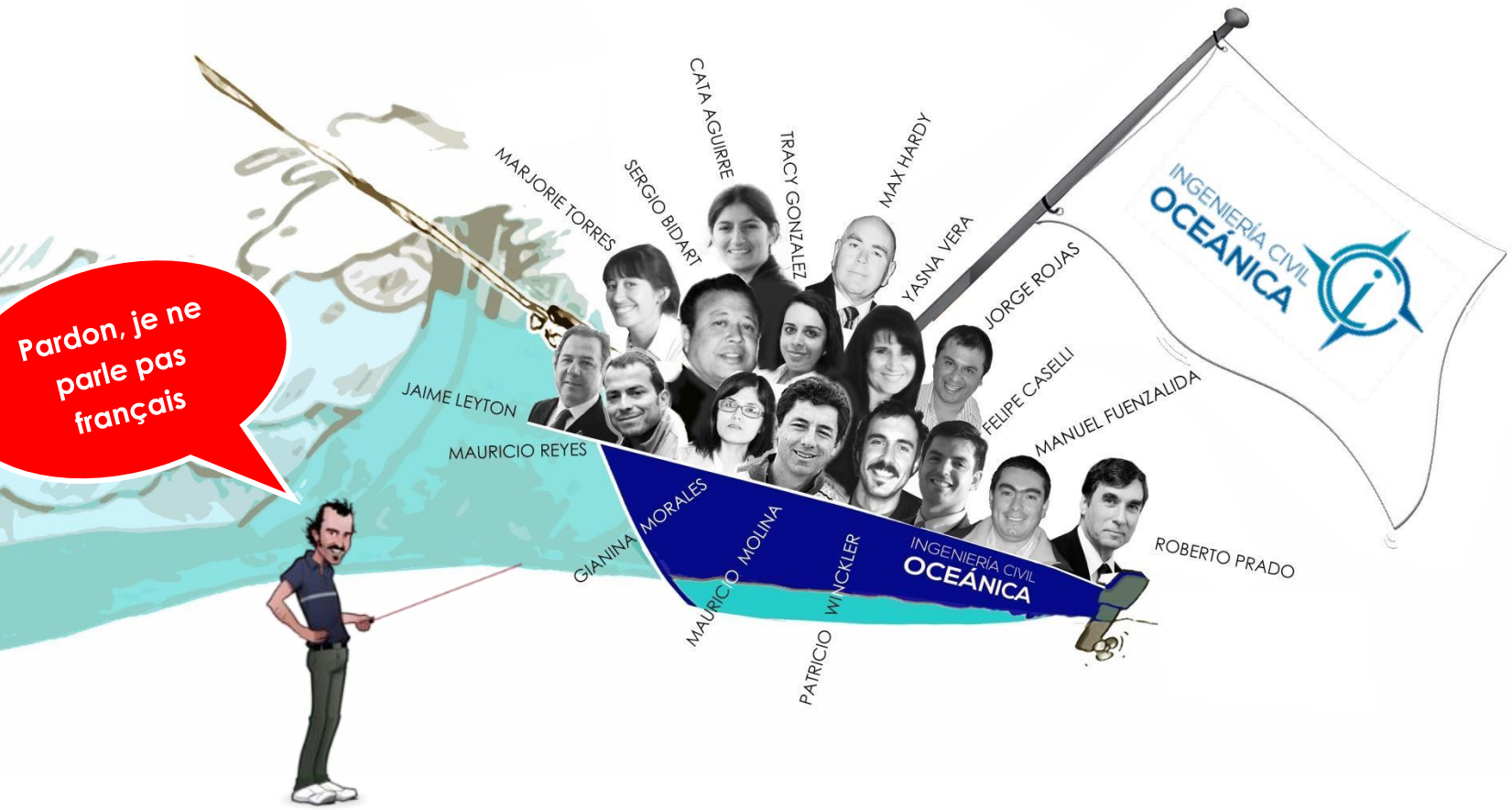
Universidad de Valparaíso
CHILE

CLIMATE CHANGE IMPACTS
ALONG THE CHILEAN COASTS !

(some) natural and built systems

The Future of our Coastlines: Sustainable Development of Coastal Areas in a Changing Environment
CANADA-CHILE COMMISSION FOR ENVIRONMENTAL COOPERATION
Ottawa and Santiago, April 27, 2021

Chile Canada



Ingeniero civil
Patricio Winckler
Patricio.winckler@uv.cl

Universidad de Valparaíso CHILE

(15)

