



Uplift rates along 23°S Chilean coast during Quaternary



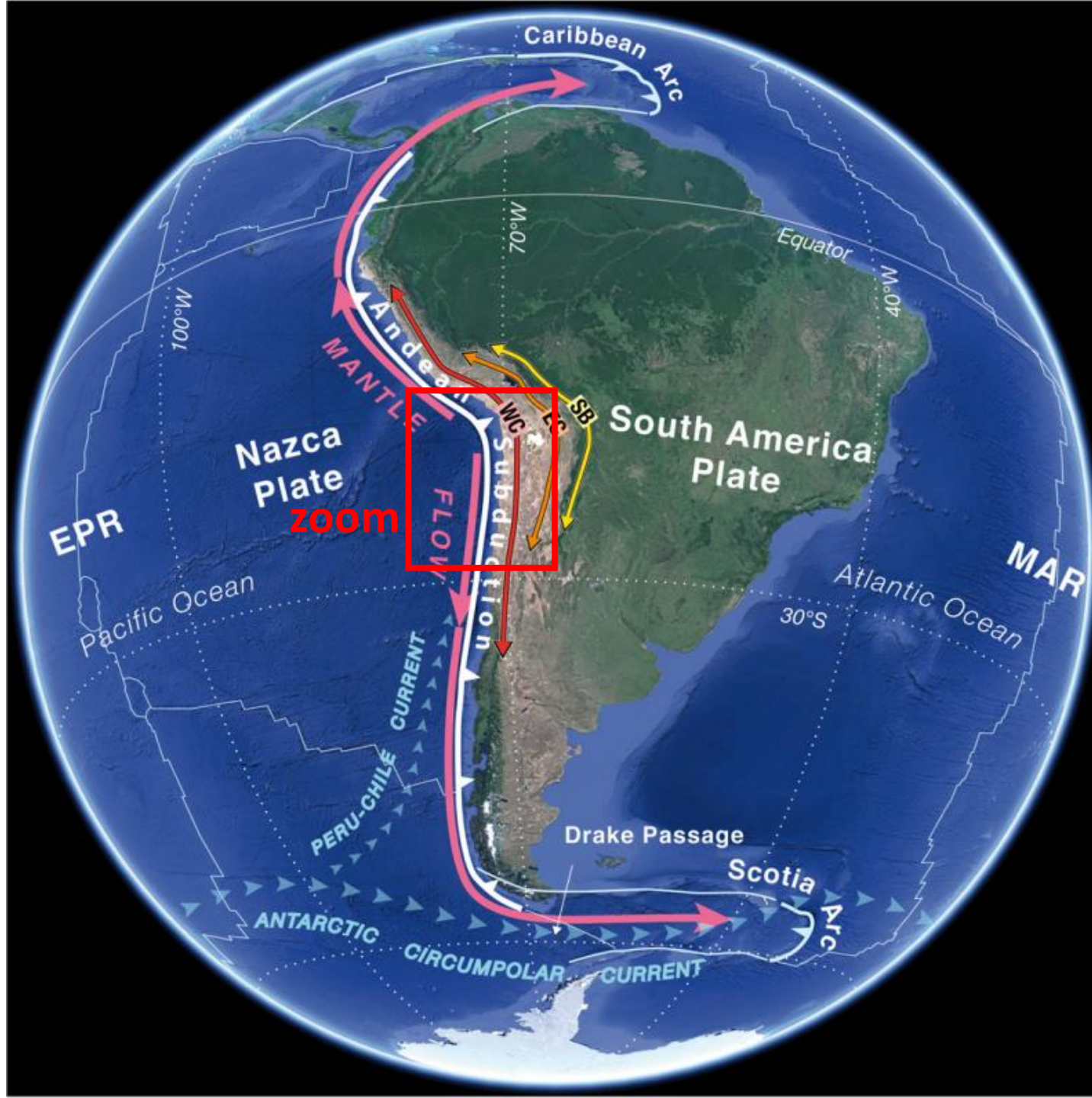
Paulina Vergara ¹, Carlos Marquardt ^{1,2}

(1) Departamento de Ingeniería Estructural y Geotécnica, Pontificia Universidad Católica de Chile

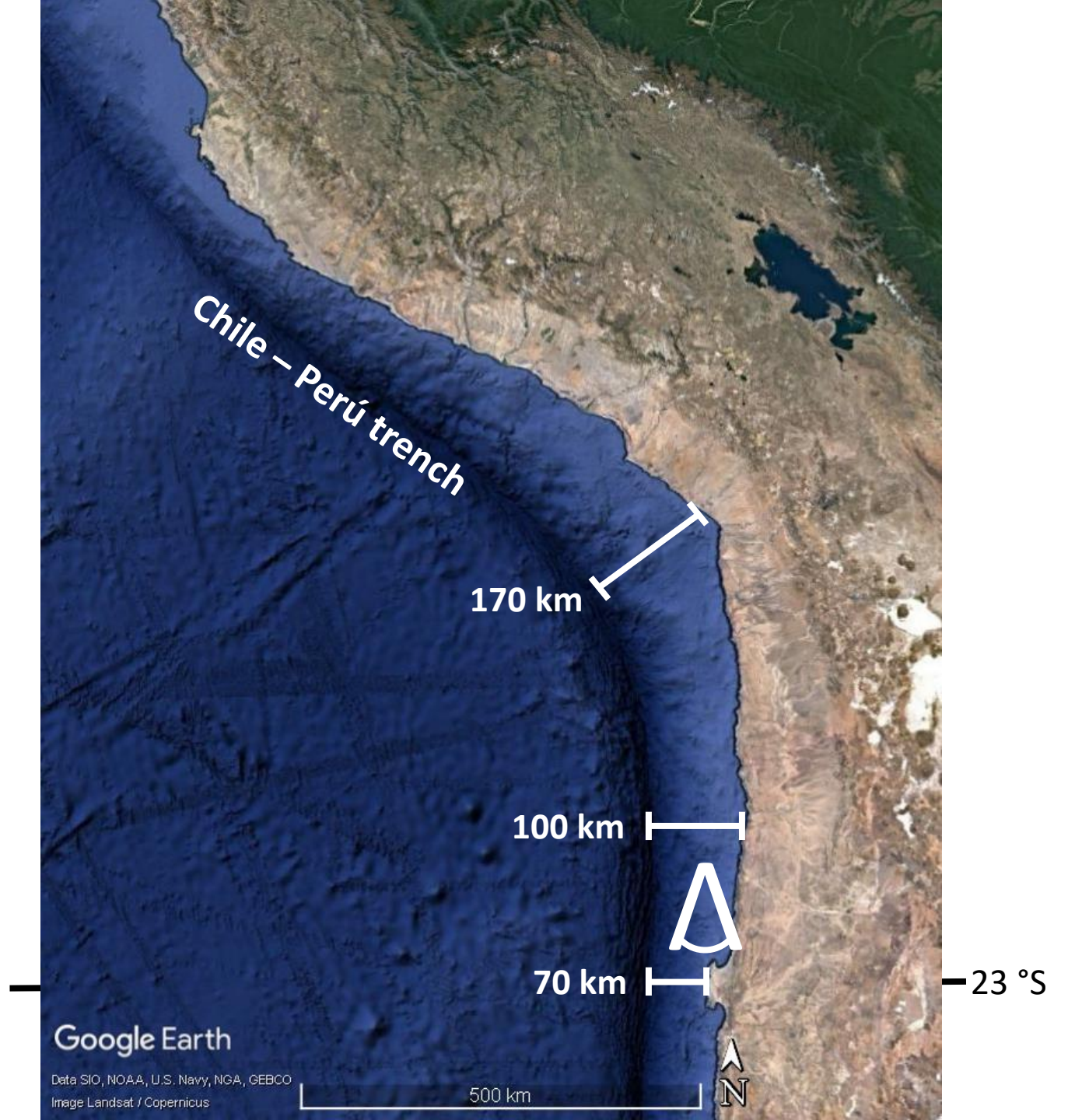
(2) Departamento de Ingeniería Minería, Pontificia Universidad Católica de Chile

