

## **Sources of ionospheric variability**

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Range-Time plots of ionospheric height derived from Macquarie Island ionograms show that wave trains of Travelling Ionospheric Disturbances (TIDs) are a common occurrence in daytime in winter though not at night. These TIDs appeared to be identical to those observed at mid-latitude's and are usually ascribed to gravity waves. In contrast, as observed by ionosondes, a major deposition of energy into the auroral zone accompanied by two bursts of intense joule heating occurred on the 23 May 2002 resulting in two massive height rises, the first of which expanded towards the equator from both auroral zones at a speed of up to 1500 m/s. The second height rise did not show such a uniform expansion with latitude. At their peak, the ionosphere was lifted by up to 300 km from the auroral zone almost to the magnetic equator and over the longest longitudinal range of observation. Conjugate TEC observations in Japan and Australia reported by Tsugawa et al (2006) showed these two events to be associated with small amplitude TIDS propagating towards the equator. Similar TEC TIDs were reported by Tsugawa et al (2006) for an auroral zone disturbance occurring on 24 October 2002. In this case the ionosonde measurements showed relatively minor changes in height. Questions arising from these measurements are discussed.