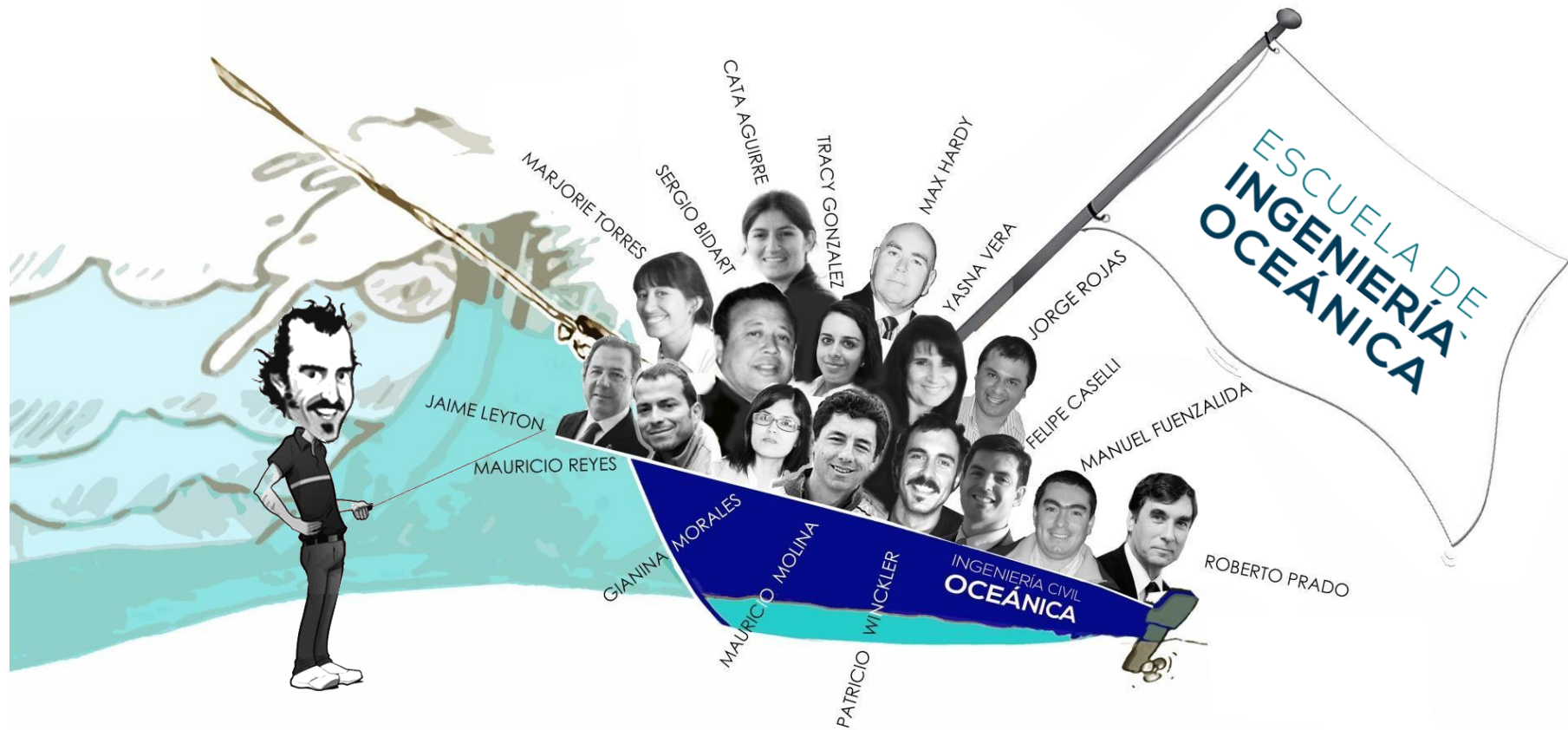




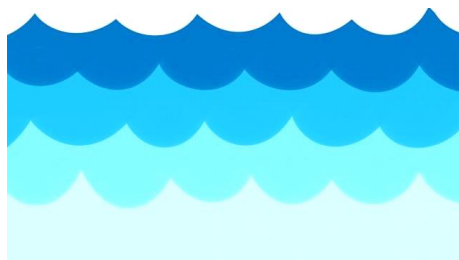
Coastal engineering on tectonically active coasts...

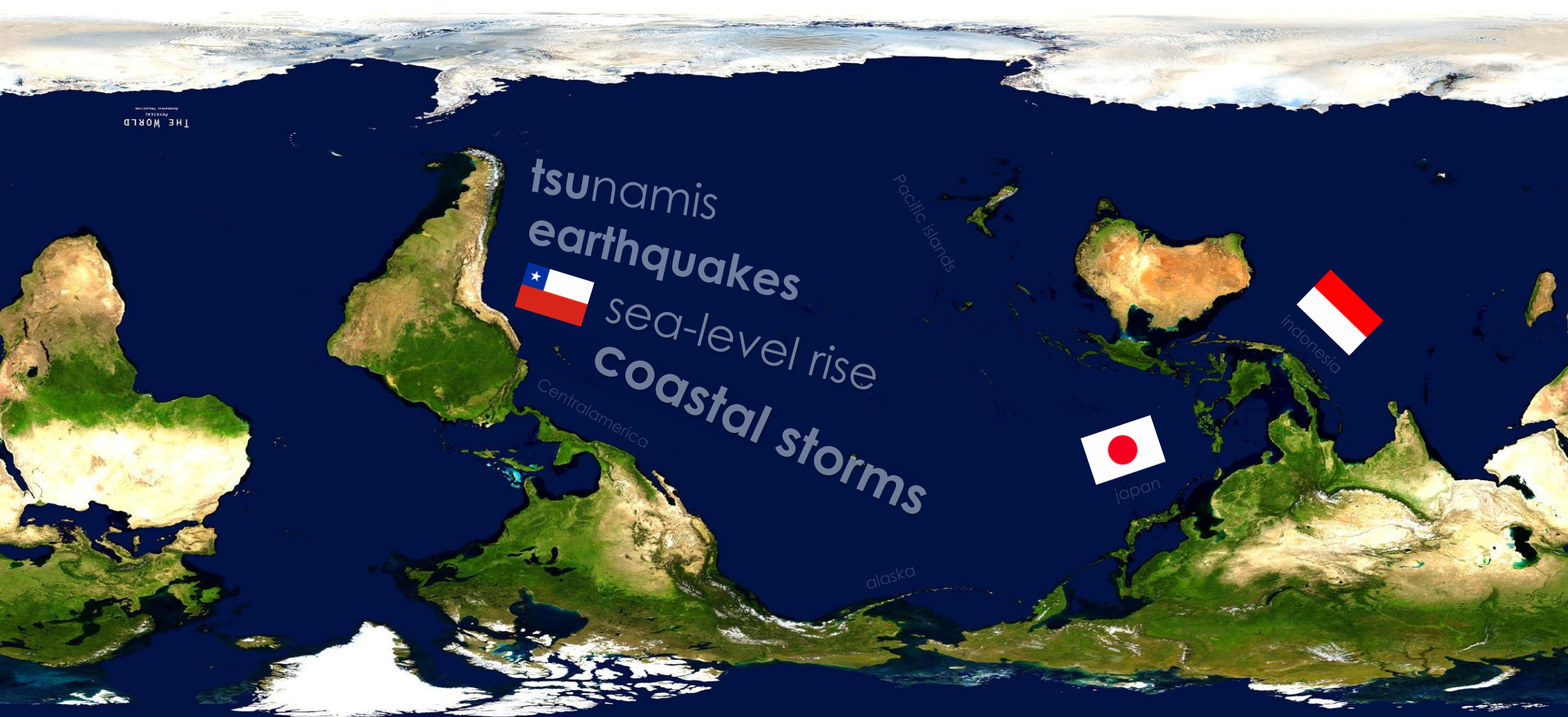
Hazards, impacts and adaptation



Ingeniero Civil, PhD.
Patricio Winckler
Patricio.winckler@uv.cl

A bit of
context...







Europe




Chile



US



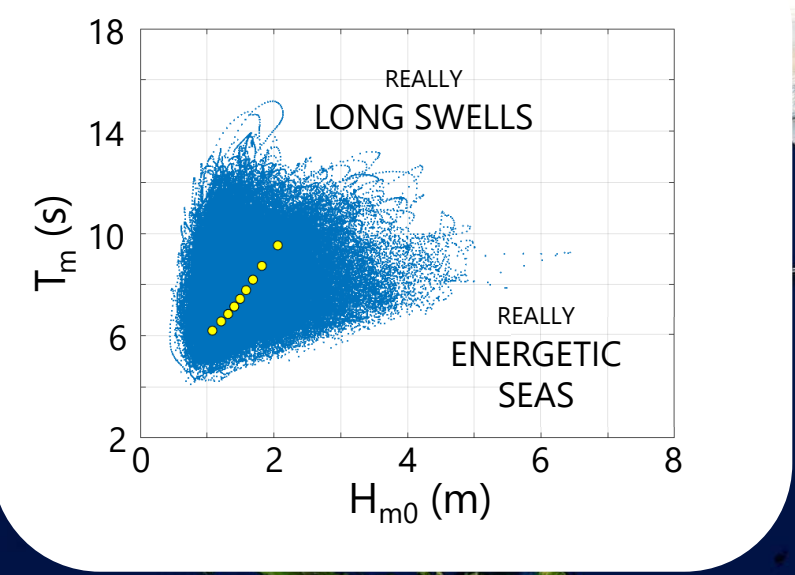
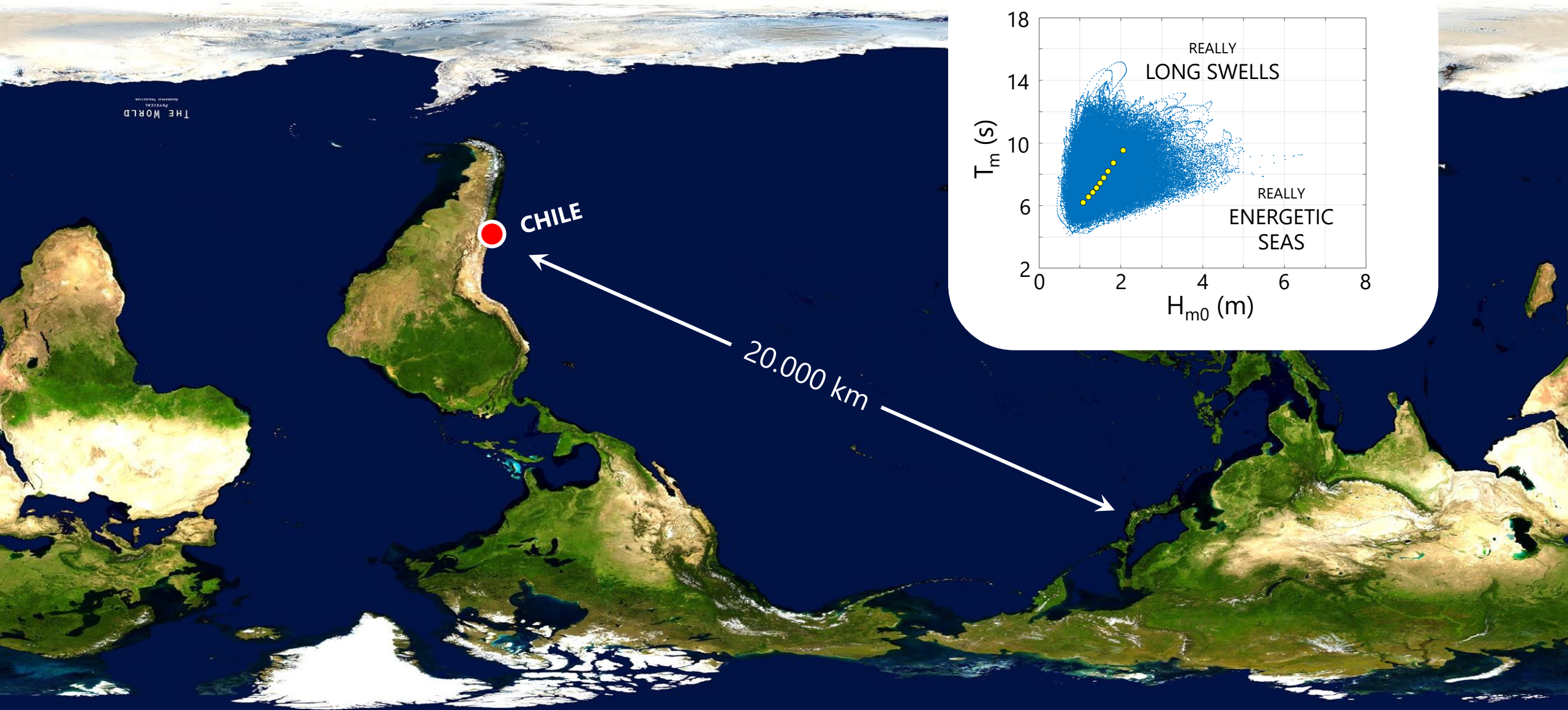
Andes
mountain range

