Center for Climate and Resilience Research

5th Anniversary

An overview of our Scientific Accomplishments

René D. Garreaud
Geophysics Department, FCFM
Universidad de Chile

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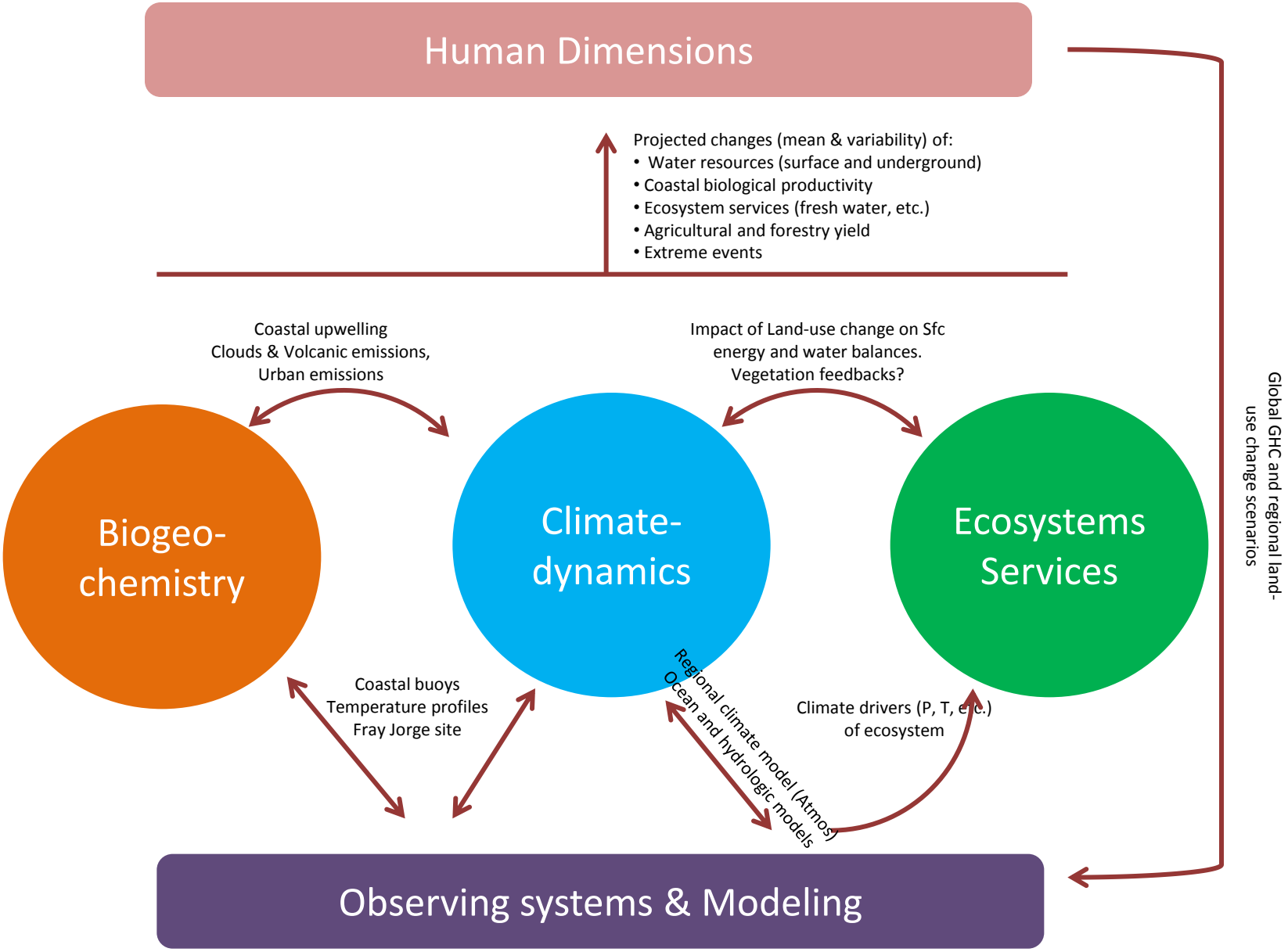
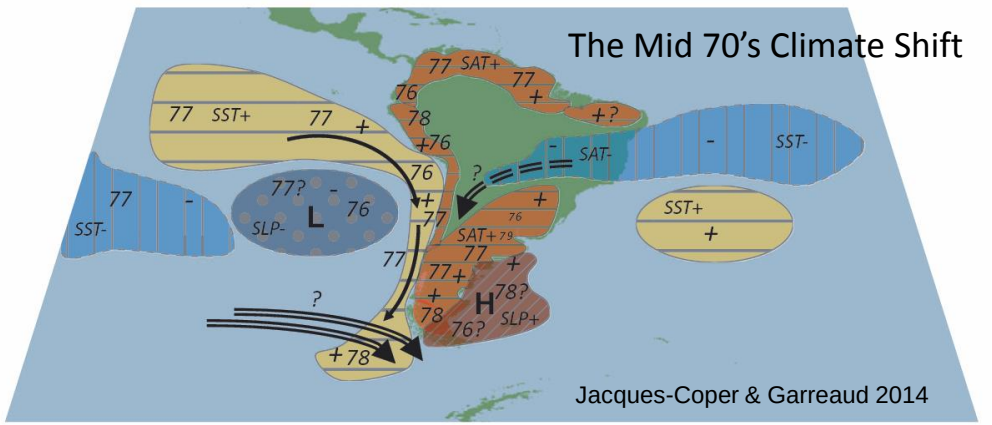
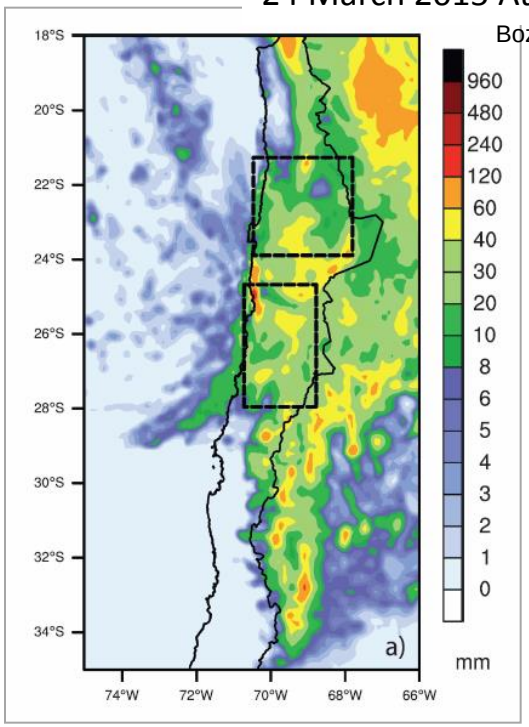

