, Finnish meteorological institute, Arctic Research, P.O.Box 503, FI-00101 Helsinki, Finland. tel: +358 050 408 1134,  
email: Laureline.Sangalli@fmi.fi