Our
school

18°S

Peru-Chile trench

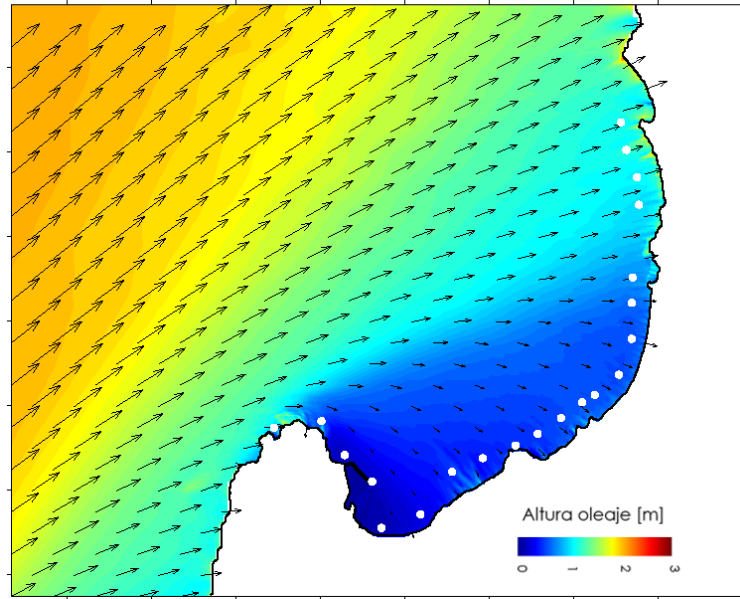
56°S



La EX
oficina de
Huguito



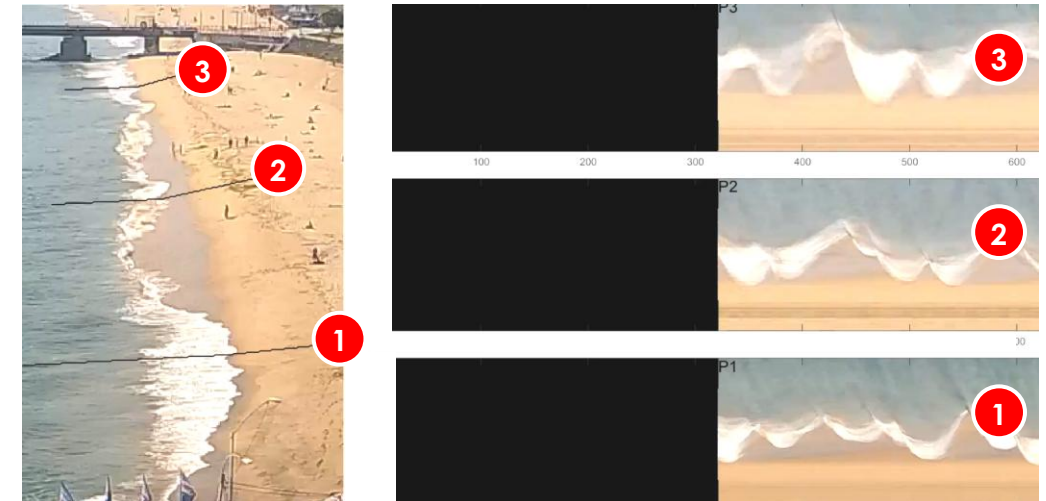
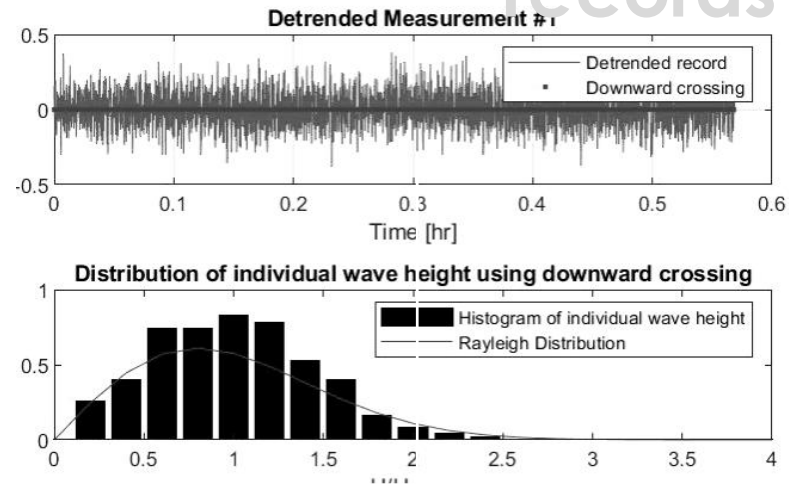
models

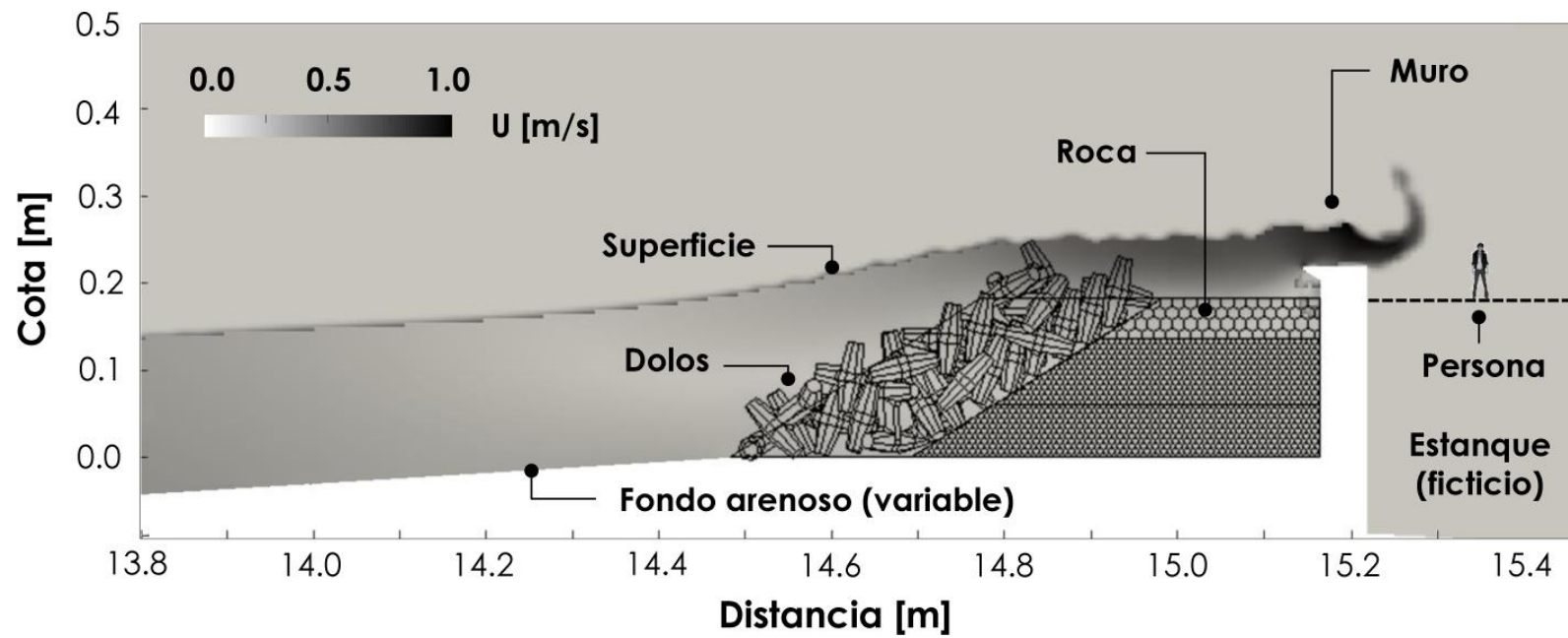
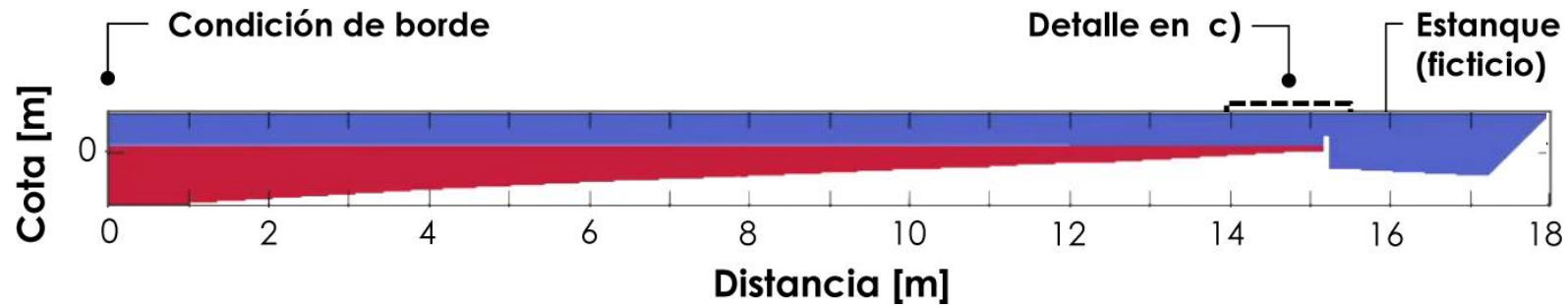


cameras



records

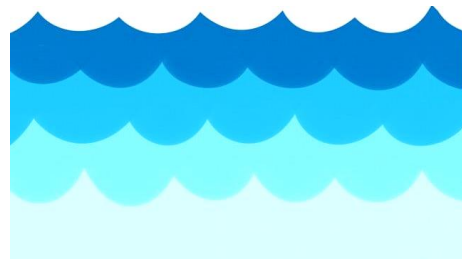




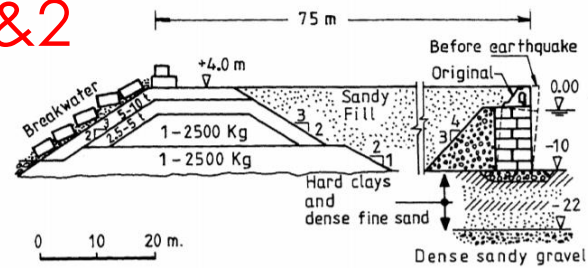
Mejores
modelos



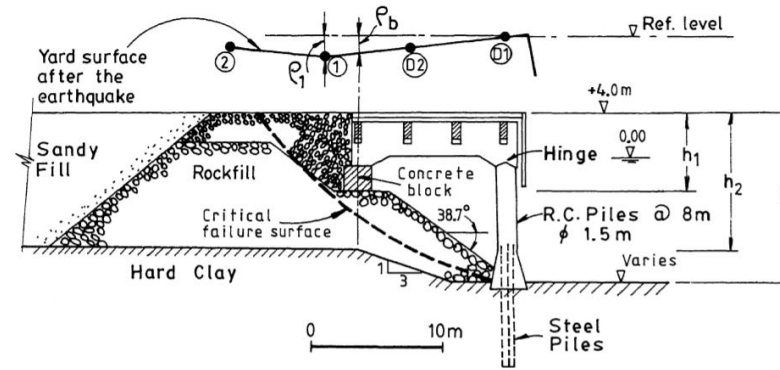
Multiple hazards & **inf**rastructure...



