The Near Real time analysis of Hunga Tonga-Hunga Ha'apai eruption in the ionosphere by GNSS

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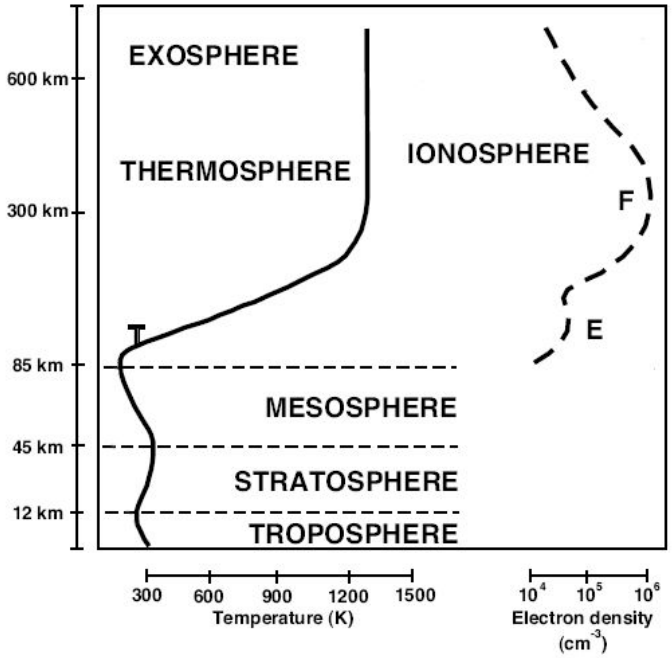
Late-breaking session: The 15 January 2022 Hunga Tonga Volcanic Eruption – Observation, Understanding and Impact of large explosive volcanic eruptions

26.05.2022

The **IONOSPHERE** is the ionized part of Earth's upper atmosphere, from ~90 to ~1000 km altitude. The ionosphere is formed by the solar radiation.