Human Dimensions
Projected changes (mean & variability) of:
• Water resources (surface and underground)
• Coastal biological productivity
• Ecosystem services (fresh water, etc.)
• Agricultural and forestry yield
• Extreme events
Coastal upwelling
Clouds & Volcanic emissions,
Urban emissions
Impact of Land-use change on Sfc
energy and water balances.
Vegetation feedbacks?
Biogeo-chemistry
Climate-dynamics
Ecosystems Services
Coastal buoys
Temperature profiles
Fray Jorge site
Regional climate model (Atmos)
Ocean and hydrologic models
Climate drivers (P, T, etc.)
of ecosystem
Observing systems & Modeling
Global GHC and regional land-use change scenarios

Climate Dynamics: From days to centuries

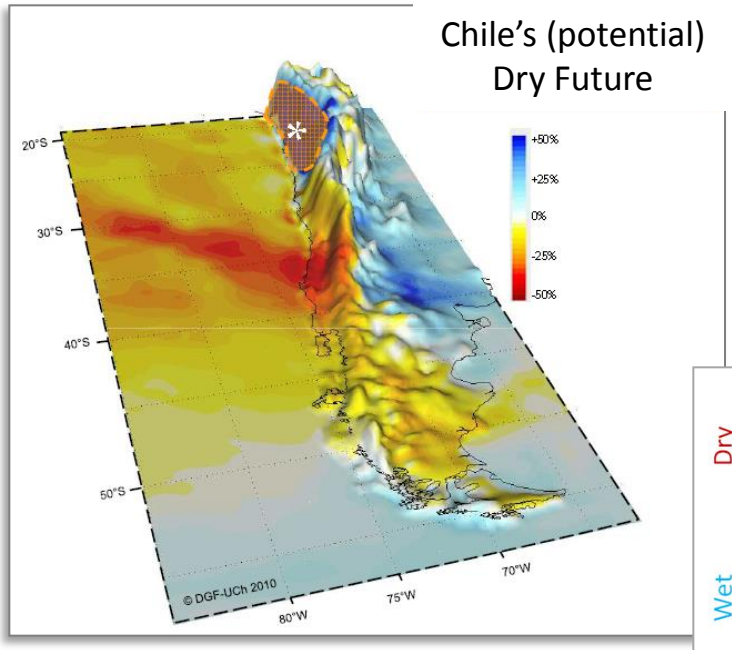


24 March 2015 Atacama Storm

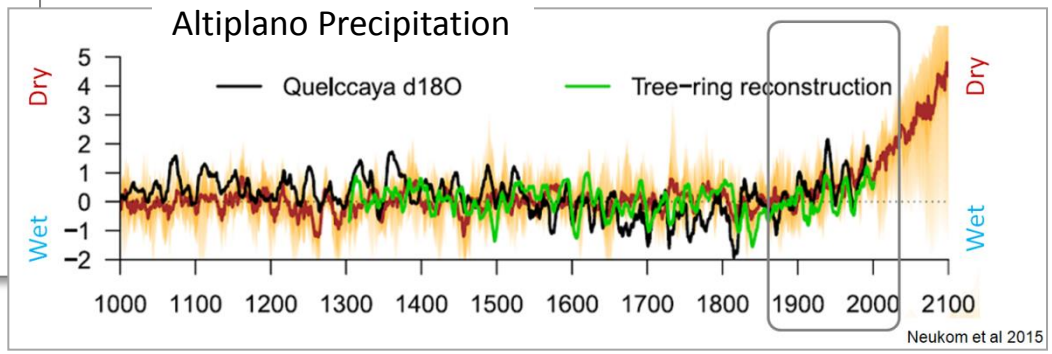
Bozkurt et al. 2016



Chile's (potential) Dry Future



Altiplano Precipitation



Past climate changes and their impacts

nature COMMUNICATIONS

ARTICLE

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Southern Annular Mode-like changes in southwestern Patagonia at centennial timescales over the last three millennia

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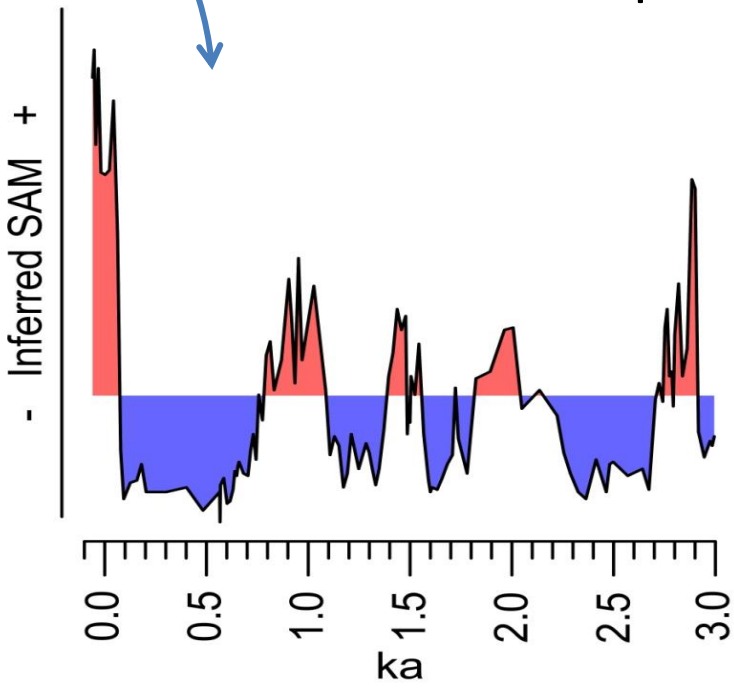
The Southern Annular Mode (SAM) is the leading mode of climate variability in the extratropical Southern Hemisphere



