

SUPPLEMENTARY MATERIAL

to the manuscript

Investigation into potential TEC changes due to 9 seismic tremors of 2021–2022

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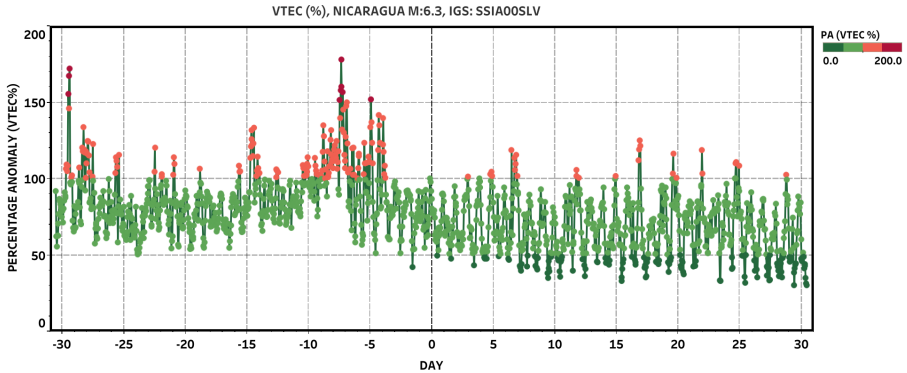


Fig. 5a. Shows percentage VTEC (%) v/s Day (green values indicate low VTEC%, orange and red values indicate high VTEC%). As the earthquake day approaches, the TEC value is rising, as can be seen. VTEC values above 100% are considered abnormal fluctuations. IGS station is SSIA00SLV from Chile.

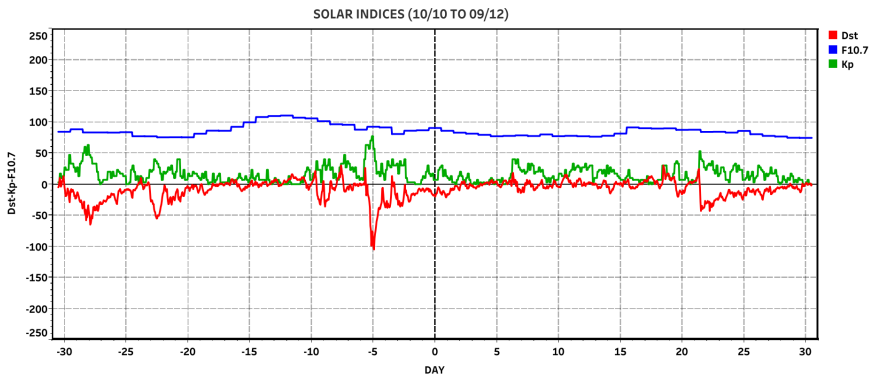


Fig. 5b. Displays values for F10.7, Dst, and Kp that are insufficient to justify such TEC abnormalities. One spike of DST above -50 was spotted around 5 days before the earthquake, which shows a spike in VTEC% value as well. But 15 days before the earthquake, observed VTEC% spikes tell a different story. Even though Dst and Kp values are at their lowest, VTEC% was seen high.