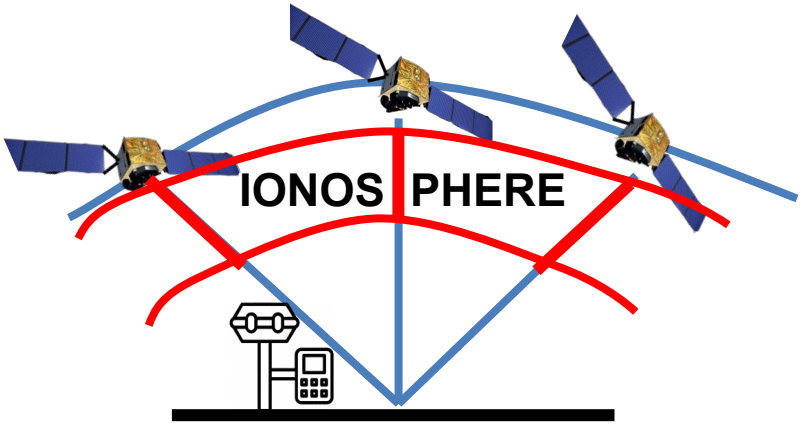
NATURAL HAZARDS

Earthquakes

Tsunamis

Volcano Eruptions

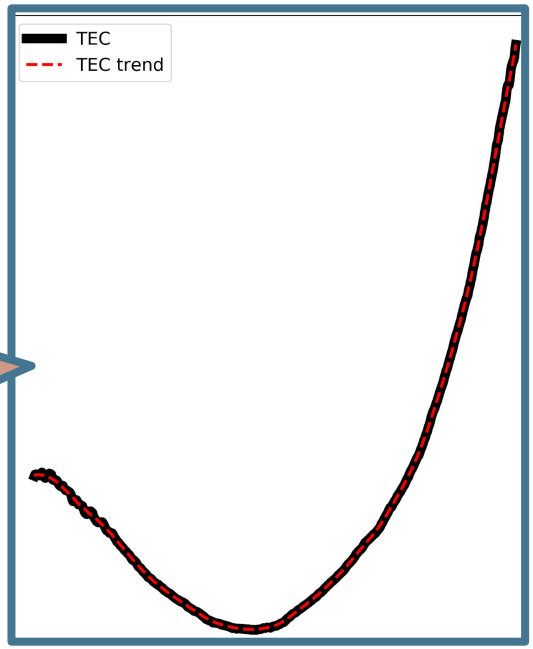
TEC by GNSS



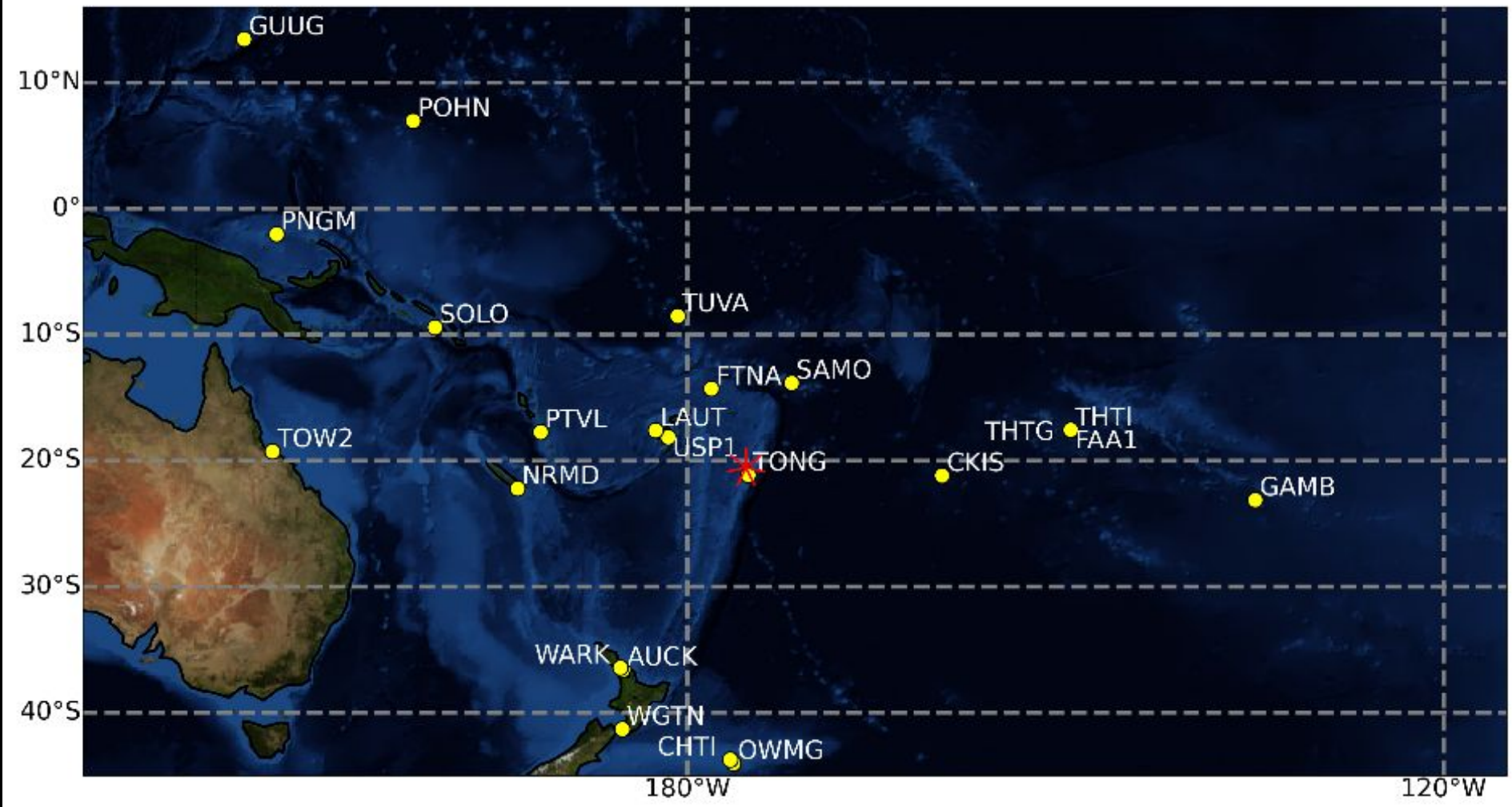
TEC = Variations + Trend

Time derivative == emphasize fast TEC variations (TID)