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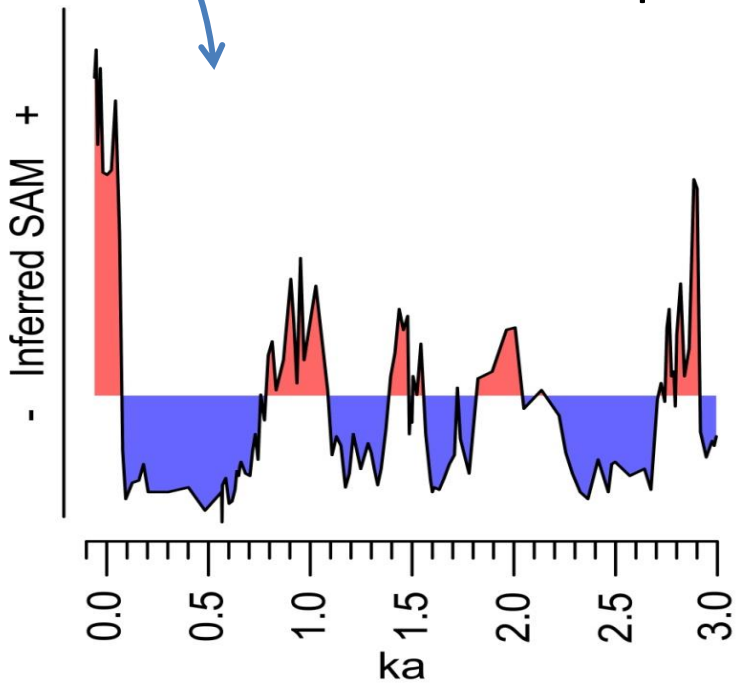
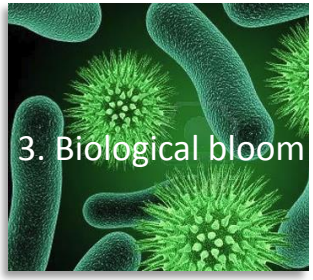


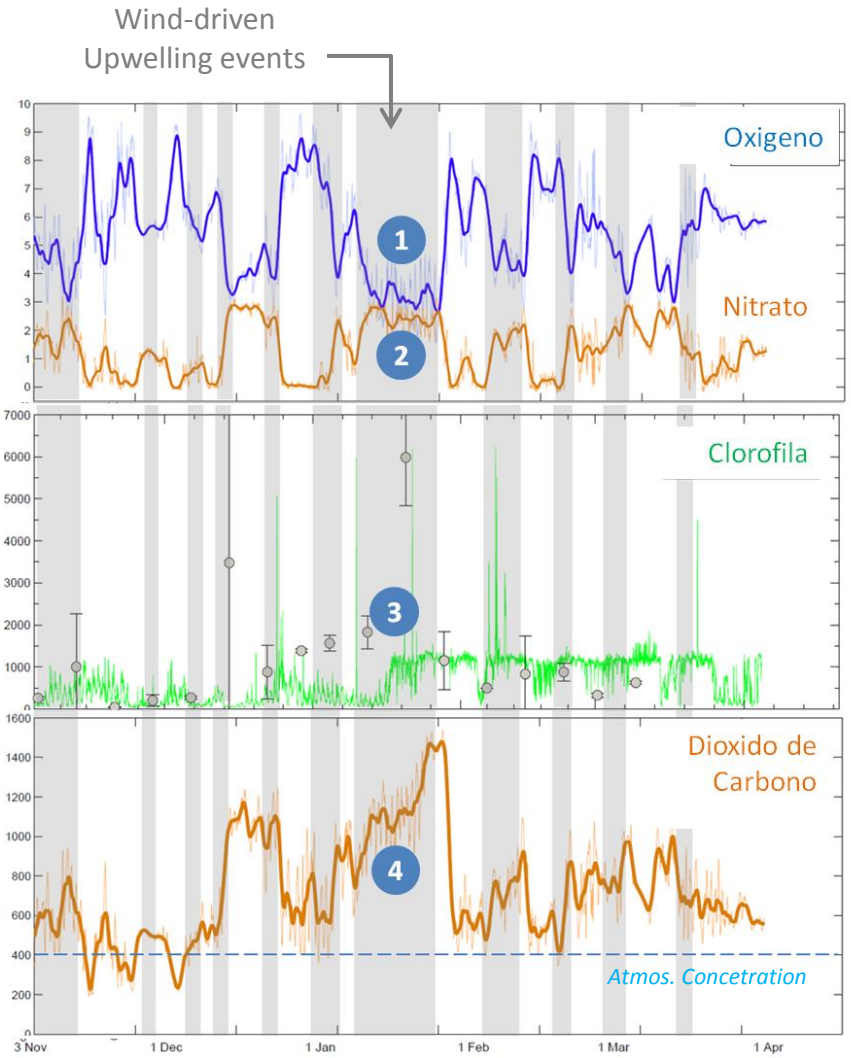
BioGeoChemistry: From wind to fish to carbon

