A Data-Driven Approach to Climate Change Adaptation for Coastal Flood Hazards in the Atoll Nation of Tuvalu

4th International workshop on waves, storm surges and coastal hazards

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University of Cantabria
IH Cantabria

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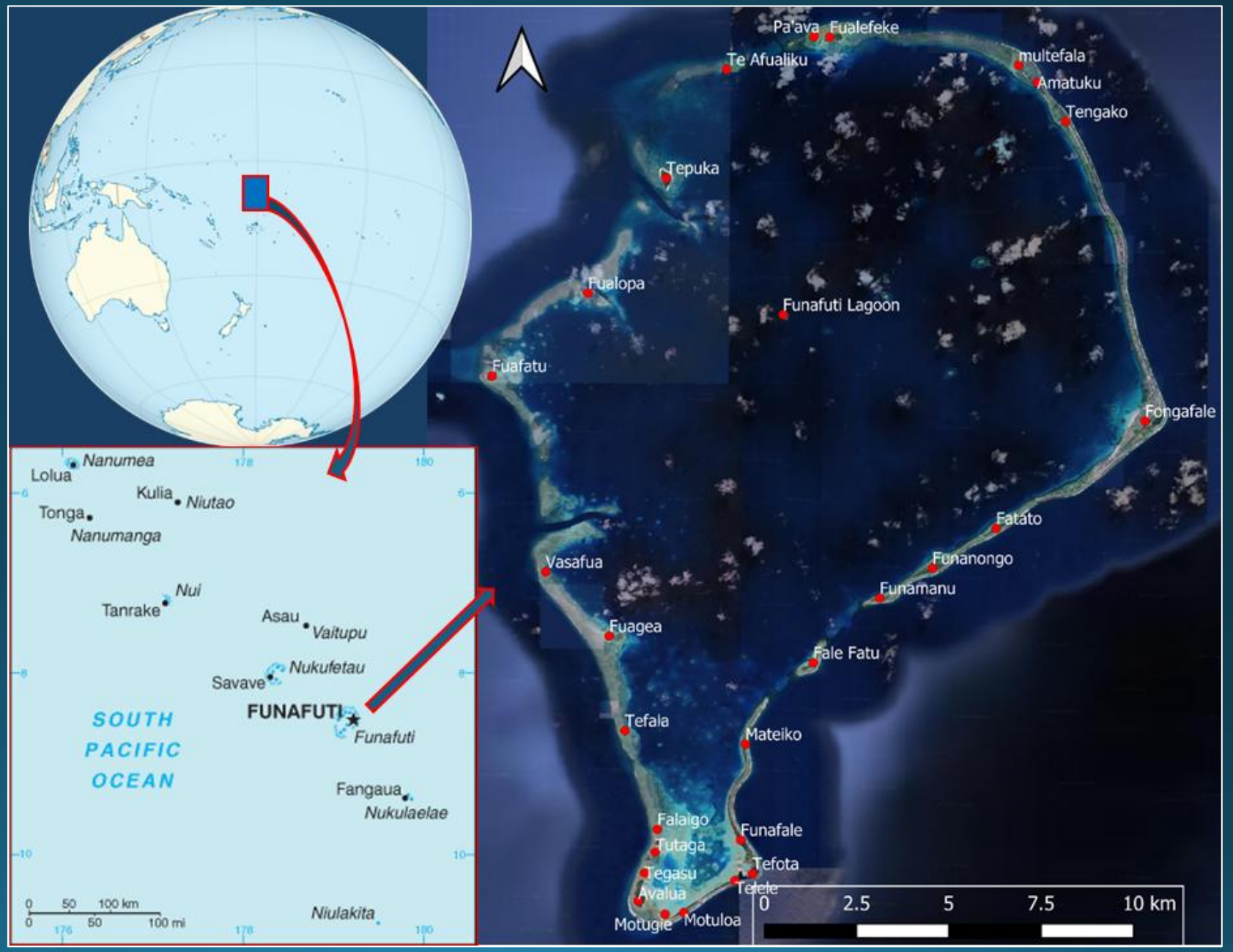
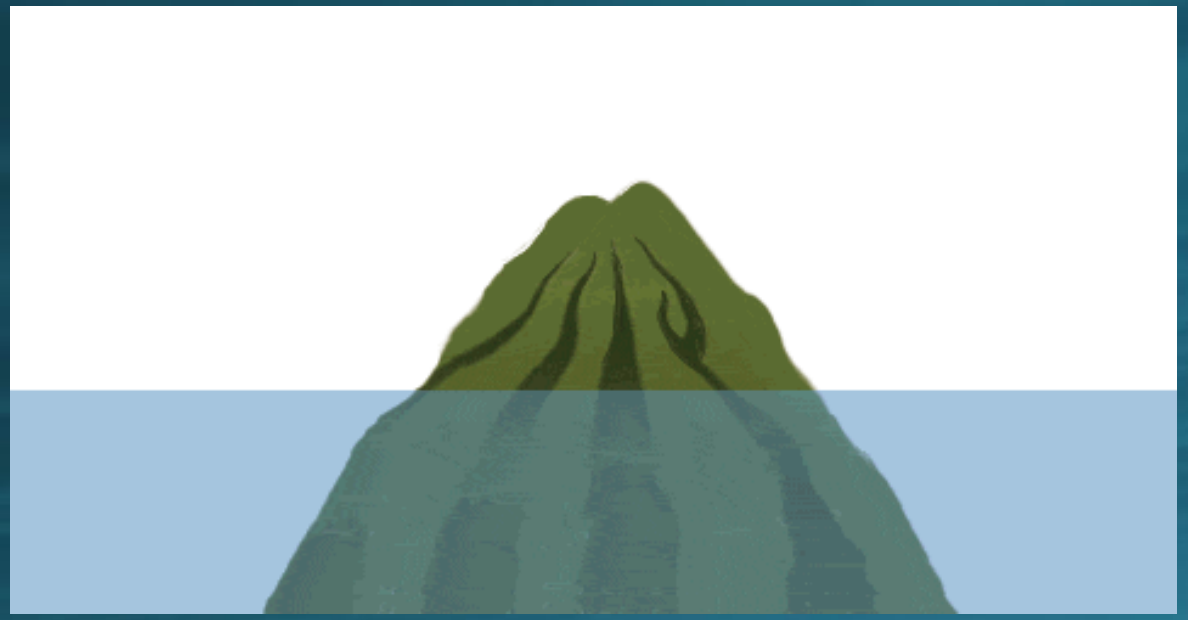
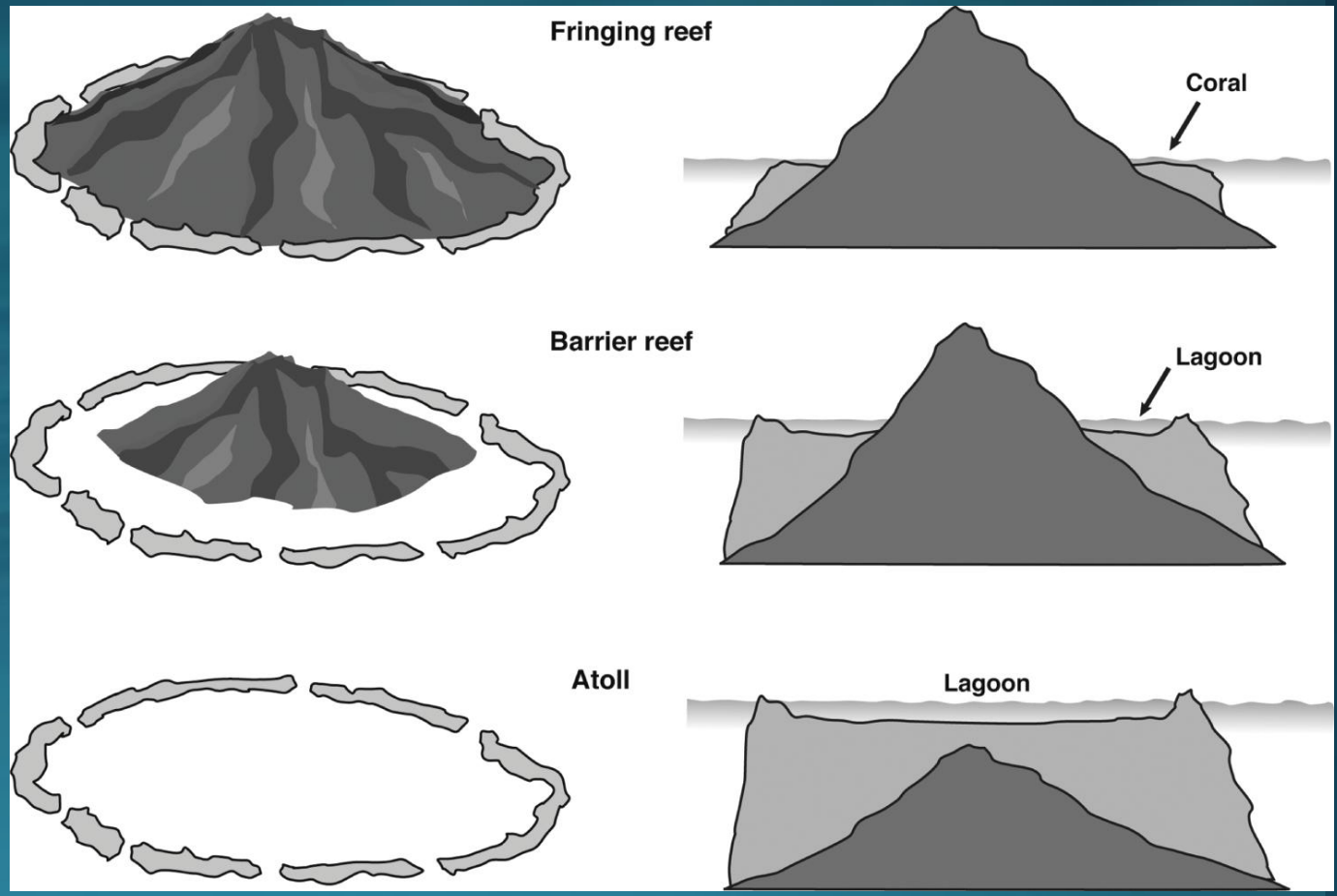
Tuvalu Coastal Adaptation Project (TCAP)