NRT approach: dTEC/dt

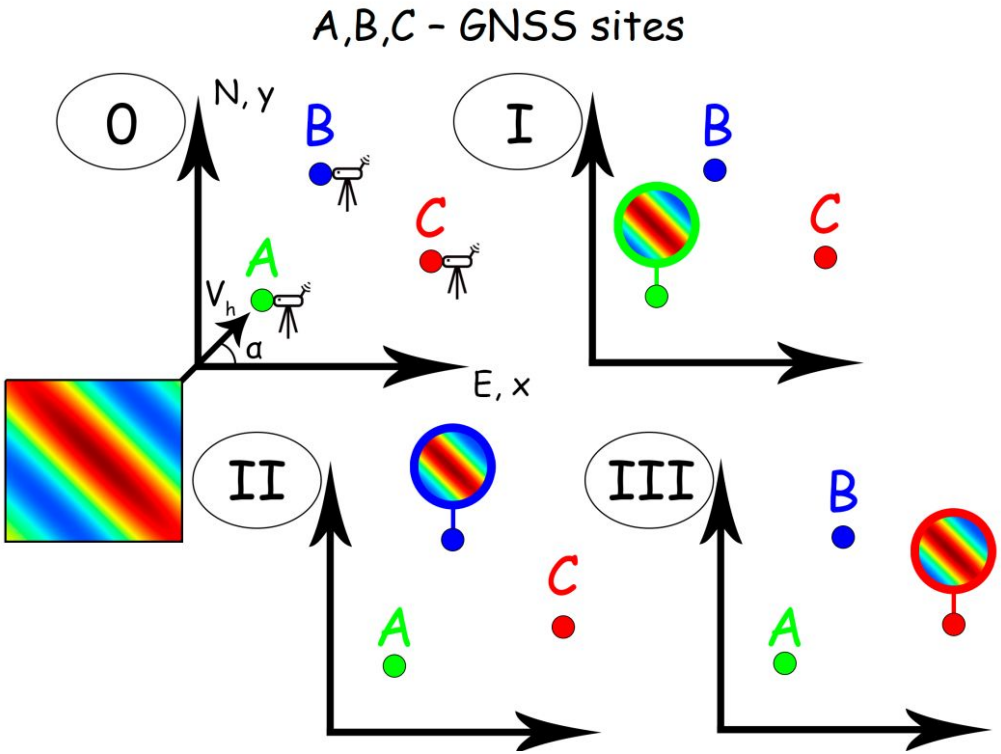


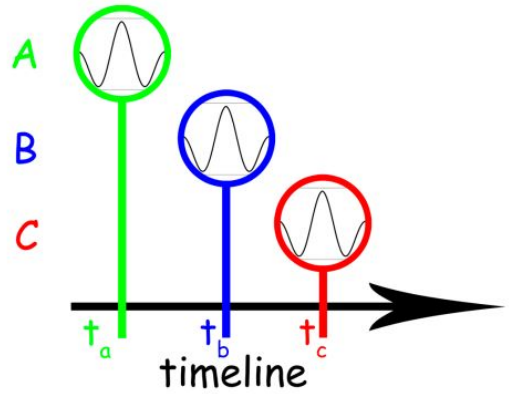
Tonga Volcano and GNSS receivers

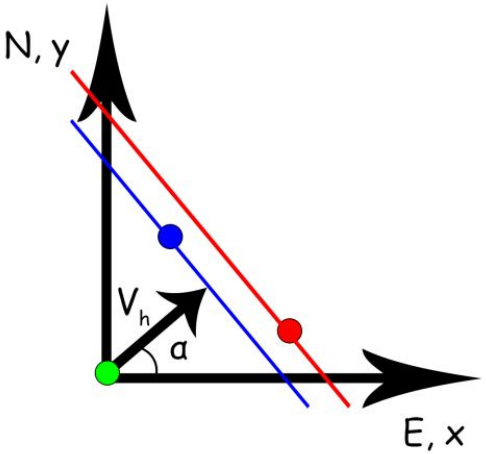


24 GNSS receivers == 500+ Ionospheric Observation Points

Methodology Explanation.



