

Evolution of the Hunga Volcano Eruption

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Hunga Caldera

Base map
Garvin et al, 2018, GRL

2009
tuff cones

2014/15 cone

Caldera 6 km diameter

1988 vents
and lava flow

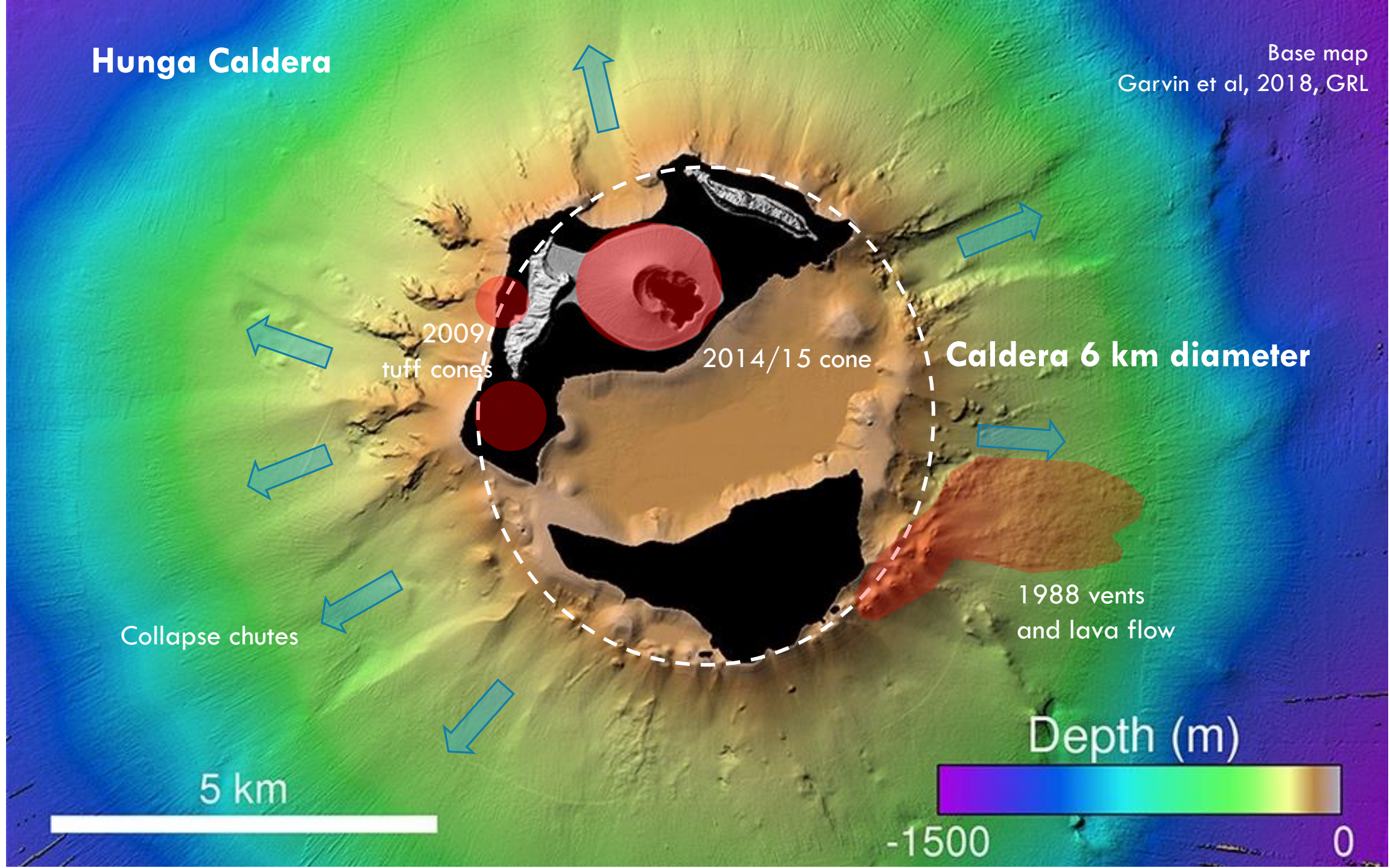
Collapse chutes

Depth (m)