Vertical motions along South Pacific

e.g.: Freisleben et al., 2020



The distance of the coastline to the trench varies in a wide range



E

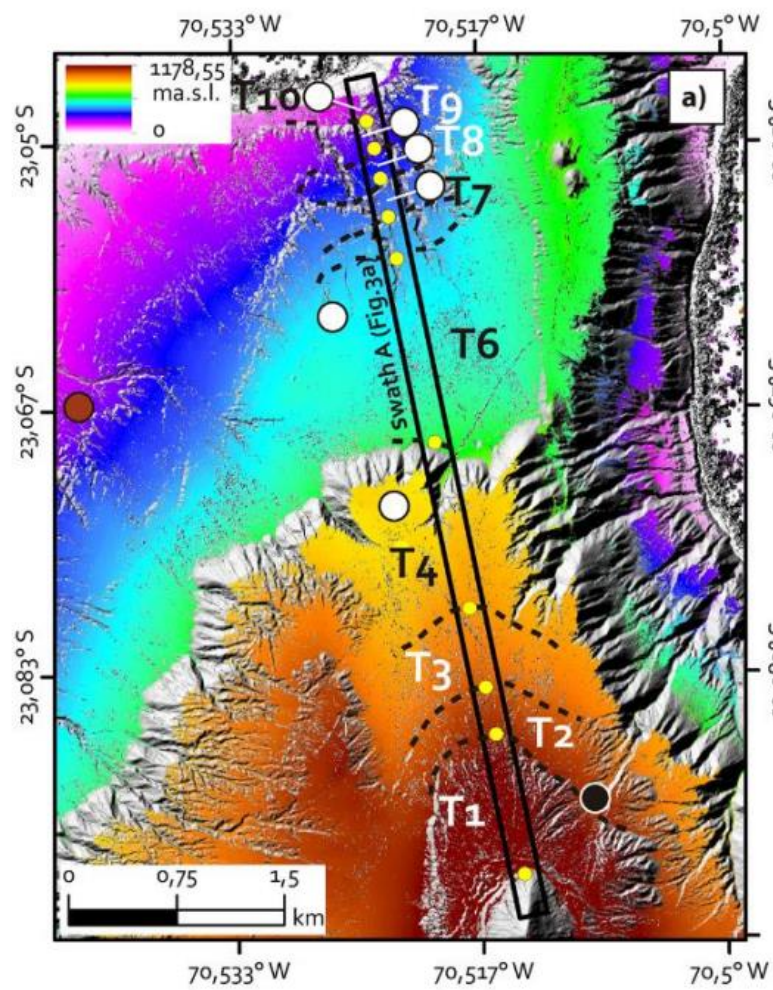
W

4

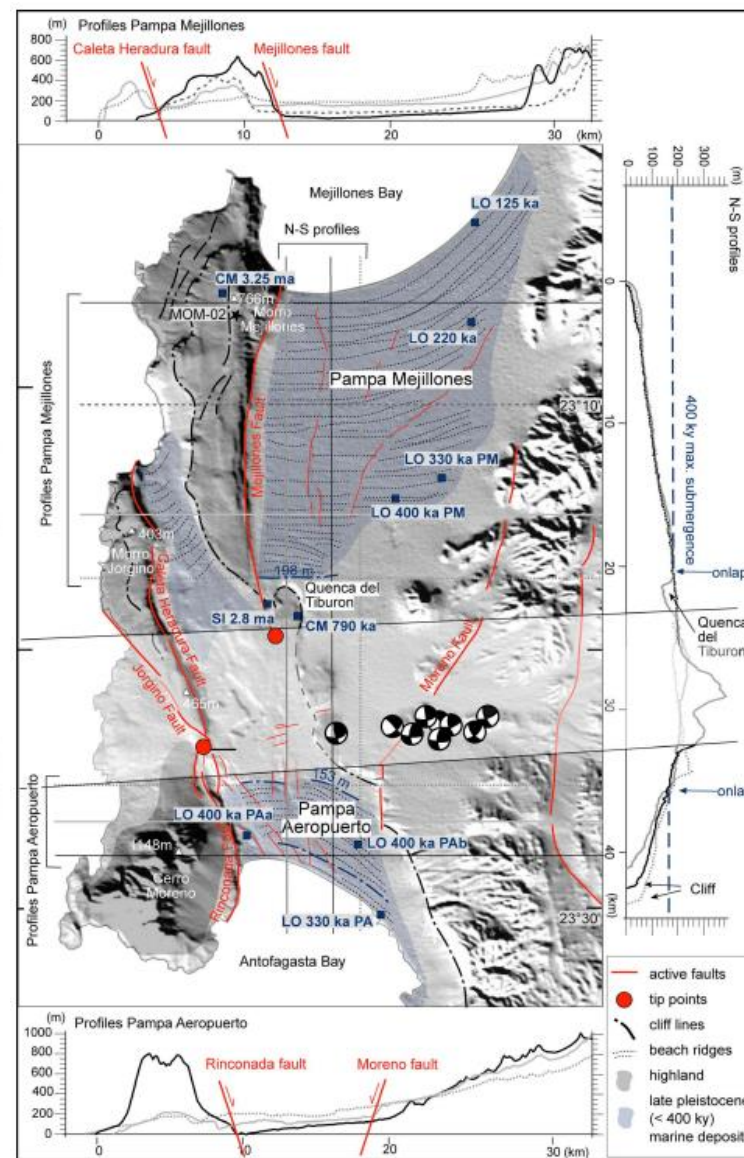


- Hyper-aridity
 - Uplift
- ➔ Very well preserved marine terraces

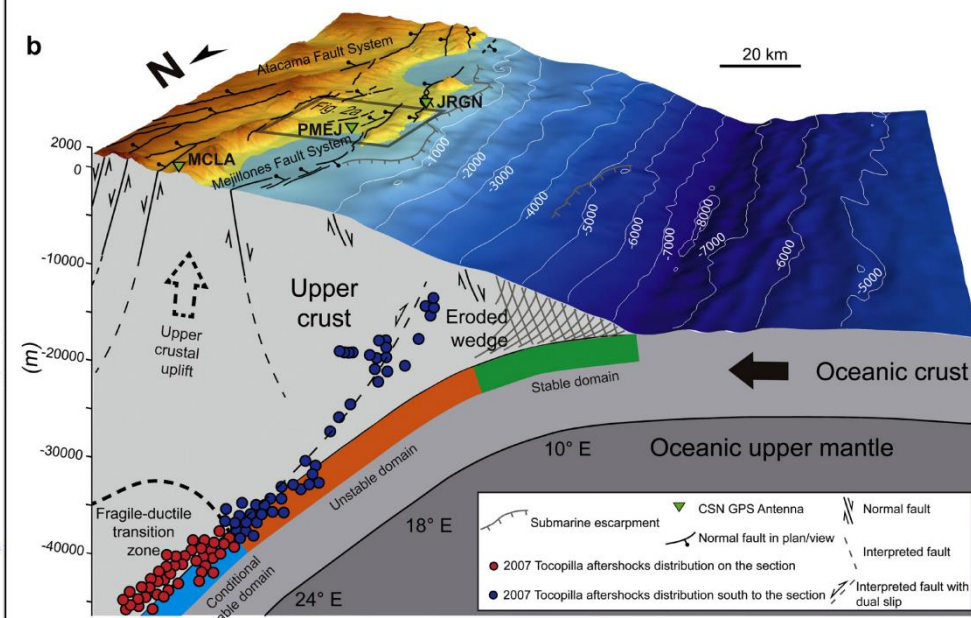
1 km



Cortés et al., 2018