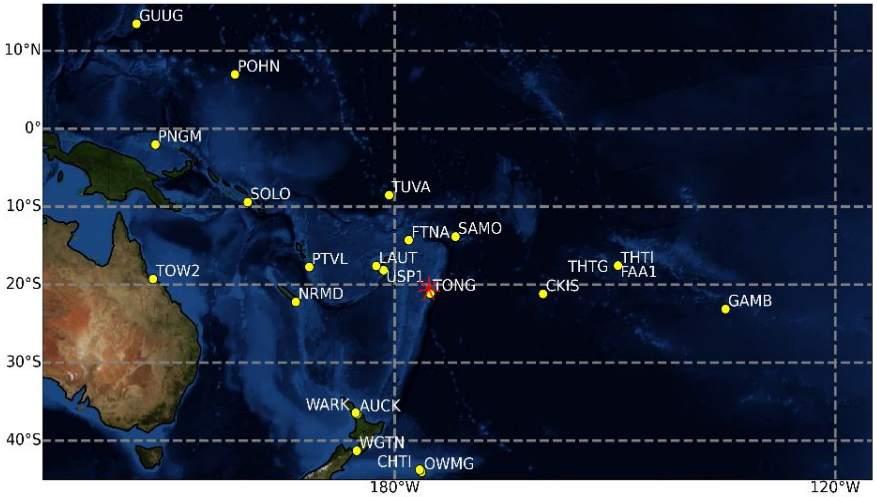




D1-GPS [Afraimovich et al., 1998]

Instantaneous Velocities Fields

a)



