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Ionospheric perturbations caused by the Tonga January 2022 volcanic eruption

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The powerful volcanic eruption on January 15th 2022 in Tonga produced an atmospheric shock wave that caused perturbations in the ionosphere around the world. This study reports observations of the thermospheric and ionospheric signatures of the eruption using a global network of approximately 5000 navigation satellite receivers that measure line of sight integrated electron density (TEC). These measurements were high-pass filtered to allow study of the fluctuating component of the ionospheric electron density, which is affected by thermospheric neutral density and winds. The measurements show long lasting ionospheric perturbations all around the world that propagate radially outward from Tonga. The traveling ionospheric disturbances (TIDs) produced by the eruption were observed propagating around the world at least three times, with a clearly discernible signature passing six times over North America. The estimated travel time around the world for the wave is approximately 36 hours. The initial wave traveled at a velocity of up to 1000 m/s, but at longer distances with a velocity of 300-320 m/s. During the first passage of the pressure wave through the Pacific and North American sectors, the initial shock wave was followed by 12 hours of increased ionospheric perturbations. The global propagation of the ionospheric disturbance is in agreement with a lower atmospheric Lamb wave that causes perturbation in the thermosphere. Further details can be found in the recently published paper [1].

[1] Zhang S-R, Vierinen J, Aa E, Goncharenko LP, Erickson PJ, Rideout W, Coster AJ and Spicher A (2022) 2022 Tonga Volcanic Eruption Induced Global Propagation of Ionospheric Disturbances via Lamb Waves. Front. Astron. Space Sci. 9:871275. doi: 10.3389/fspas.2022.871275