1. Low O2

2. Plenty of nutrients



4. CO2 and others GEI Chimney



Nov 2016 – Abril 2017

POSAR
Plataforma de Observación del Sistema Acoplado Océano AtmósfeRa

BioGeoChemistry: From wind to fish to carbon

Surgencia más activa y durante más tiempo

Enfriamiento costero

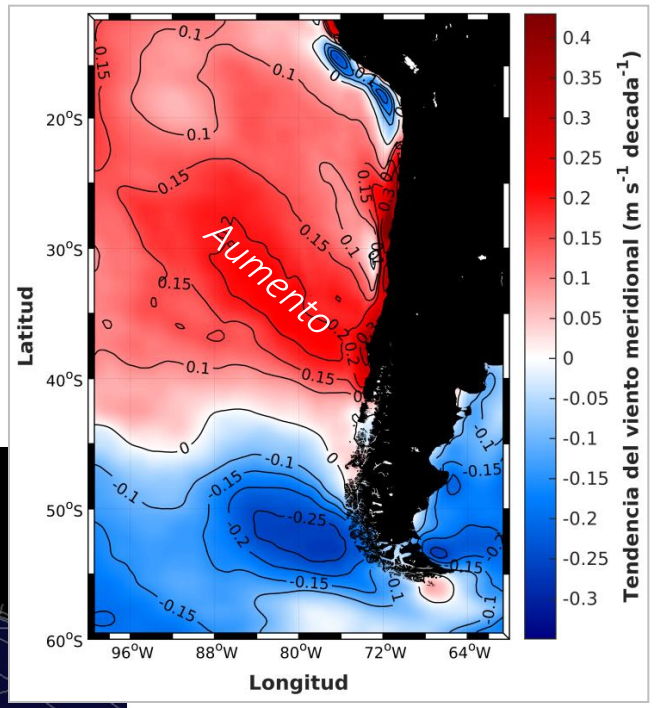