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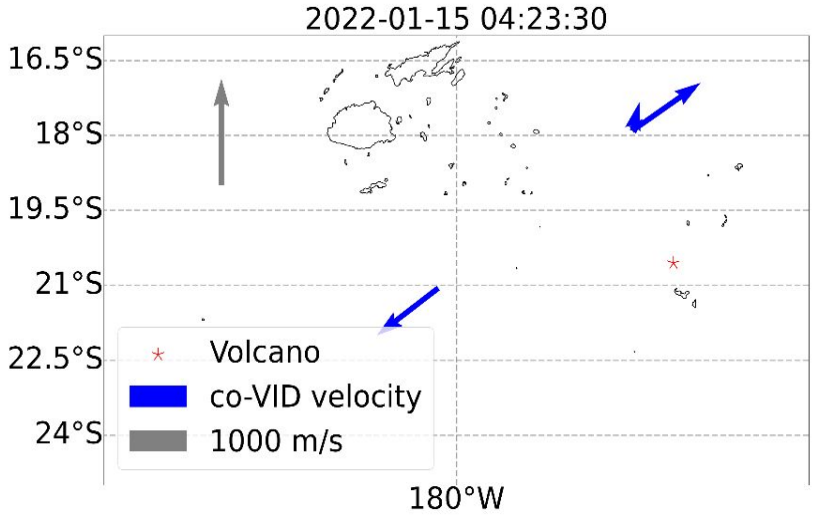
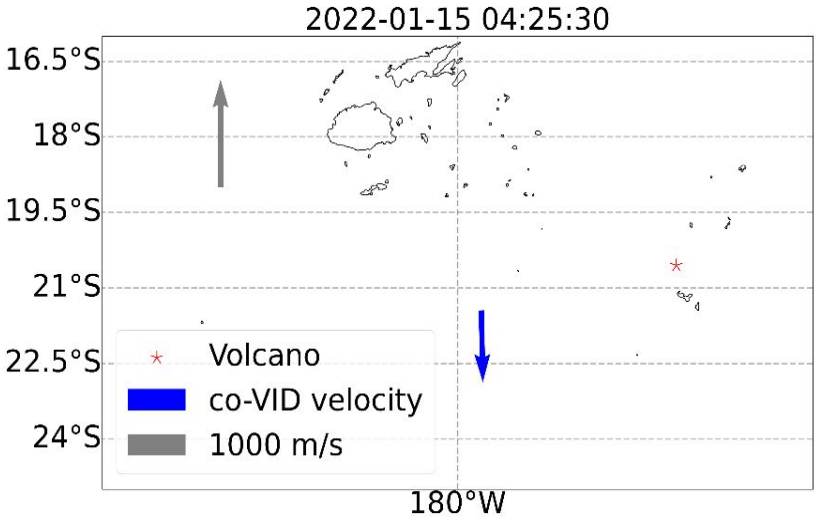
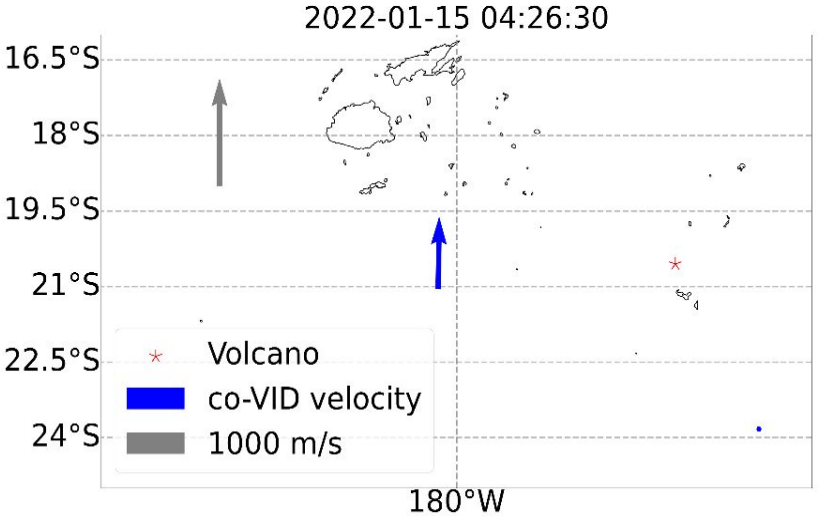


