Further Challenges for Warnings of Tsunamis
Learnings from recent tsunamis generated by non-seismic and complex sources

Lessons learnt from Tonga 2022 tsunami event

Unexpected Events - Importance of Community Awareness and Preparedness

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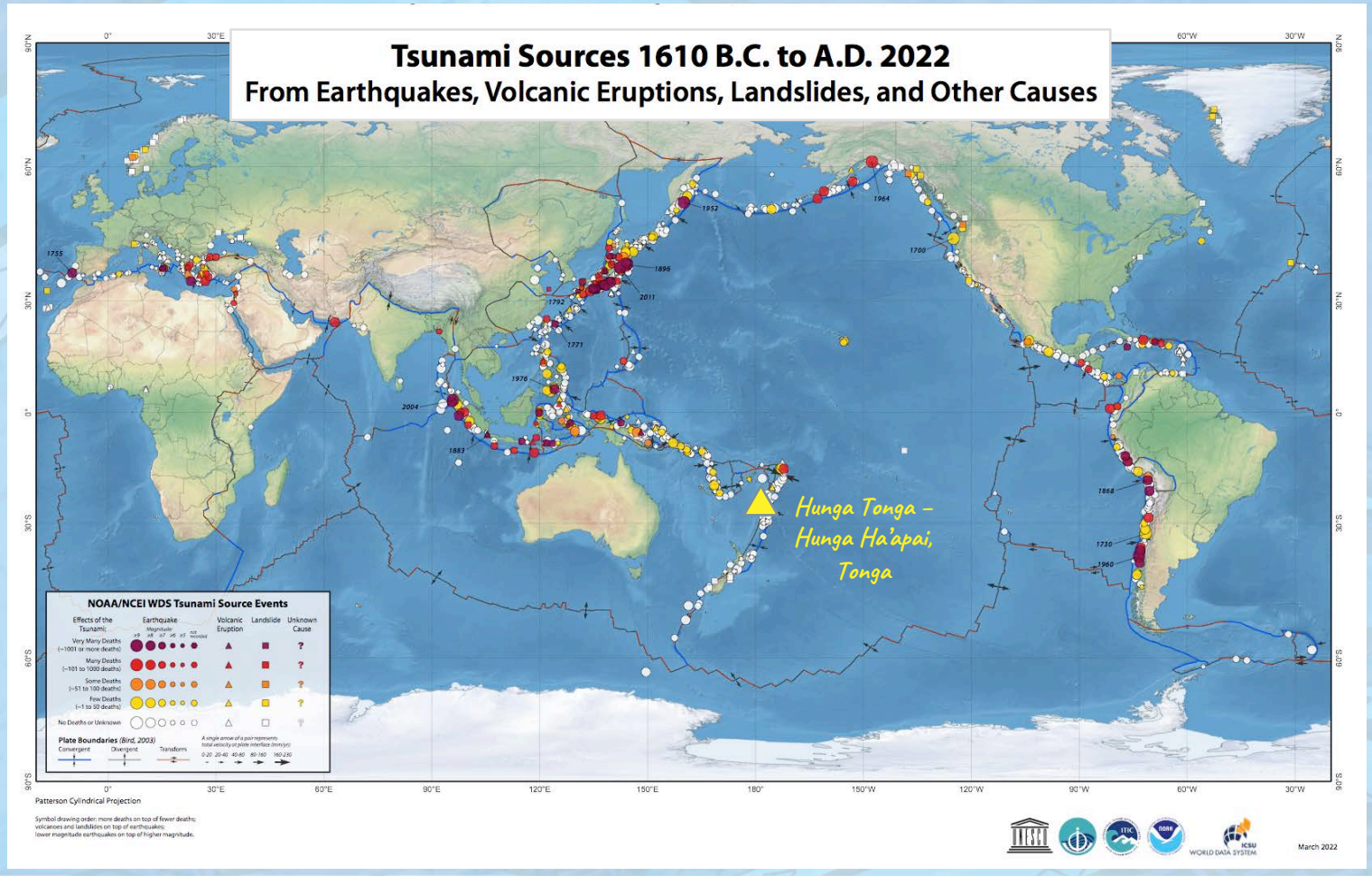
Tsunamis – what, when, where, how



Tsunamis – what, when

WHAT IS A TSUNAMI?