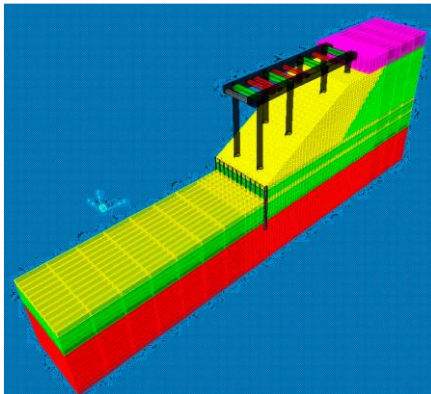
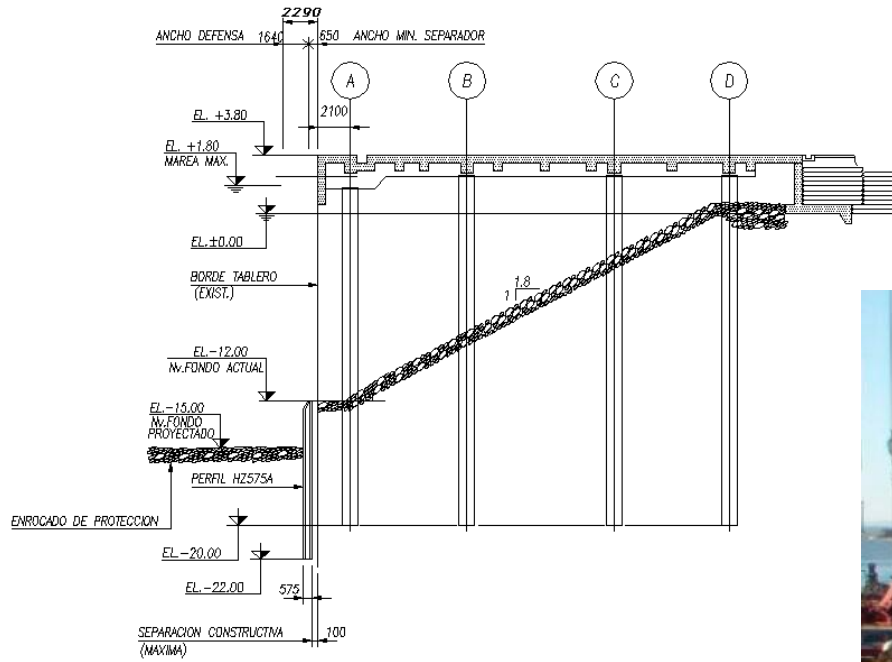
Berth 1&2



Berth 6&7



Earthquake 1985



Post-earthquake 1985



san vicente

talcahuano

Earthquake 2010



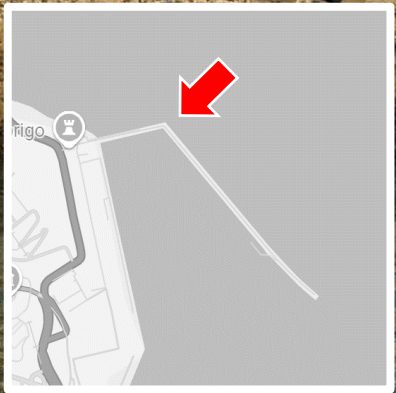


Our
school



↑
~10 m
3 Pisos
↓





March 11th, 2011



Kamaishi brackwater

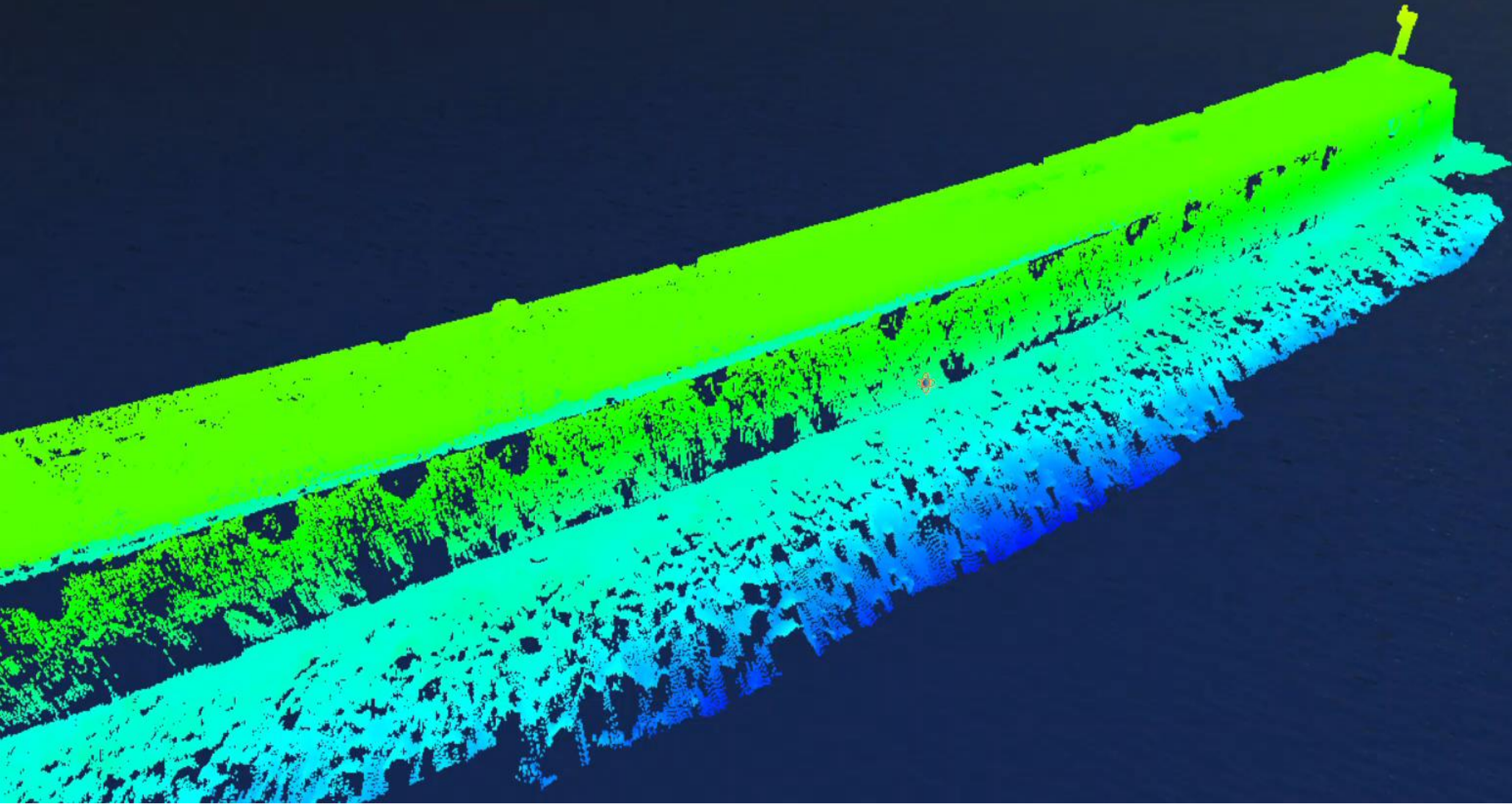
**TARO
ARIKAWA**

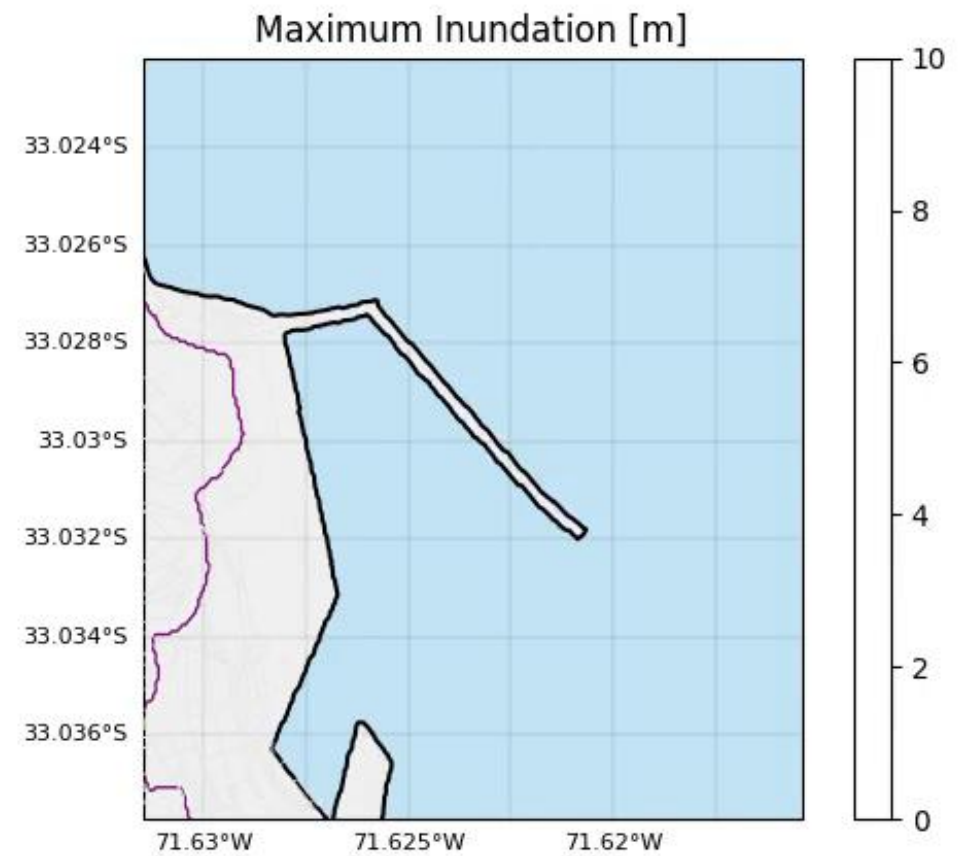
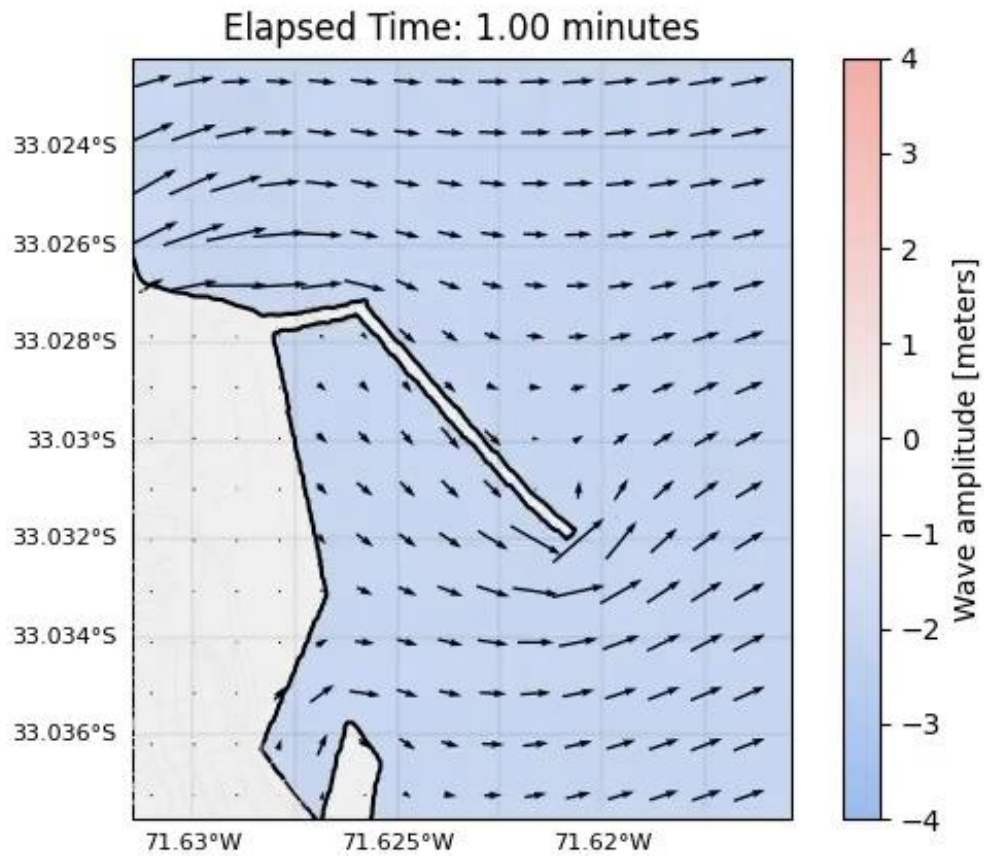