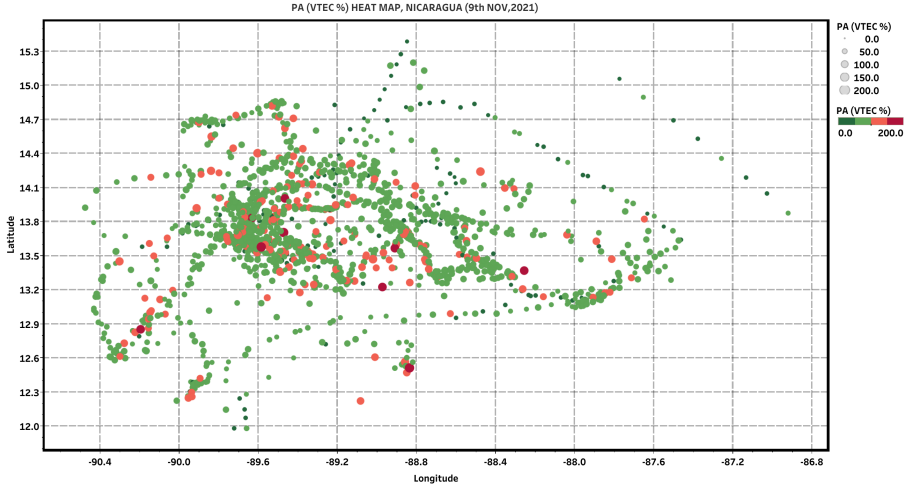


Fig. 5c. A heat map near El Salvador is displayed on a globe map (about 400 km from the earthquake epicentre in Nicaragua). Red and orange dots indicate VTEC% abnormalities (scattered over large regions). The coordinate of the earthquake epicentre is shown in Table 1 ($11^{\circ}13' N$, $86^{\circ}32' W$), which is near the region of recorded VTEC% values.

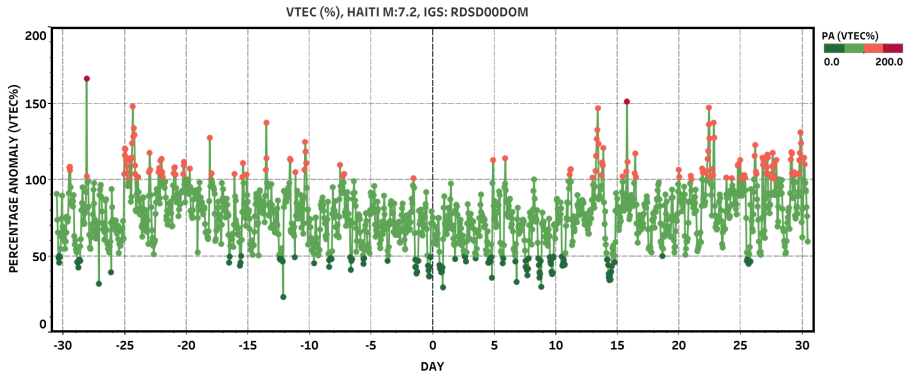


Fig. 6a. Shows percentage VTEC (%) v/s Day (green values indicate low VTEC%, orange and red values indicate high VTEC%). As the earthquake day approaches, the TEC value is rising, as can be seen. VTEC values above 100% are considered abnormal fluctuations. IGS station is RDS00DOM from Haiti.

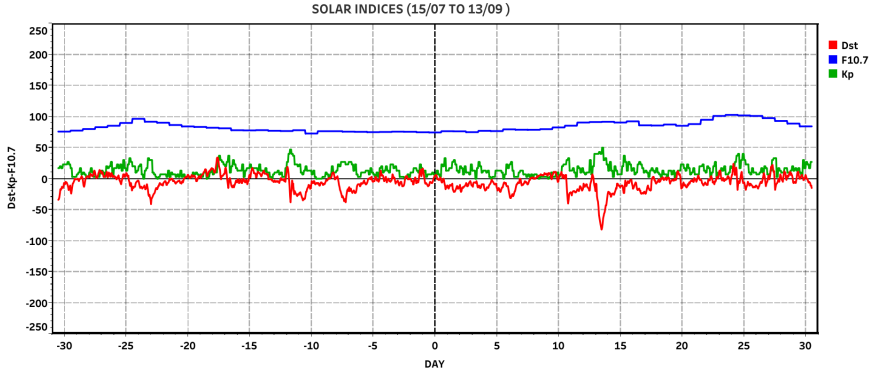


Fig. 6b. Displays values for F10.7, Dst, and Kp that are insufficient to justify such TEC abnormalities. Few spikes in VTEC% have been seen a few days before the earthquake day, with only one spike on the 14th day after the earthquake, which is in positive correlation with the VTEC% spike.