minutes

Patricio Winckler
JEFE DE PROYECTO

Cata Marinkovic – Andrés Pica
Eduardo Bustos
APOYO CCG

AMENAZAS
Manuel Contreras
LÍDER EQUIPO AMENAZAS

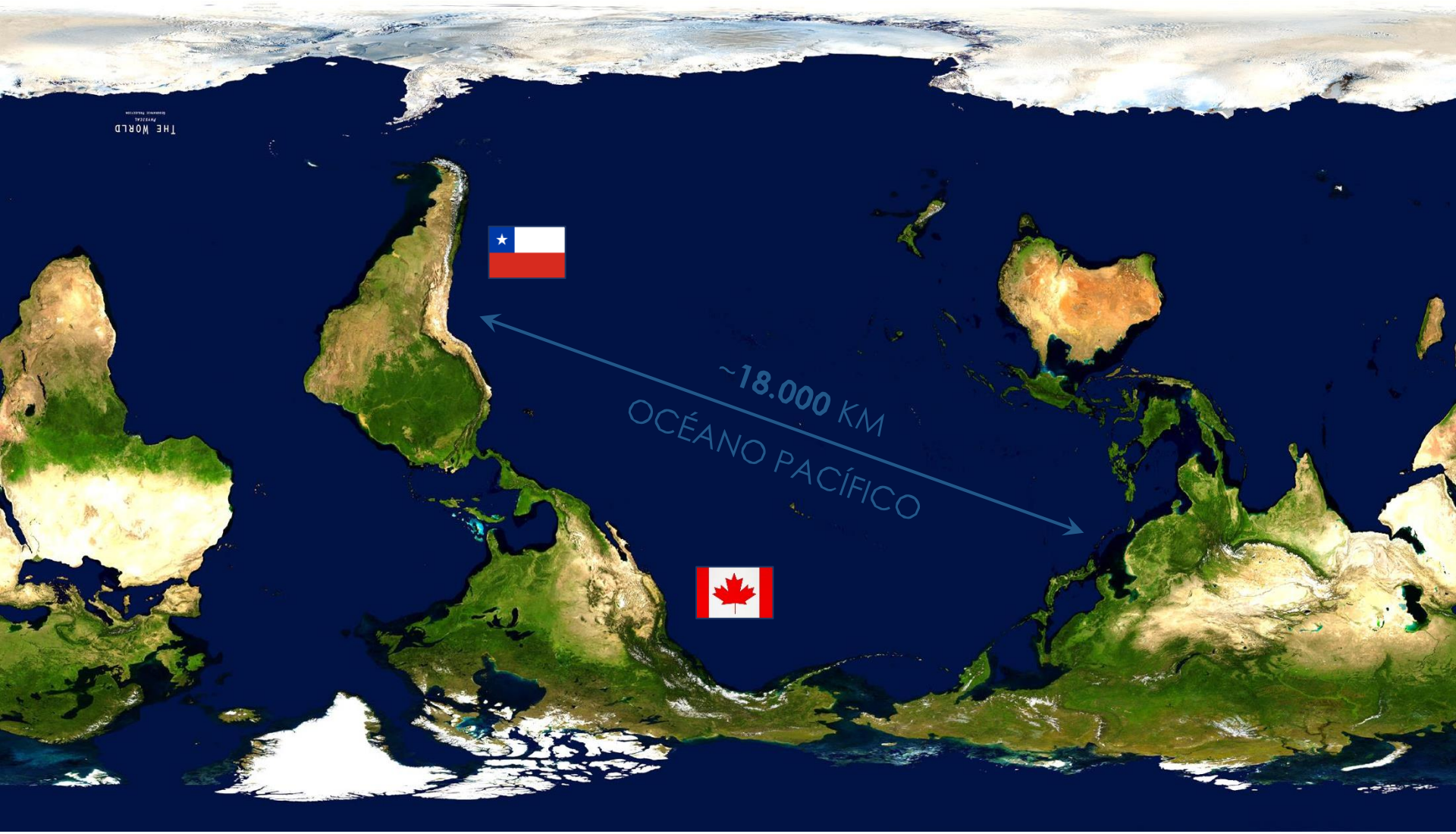
- **Nicolás Bambach** — PROYECCIÓN VARIABLES CLIMÁTICAS
- **Julio Salcedo** — PROYECCIÓN NIVEL DEL MAR
- **Javiera Mora** — PROYECCIÓN OLEAJE
- **Cesar Esparza** — MODELACIÓN COSTERA Y OLEAJE
- **Sebastian Vicuna** — RECURSOS HÍDRICOS

VULNERABILIDAD E IMPACTOS
Sebastián Vicuña
LÍDER EQUIPO VULNERABILIDAD

- **Manuel Contreras – Patricio Winckler** — INFRAESTRUCTURA Y PUERTOS
- **Oscar Melo** — ANÁLISIS ECONÓMICO
- **José Miguel Fariña** — HUMEDALES Y ECOSISTEMAS COSTEROS
- **Carolina Martínez –Roberto Agredano**
  Iván Torres – Luis Flores
  EROSIÓN EN PLAYAS
- **Stefan Gelcich** — COMUNIDADES Y PESCA ARTESANAL

Cristián Larraguibel – David Morales – Nikolás Bassi – Macarena Pérez
GEODATABASE Y SIG

Centro UC Cambio Global · Universidad de Valparaíso Chile · Universidad de Playa Ancha · Pontificia Universidad Católica de Valparaíso · Universidad Católica del Maule · CIGIDEN · OSTA-R UV



http://www.worldmapsonline.com/


De qué hablamos cuando hablamos de la costa chilena
?!
ATMÓSFERA
ACONCAGUA
MAIPO
MATAQUITO
MAULE
ITATA
BIOBÍO
HIDRÓSFERA
CRIÓSFERA
ANTROPOSFERA
GEÓSFERA
BIÓSFERA
TECNOSFERA

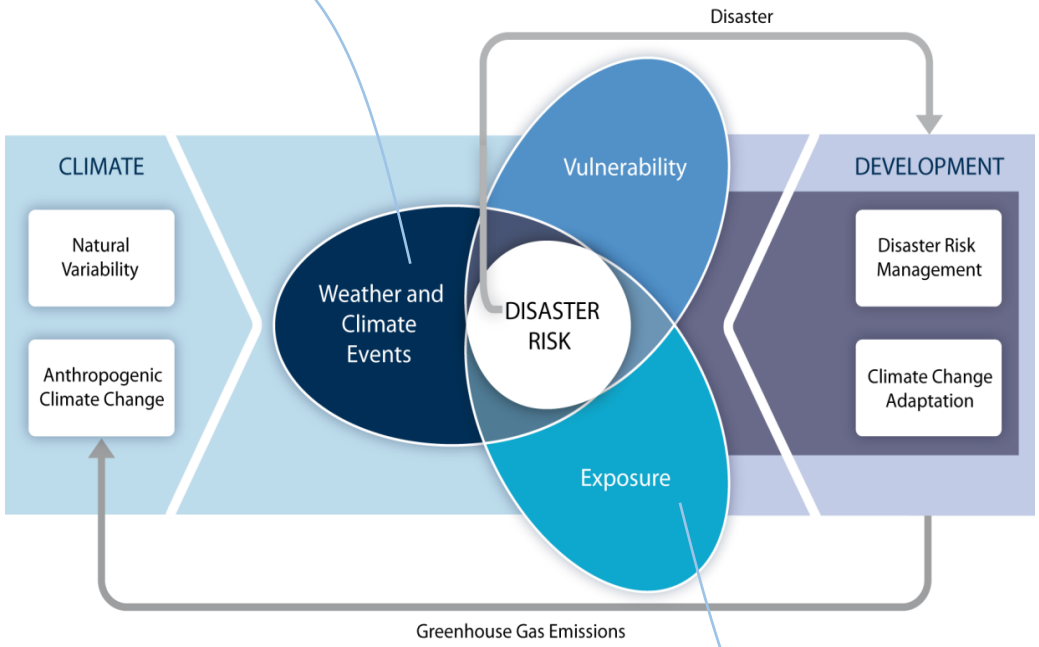
Winds
Forcing waves

Waves
Coastal storms

Mean sea level

River flow
Feeding wetlands

Flooding
Elevation



Ports
Fishing ports
Wetlands
Dunes
Beaches
Biodiversity
Infraestructure
Cities

IPCC (2012, 2014)

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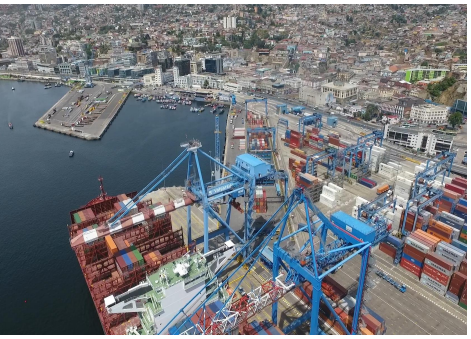
CHILE