Mayor disponibilidad de nutrientes

Más episodios de hipoxia

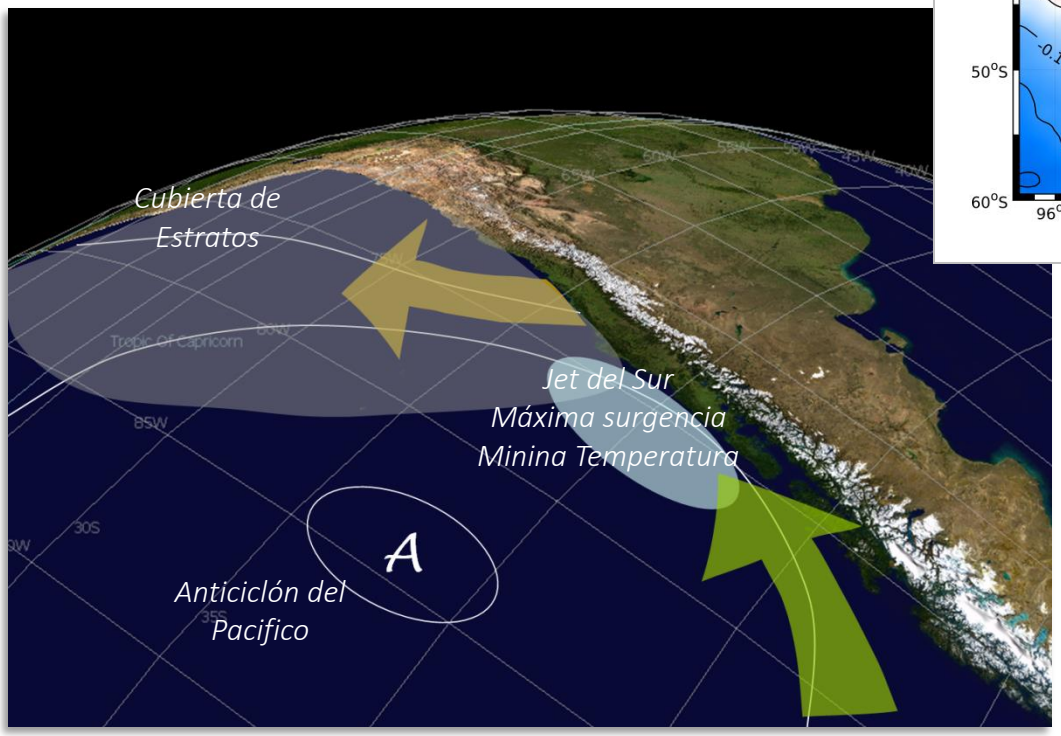
Mayor turbulencia

Recursos Pesqueros, FANs ???

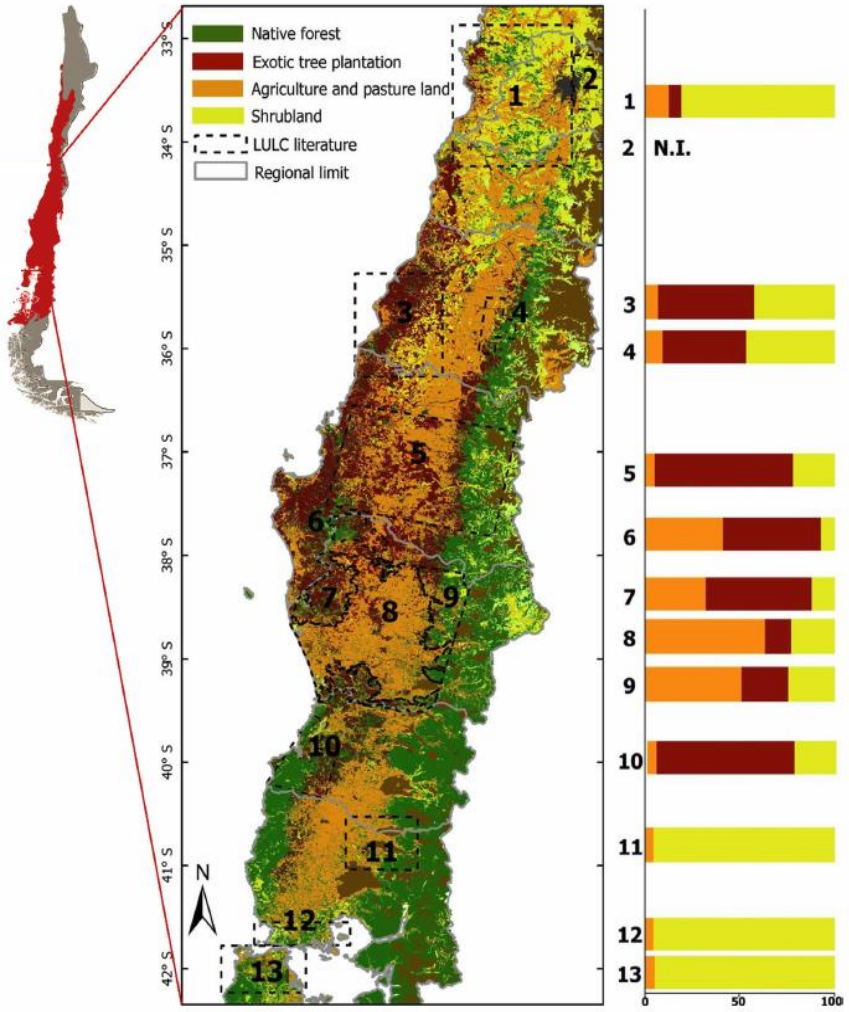
Aumento emisiones GEI



Tendencias de Viento del Sur 1990-2015 (Aguirre et al. 2017)