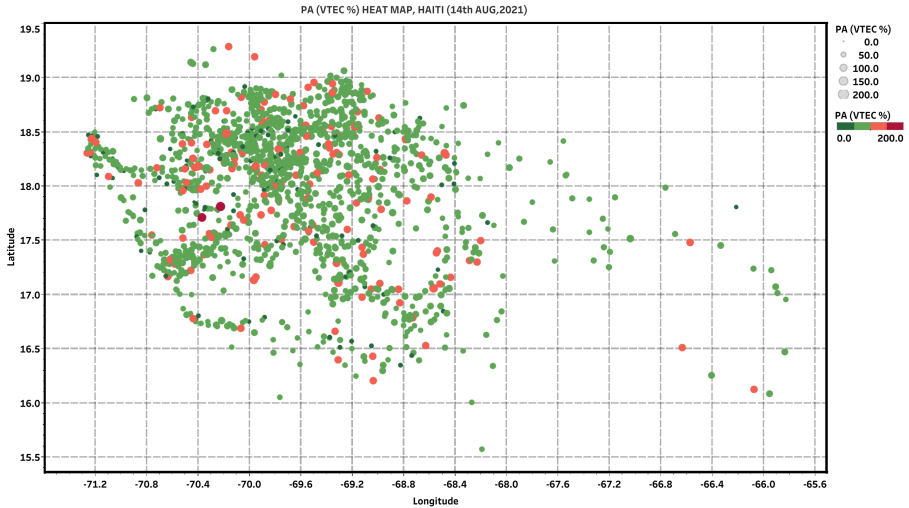


Fig. 6c. Shows a heat map on a global map that is close to the Dominican Republic (around 250 km from the Haiti earthquake epicentre). Red and orange dots indicate VTEC% abnormalities (scattered over a large region). The coordinate of the earthquake epicentre is shown in Table 1 ($18^{\circ}26' N$, $73^{\circ}29' W$), which is near the region of recorded VTEC% values.

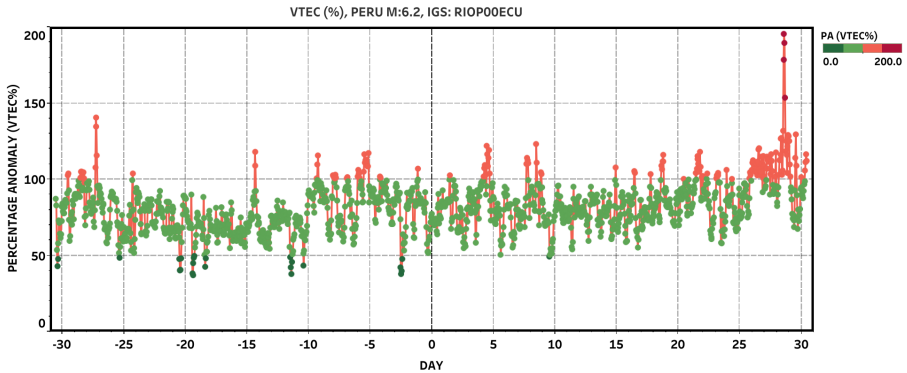


Fig. 7a. Shows percentage VTEC (%) v/s Day (green values indicate low VTEC%, orange and red values indicate high VTEC%). As the earthquake day approaches, the TEC value is rising, as can be seen. VTEC values above 100% are considered abnormal fluctuations. IGS station is RIOP00ECU from Peru.

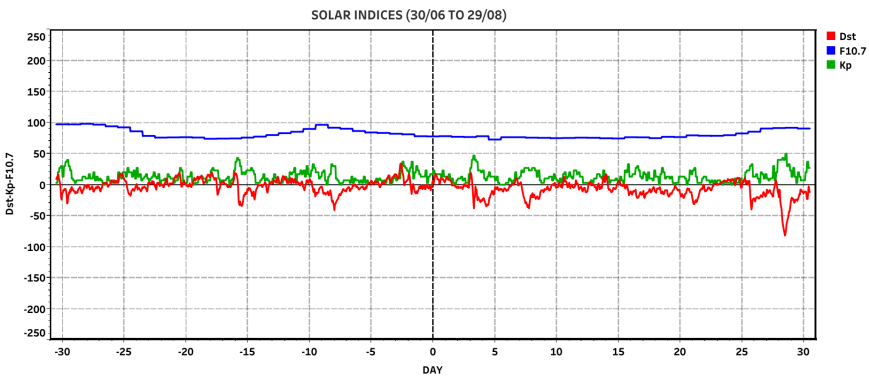


Fig. 7b. Displays values for F10.7, Dst, and Kp that are insufficient to justify such TEC abnormalities. The spike wasn't seen in Dst or Kp before any days of the earthquake day. But before the earthquake, few spikes were visible in VTEC%. A peak in Dst has been seen around 27th and 28th day after the earthquake.