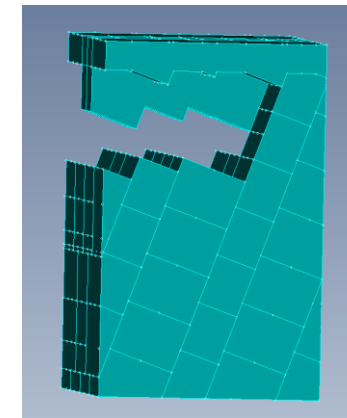
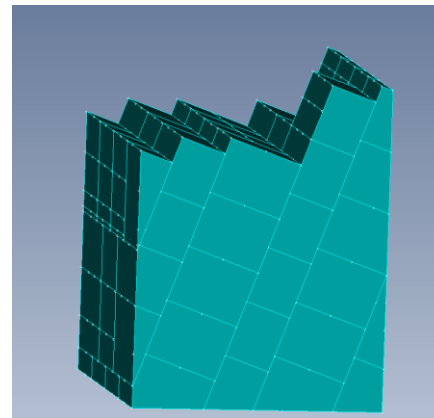
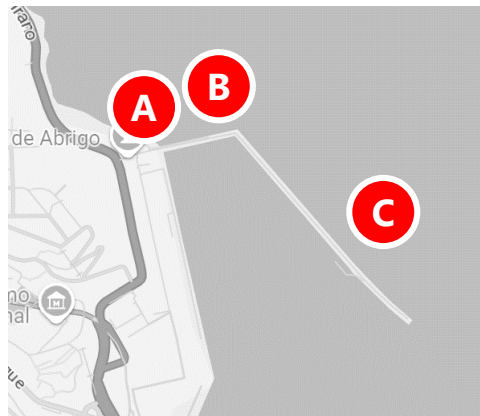
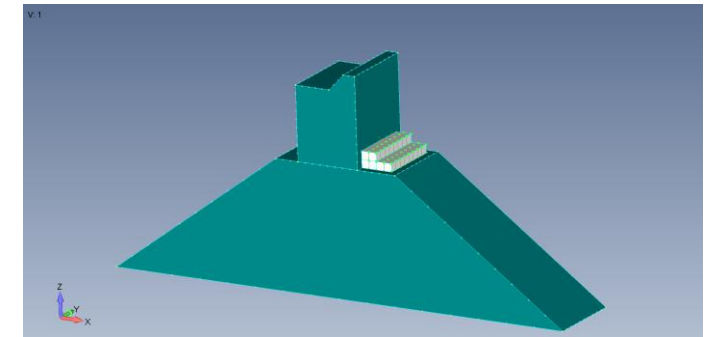
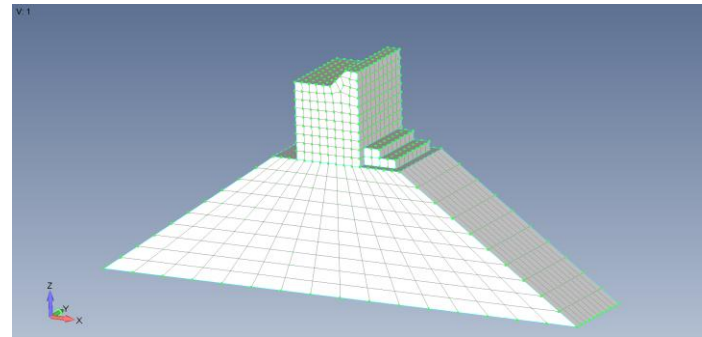
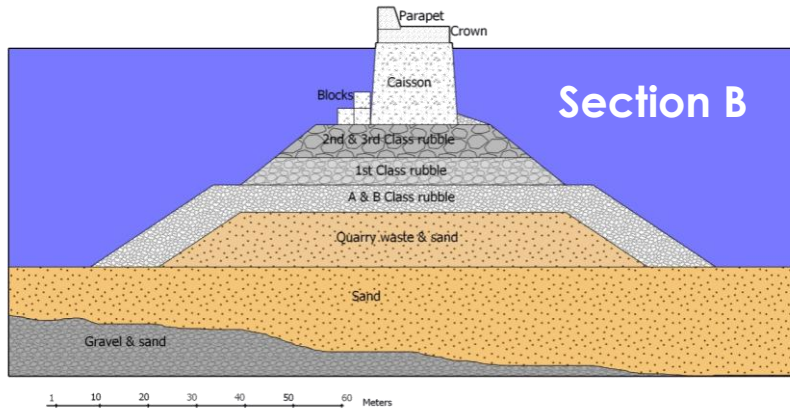
**TARO
ARIKAWA**



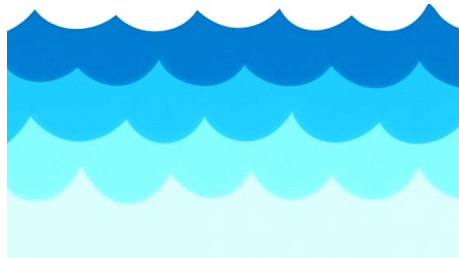




Hydrodynamic Structural Geotechnical

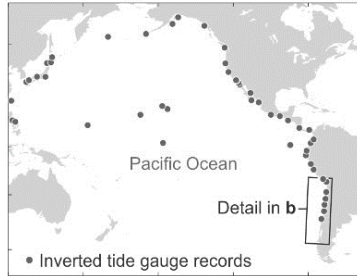


Multiple hazards earthquakes...





KENJI
SATAKE



FAR FIELD TSUNAMI

“We must become storytellers”



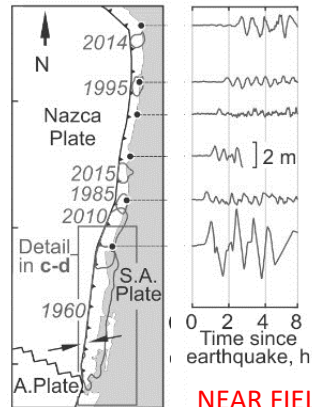
DANIEL MELNICK



MATÍAS CARVAJAL



MARCOS MORENO



NEAR FIELD TSUNAMI

archivo de indias
2010
 valdivia
 maullín
 geología
1960
 sedimentos tsunami
 breaching
 1837
 paleotsunami
 historia



MARCO
CSTERNAS



INÉS LUCÍA
CIFUENTES



SERGIO
BARRIENTOS

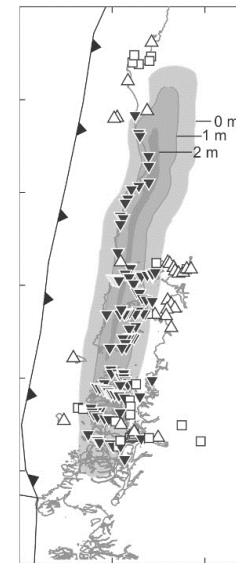


HIROO
KANAMORI

EARTHQUAKE

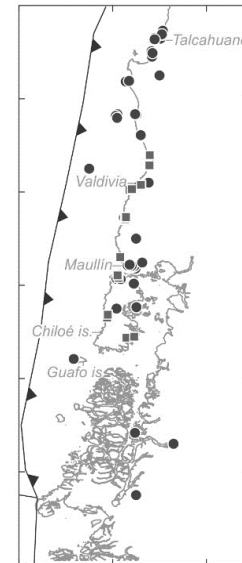


GEORGE
PLAFKER geologist of earthquakes



Surveyed land-level changes
 △ Uplift □ No level change
 ▼ Subsidence

COSEISMIC UPLIFT / SUBSIDENCE



Surveyed tsunami
 ● Other studies
 ■ This study

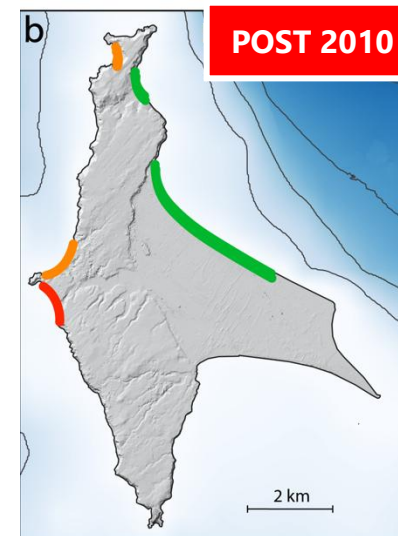
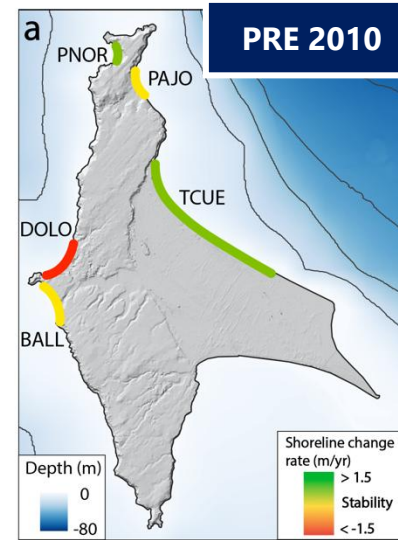
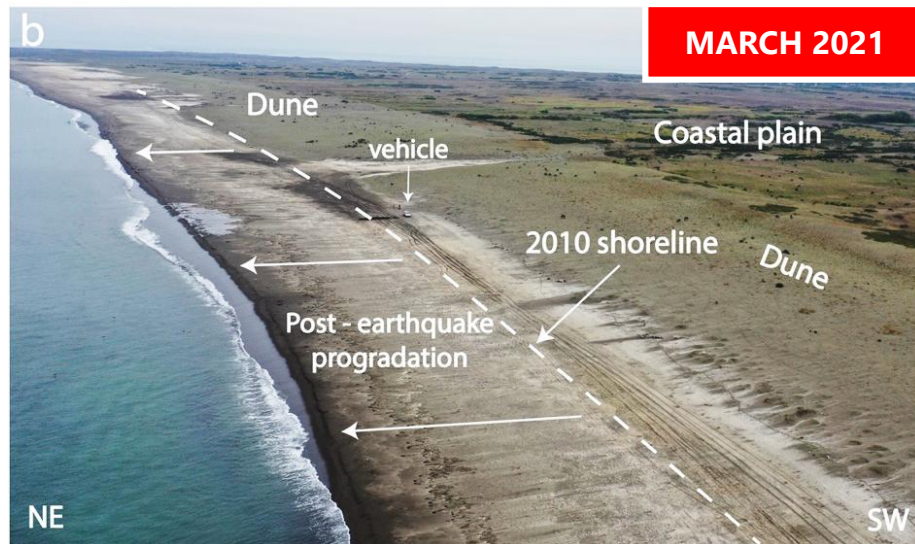
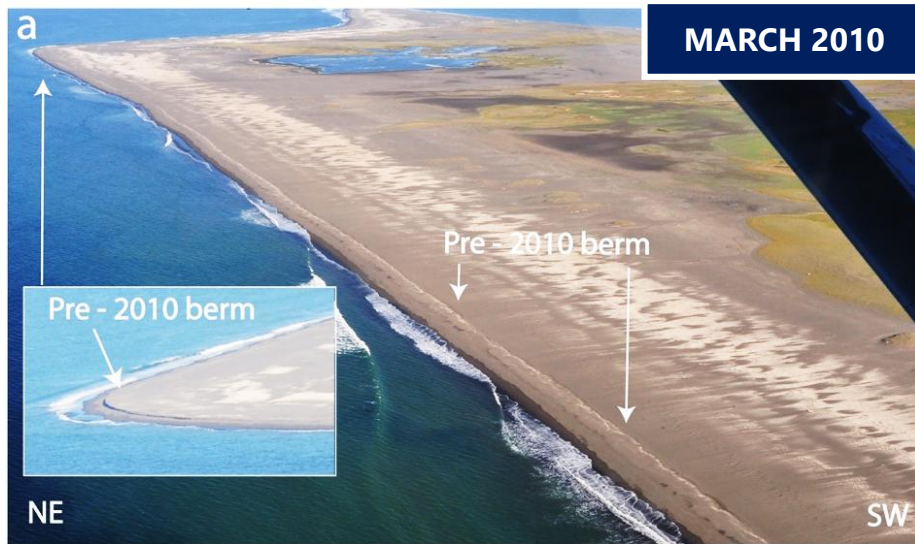
INTERVIEWS