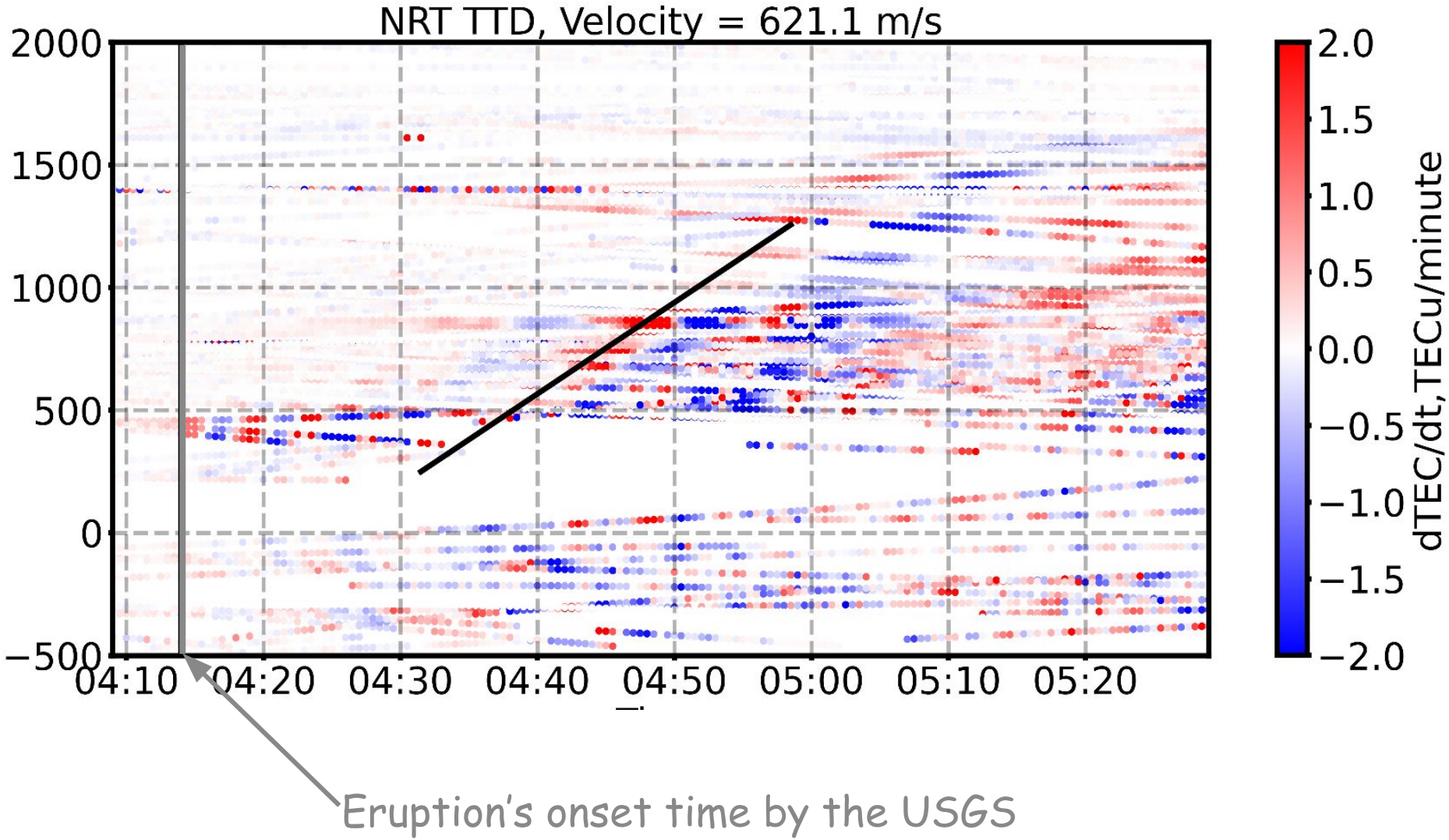
c)