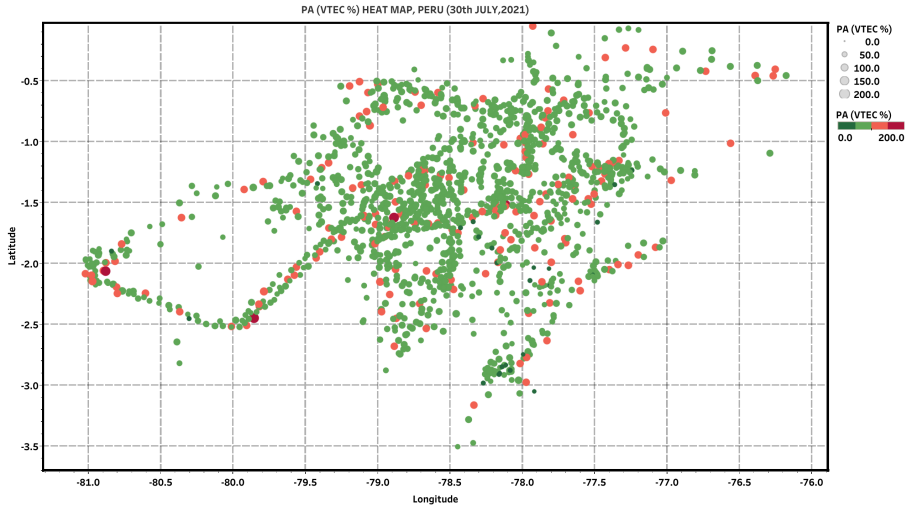


Fig. 7c. Shows heat map on the world map scale near Dominican Republic (~250 km, from the earthquake epicentre, Haiti). Red and orange dots indicate VTEC% abnormalities (scattered over a large region). The coordinate of the earthquake epicentre is shown in Table 1 (4°59' S, 80°37' W), which is near the region of recorded VTEC% values.

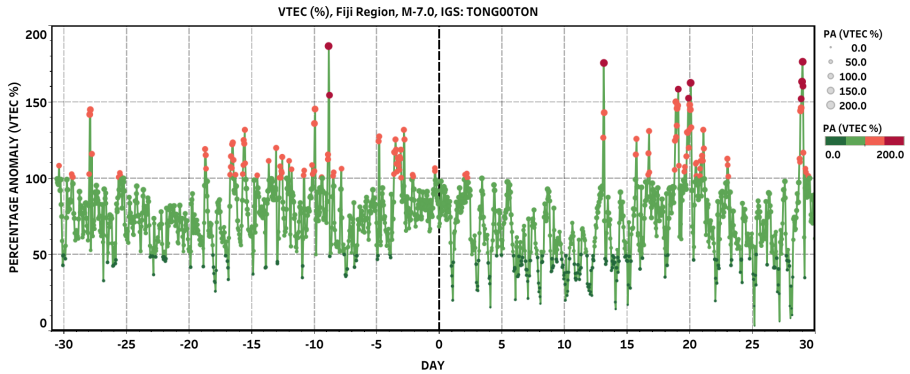


Fig. 8a. Shows percentage VTEC (%) v/s Day (green values indicate low VTEC%, orange and red values indicate high VTEC%). As the earthquake day approaches, the TEC value is rising, as can be seen. VTEC values above 100% are considered abnormal fluctuations. IGS station is TONG00TON from Fiji Island.