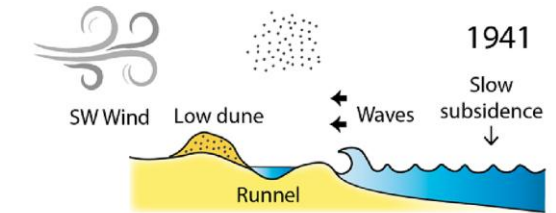
BRIAN
ATWATER



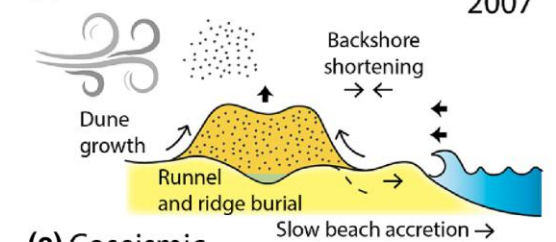
HELLMUTH
SIEVERS



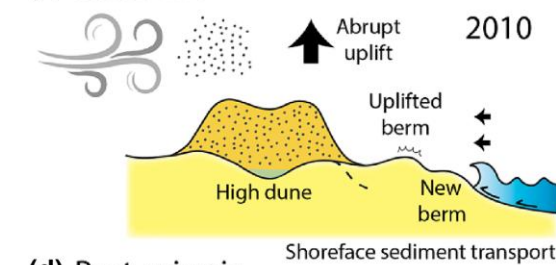
(a) Interseismic



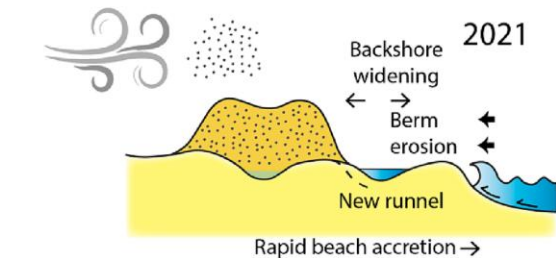
(b) Late interseismic



(c) Coseismic



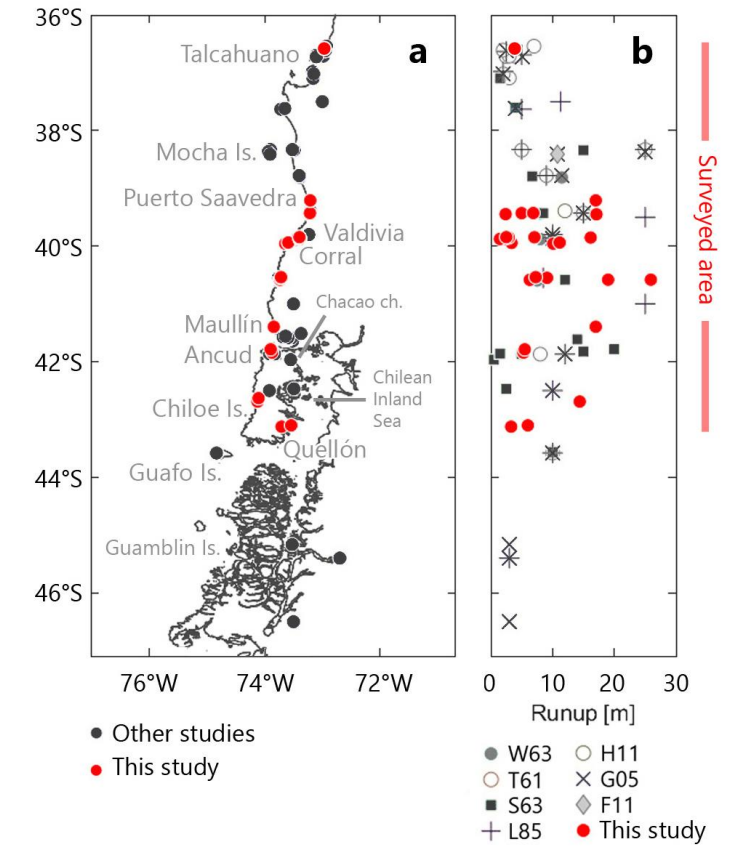
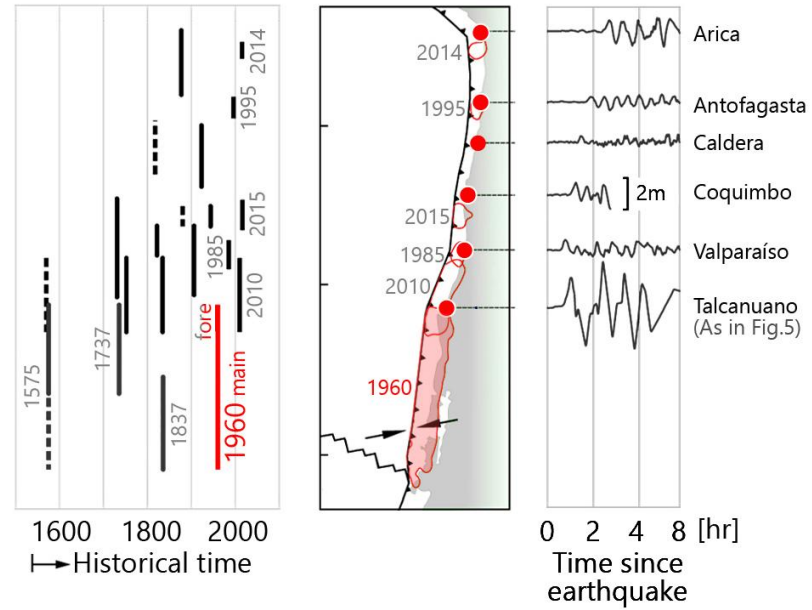
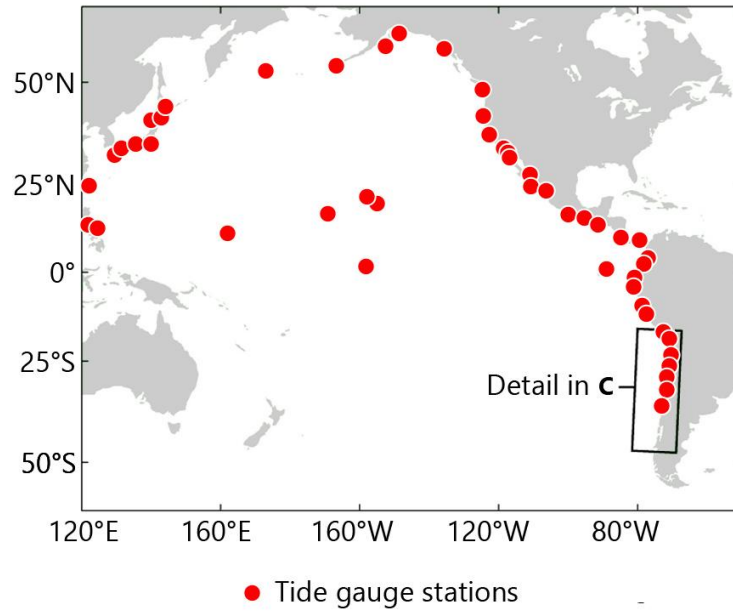
(d) Post-seismic



The seismic cycle

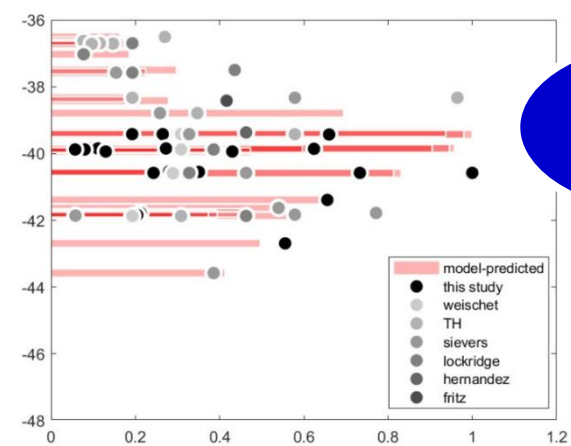
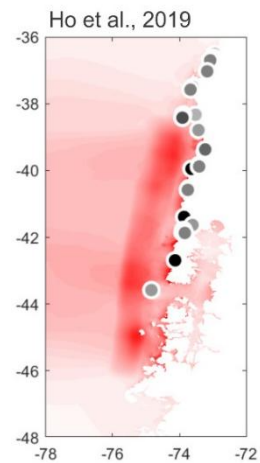
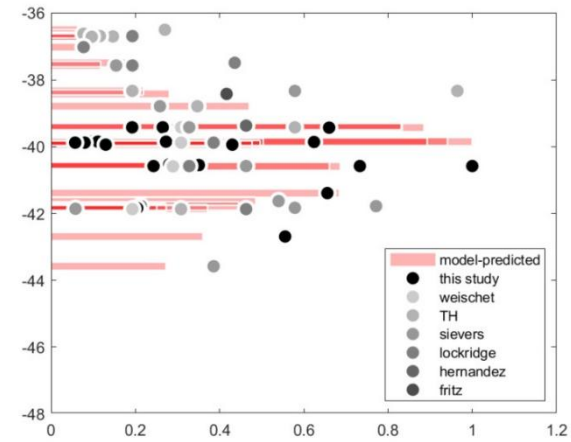
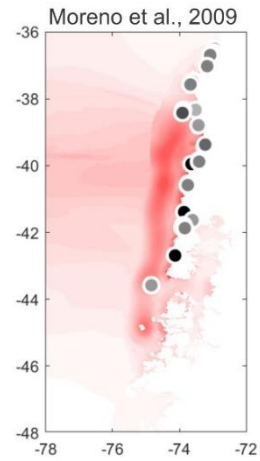
Diego Aedo





**DAVID ROCKEFELLER CENTER
FOR LATIN AMERICAN STUDIES**
HARVARD UNIVERSITY

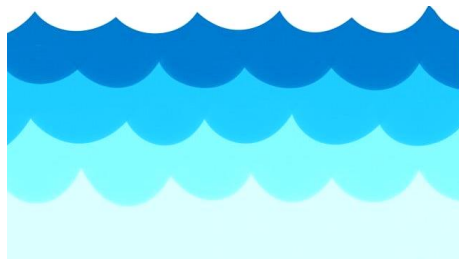
RELIEVE & MODELO MEDICIONES TSUNAMI



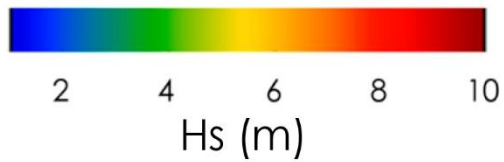
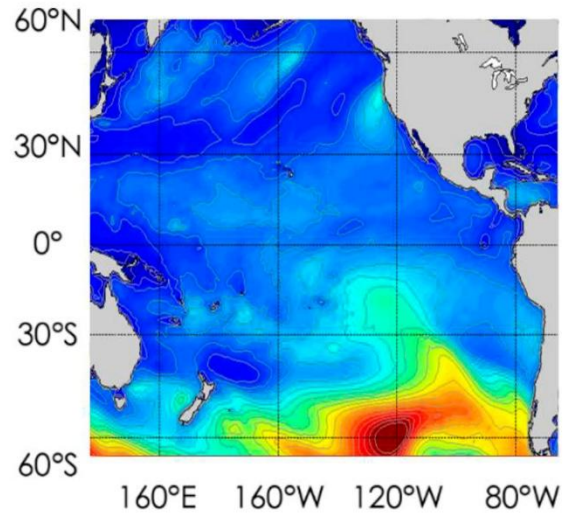
Dónde
viene el
próximo



The future of our **coasts**...

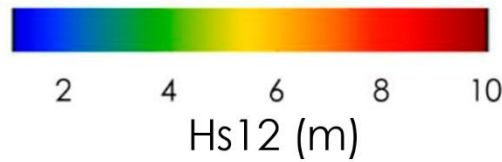
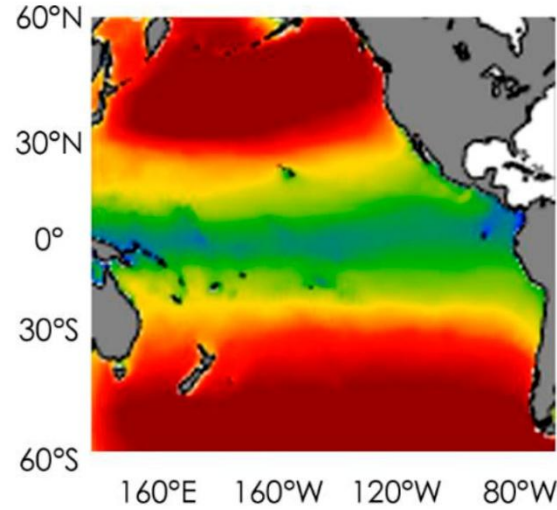


METEOROLOGÍA



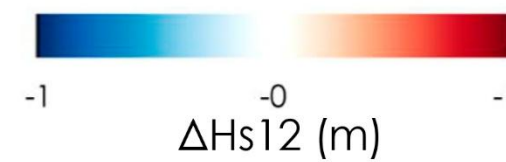
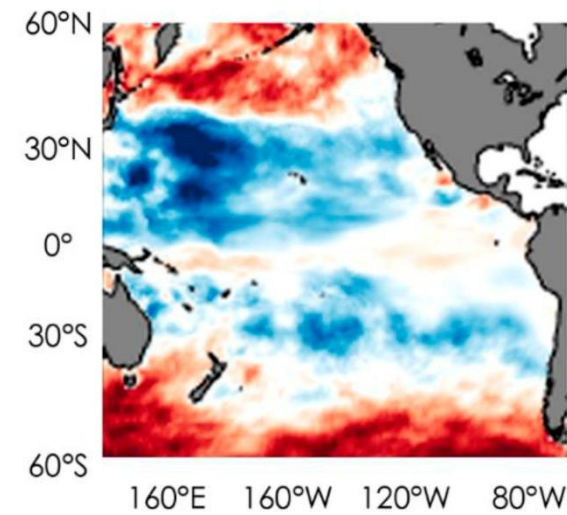
19-02-2025