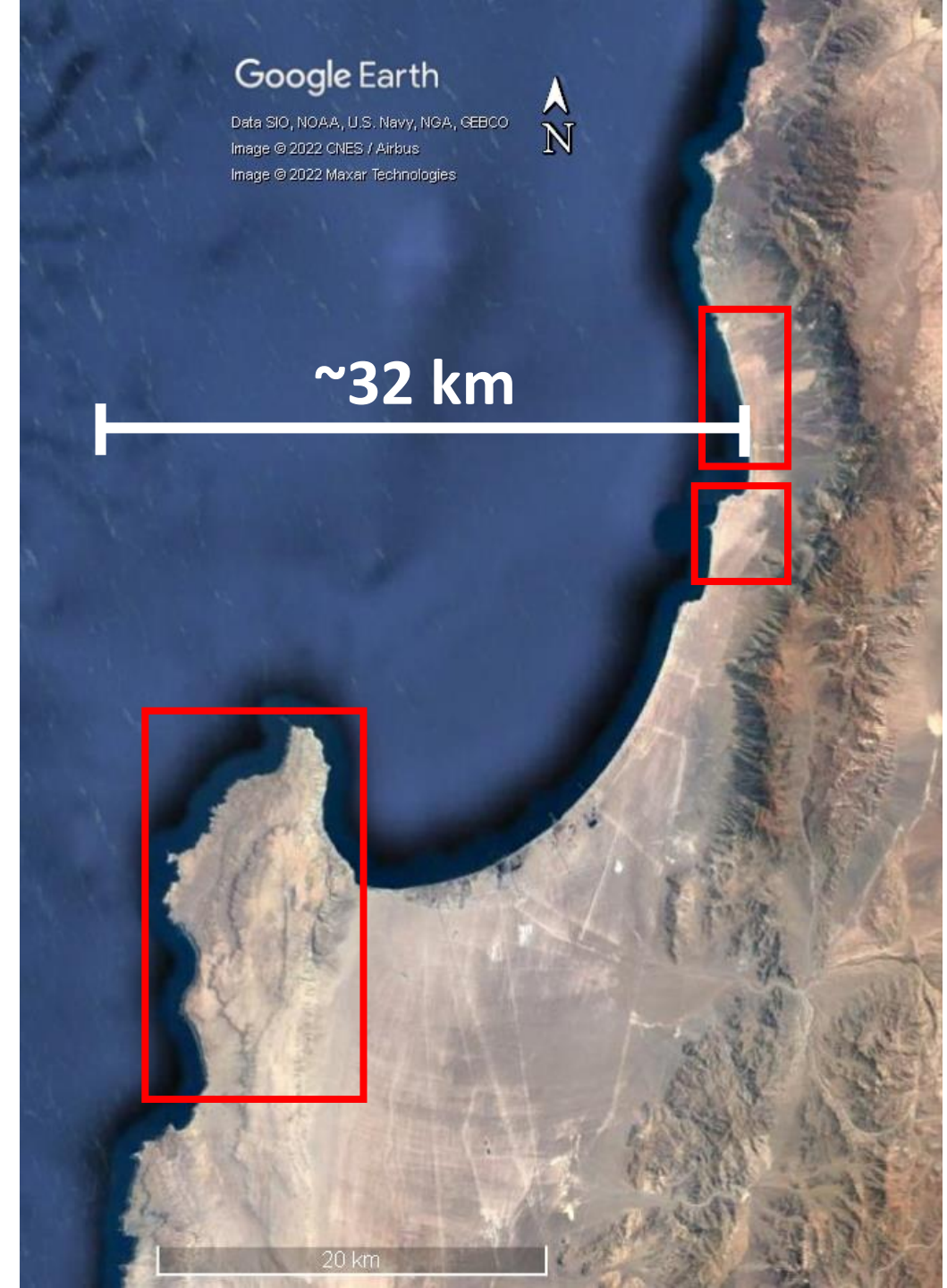
Victor et al., 2011



González-Alfaro et al., 2018

Study area

- Hornitos - Punta Chacaya
- Morro Mejillones

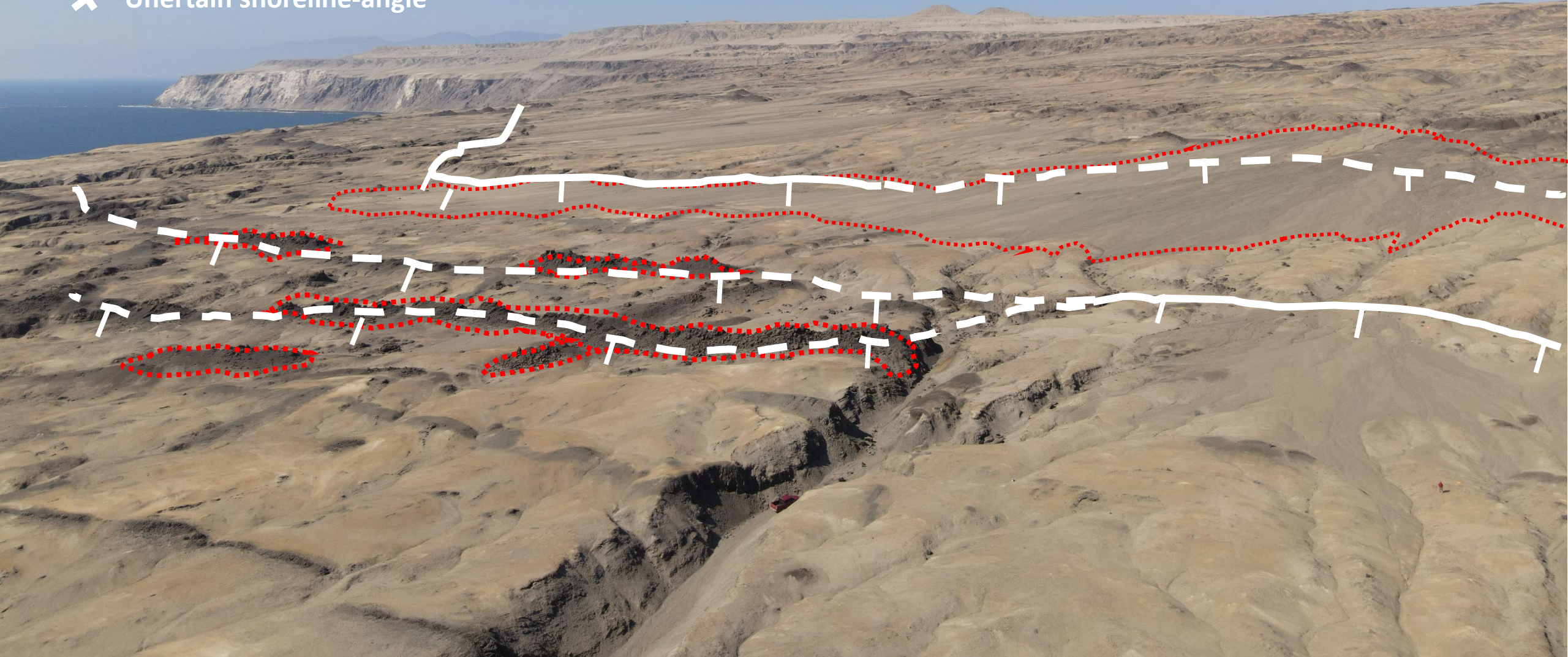


NW

SE

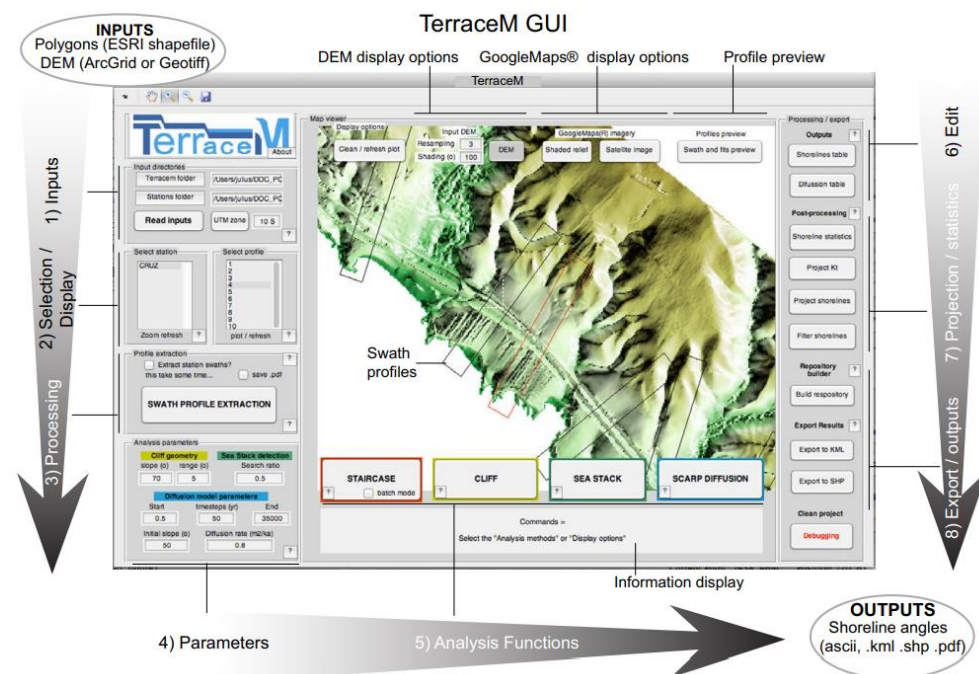
7

- ↗ Certain shoreline-angle
- ↘ Unertain shoreline-angle



Methodology: determination of the height shoreline-angle

Topography:
Corrected Alos-Palsar DEM (~5 m) using field data (differential GPS, ~3 cm, topographic sections and hand GPS, ~3 m)



TerraceM: interface for modeling marine terraces

Methodology: correlation of the marine terrace to a MIS (age and sea level height)

Marine Isotope Stages:
association with marine
terraces at 23°S in a time
of the maximum sea level
during Quaternary

e.g.:

