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Tonga volcanic eruption 2022 and associated tsunami detection with the GNSS derived TEC perturbation

Mahesh N Shrivastava[(1),(2)(3)*], Ajeet K Maurya[(4)], Juan Gonzalez[(5)], A S Sunil[(6)], Anup Nambiathody[(6)], Francisca Sanchez[(7)], P S Sunil[(6)], Vijith V[(6)], and Gabriel Gonzalez[(1),(3)]
(1)Universidad Catolica del Norte, Antofagasta, Chile, (2) Millenium Institute on Volcanic Risk Research - Ckelar Volcanoes, Antofagasta, Chile (3)National Research Center for Integrated Natural Disaster Management, Santiago, Chile, (4)Babasaheb Bhimrao Ambedkar University, Lucknow, India, (5)Universidad Catolica de la Santísima Concepcion, Concepcion, Chile, (6)Cochin University of Science and Technology, Kochi, India, (7)Universidad de Atacama, Copiapó, Chile; e-mail: mahesh.shrivastava@ucn.cl

Tonga volcanic eruption occurred at 04:10 UTC on January 15, 2022 of the Hunga Tonga-Hunga Ha'apai underwater, located ~65km north of Tonga's capital, Nukualofa, produced around 1.2 meter tsunami and a huge plume of ash, steam and gas rising from the ocean (Australia's Bureau of Meteorology). The tsunami propagation has been identified in the Japan, Alaska, north America, and south America specially very dominate tsunami height detected in the Chilean coastal region in the east. We proposed the identify the tsunami propagation direction with the Global Navigation Satellite System (GNSS) derived Total Electron Content (TEC) perturbation. At the first glance the signals of tide gauge sites along rim of the Pacific Ocean, it seems a very complex nature. We first focus surrounding of the Tonga volcan eruption to establish the relation between tsunami propagation and TEC perturbation. We considered data from GNSS sites within a ~5000 km radius from the volcanic eruption obtaining estimates of ionospheric TEC perturbation. We detected gravity wave signatures in TEC perturbation concentrated in the southwest of Tonga, which directly correlates with the direction of propagation of the tsunami triggered by the eruption. The tsunami propagation signals at the rim of Pacific Ocean are very complex. we could not establish any relation with TEC perturbation. We propose that tsunami source is not only much significant but also the medium as geomorphological features such as ocean ridge and depth of the trench for tsunami propagation. For understanding the medium role for tsunami propagation, we are presenting here the tide gauge analysis of Tonga volcan 2022 and a tsunamigenic earthquake Mw 8.2 2021 in the Chilean coastal region.