CLIMA



Media 1985-2004

CAMBIO CLIMÁTICO



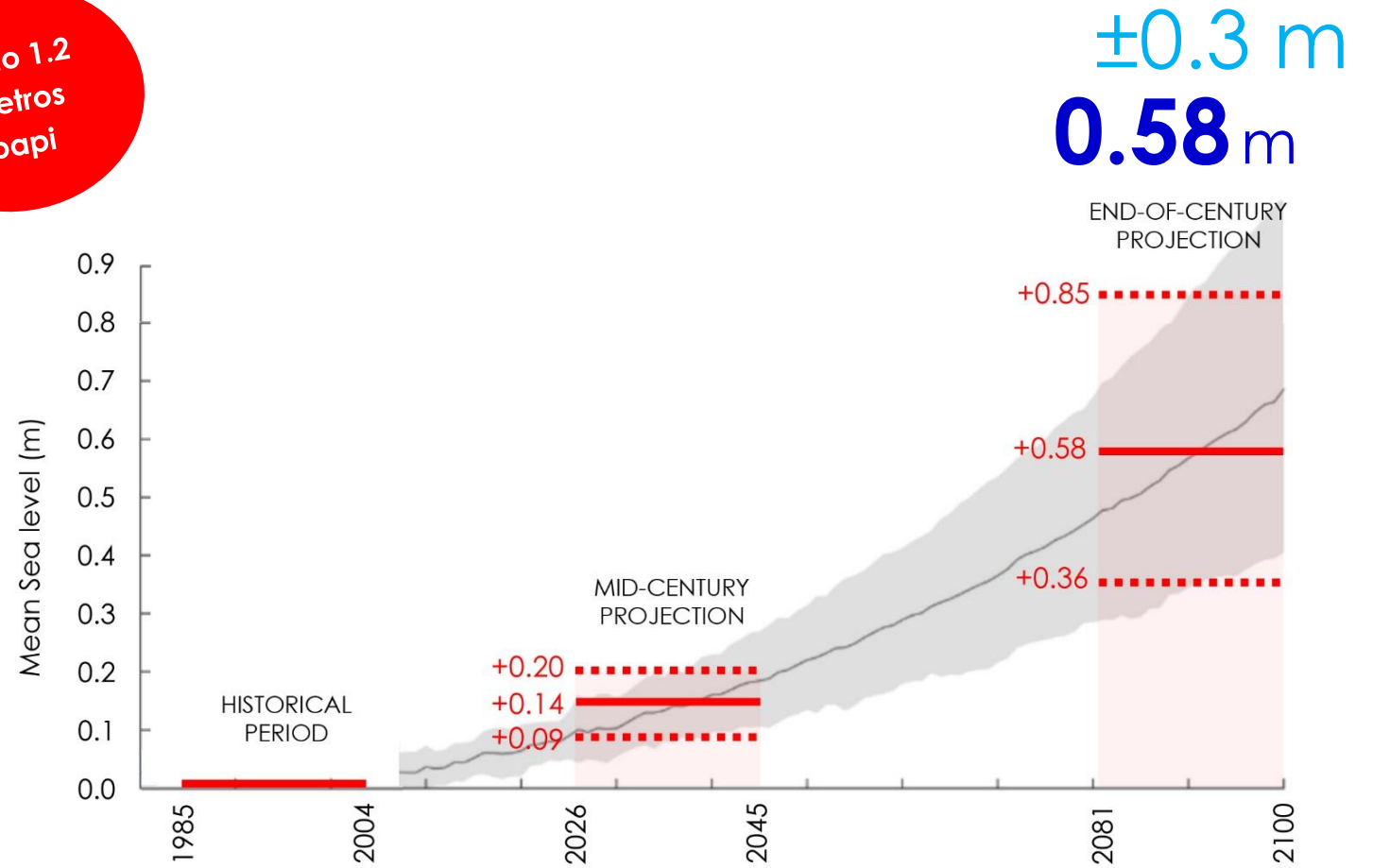
Media 2081-2100

Rivers are
not strong
enough





Mido 1.2
metros
papi



290 videos



Hurricane Sandy
October 29th 2012

2 Pisos

This blue color represents the height of potential flooding from future severe weather.

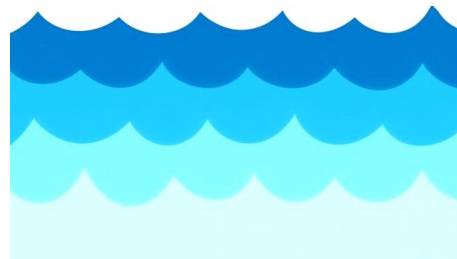
The Battery Park City Authority is responding to this threat through its resiliency projects, in conjunction with the City of New York.

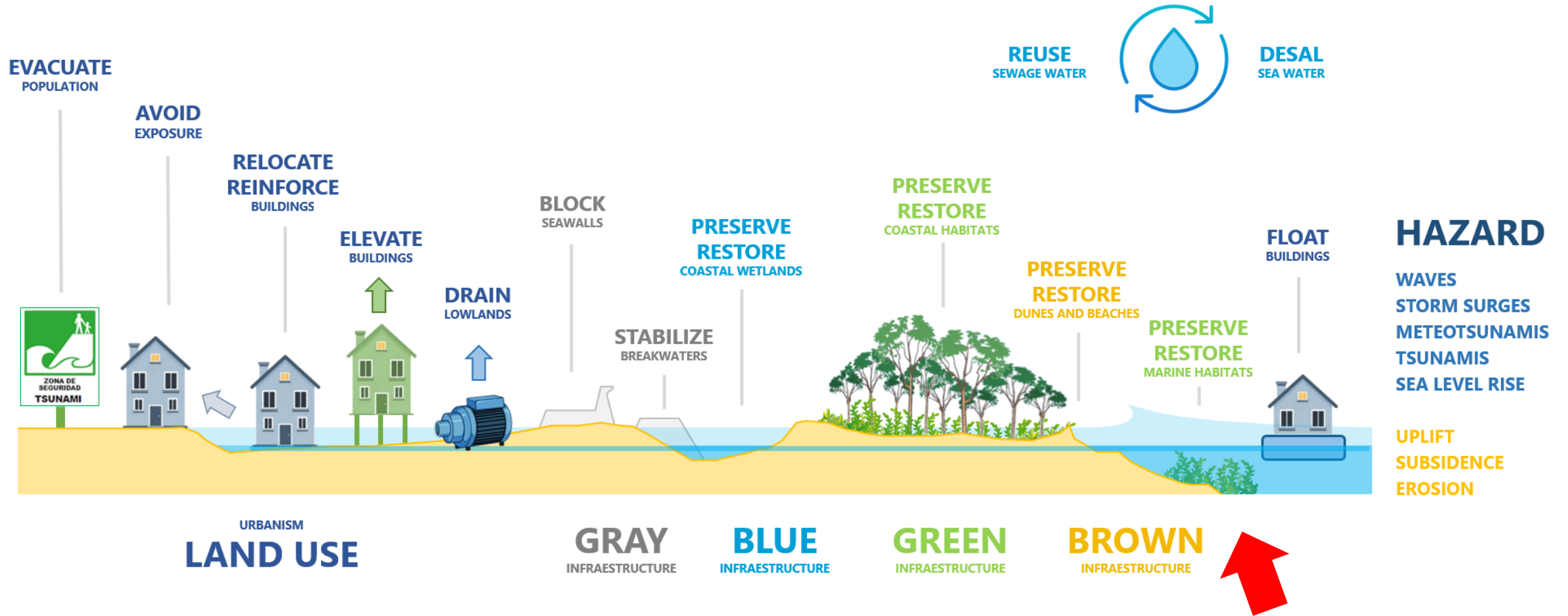
This height is calculated for a 2050 100-year storm based on Sea Level Rise estimates as published by the NYC Panel on Climate Change.



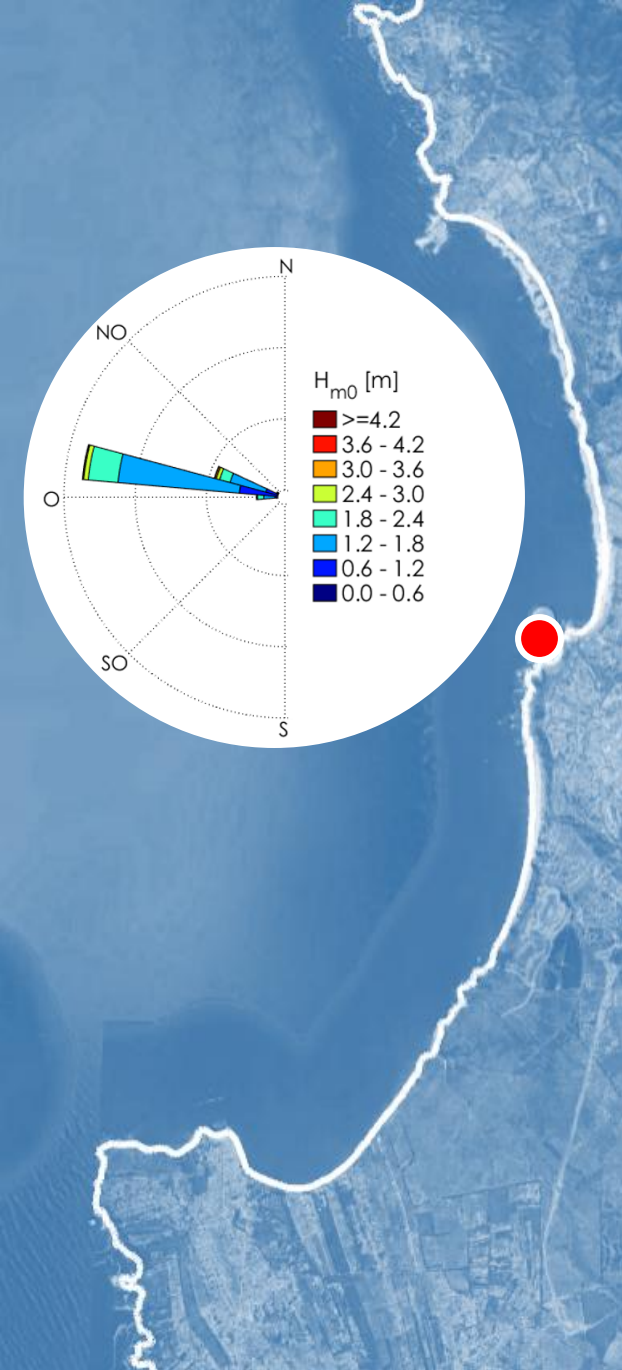


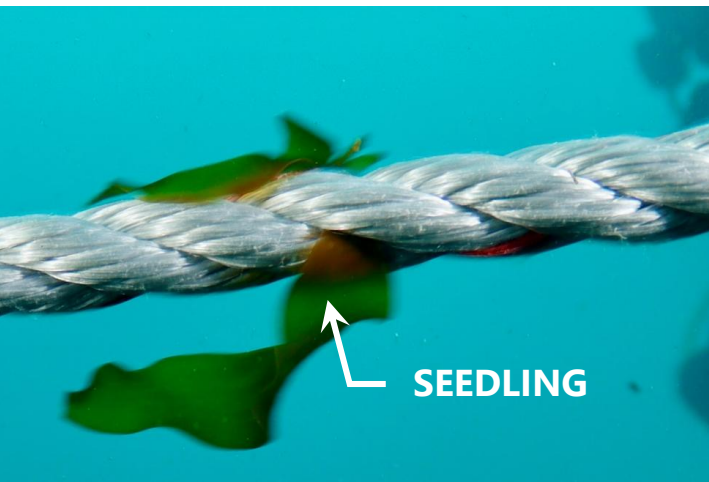
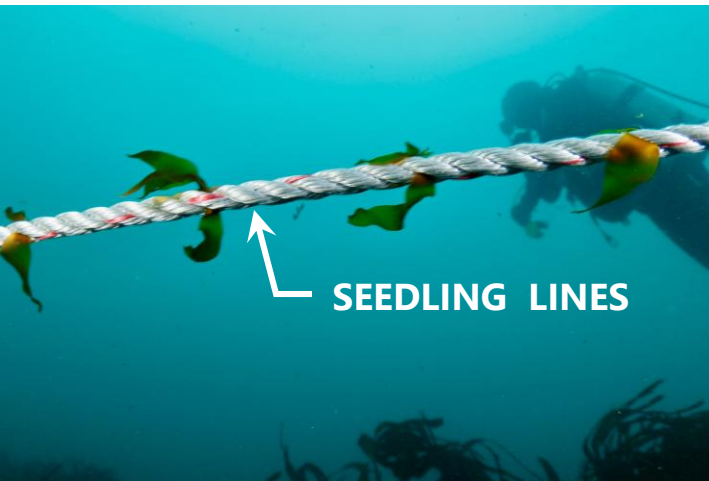
Coastal
adaptation...