A series of ocean waves caused by an earthquake, landslide or volcanic eruption. Waves can be 10 metres or higher.

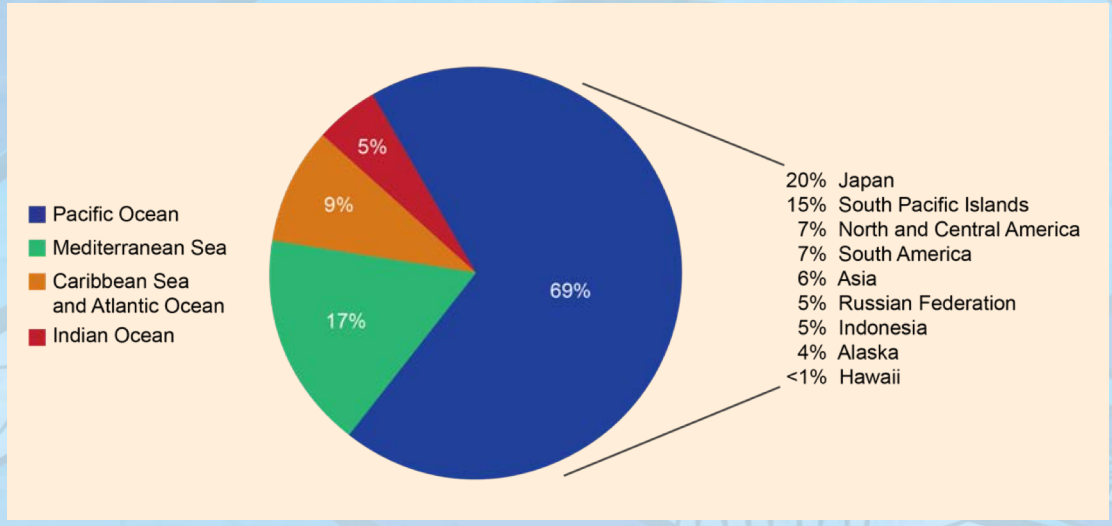
WHEN DOES IT OCCUR?

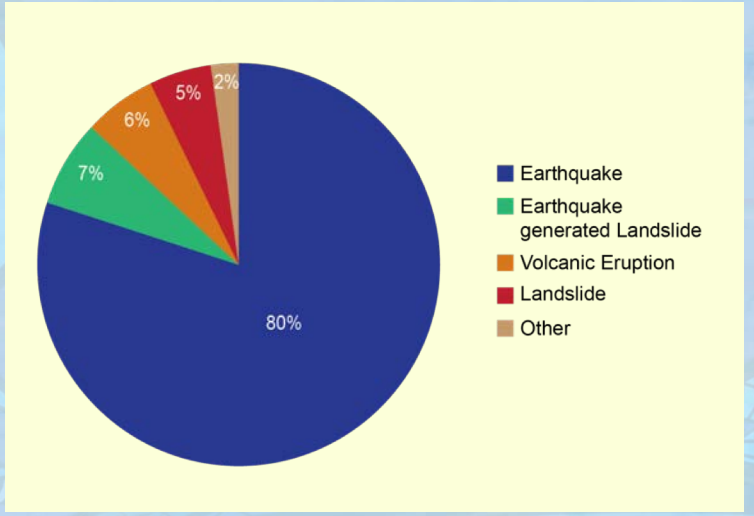
Anytime and anywhere, and if local, can attack in minutes. You cannot outrun a tsunami.

WHAT IS ITS IMPACT?

Floods coastal areas devastating homes, contaminating soil, killing coral, and flattening landscapes.