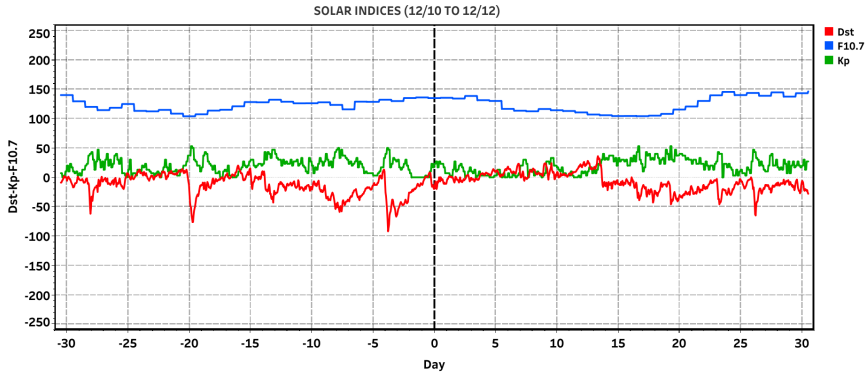


Fig. 8b. Displays values for F10.7, Dst, and Kp that are sufficient to justify such TEC abnormalities. In 2021, due to the increasing phase of the solar cycle, the solar radiation effects have shown positive effects on Dst and Kp values as well as VTEC% has shown high variations. Hence for this case Dst and VTEC% anomalies are in positive correlation. Effects of VTEC% due to seismic activity might be hard to separate out.

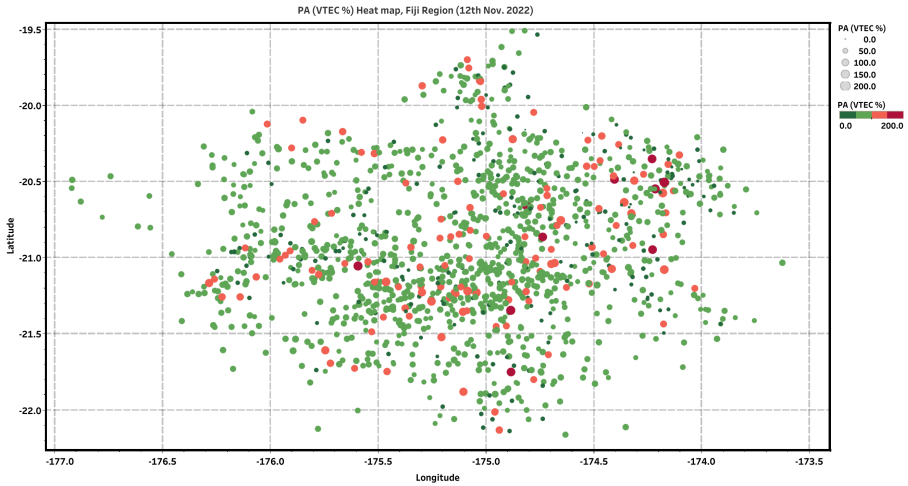


Fig. 8c. This graph displays the percentage anomaly (VTEC%) for the Fiji Island earthquake (lights and dark green dots indicate the typical VTEC%), whereas orange and red dots depict VTEC between 100–149% and 150–200%, respectively. High values of VTEC% were observed all over the region around the earthquake epicentre, but solar radiation might be the cause of such variations.

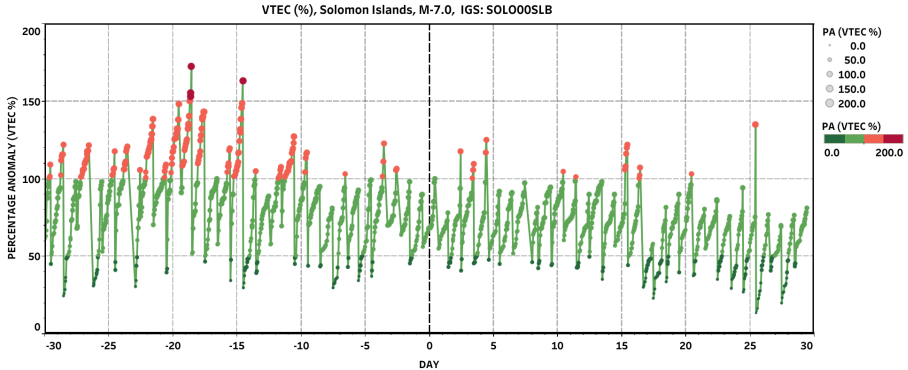


Fig. 9a. Shows percentage VTEC (%) v/s Day (green values indicate low VTEC%, orange and red values indicate high VTEC%). As the earthquake day approaches, the TEC value is rising, as can be seen. VTEC values above 100% are considered abnormal fluctuations. IGS station is SOLO00SLB from Solomon Island.