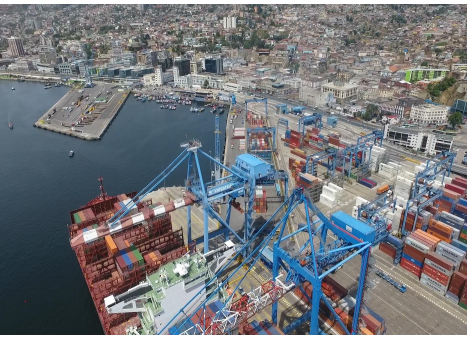
CALEUCHE
LITORAL VALPARAISO




- **Flooding** of coastal areas
- Changes in the dynamics of **wetlands**
- Erosion of **beaches** and **cliffs**
- Erosion of **dunes**
- Changes in the dynamics of **estuaries**
- Operational downtime in commercial and minor **ports**
- Damage on **coastal infrastructure**
- Loss of **deltas**
- others

(exposure)

below 10 masl




546 **caletas** de pescadores

1692 humedales

256 campos dunares

1172 **playas**

156 lugares de interés para la **biodiversidad**

1198 **equipamientos**

171 **terminales** marítimos

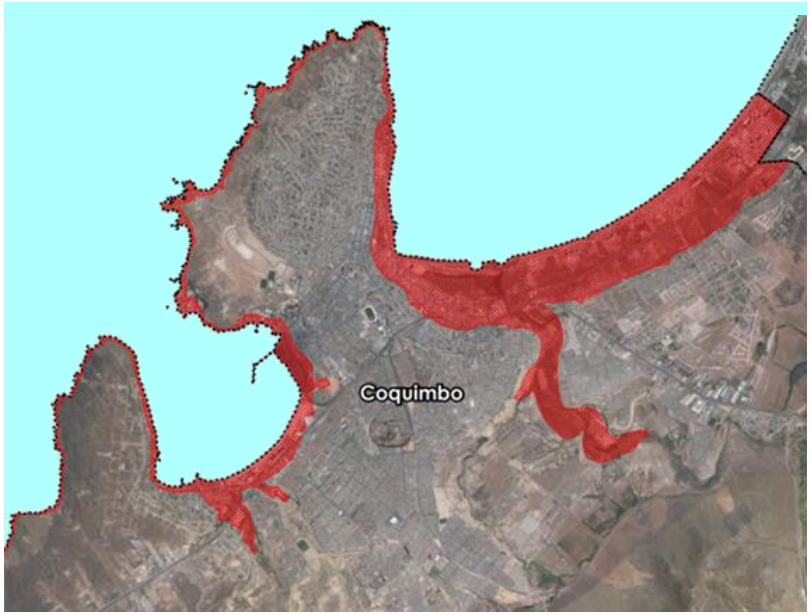
475 elementos de **infraestructura** costera

477 asentamientos

Viña del Mar, Región de Valparaíso

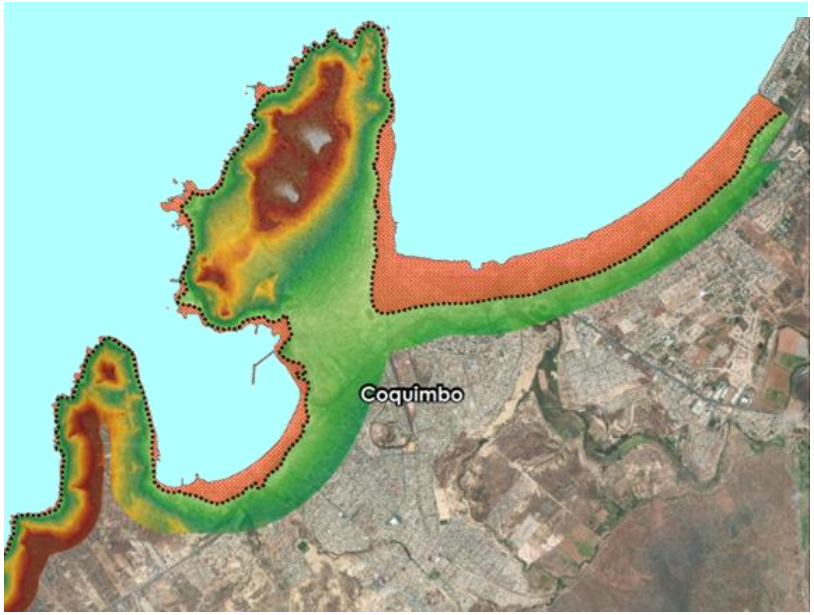
Chile's

coastal digital elevation model



Satellite data

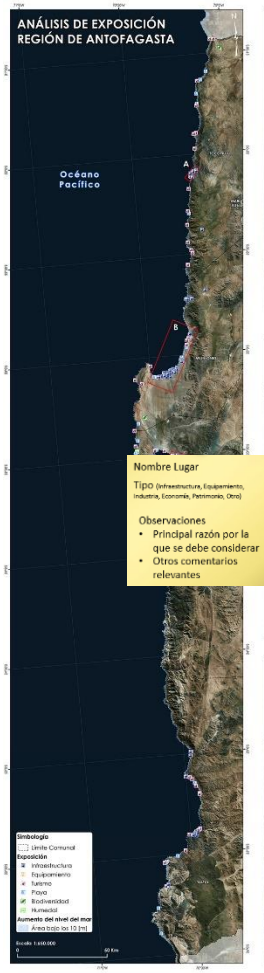
ASTER GDEM-2 ALOS WORLD
3D ALOS PALSAR

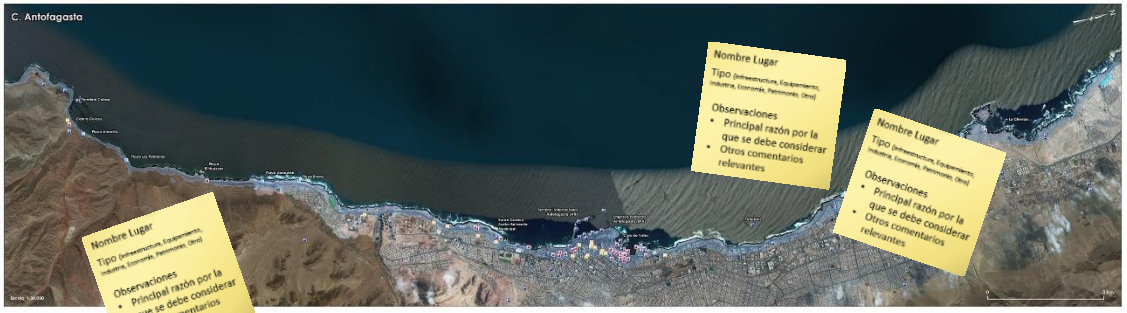


Topographic survey

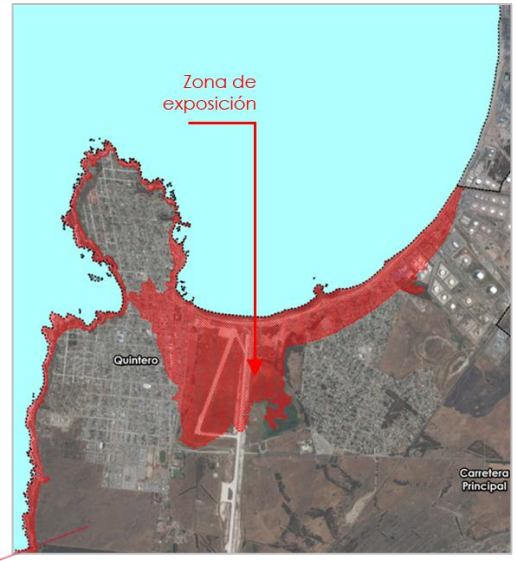
SHOA

Cartography (participatory)