- US$40.2 million Green Climate Funded, with co-financing from Australian and Tuvaluan Governments.
- United Nations Development Programme (UNDP) implementation over 8.5 years.
- Protected over 3km of vulnerable coastline across three islands
- Including 730 meters in Funafuti, creating 7.3ha of flood-free land until 2100.



TCAP: Tuvalu Geologic Setting

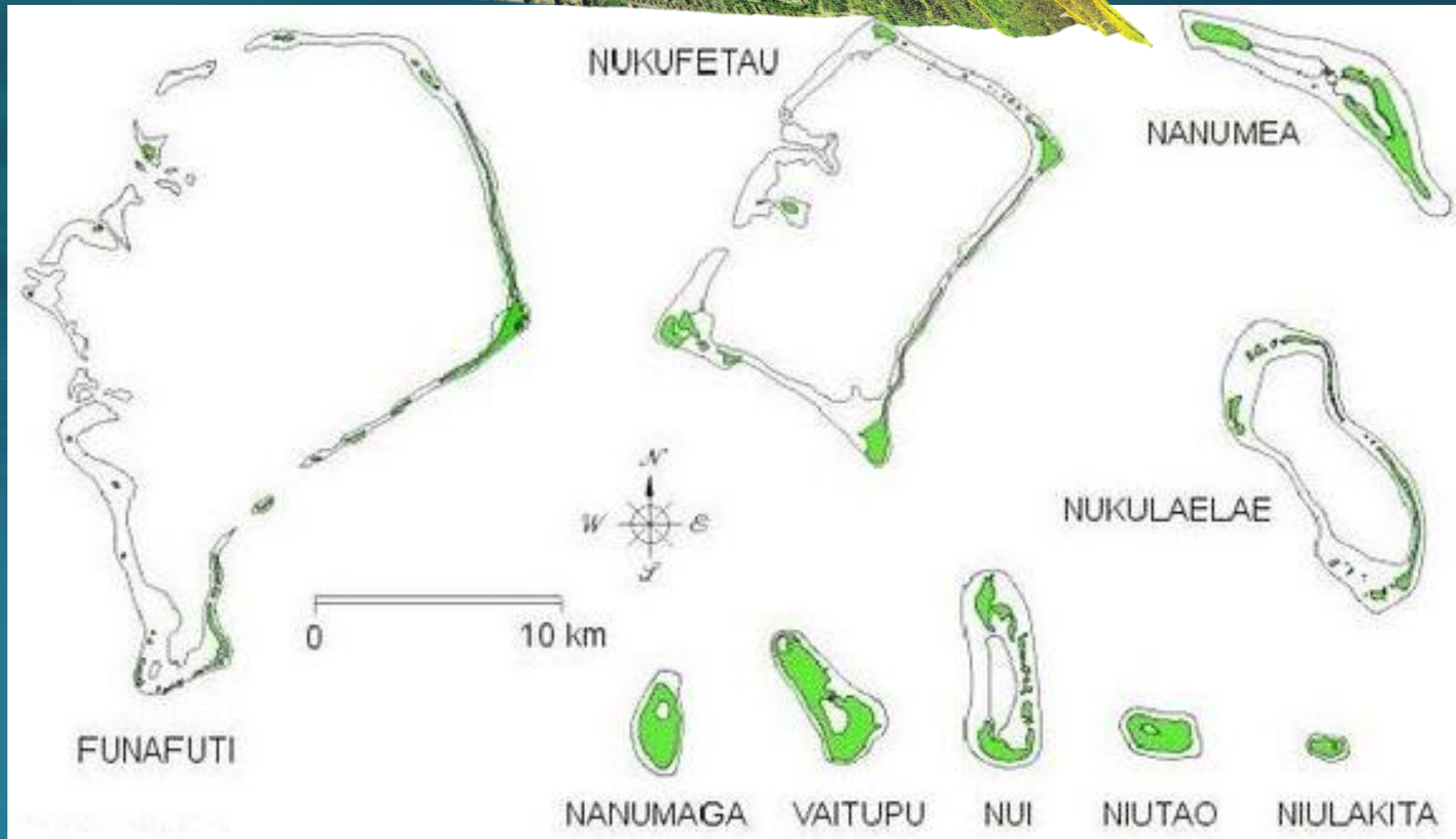




TCAP: LiDAR Data Collection

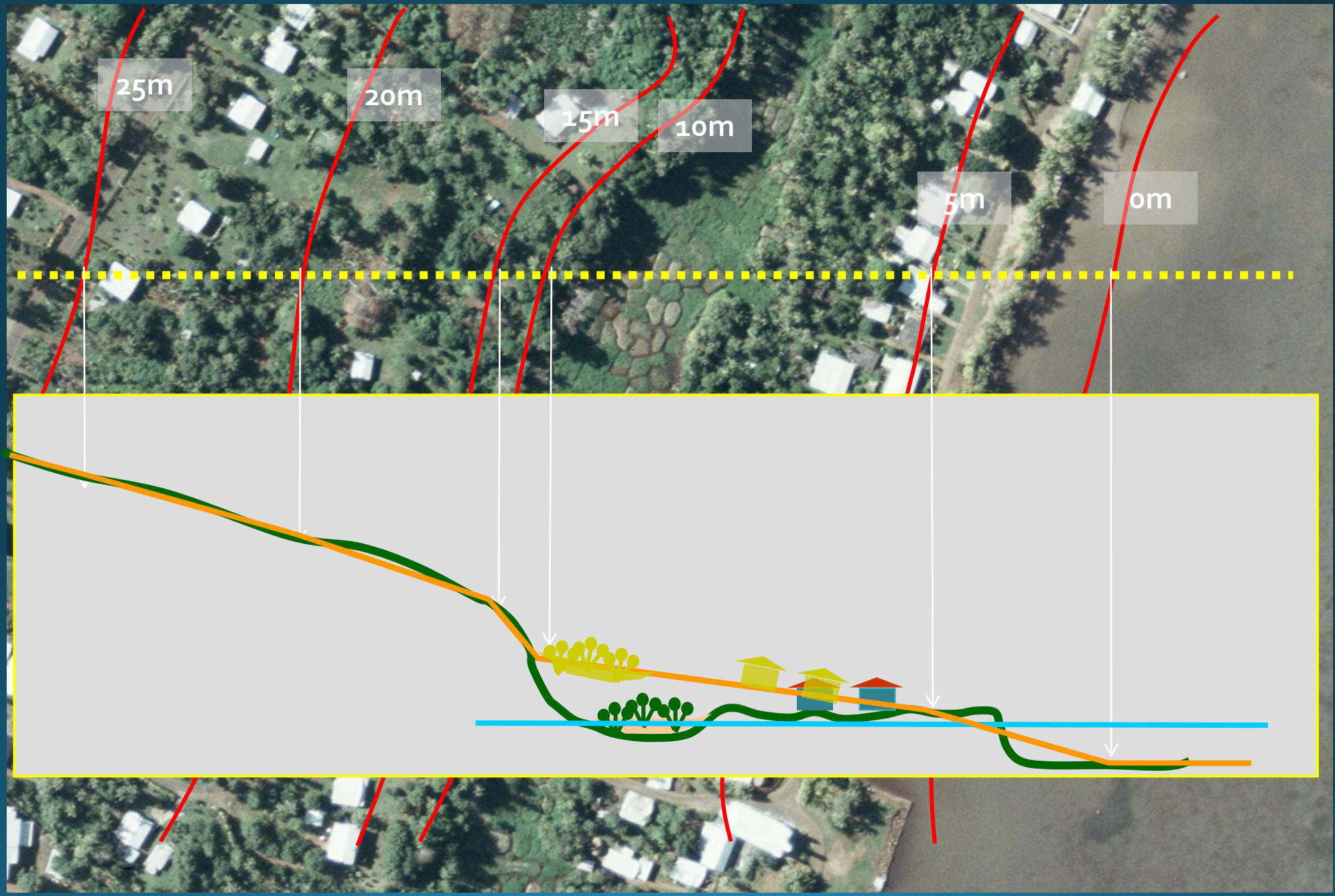
- Survey covered all 9 atolls; *all land, reefs and lagoons*.
- Complement existing deep water bathymetry (> 50m depth)
- No other Country in the region has such *high-quality data* covering all islands and communities.
- Has very broad use across many needs; e.g. *Navigation, Fisheries, Conservation, Land-use planning & Development, Land tenure, Adaptation, etc.*

➢ This is the high-quality data Tuvalu needs in order to *model wave transformation, overtopping and inundation* and to understand **sea level rise** impacts.



TCAP: LiDAR Data Collection

Why is high-quality data important?