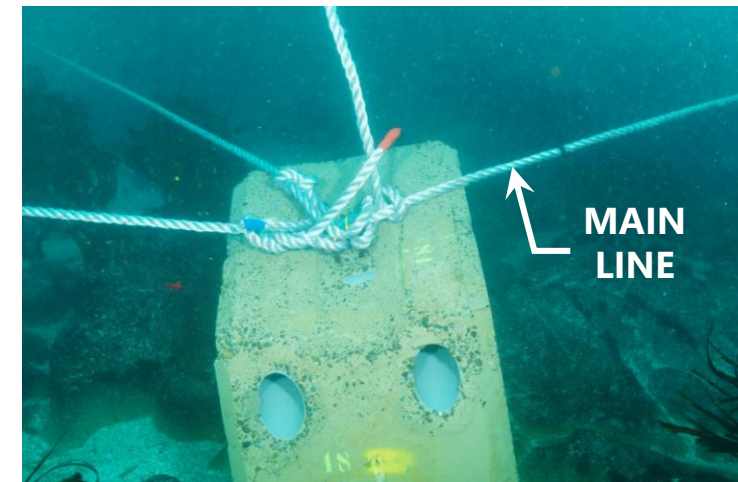
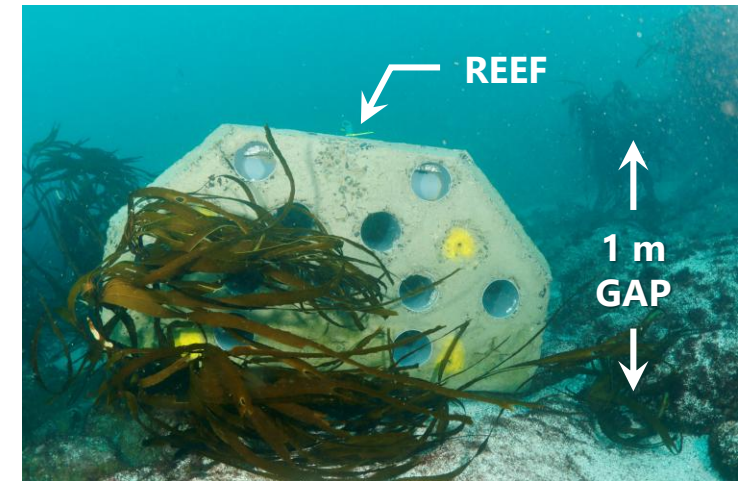
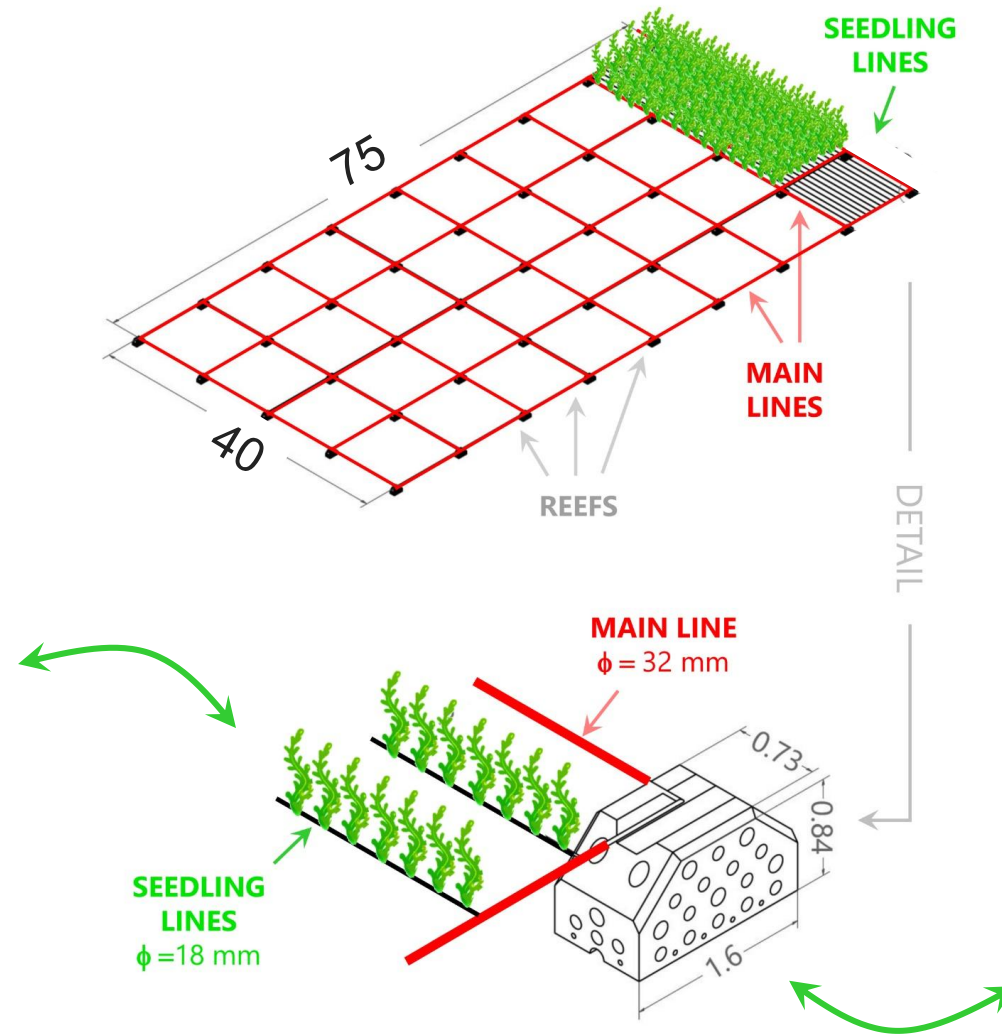


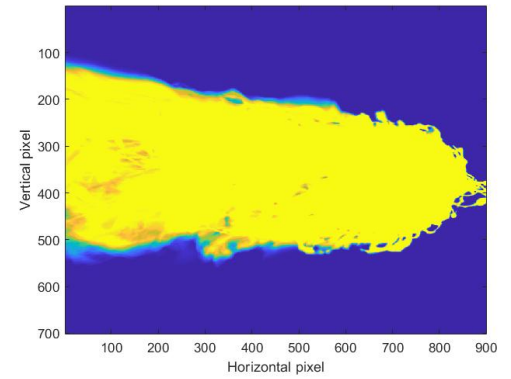
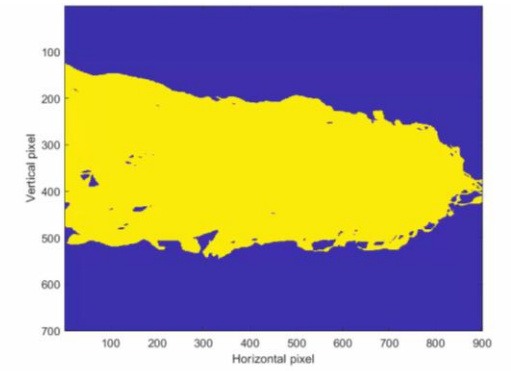
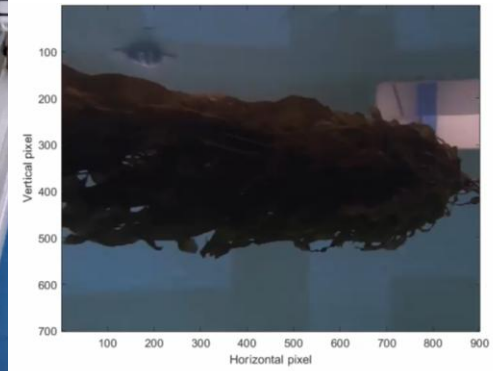
**Prototyping an
engineered kelp field
to attenuate long swells:
Application to South Pacific Coast**

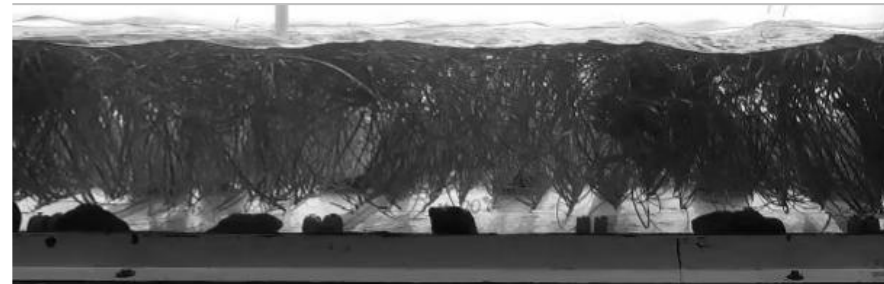
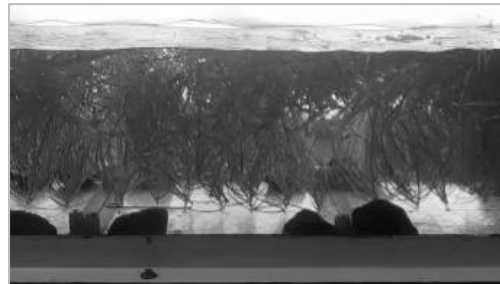
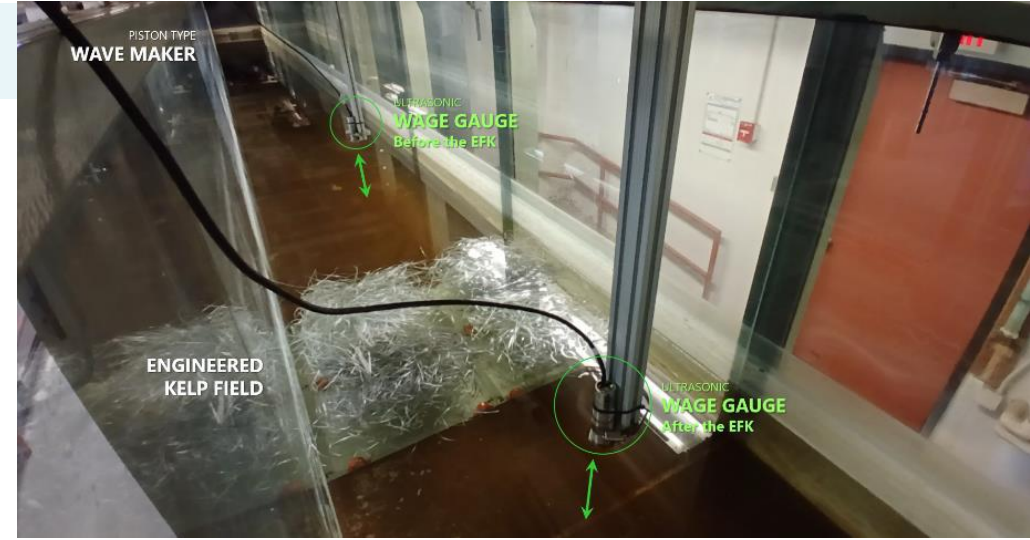




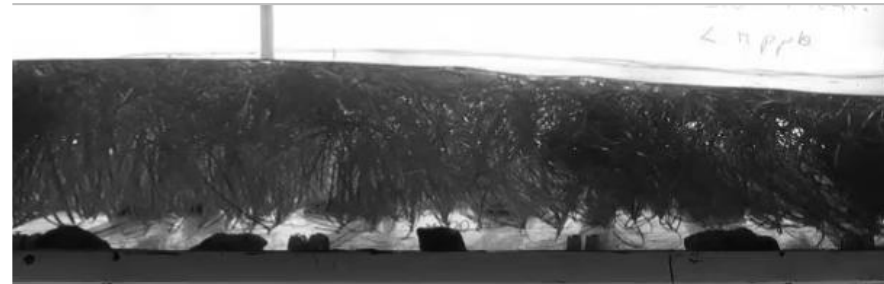
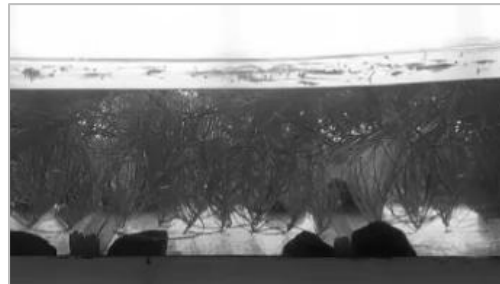
MACROCYSTIS PYRIFERA
GIANT KELP