5 km

-1500

0

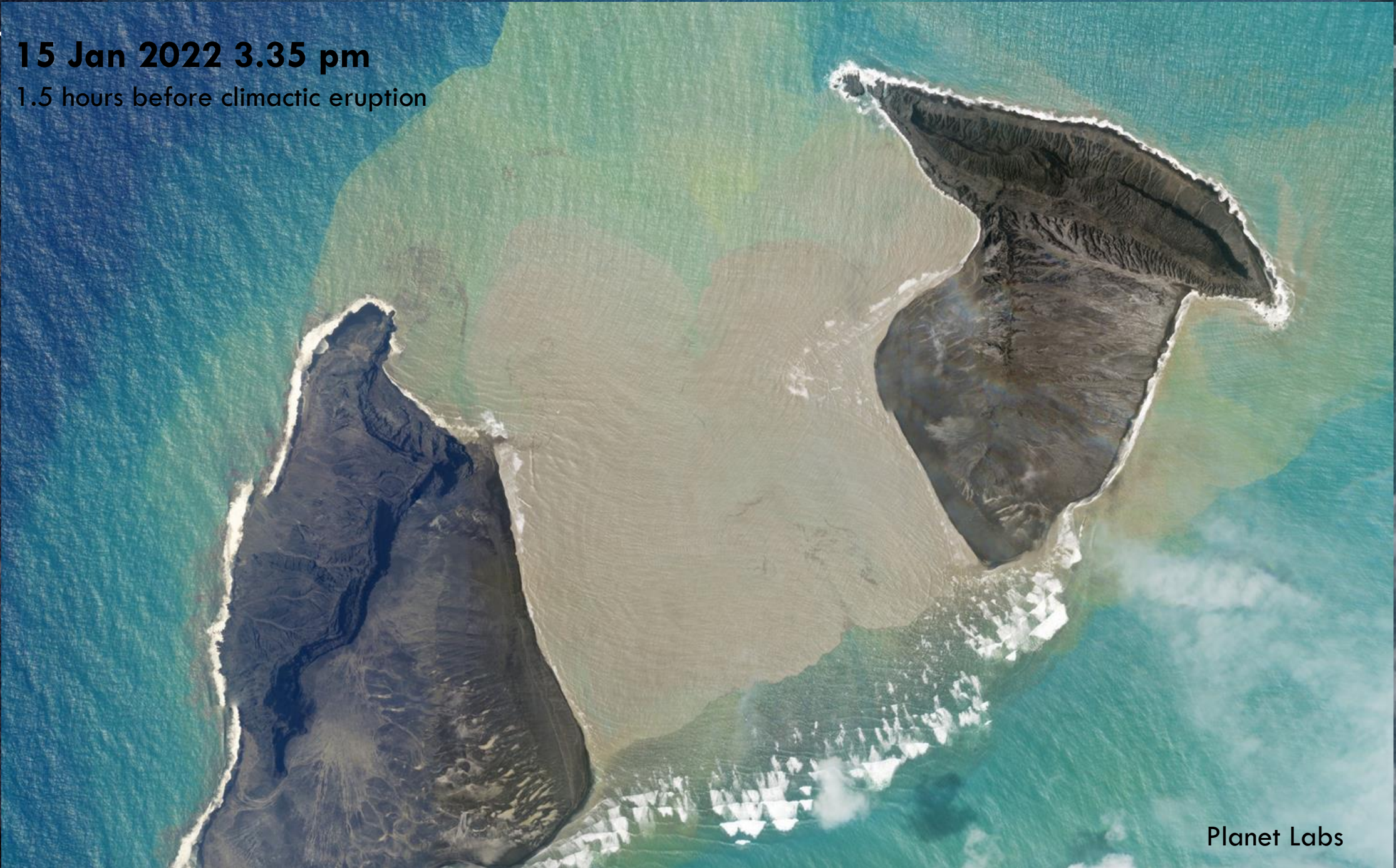


6

15 Jan 2022 3.35 pm

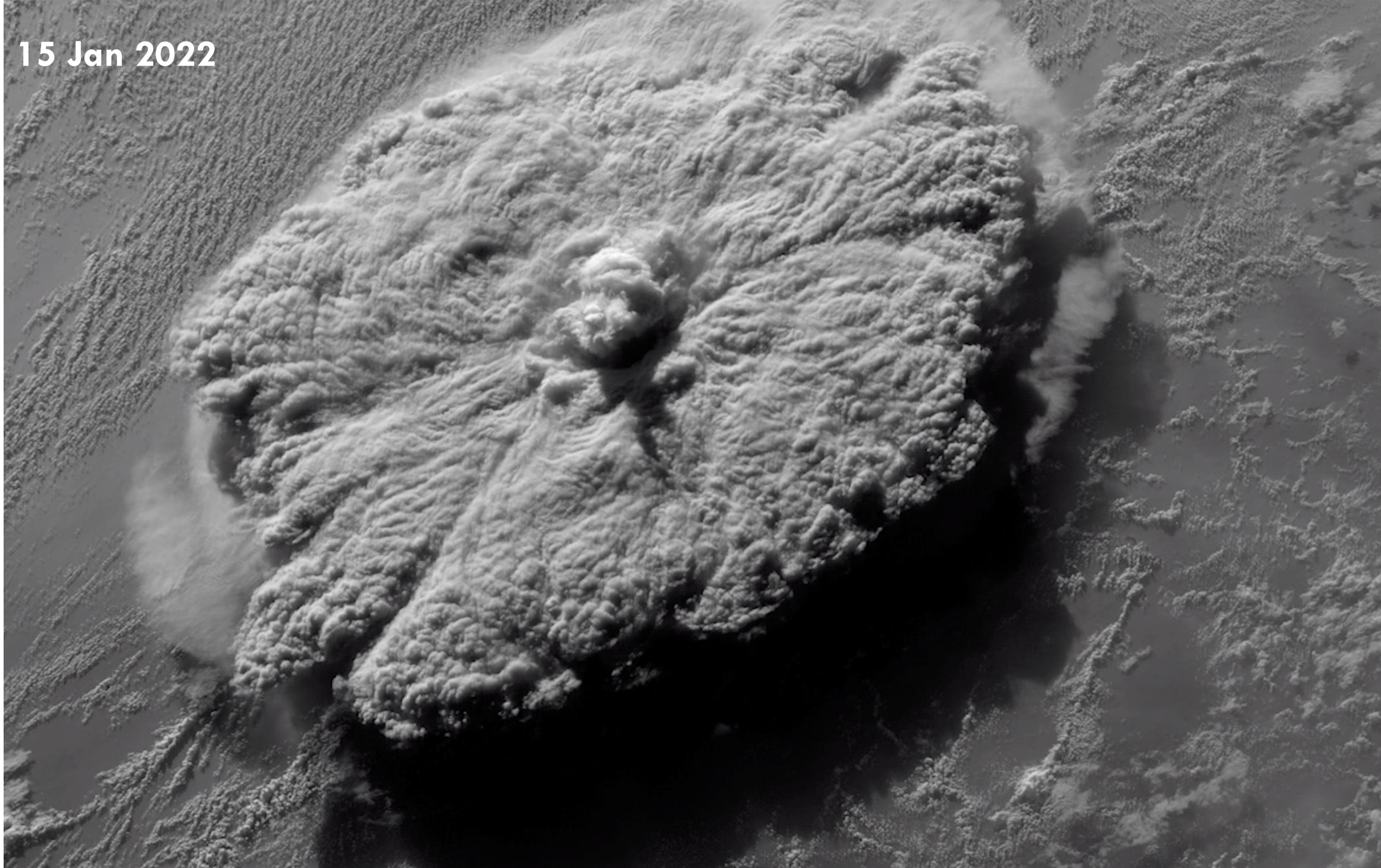
1.5 hours before climactic eruption