Ecosystem Services: From despair to hope

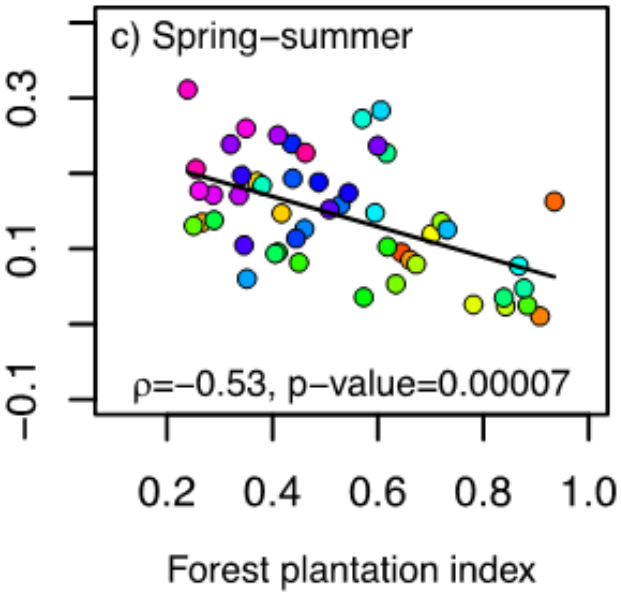


Miranda al. 2015

Native forest Loss 1973-2011 782.000 ha (19% of the initial area)

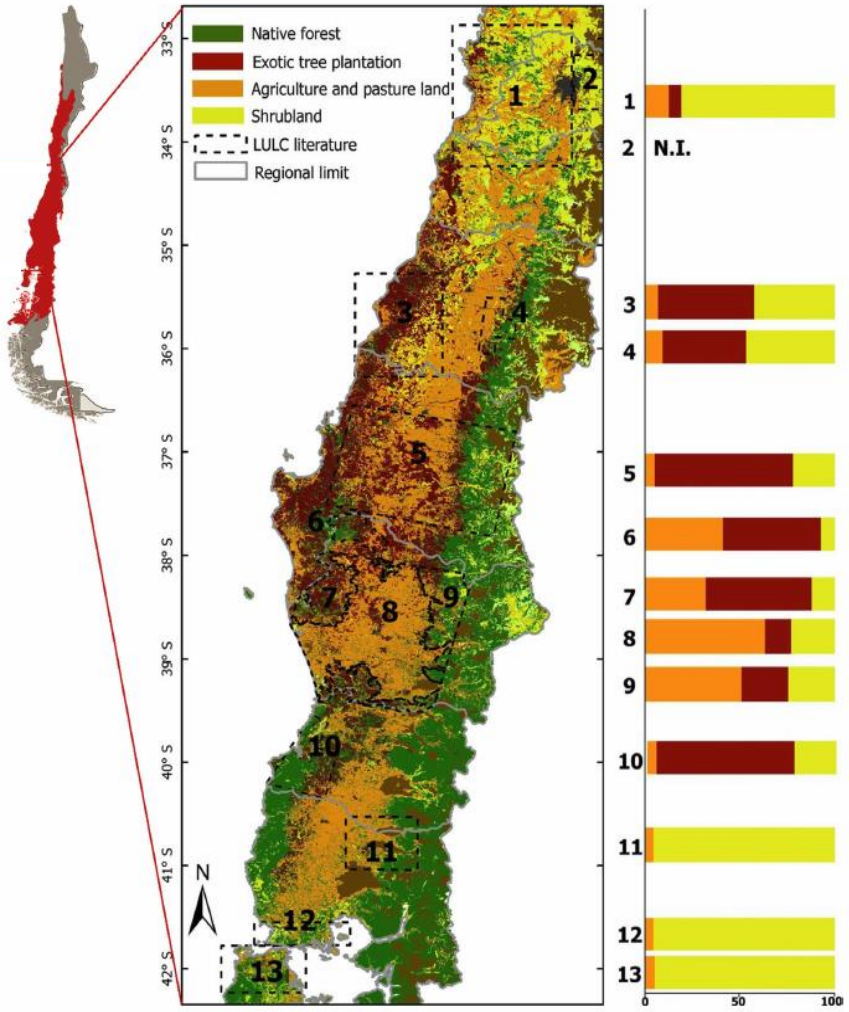
Mainly due to its conversion to Exotic Forest Plantations and Shrublands