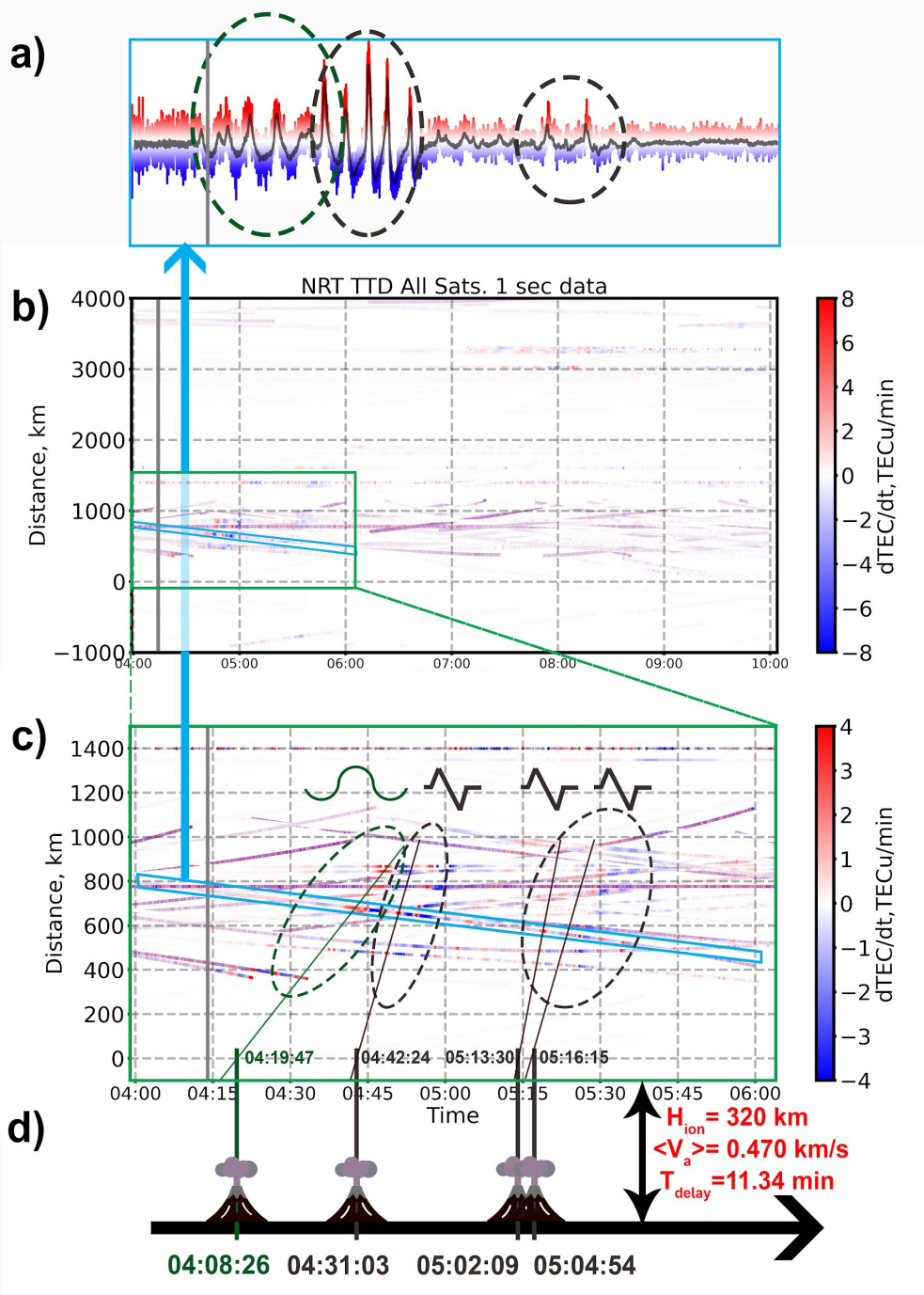
d)