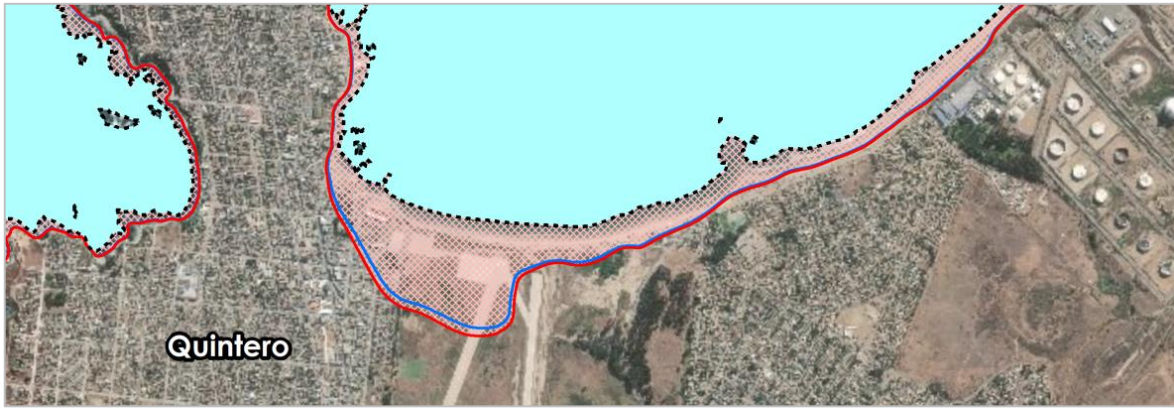


exposure **hazard**



10 m above sea level

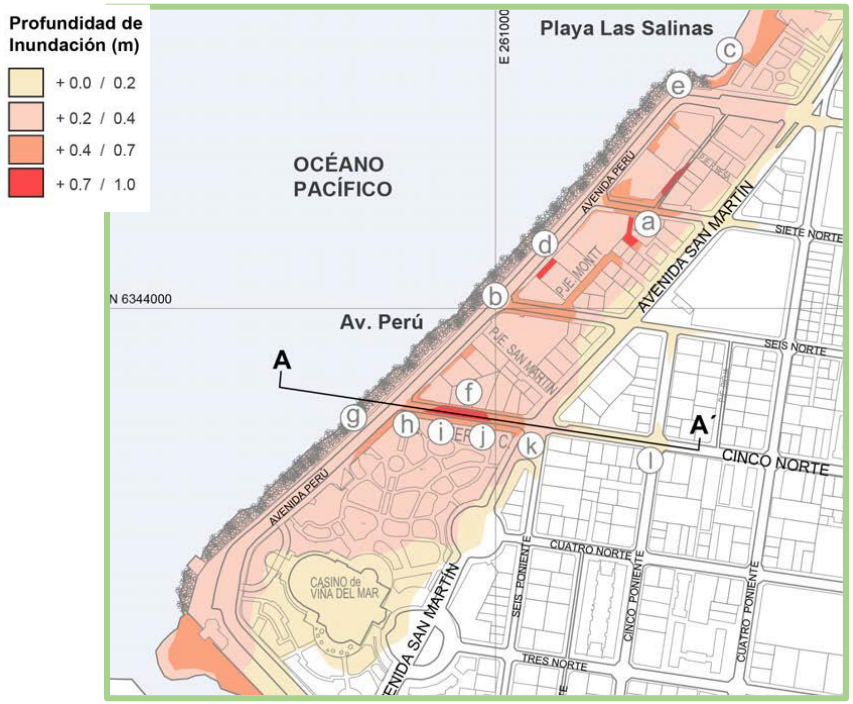
1960
2010
etc



Storm waves

June 27th 2017

(field survey)



Efectos del cambio climático en la zona urbana turística y costera de viña del mar: levantamiento de daños para una inundación por marejadas y percepción de seguridad (2019)