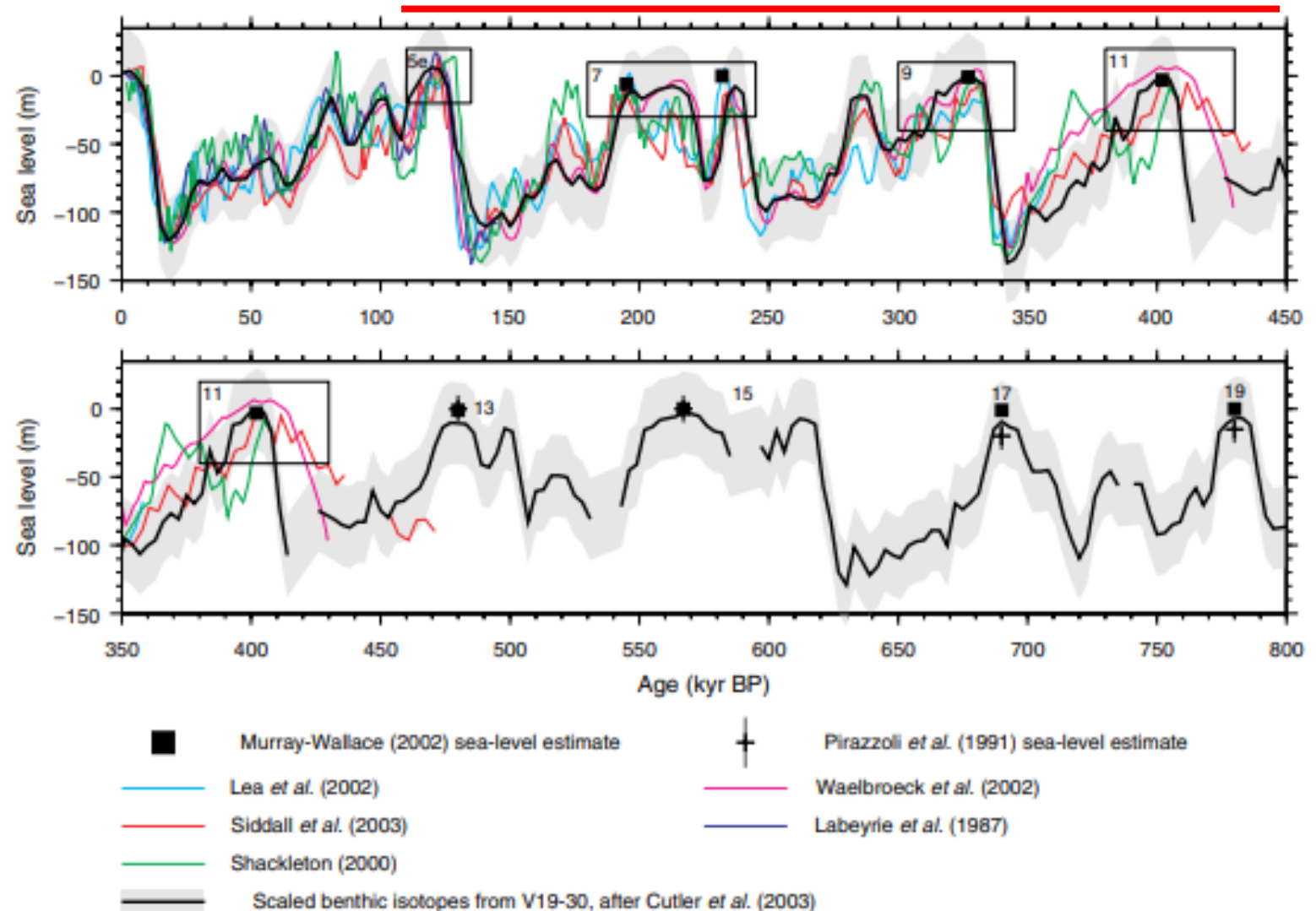
Ortlieb, 1994

Binnie et al., 2016

Cortés-Aranda et al., 2018

Freisleben et al., 2020

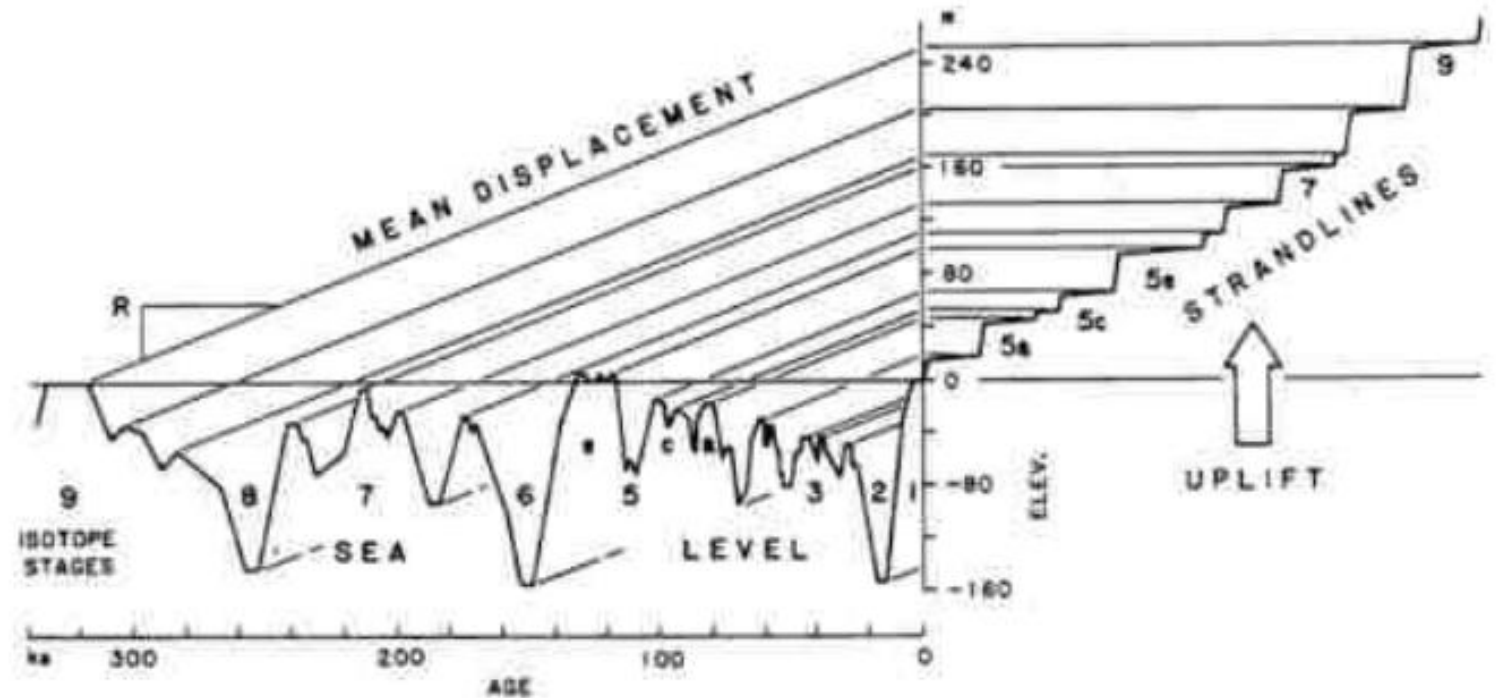
González-Alfaro et al., 2018



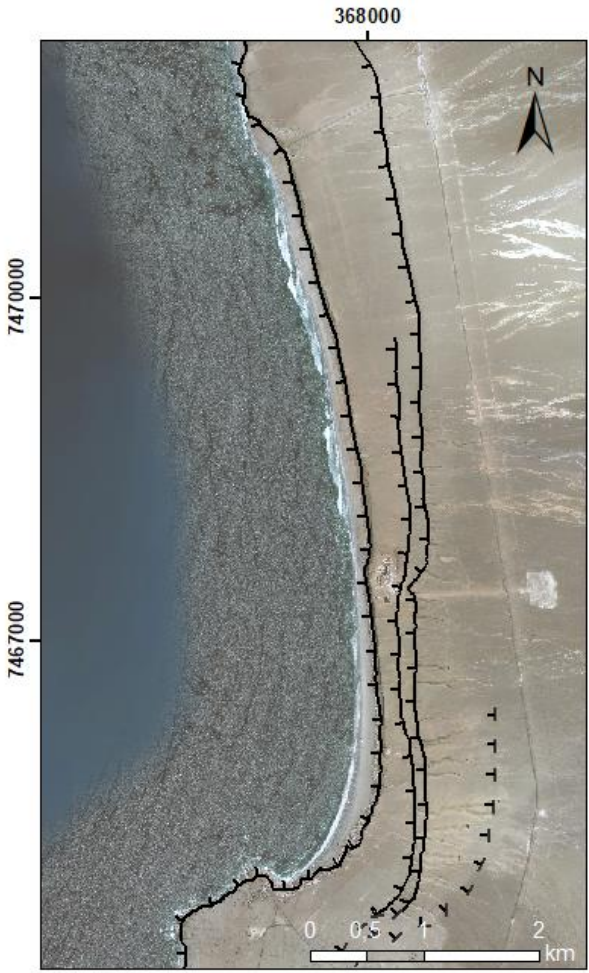
Methodology: uplift rates

Lajoie equation: constant uplift rate assumption

$$U_r = \frac{(T_e - SI)}{t}$$



Morpho-metric analysis: long-term uplift rates results

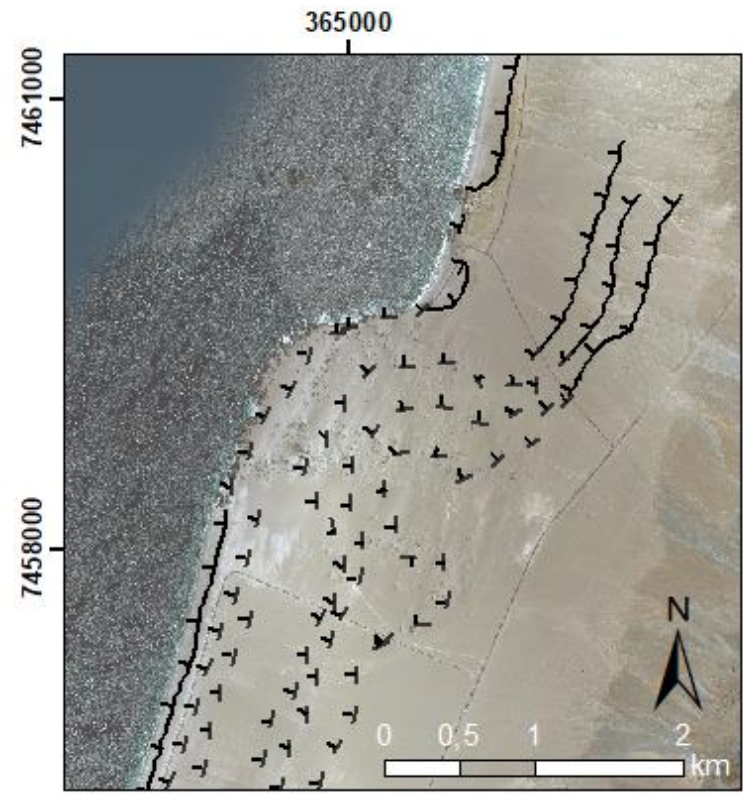


Source: Ortlieb, 1994

height (m)	MIS	Age (ka)	uplift rate (m/ka)
52	5e	127	0,41
61	7c	217	0,29
73	9e	328	0,22

Note: Errors are similar for each measure, and less than 10%.