MAXAR

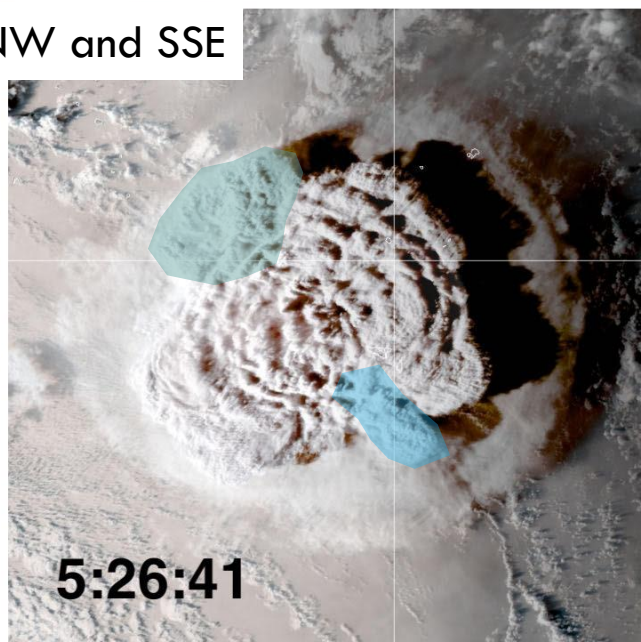
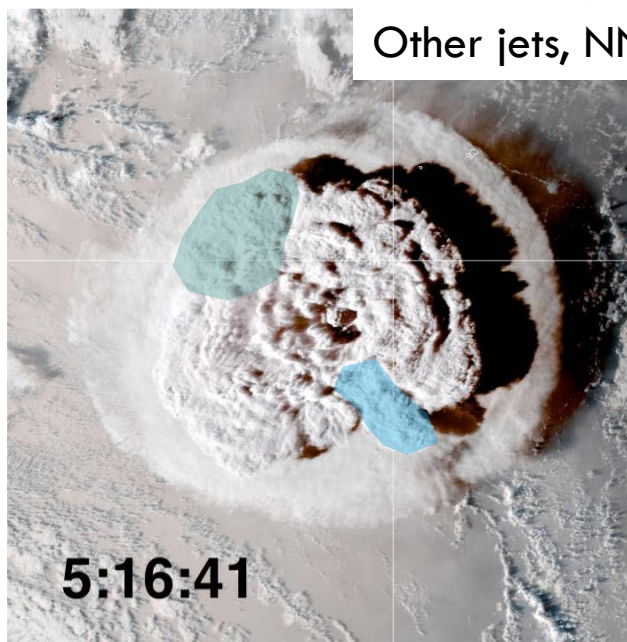
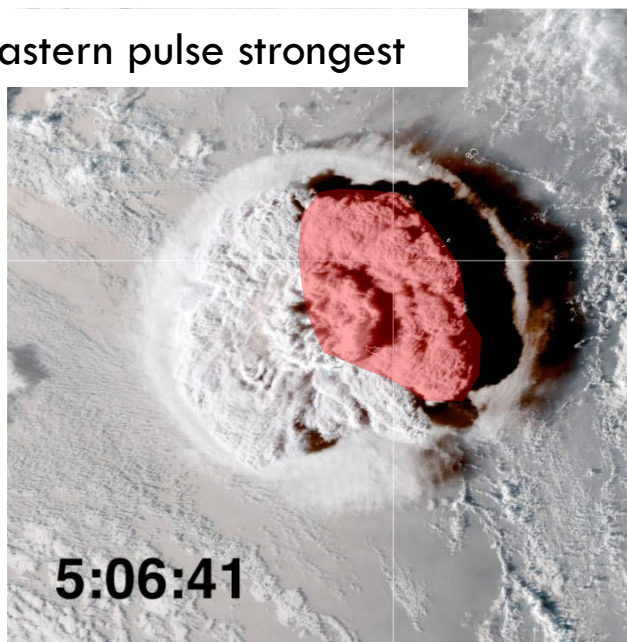