Felipe Igualt, Wolfgang Breuer, Manuel Contreras-López y Carolina Martínez

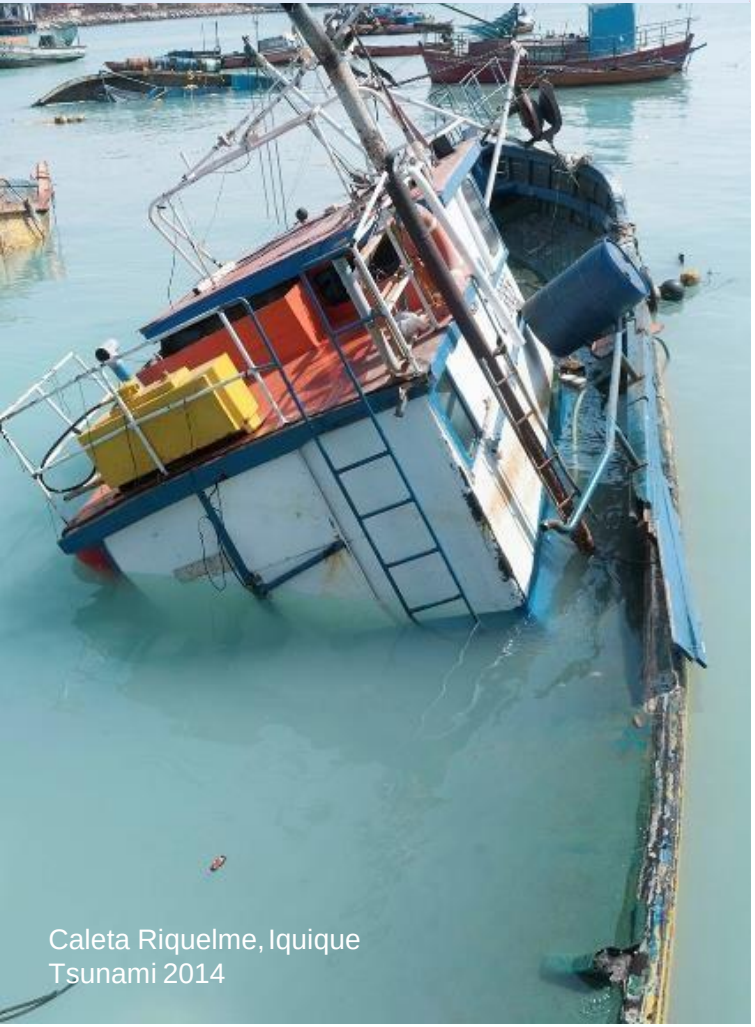
Tsunami

Based on the July 8th 1730 event

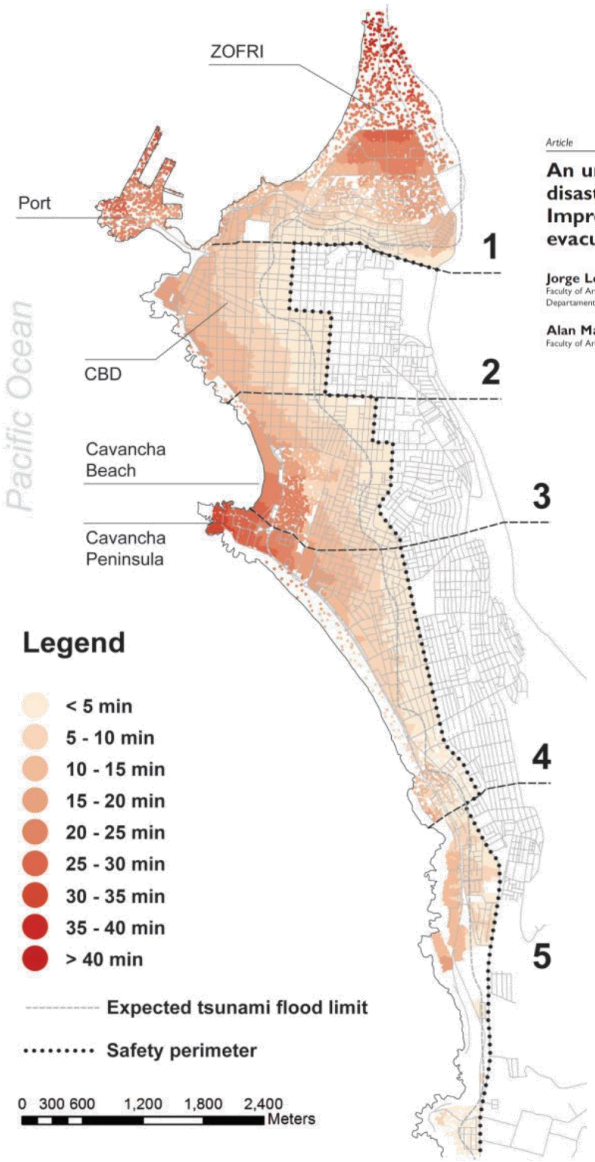
(model)

Examining the role of urban form in supporting rapid and safe tsunami evacuations: a multi-scalar analysis in Viña del Mar, Chile (2018)

Jorge León, Cyril Mokrani, Patricio Catalán, Rodrigo Cienfuegos, Carolina Femenías



Caleta Riquelme, Iquique
Tsunami 2014



Article

B Planning and Design

An urban form response to disaster vulnerability: Improving tsunami evacuation in Iquique, Chile

Environment and Planning B: Planning and Design 2016, Vol. 43(5) 826–847

DOI: 10.1177/0265813515597229
epb.sagepub.com
SAGE

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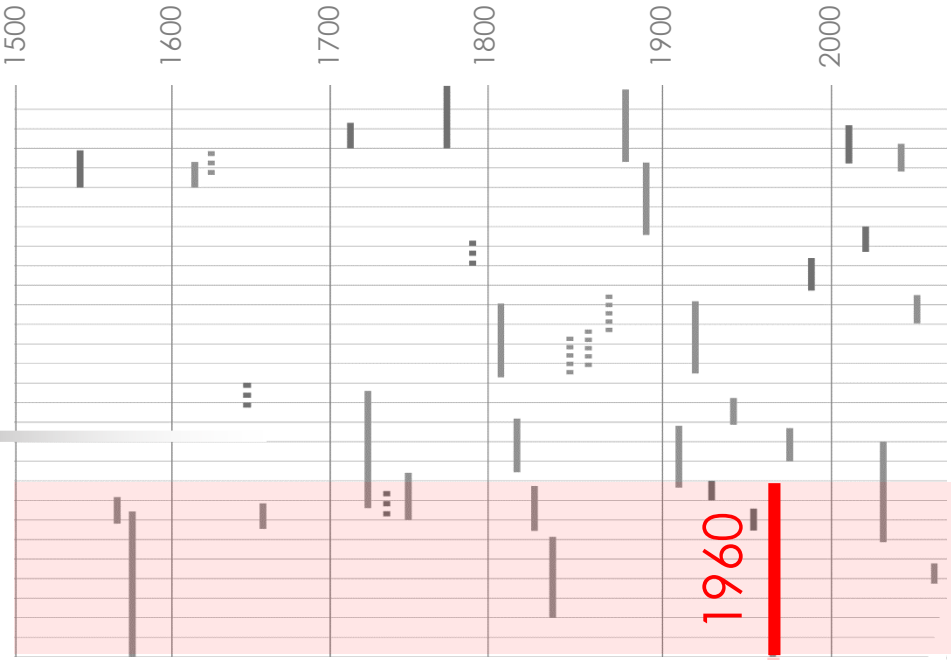
Faculty of Architecture, Building and Planning, University of Melbourne, Melbourne, Australia; Departamento de Arquitectura, Universidad Técnica Federico Santa María, Valparaíso, Chile

Alan March
Faculty of Architecture, Building and Planning, University of Melbourne, Melbourne, Australia

Figure 1. Evacuation zones and total 'optimistic' evacuation times in Iquique.