- Observed shoreline-angle
- Inferred shoreline-angle
- Covered shoreline-angle



heigh (m)	MIS	Age (ka)	uplift rate (m/ka)
30	5c	96	0,47
52	5e	127	0,41
61	7c	217	0,29
76	9e	328	0,23

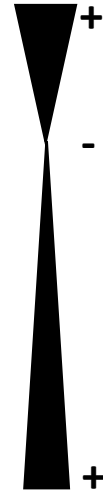
Note: Errors are similar for each measure, and less than 10%.



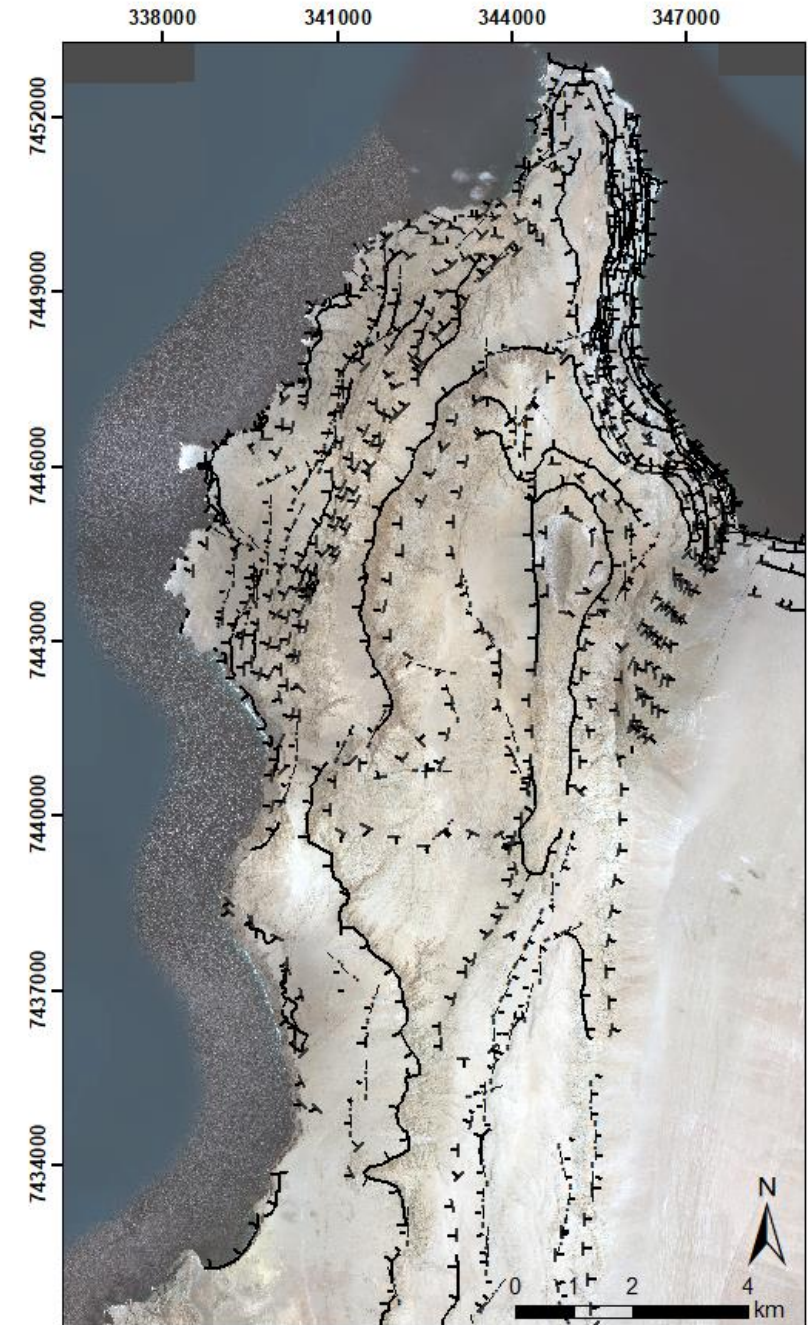
Morpho-metric analysis: long-term uplift rates results

height (m)	MIS	Age (ka)	uplift rate (m/ka)
40	5c	96	0,57
55	5e	127	0,43
69	7c	217	0,32
80	7e	241	0,33
98	9a	280	0,34
132	9c	320	0,39
147	9e	328	0,45
165	11	367	0,45

Note: Errors are similar for each measure, and less than 10%.