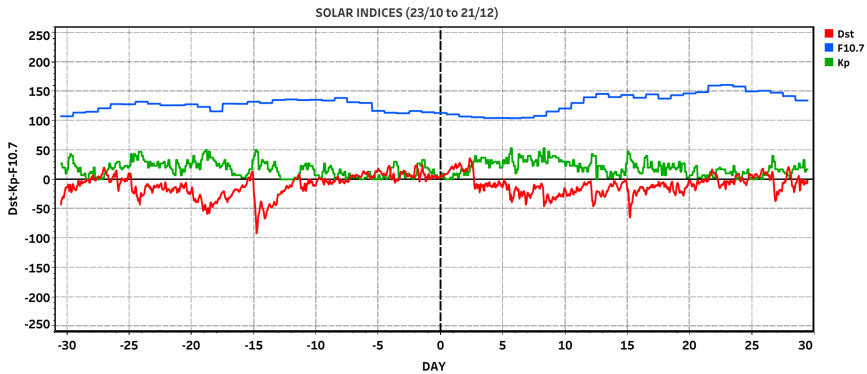


Fig. 9b. Displays values for F10.7, Dst, and Kp that are sufficient to justify such TEC abnormalities until 10 days prior to the earthquake due to high disturbance in the Dst, but 5 days before and after the earthquake there are some variations which are in low solar minima period. 10 days after the earthquake, high solar flux was observed but high VTEC % wasn't observed.

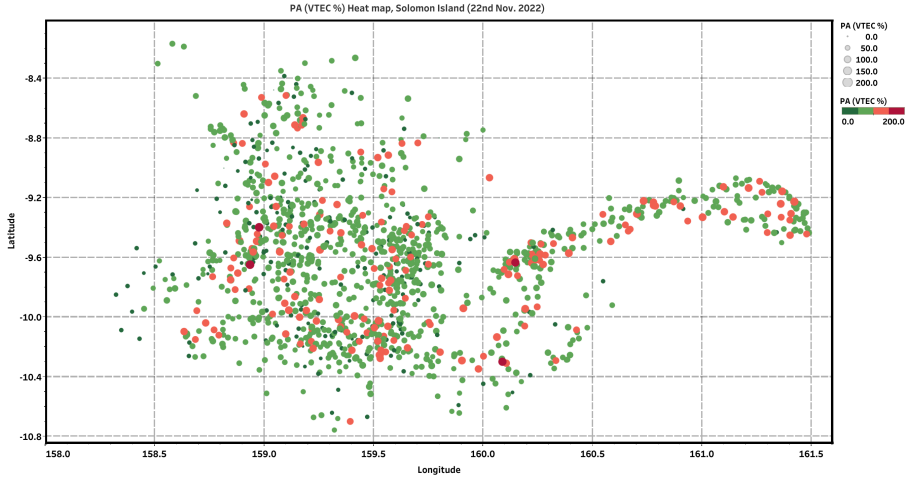


Fig. 9c. Shows percentage anomaly (VTEC %) for Solomon Island Earthquake (lights and dark green dots indicate the typical VTEC%), whereas orange and red dots depict VTEC between 100–149% and 150–200%, respectively. Many Orange and Red spots are observed for Solomon Island earthquake, in the earthquake epicentre region (9°49' S, 159°28' E).

