

# Tomographic reconstruction of the ionosphere using ground-based GPS data in the Australian region

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## Abstract

This paper describes the experimental procedures of tomographic imaging techniques that have been developed and used at La Trobe University. Tomographic imaging provides a powerful technique for obtaining images of the ionospheric electron density distribution, and is a relatively new technique which has promising features to supplement the most expensive ground-based vertical sounding instruments such as ionosonde and incoherent radar. The technique, which involves monitoring radio transmission from Global Positioning System (GPS) along a meridional chain of ground based receivers, has particular potential for complementing temporal measurements by other observing techniques such as ionosondes. The tomographic inversion algorithm has been applied to actual GPS-based total electron content (TEC) measurements obtained during two severe magnetic storm periods (18 August 2003 and 31 March 2001). The tomographic reconstruction presented here revealed important features in ionospheric structure such as ionization troughs and quasi-wave formations. Electron density profiles obtained by the tomographic reconstruction method are in excellent agreement with profiles obtained by ionosondes at or near the GPS receiver stations, confirming the validity of the tomographic algorithm that has been developed. Geophysical interpretations of the observations are also presented.

**Key words:** Tomographic reconstruction, TEC, and GPS