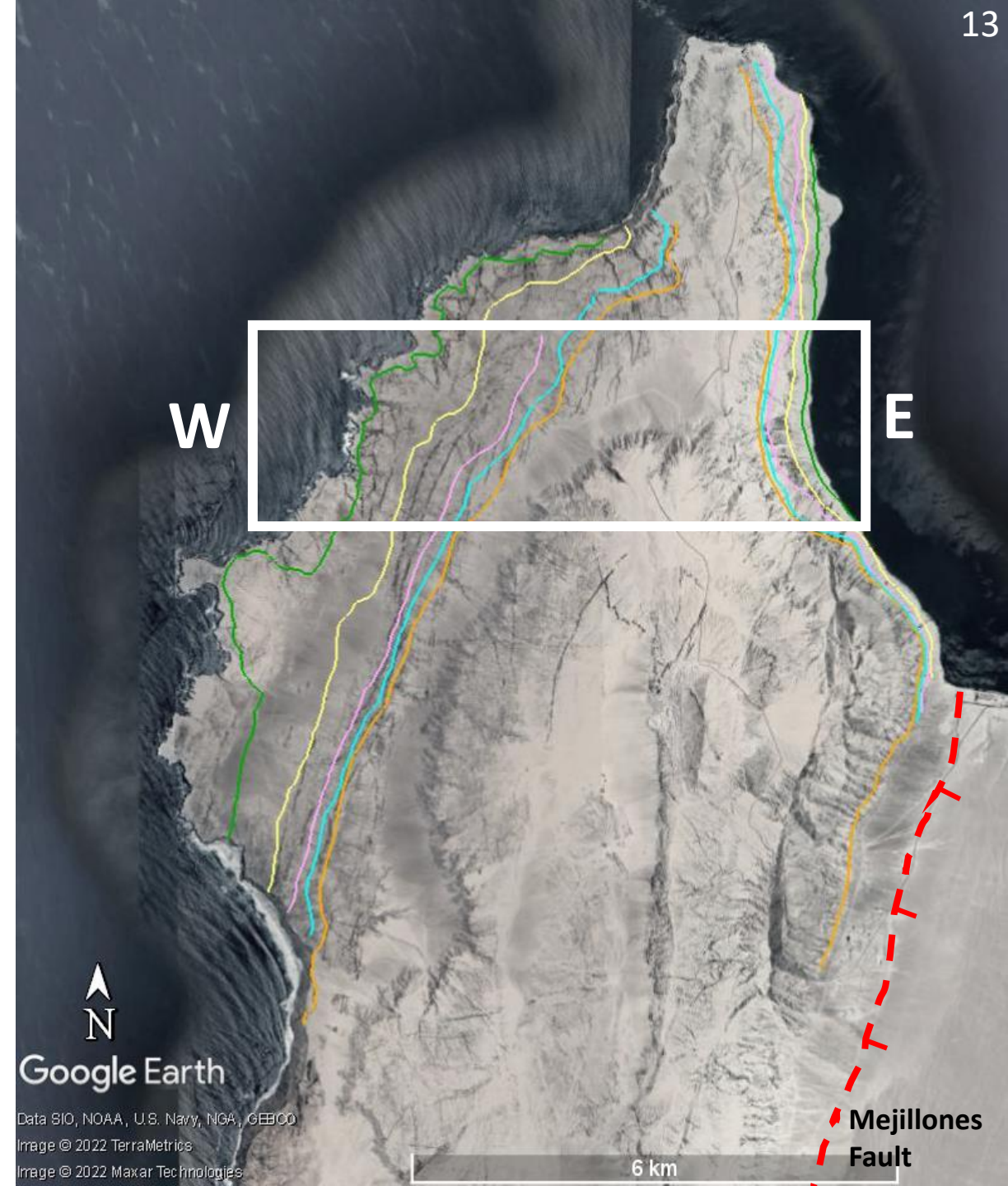
-  Observed shoreline-angle
-  Inferred shoreline-angle
-  Covered shoreline-angle