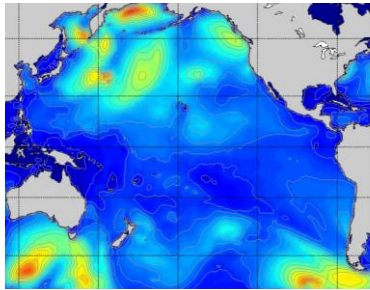


Lake short waves



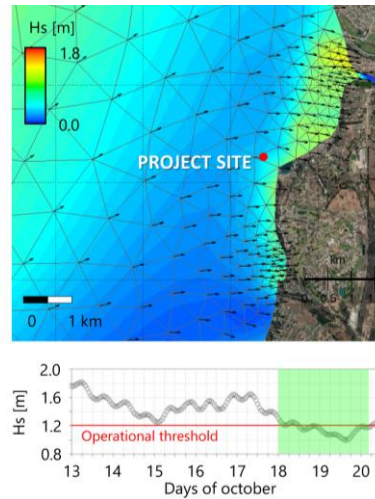
Ocean swells

OPERATIONS WAVE CLIMATE CHARACTERIZATION



PACIFIC-WIDE
WAVE MODEL

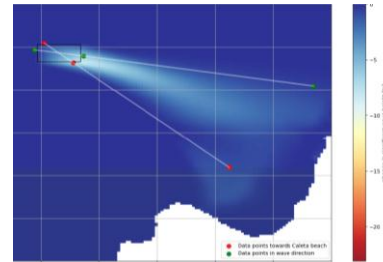
WAVEWATCH III



NEARSHORE
WAVE MODEL

SWAN
 Simulating WAVes Nearshore

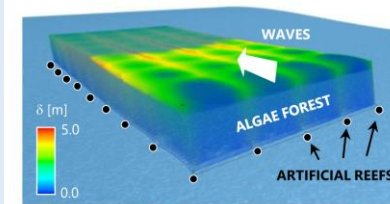
HYDRAULIC EFFICIENCY



WAVE KELP-FIELD
INTERACTION MODEL

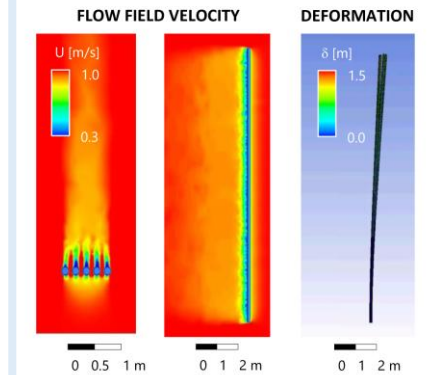
XBEACH


STRUCTURAL DESIGN



WAVE STRUCTURE
INTERACTION MODEL

AQUASIM

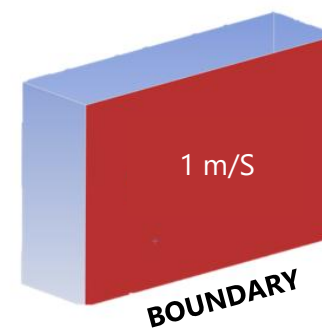
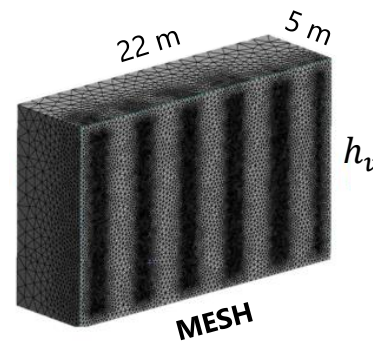
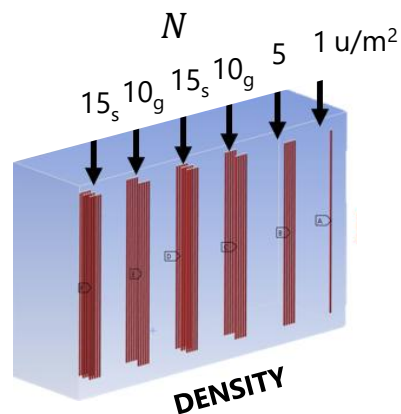
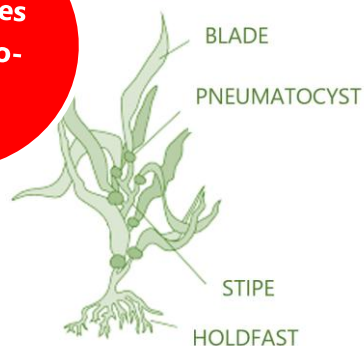
WAVE KELP-ARRAY
INTERACTION MODEL

ANSYS
 FLUENT®

DESIGN APPROACH

SENSITIVITY ANALYSIS OF DRAG COEFFICIENTS

No studies
for macro-
cystis



96 CASES

Kelp diameter

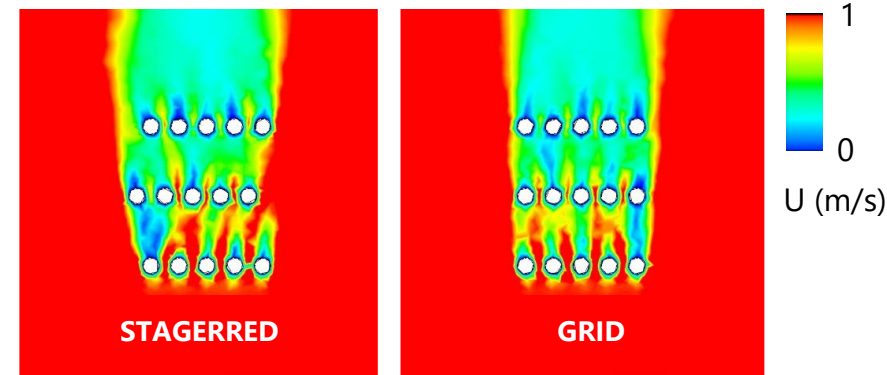
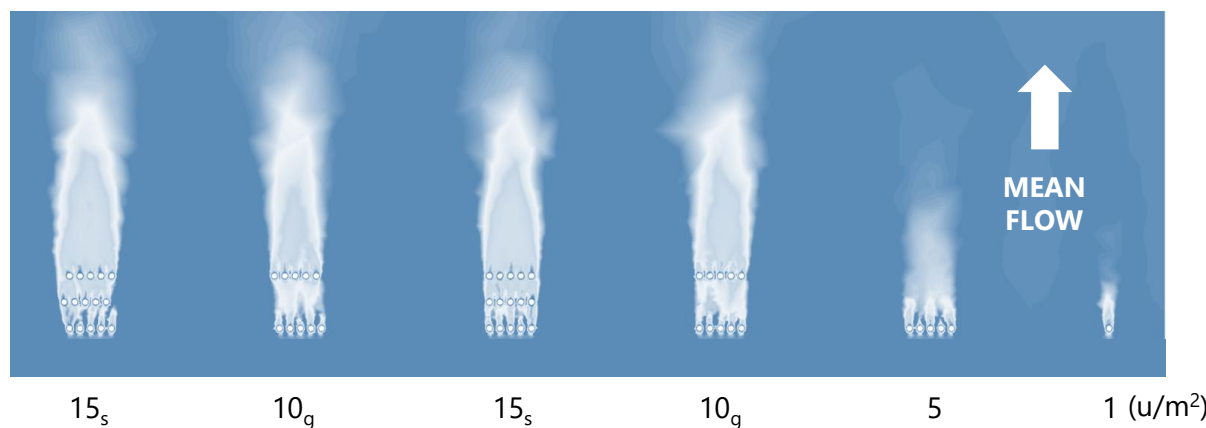
$\phi = 30, 60, 90, 120$ mm

Kelp height

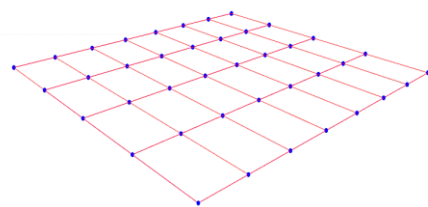
$h_v = 1, 4, 8, 12$ m

Kelp density

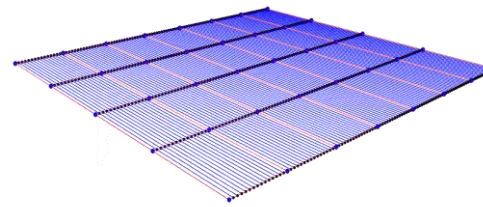
$N = 1, 5, 10_s, 10_g, 15_s, 15_g$ u/m²



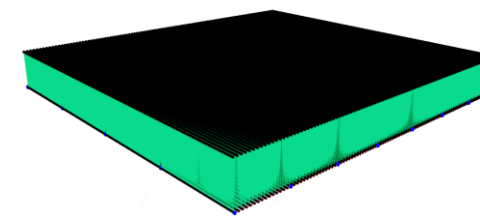
DESIGN APPROACH STRUCTURAL ANALYSIS



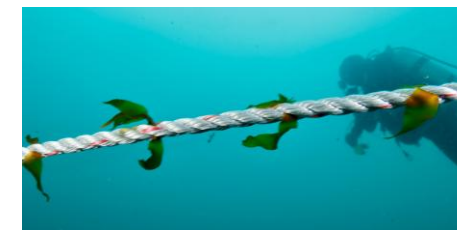
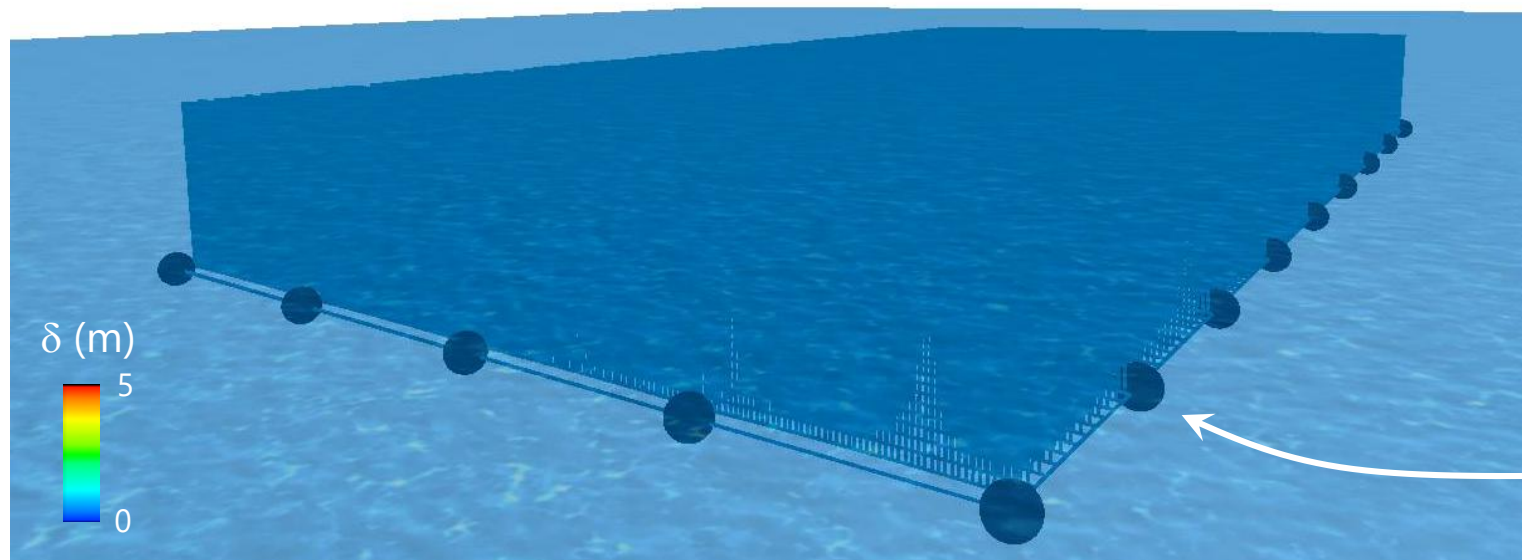
STRUCTURAL LINES



SEEDLING LINES



KELP INDIVIDUALS







MIMAR WEB

to be continued...

www.cona.cl/pub/libros/Costas_de_Chile.pdf



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