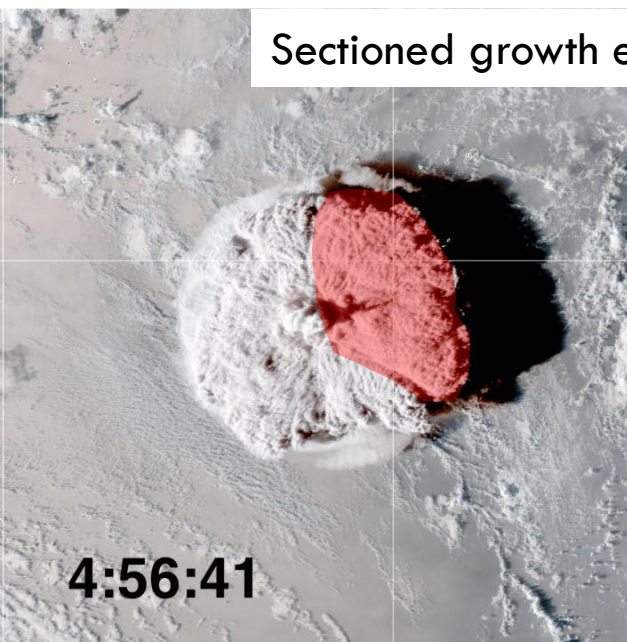
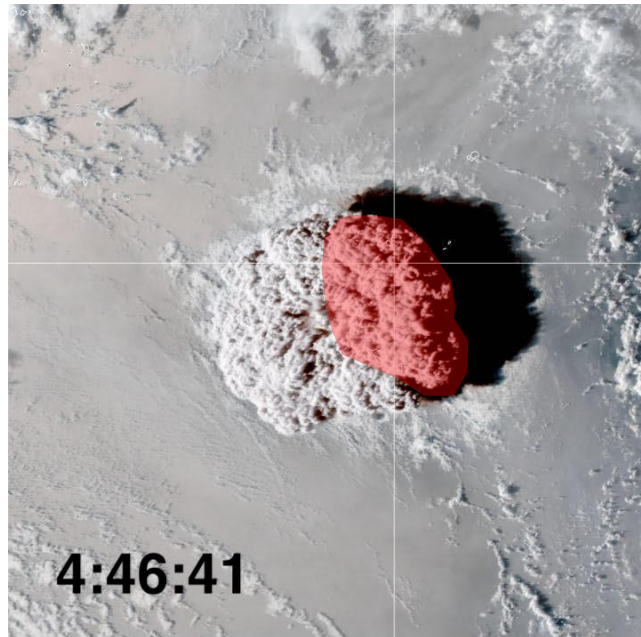
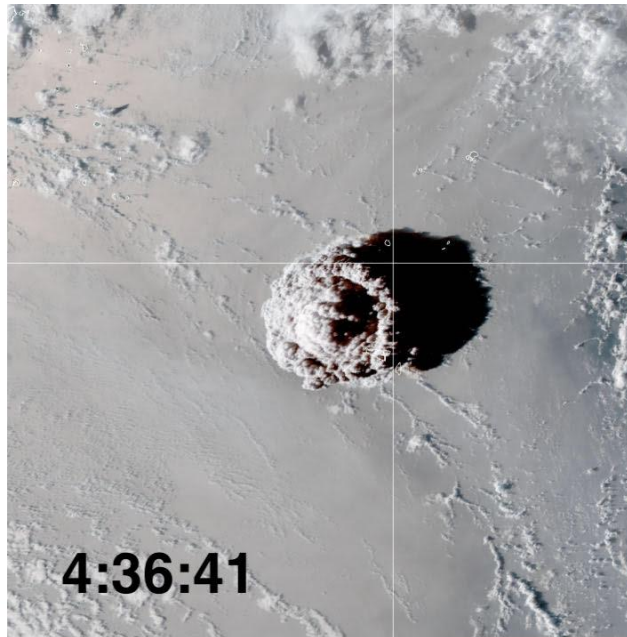
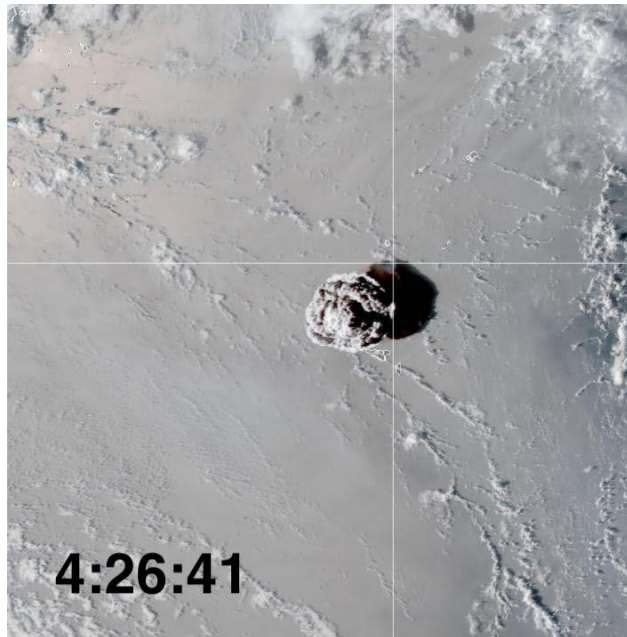