Gentileza: Jorge León (UTFSM)

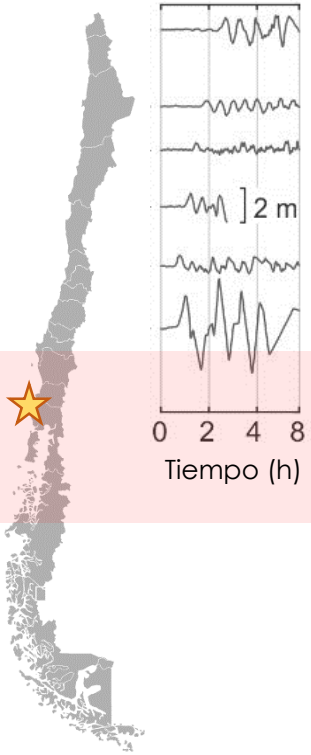


INCERTIDUMBRE

evidencia

Científica

evidencia empírica e interpretación de acuerdo con el método científico que sirve para apoyar o contrarrestar una teoría o hipótesis científica



RED SISMOLÓGICA NACIONAL 1908

RED MAREOGRÁFICA NACIONAL 1944

TESTIMONIOS
(VIVOS EN 2018)

HISTORIA 1570

PALEOSISMOLOGÍA

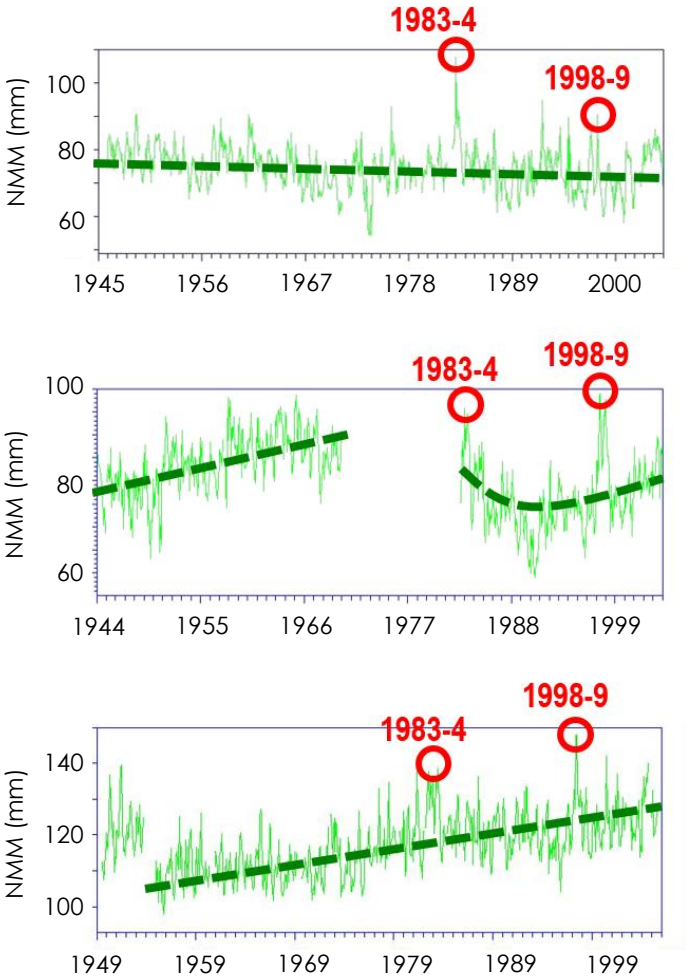
Sievers 60
Plafker 68

2010 **LEVANTAMIENTOS**
POST-TSUNAMI

1995 **SATÉLITES**
GPS, INSAR

(long term climatic hazard)

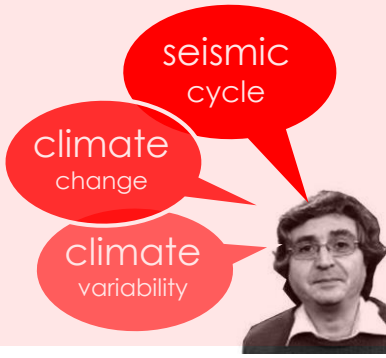
ENOS



±3 m
coseismic
uplift/subsidence

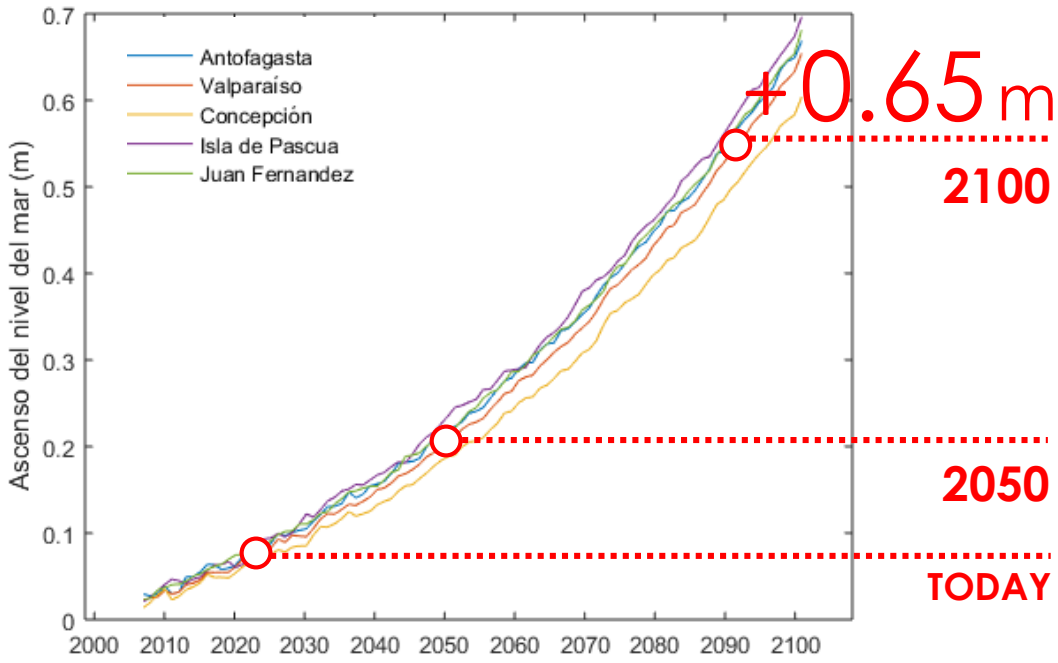
±0.4 m
ENOS

+0.65 m
Sea level rise 2100
RCP 8.5



+1.68 m
Sea level rise 2100

Pier 14
San Francisco



(vulnerability & risk)