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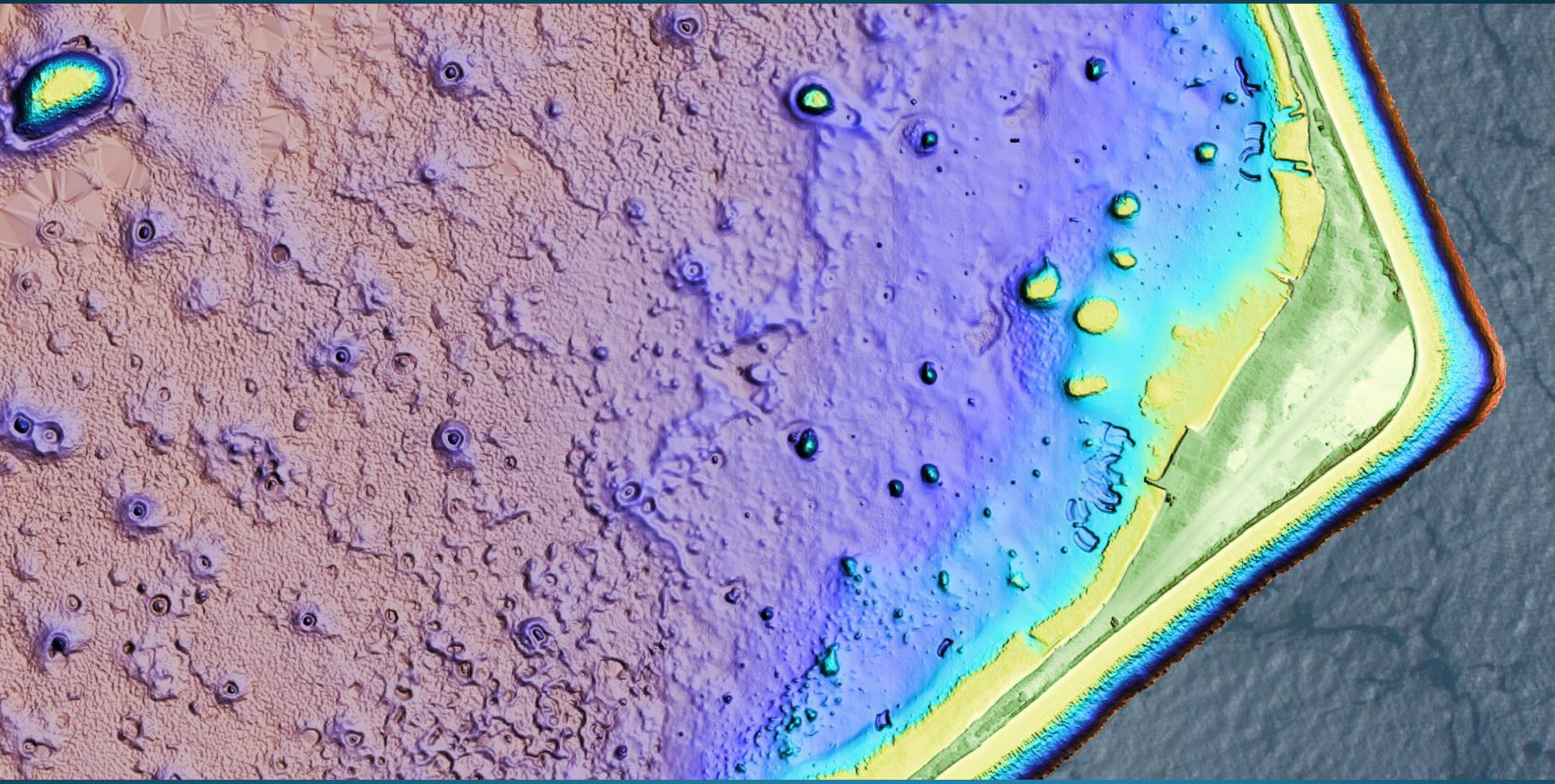