Planet Labs

15 Jan 2022



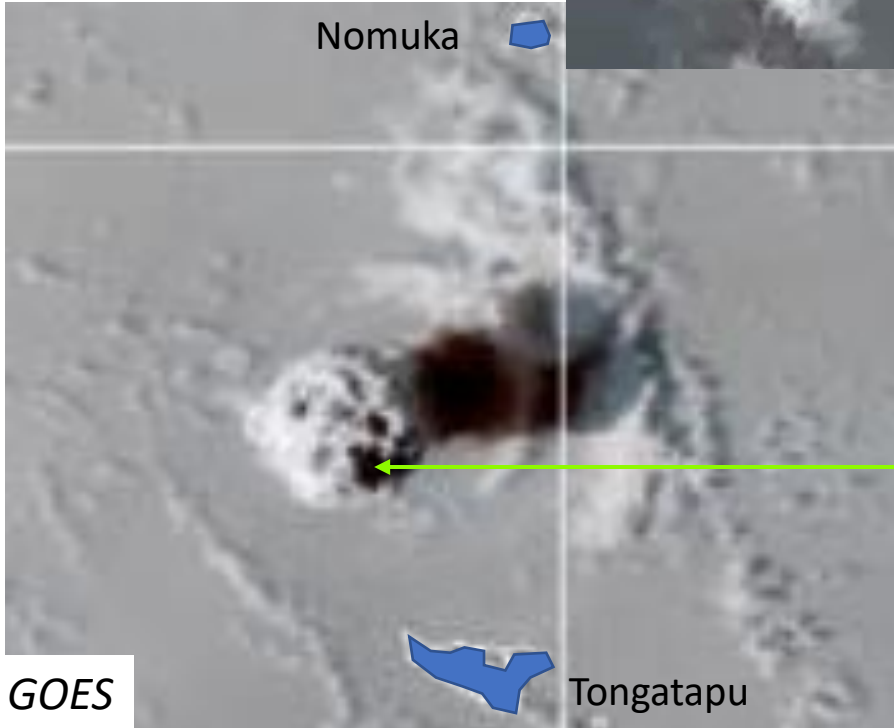
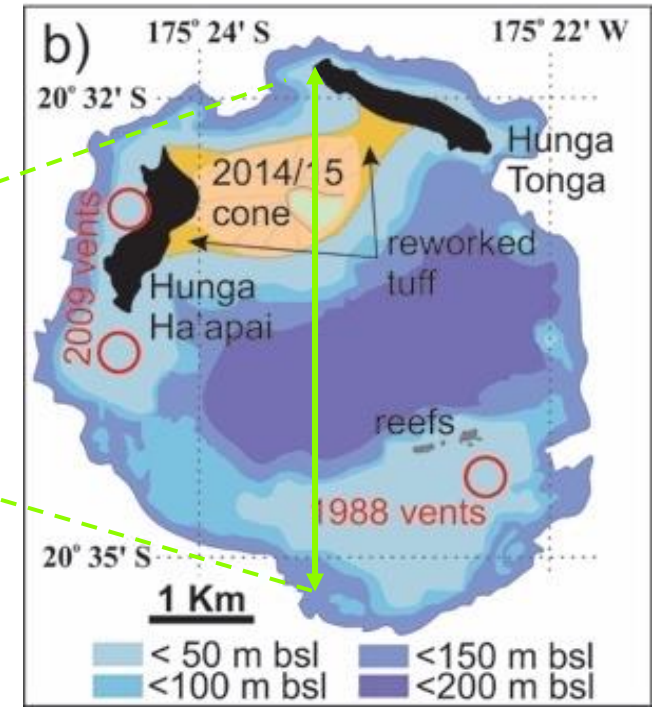
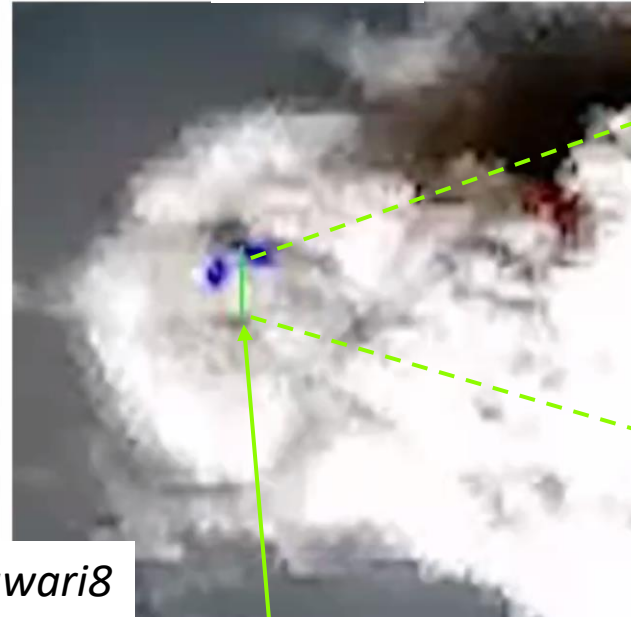
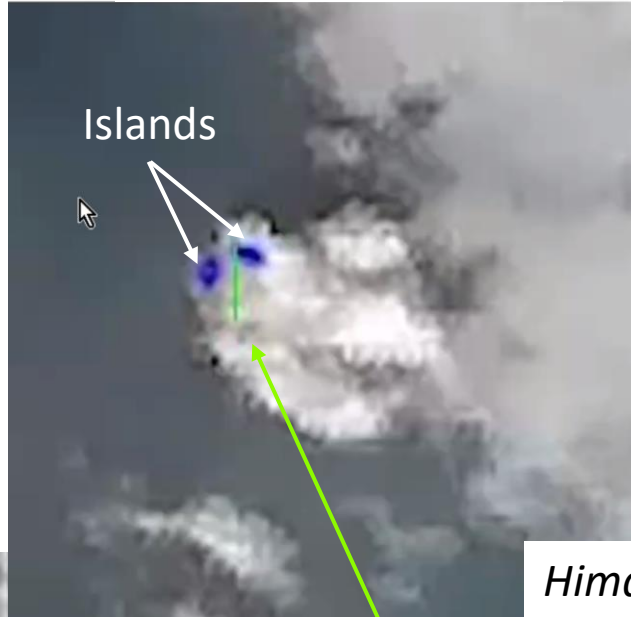
15 Jan 2022 ~17:01 Tonga time (4:01 UTC) - Climactic eruption over ~2 hours