Peñuelas, La Serena


My office

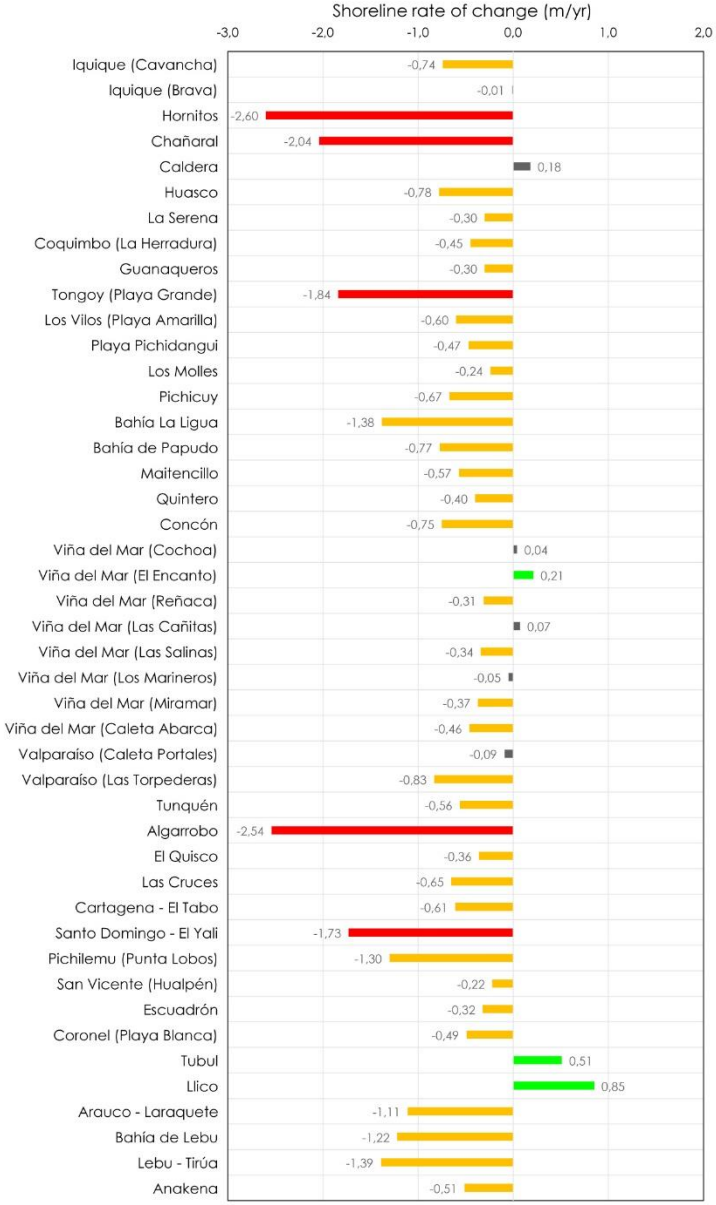
Universidad de Valparaíso
CHILE

BEACHES

Playa Reñaca, Viña del Mar

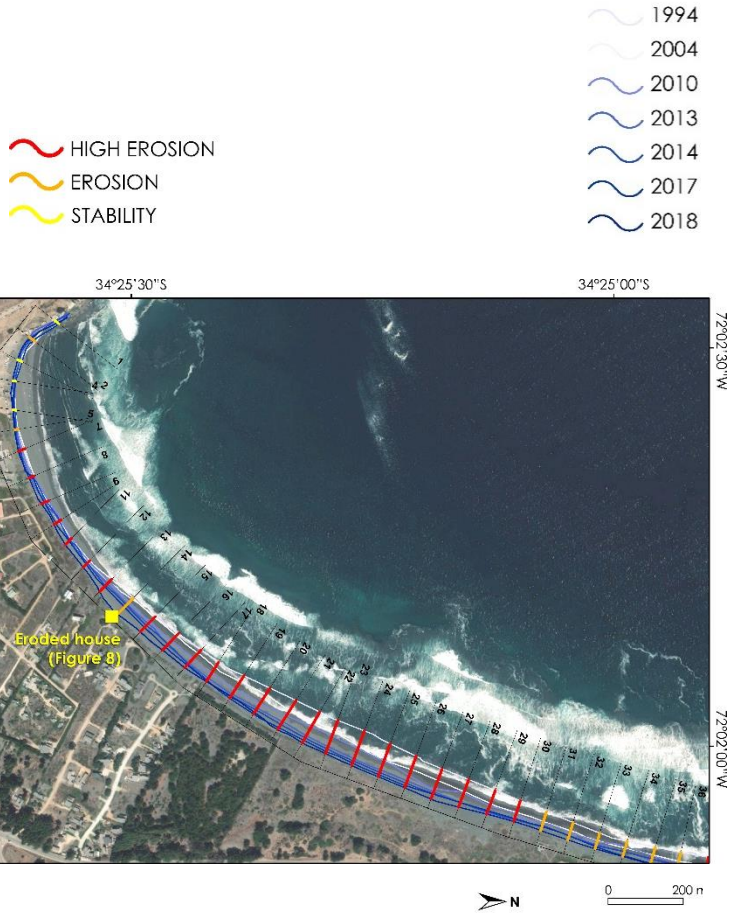
45

PLAYAS
2000 km



80%

EN EROSIÓN

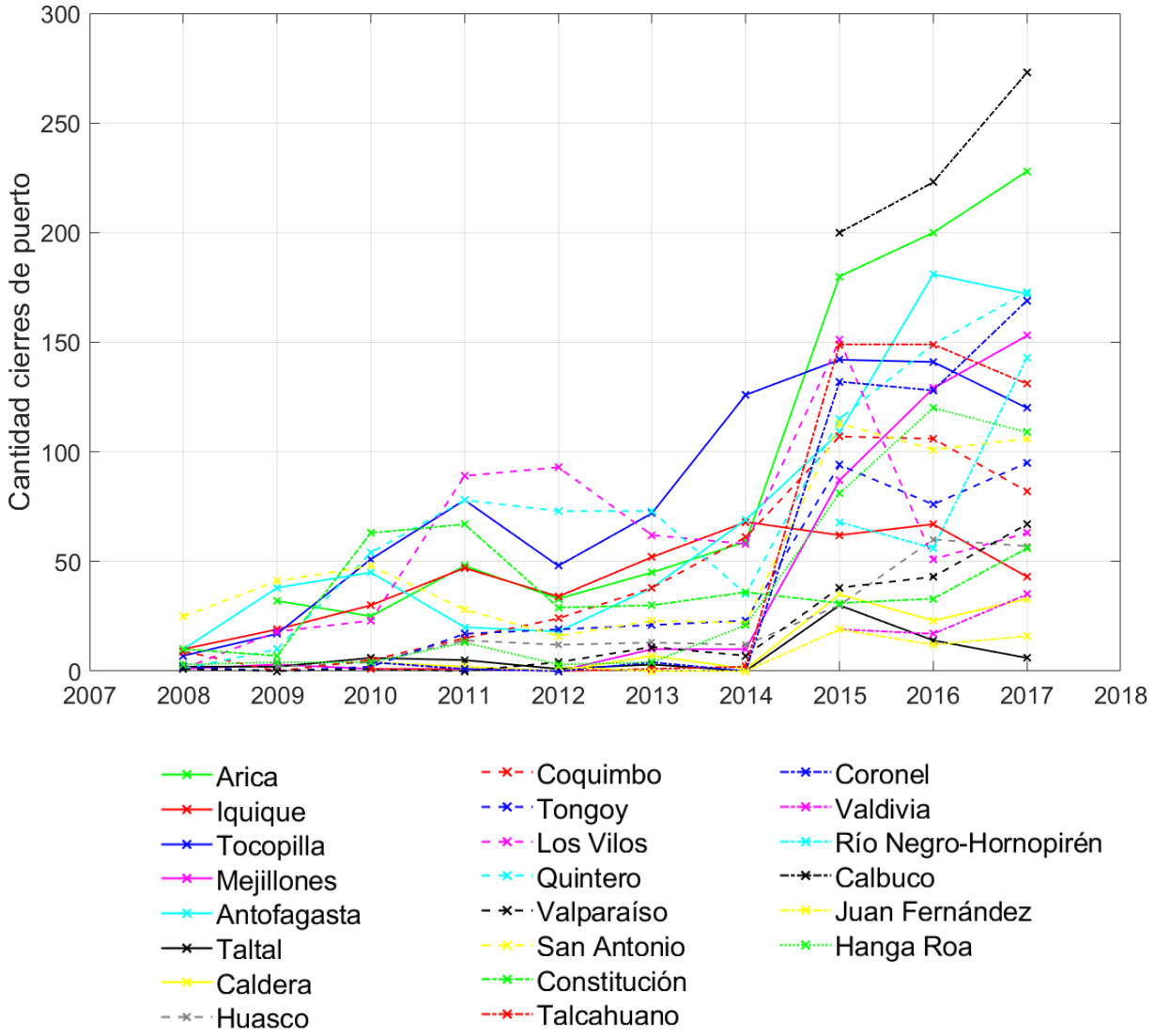


Universidad de Valparaíso
CHILE

PORTS

Puerto de Valparaíso


Arica
Arica y Parinacota
Iquique
Patillos
Patache
Tarapacá
Tocopilla
Michilla
Angamos
Mejillones
Antofagasta
Caleta Coloso
Antofagasta
Chañaral-Barquito
Caldera
Huasco
Atacama
Coquimbo
Guayacán
Los Vilos
Coquimbo
Quintero
Ventanas
Valparaíso
Valparaíso
San Antonio
Metropolitana
Del Lib. B. O'higgins
Del Maule
Lirquén
Penco
Talcahuano