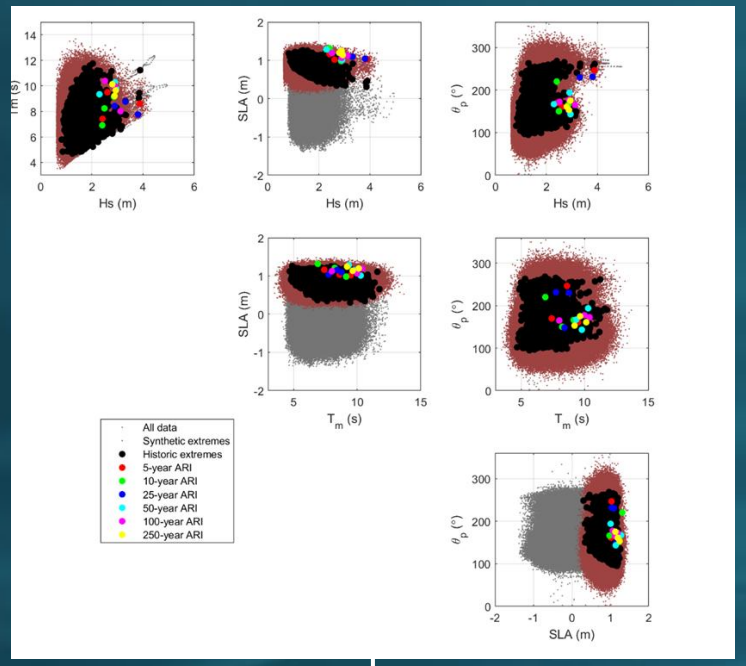
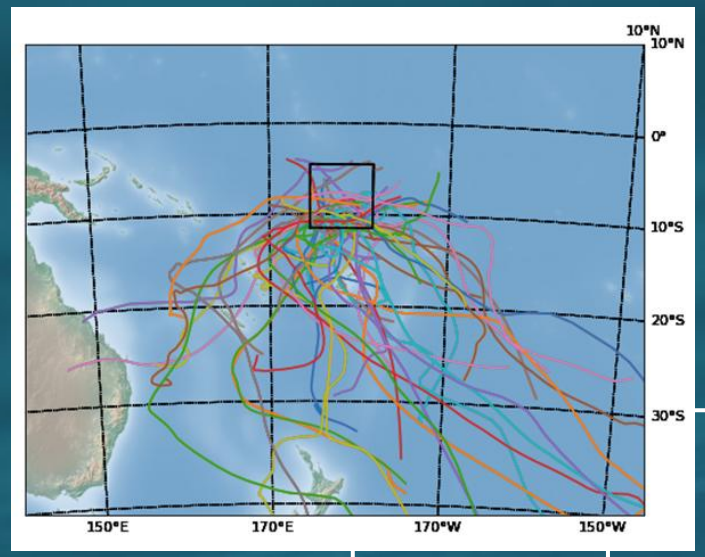
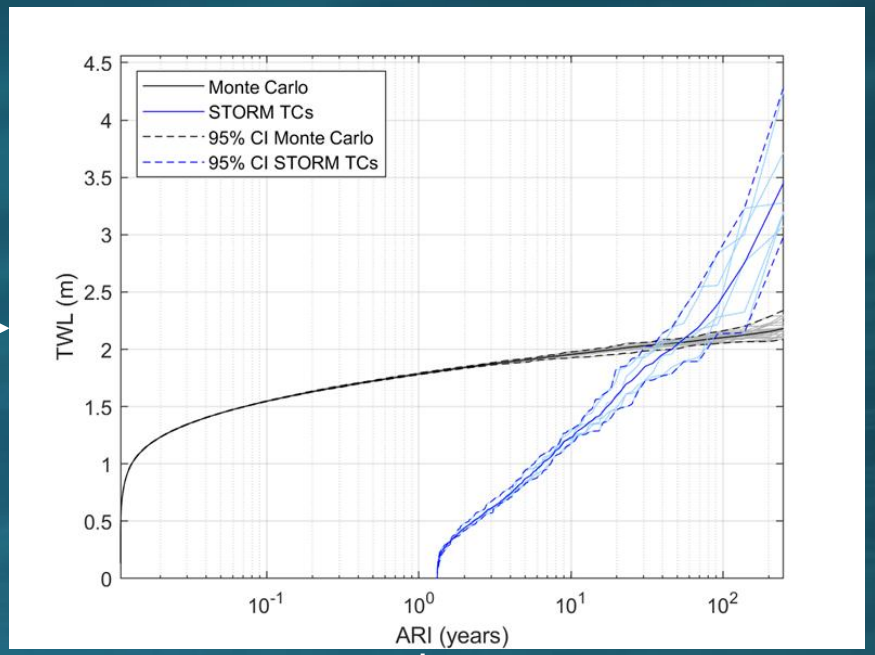


