Space Studies of the Upper Atmospheres of the Earth and Planets including Reference Atmospheres (C)
Conditions of Enhanced Risk for the Ionospheric Weather (C1.2)

IONOSPHERIC DISTURBANCES CAUSED BY THE 2022 HUNGA-TONGA VOLCANIC ERUPTION DETECTED OVER EUROPE

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The 15 January 2022 eruption of the Hunga Tonga-Hunga Ha'apai volcano in the Pacific Ocean provides a unique opportunity to study the reaction of the ionosphere to large explosive events. Volcanic eruptions of this magnitude are very rare. No event of this scale has occurred while the current level of ionosphere monitoring infrastructure has been available. In the past decade significant advances have been made in the development of various methodologies for the detection and characterisation of travelling ionospheric disturbances. This event allows us both to study the propagation of travelling disturbances around the world and to evaluate and compare various techniques for the automatic detection of such disturbances.

We focus on the detection of the ionospheric disturbances over Europe. This region has the advantage of a dense network of observatories providing both ionosonde and GNSS derived TEC data. This allows us to track to passing disturbances with relatively high resolution in both time and space. We combine a variety of data, including atmospheric pressure measurements, ionosonde soundings and derived electron density profiles, HF Doppler observations, in situ plasma density measurements, and TEC data to track the disturbances across the region as well as their vertical movement. Since the region under study is closer to its antipode than to the eruption itself, we can detect the effects of atmospheric gravity waves travelling along the great circles in both directions.

Several techniques have been developed in recent years to automatically, in real-time, detect travelling ionospheric disturbances. Most of these systems are primarily optimised for the detection of large-scale events associated with geomagnetic disturbances. The remotely observed ionospheric disturbances due to earthquakes, anthropogenic explosions, or in this case a volcanic eruption are smaller, and fall under what are called medium scale disturbances. We will verify the performance of different real-time monitoring methods in automatically detecting these disturbances, and evaluate their capacity for detecting ionospheric signatures of such smaller scale phenomena.