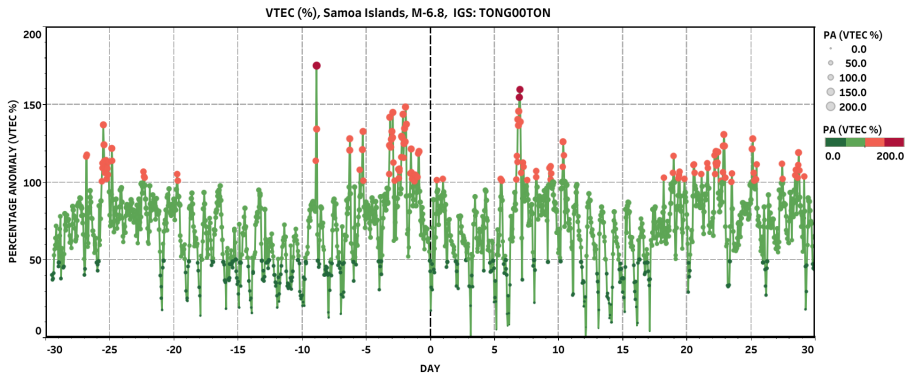


Fig. 10a. Shows percentage VTEC (%) v/s Day (green values indicate low VTEC%, orange and red values indicate high VTEC%). As the earthquake day approaches, the TEC value is rising, as can be seen. VTEC values above 100% are considered abnormal fluctuations. IGS station is TONG00TON from Samoa Island.

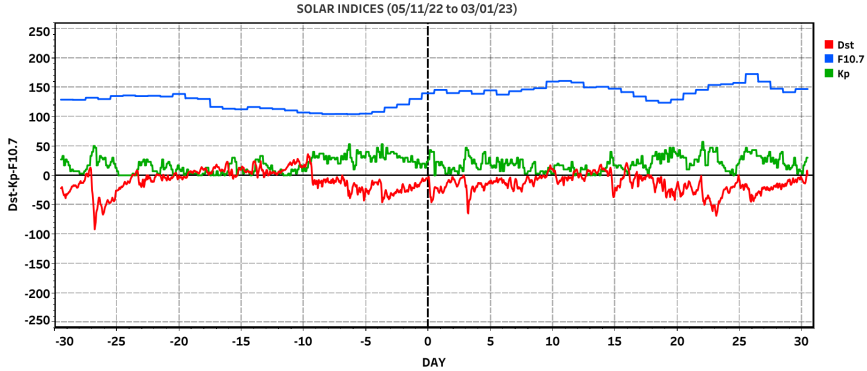


Fig. 10b. Displays values for F10.7, Dst, and Kp that are insufficient to justify all TEC abnormalities. In this case, VTEC% has shown higher values in a time period when the solar radiation was low (0–10 days before) compared to a time period when it was high (25–27 days before).

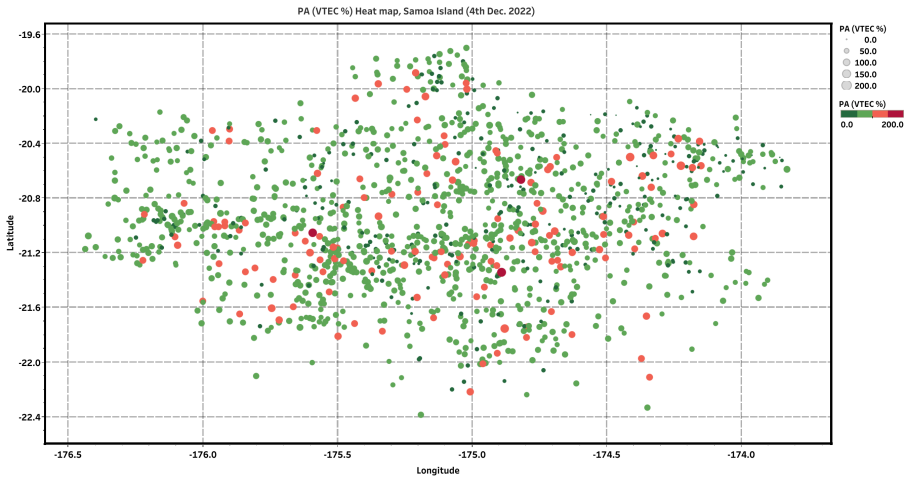


Fig. 10c. This graph displays the percentage anomaly (VTEC%) for the Samoa Island earthquake (lights and dark green dots indicate the typical VTEC%), whereas orange and red dots depict VTEC between 100–149% and 150–200%, respectively. The coordinate of the earthquake epicentre is shown in Table 1 (15°21' S, 172°69' W), which is near the region of recorded VTEC % values.