TCAP: Coastal flood hazard assessment (SPC)







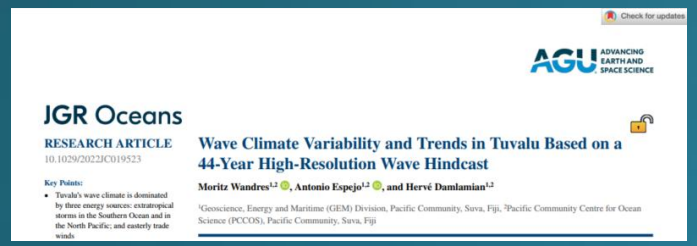
Empirical model (Merrifield et al. 2014)

- $TWL = \eta_{MSLA} + \eta_{tide} + \eta_2$

$$\eta_2 = b_1 H_b + b_0$$

$$H_b = \left(H_s^2 T_p (4\pi)^{-1} \cos(\theta_p - \theta_N) \sqrt{\gamma g}\right)^{\frac{2}{5}}$$

Pick combinations of Hs, Tp, Dir, MSLA corresponding to each ARI (5, 10, 25, 50, 100, and 250)



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TCAP: Coastal Engineering Design

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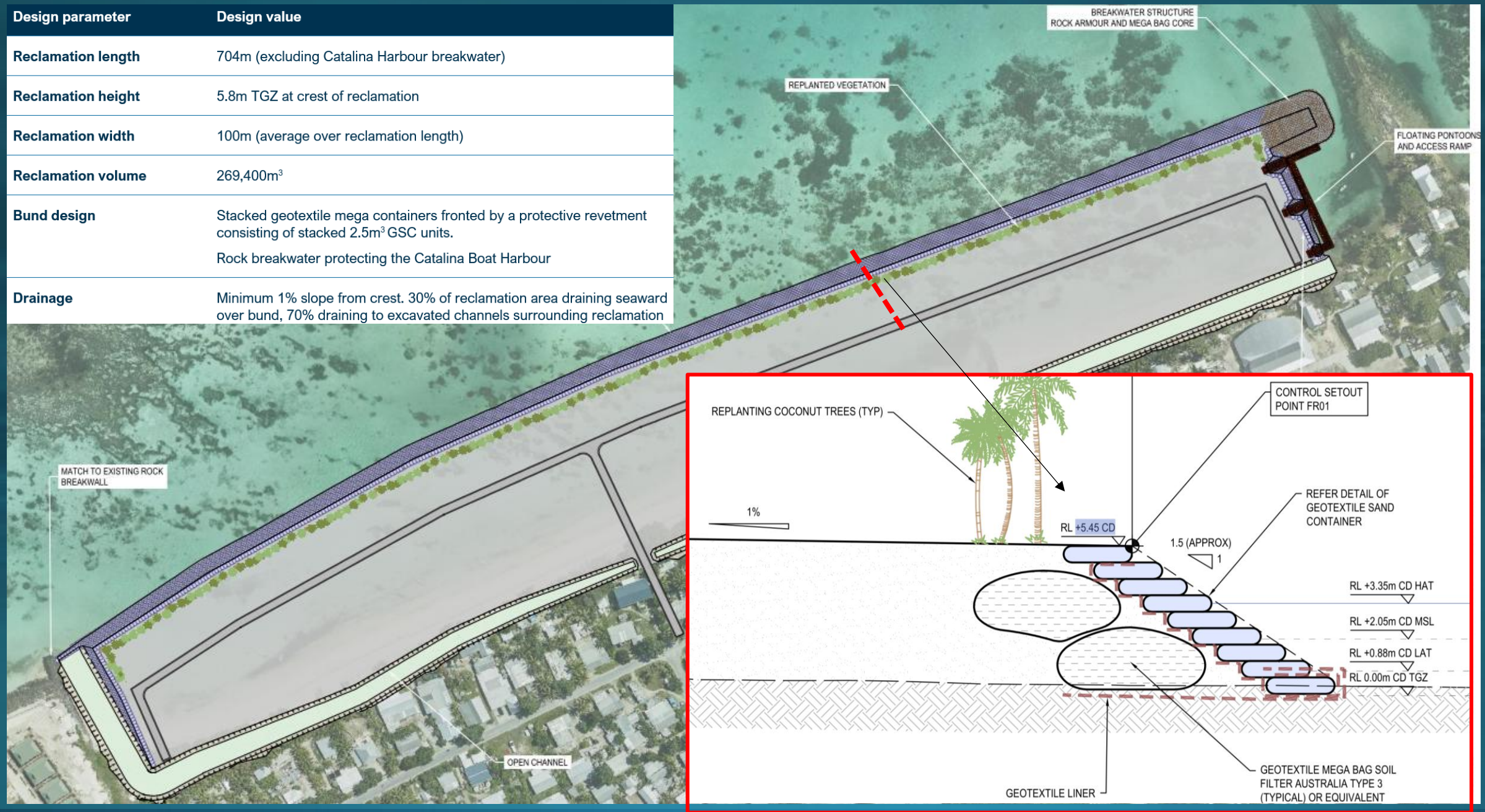
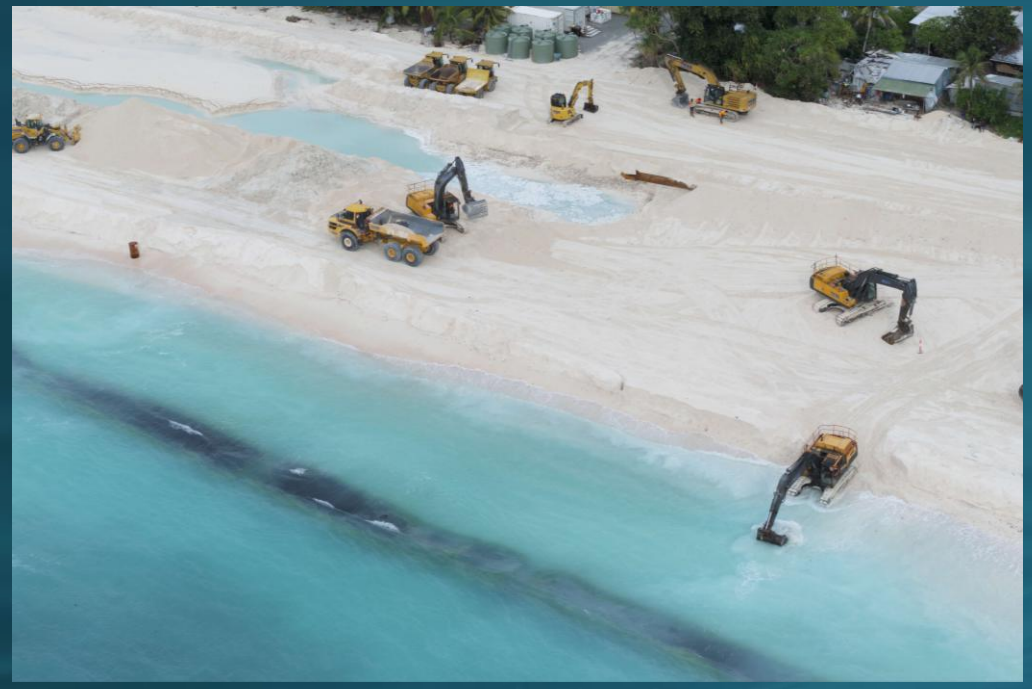
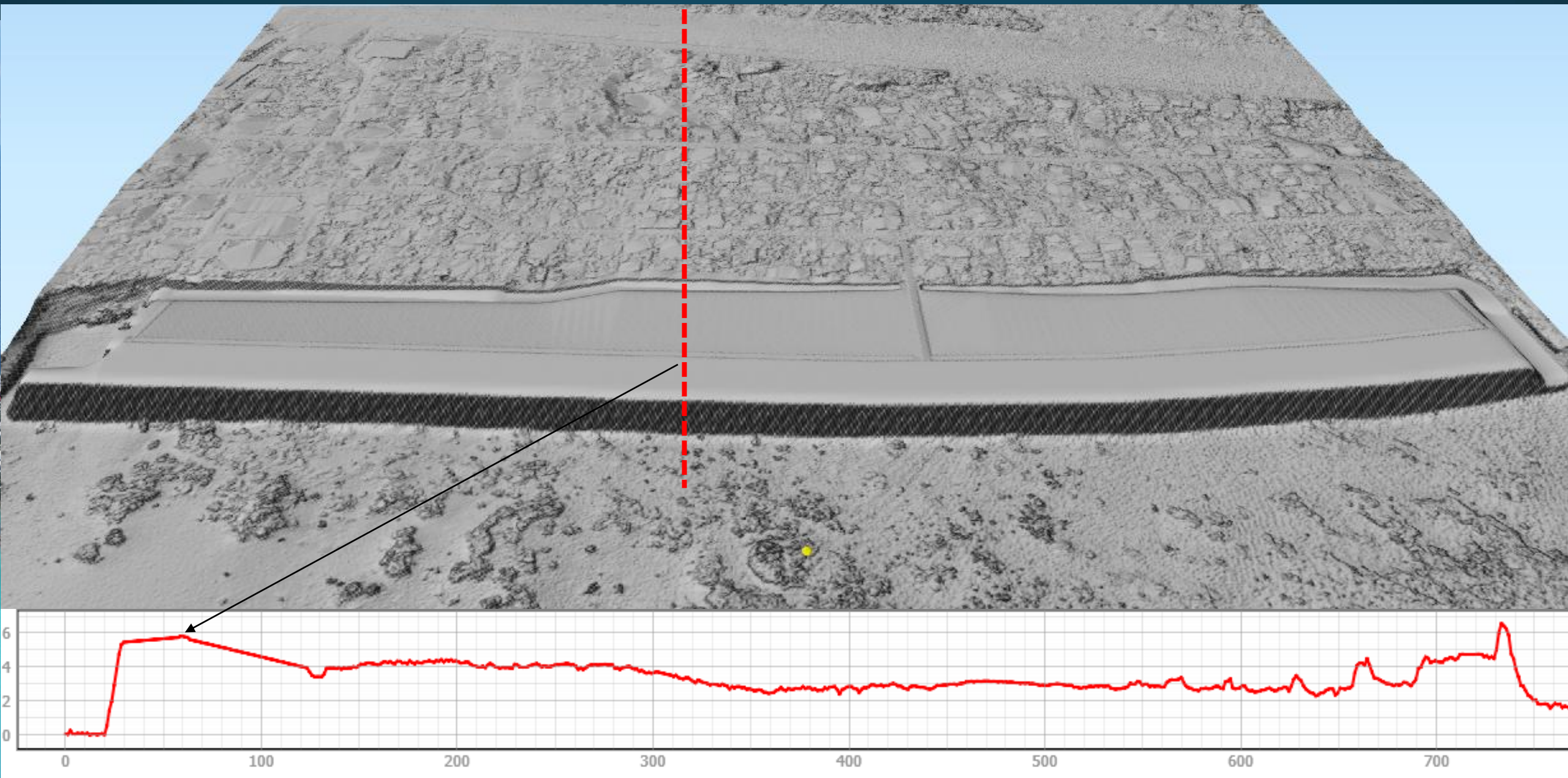
Design parameter	Design value
Reclamation length	704m (excluding Catalina Harbour breakwater)
Reclamation height	5.8m TGZ at crest of reclamation
Reclamation width	100m (average over reclamation length)
Reclamation volume	269,400m^3
Bund design	Stacked geotextile mega containers fronted by a protective revetment consisting of stacked 2.5m^3 GSC units. Rock breakwater protecting the Catalina Boat Harbour
Drainage	Minimum 1% slope from crest. 30% of reclamation area draining seaward over bund, 70% draining to excavated channels surrounding reclamation



TCAP: Coastal Engineering Design & Implementation



Tuvalu Coastal Adaptation Project (TCAP)

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