15 January 2022 Eruption onset

17:07:30 Tonga Time

17:17:30



Apparent onset vent (dark spot) identified 5 km south of islands on southern caldera rim (initially noted by M Ichihara and T Kaneko – ERI)

Highest plume portion – south-east area

Southern caldera rim – collapse or trap-door caldera opening?

Caldera change

Hunga Ha'apai

Typically 0.647 km²
Jan 2022 0.167 km²
25% remaining

Hunga Tonga

Typically 0.371 km²
Jan 2022 0.033 km²
9% remaining

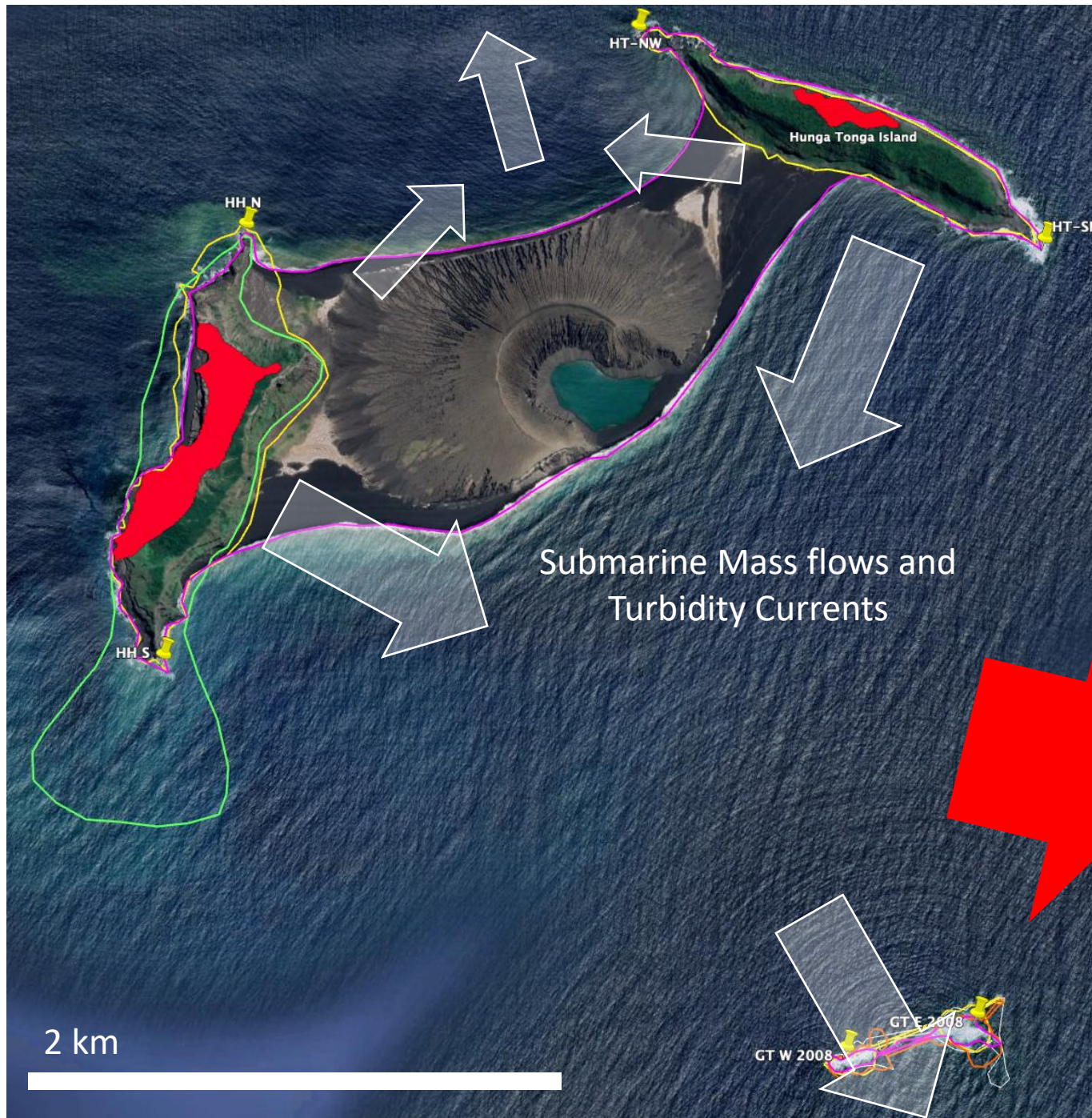
Total island pre-2022
2.91 km²

Submarine Mass flows and
Turbidity Currents

Possible flank collapse
In E or SE quarter

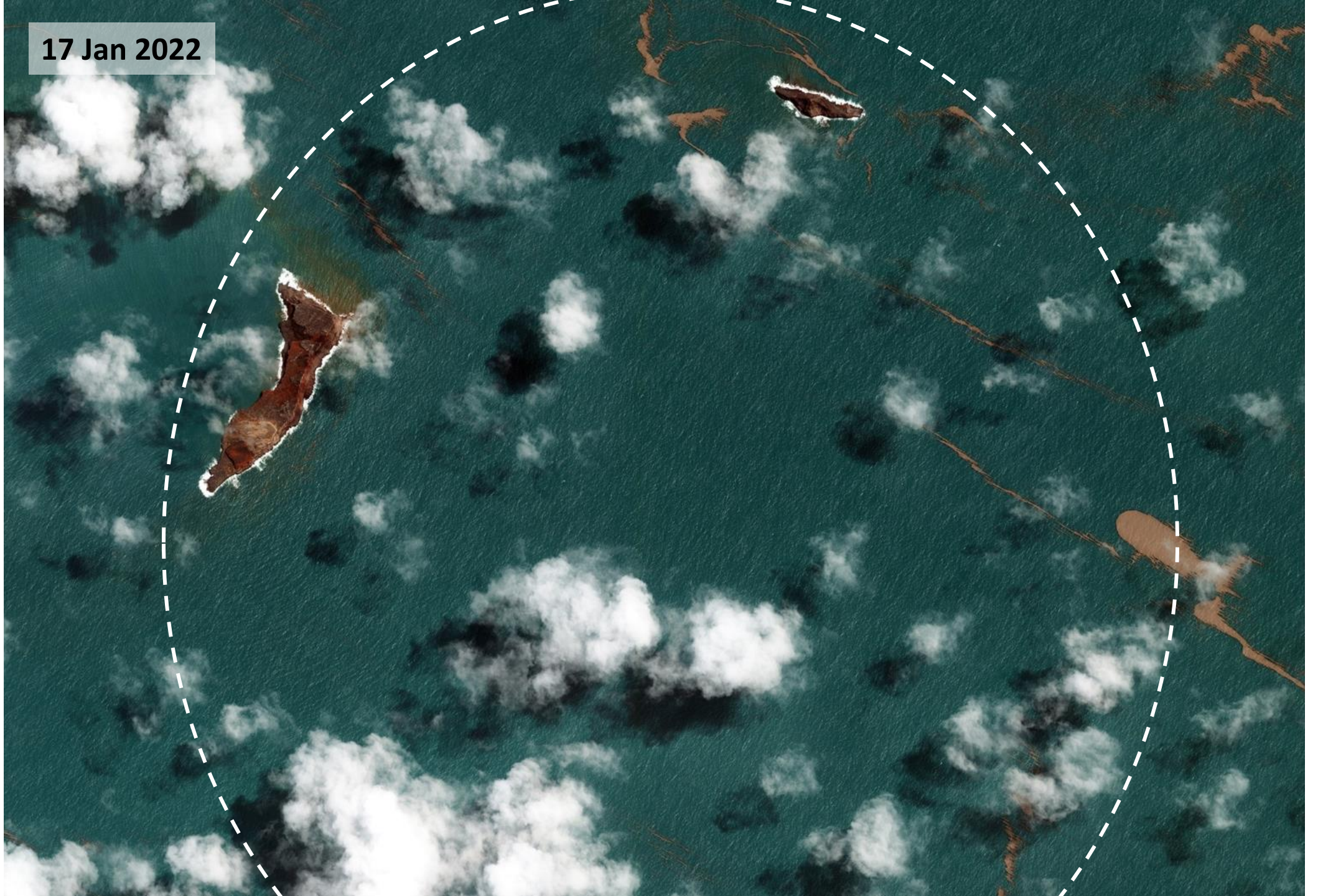
GT – Southern Shoals/island
Typically 0.045-0.071 km²
Post 22 eruption Absent