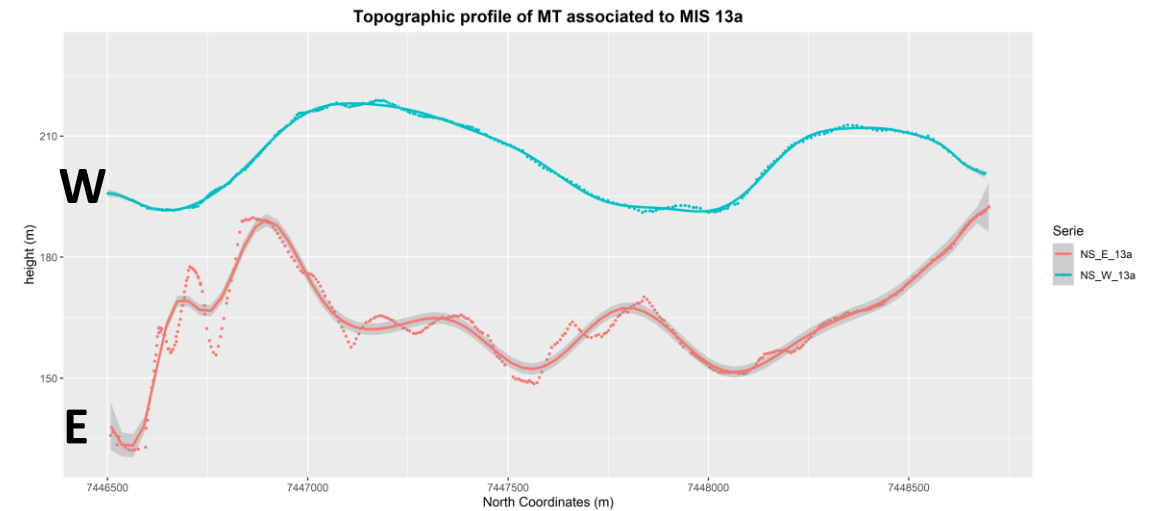
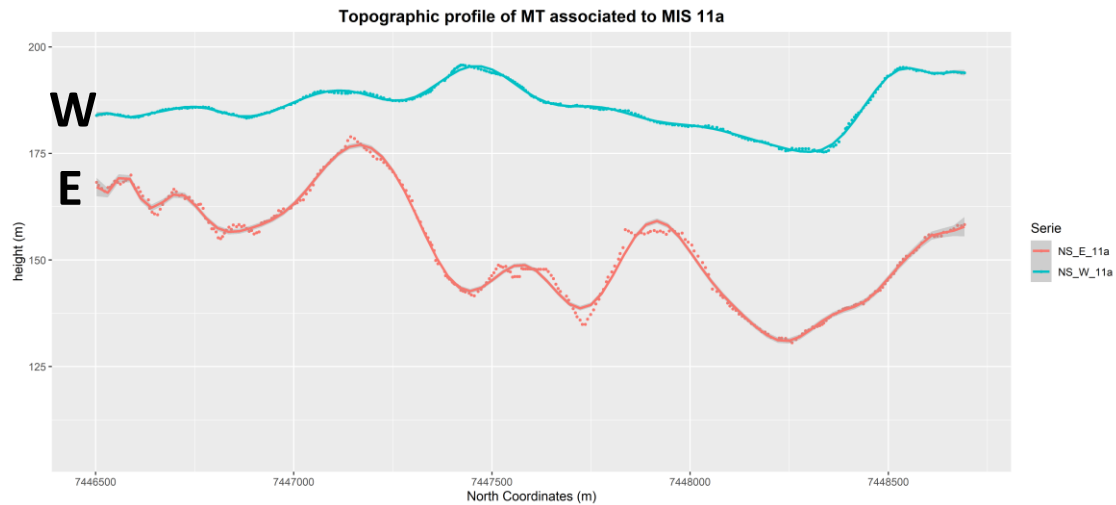
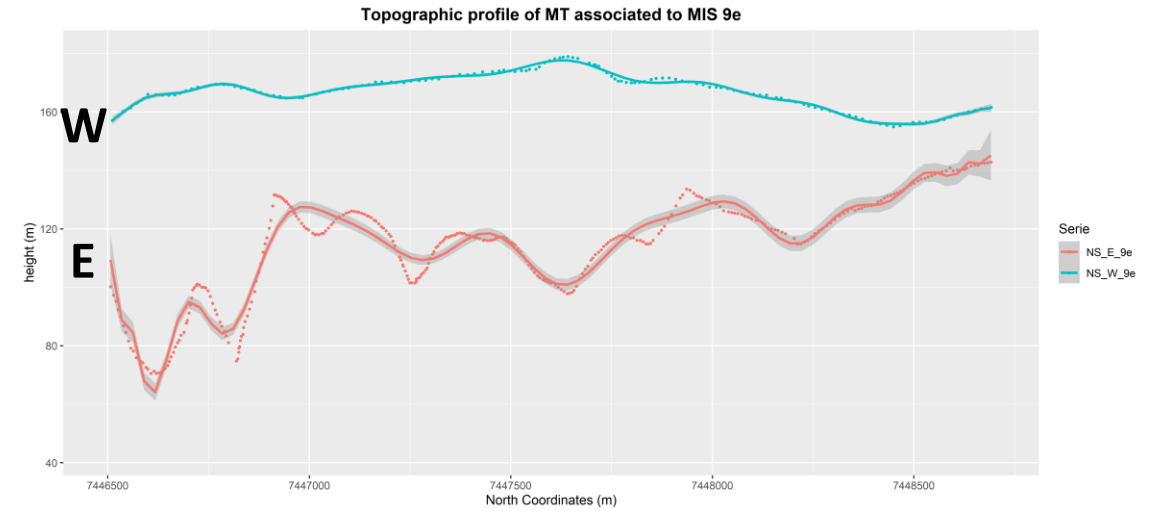
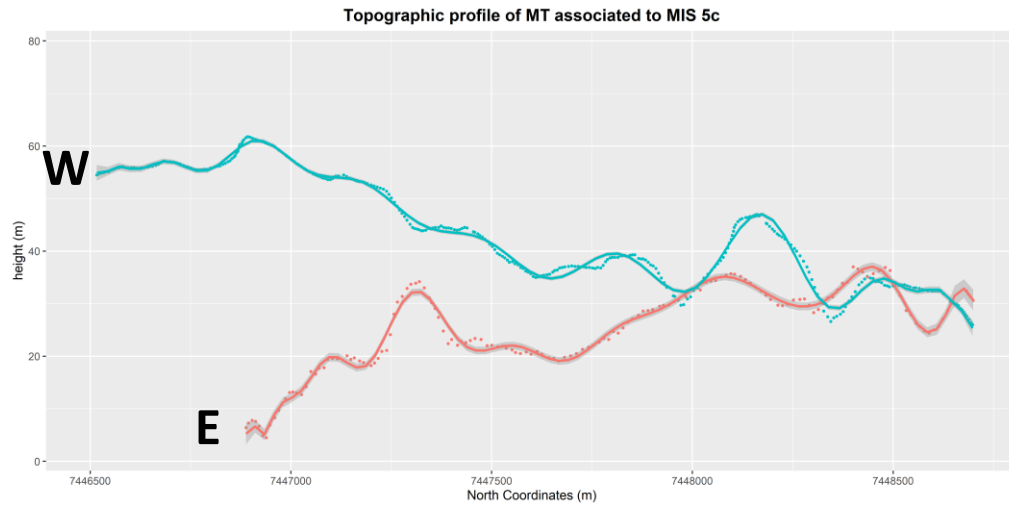
Uplift rates only considers marine terraces associated to MIS5 to MIS11 due to the confidence of the dating for those MIS

Morpho-metric analysis: results

- MT associated to MIS 5c
- MT associated to MIS 9a
- MT associated to MIS 9e
- MT associated to MIS 11a
- MT associated to MIS 13a



Morpho-metric analysis: results



Height error are imperceptible in the y axis.

Summary

1. There are differences in the coastal areas uplift rates related to the distance to the trench, these are higher close to the trench.
2. The uplift rates estimations shows an increase for the last ~ 125 ka in comparation for the last ~ 360 ka:
 - From 0,3 to 0,5 m/ka at Morro Mejillones
 - From 0,2 to 0,4 m/ka at Hornitos-Punta Chacaya

An aerial photograph of a vast, desolate volcanic landscape. The terrain is characterized by numerous layers of dark, jagged lava flows and lighter-colored sand dunes, creating a complex, undulating surface. In the upper left, a deep blue ocean meets a steep, white cliff face. A small red car is visible on a ridge in the middle right, providing a sense of scale to the immense landscape. The sky is clear and blue.

Thank you for your
attention 😊