

Conjugate observations of low-latitude travelling ionospheric disturbances by a 630-nm airglow imager at Indonesia and the CHAMP satellite

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We report the first comparison of ground and satellite measurements of equatorial travelling ionospheric disturbances (TIDs) by using a 630-nm airglow imager and the CHAMP satellite. The airglow images are obtained at Kototabang (KTB), Indonesia (geographic coordinates: 0.2S, 100.3E, geomagnetic latitude: 10.6S), during a 7-year period from October 2002 to October 2009. Only three TID events with ground and satellite conjugate measurements are found on April 30, 2006 (event 1), September 28, 2006 (event 2) and April 12, 2004 (event 3). All three events were southward-moving structures in 630-nm airglow images. The events 1 and 2 are single pulse with horizontal scales of ~500-1000 km. The event 3 show three wave fronts with horizontal scale size of 500-700 km. For event 2, the neutral density shows in-phase variations with the airglow intensity. However for events 1 and 3, they are out of phase. The relation between electron density and airglow intensity is out of phase for event 1, while their relationship are unclear for event 2 and 3, suggesting that ionospheric plasma variation is not the cause of the observed TID. If the TIDs are caused by gravity waves in the thermosphere, in and out of phase relationships between neutral density at an altitude of 400 km at CHAMP and airglow layer at 250 km, should depend on the vertical wavelength of the gravity wave, which is highly affected by background wind. We estimate possible vertical wavelengths for those events to explain the observed phase relationships between neutral density and airglow intensity.

Keywords: Travelling Ionospheric Disturbances, CHAMP, Airglow Imager