2 km



Caldera changes

17 Jan 2022

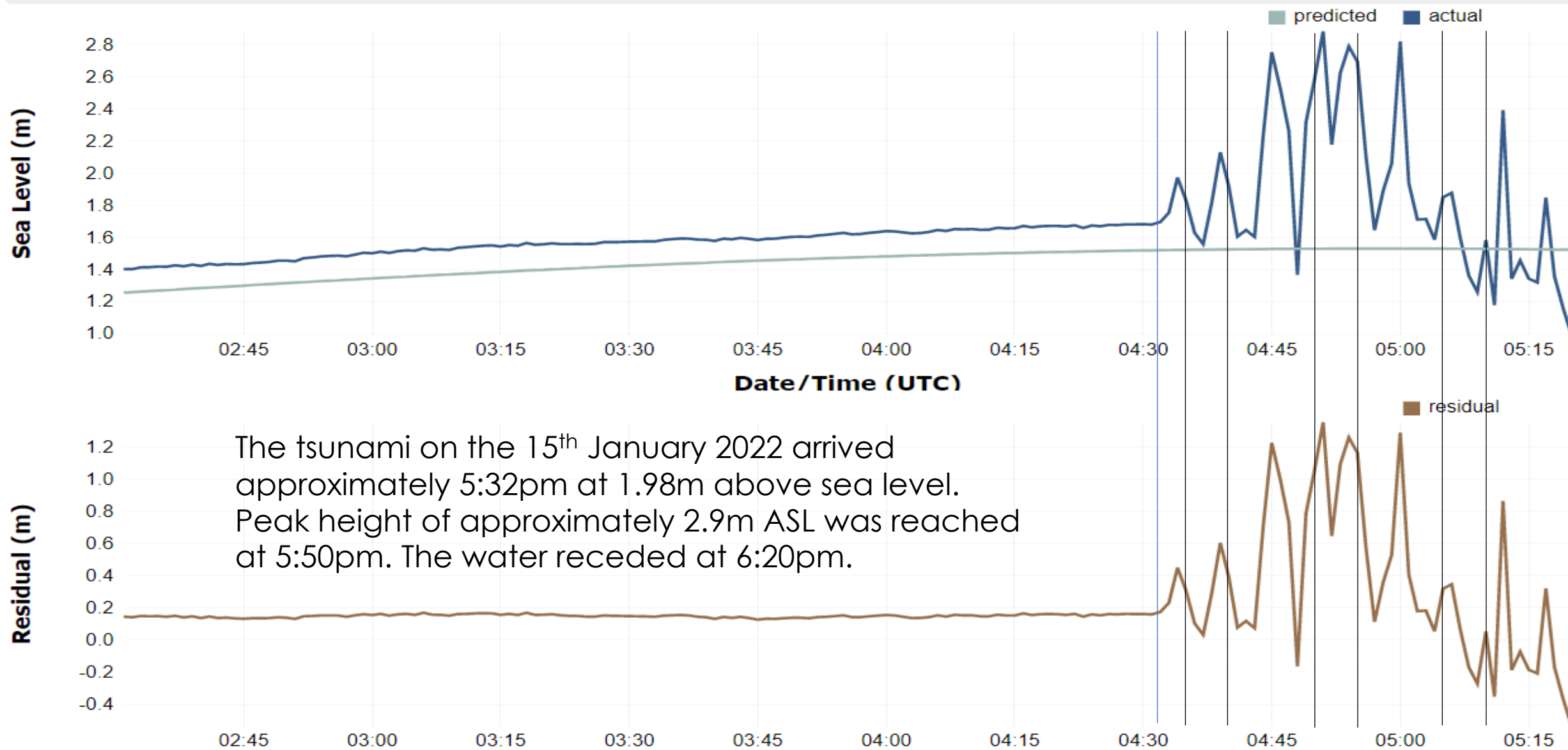


Tonga - Nuku'alofa

Sea Level

3 hours of data displayed

Sea Level



Eruption timeline (15.01.22 UTC) (incl USGS plume/lightning, eye-witnesses and Japanese observations)

~0350 infrasound detected

0401:30 Earthquake at caldera with a **trapdoor** or subsidence mechanism – *generates first tsunami - +ve wave*

0403 Eruption onset?

0406 first plume visible *GOES-17, seen on Himawari8 at 0407*

0408 M4.7 EQ (to be confirmed)

0408 volcanic lightning starts (plume is >8km) *GOES GLM*

0413 M4.7 EQ (*plume photographed from boat 0411*)

0415 M5.8 EQ (USGS detected)

0416 (41s) eruption plume 16-18 km-high

0421 M5.5 EQ (Japanese detected)

0425:30 Lamb pressure wave origin (*tsunami witnessed 0427*) (*shock witnessed 0432*)

0426 Umbrella reached Tongatapu, 65 km away

0426 First Tsunami Wave Arrival at Western Tongatapu

0440 M4.8 EQ – USGS

0445 Third Tsunami Wave at Nuku'alofa Tide Gage

0456 Max plume height reached 55 km **MER 5 x 10⁹ for 40-50 min**

0506 Upwind expansion slows (*ashfall starts at 0500 on/near Tongatapu – lapilli fall first*)

0530 M4.7 EQ -USGS

0536 stratospheric umbrella recedes downwind, a tropospheric umbrella cloud below is revealed

0544 Submarine cable 2 (international) goes down – SSE of Hunga – 35 km stretch damaged/buried

0746-0900 lightning intensified

0806 new eruption input into stratospheric umbrella ~20 km high **MER ~ 10⁷ kg/s for 40 min** (*booms heard*)

0952 M4.4 EQ - USGS

1500 Lightning stops – eruption produced intermittent **>8 km plumes for ~11 hrs**

Questions:

What triggered eruption

What happened at 0415?

What happened at 0421-25?

Malo 'Aupito

Thank you for the opportunity.