Tsunamis – where, how



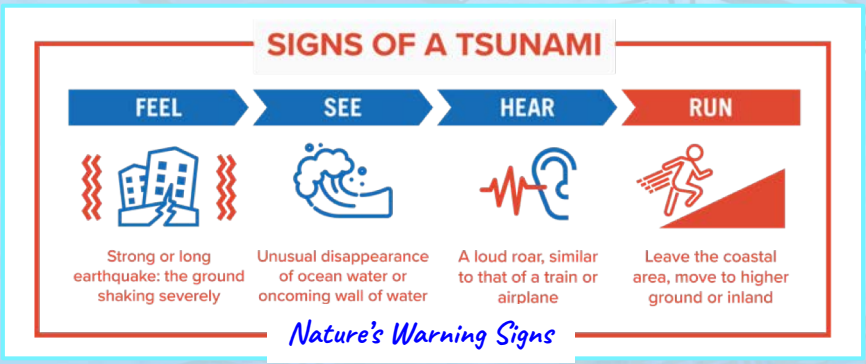


- 69% in Pacific
- 87% from earthquakes. Earthquake-generated landslides
- 90% deaths from local or regional tsunamis

The Issues - Tonga

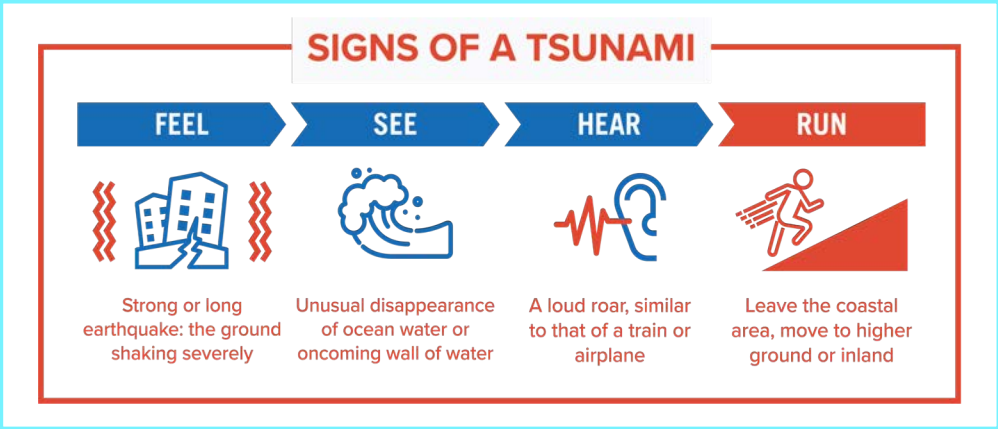
- Not an earthquake! Warning for 'unfamiliar' event: ==> 'Detect', then Warn
- What to do the next time
  - Next Science ? New, faster, better Detection and Forecast
  - Next Community ?
    - Are you ready? Plan ahead. Be Prepared.
    - How to Detect? Nature's Warning Signs
    - How to be Safe? Get Tsunami Ready now !

Ha'apai, Tonga (TGS)



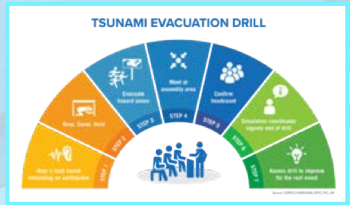
What happened – See, Hear, Feel, Act

- Remember Past - Day before, small eruption, small waves, sulfur smell, next day
- AS IT HAPPENS
  - SEE the steam/ash cloud. HEAR the loud Explosion. FEEL ground shaking.
    "everyone knew something going to happen since never happened before"
  - AS IT ARRIVES, SEE
    - See unusual ocean –
      Witness fast draining
      Swirling water eddies
    - Animals disturbed
      Birds flying, Ash falling



Lessons Learnt

- Noting historically, earthquake generate 90% of tsunami (volcano 6%),
  Prepare for earthquakes, but be aware of the 10%
- For local (close by) and distant, NEED TO BE TSUNAMI READY !
- Science (priority): Simply ETA (time to reach) fr ALL sources
- Communities: Must Plan Ahead, get Tsunami Ready
  What to do? Where to go? Practice beforehand
  YOU must act yourself – personal action / responsibility
- Communications: Must be Reliable, Robust, Redundant, Realistic
  Must broadcast. Must be simple. Must reach (low and high-tech)



ʻŌlelo Noʻeau, Hawaiian proverb or wise saying

“ ʻIliki ke kai i ka ʻopeʻope lā, lilo!
I lilo nō he hāwāwā.”

A person who fails to watch out often loses!
Never turn your back on the sea.

Mary Kawena Pukui