San Vicente
Coronel
Del Bío-Bío
De La Araucanía
Corral
De Los Ríos
Calbuco
De Los Lagos
Chacabuco
Aysén
Isla Guarello
Cabo Negro
Puerto Natales
Punta Arenas
Puerto Williams
Magallanes


Cantidad cierres de puerto
300
250
200
150
100
50
0
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
Arica
Iquique
Tocopilla
Mejillones
Antofagasta
Taltal
Caldera
Huasco
Coquimbo
Tongoy
Los Vilos
Quintero
Valparaíso
San Antonio
Constitución
Talcahuano
Coronel
Valdivia
Río Negro-Hornopirén
Calbuco
Juan Fernández
Hanga Roa

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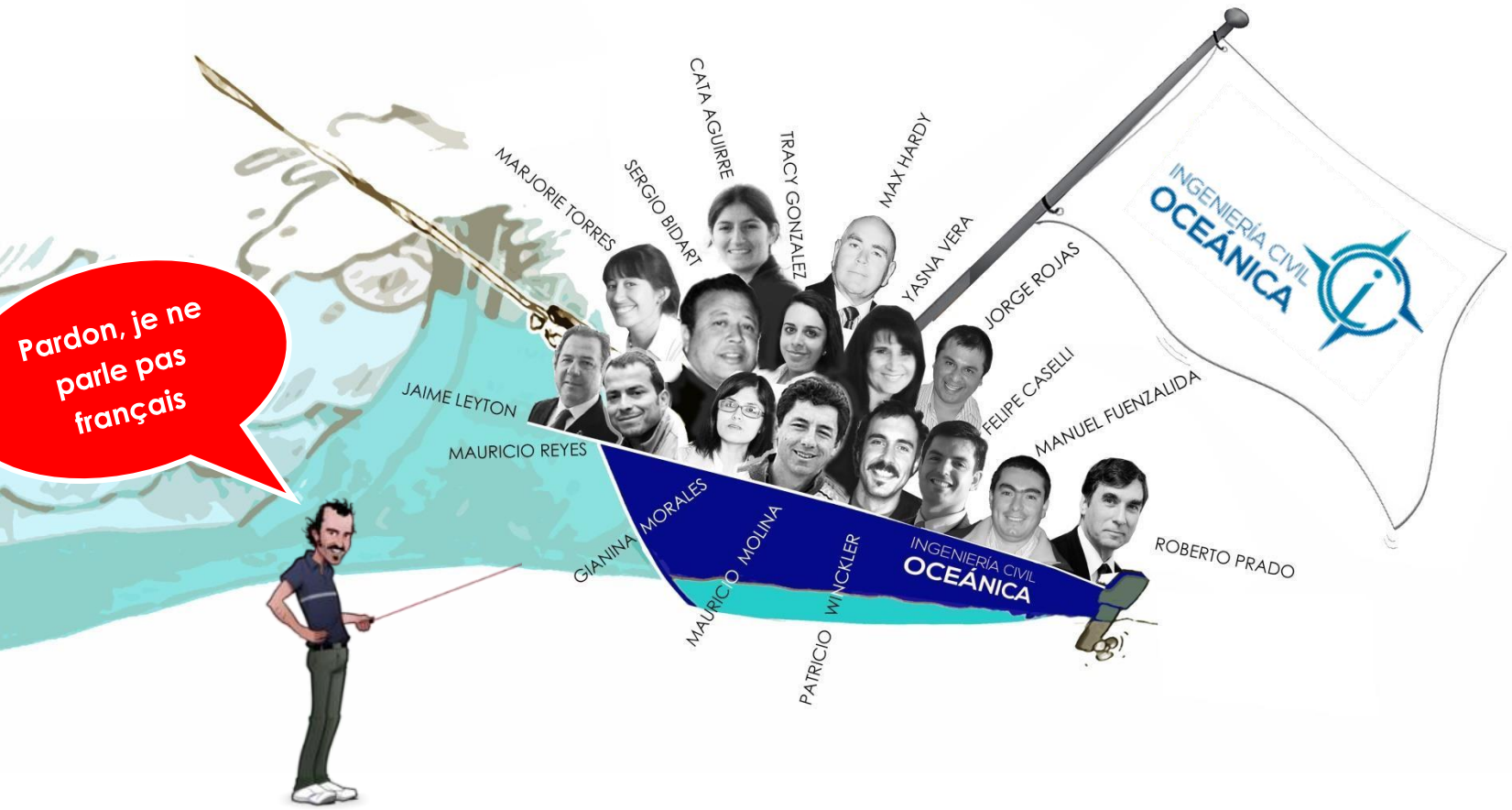
WETLANDS



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