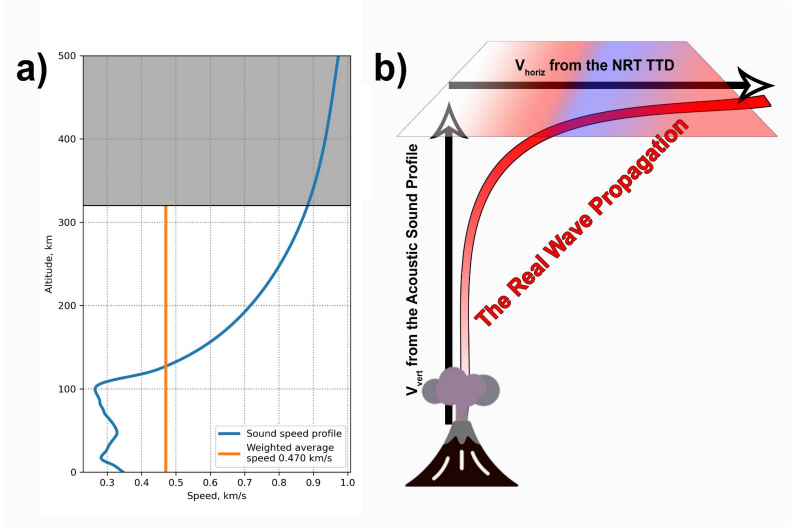


NRT TTD “look” on the response



Hunga Tonga eruption case by 1-sec data. Analysis by NRT TTD





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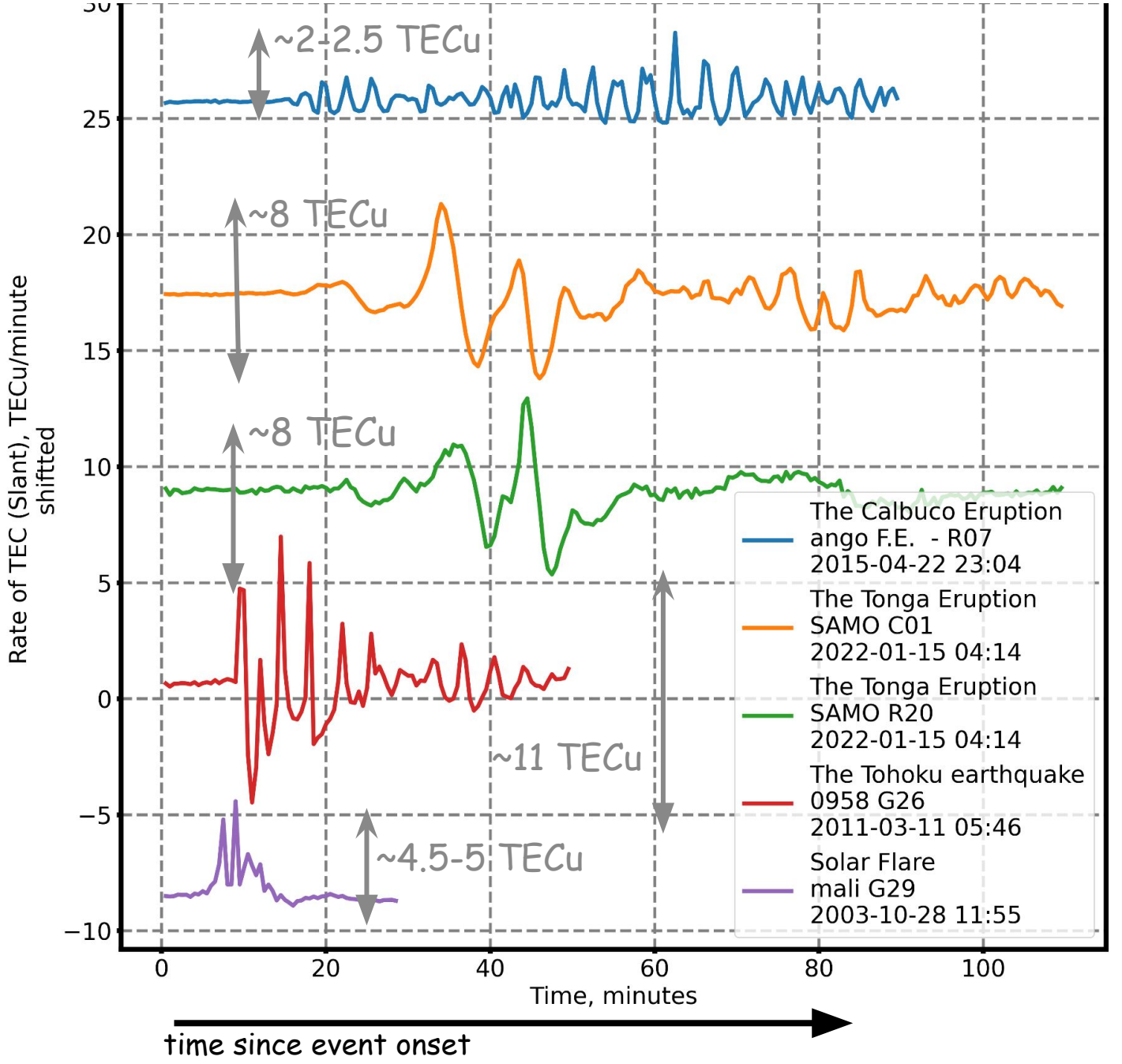
~2-2.5 TECu
~8 TECu
~8 TECu
~11 TECu
~4.5-5 TECu
Rate of TEC (Slant), TECu/minute
shiftted
Time, minutes
time since event onset
The Calbuco Eruption
ango F.E. - R07
2015-04-22 23:04
The Tonga Eruption
SAMO C01
2022-01-15 04:14
The Tonga Eruption
SAMO R20
2022-01-15 04:14
The Tohoku earthquake
0958 G26
2011-03-11 05:46
Solar Flare
mali G29
2003-10-28 11:55

THANK YOU FOR ATTENTION!