Basin's water production (Q/R)



Alvarez-Garreton et al. 2017

Ecosystem Services: From despair to hope



Miranda al. 2015

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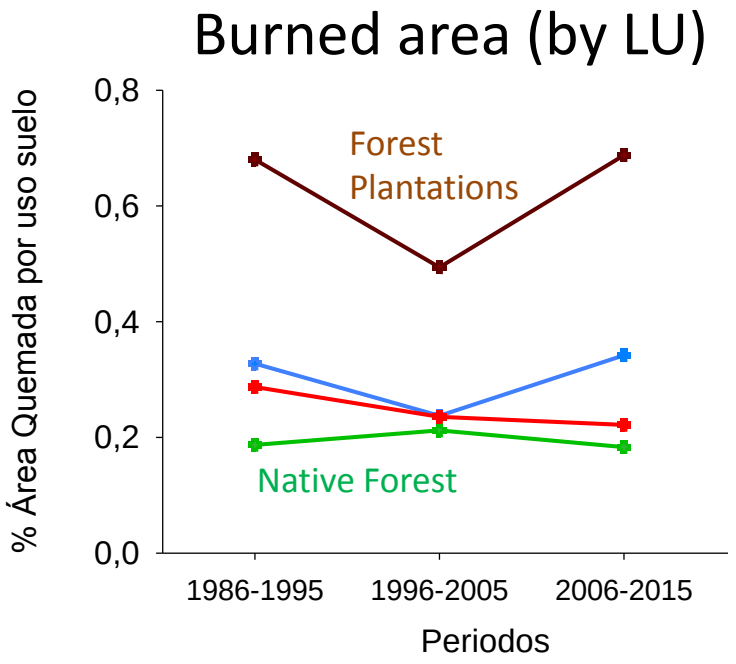
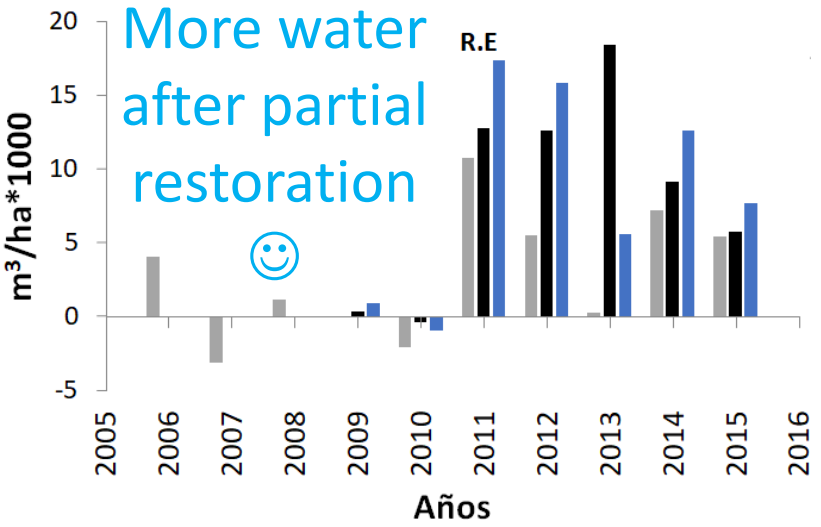


Lara et al. 2017

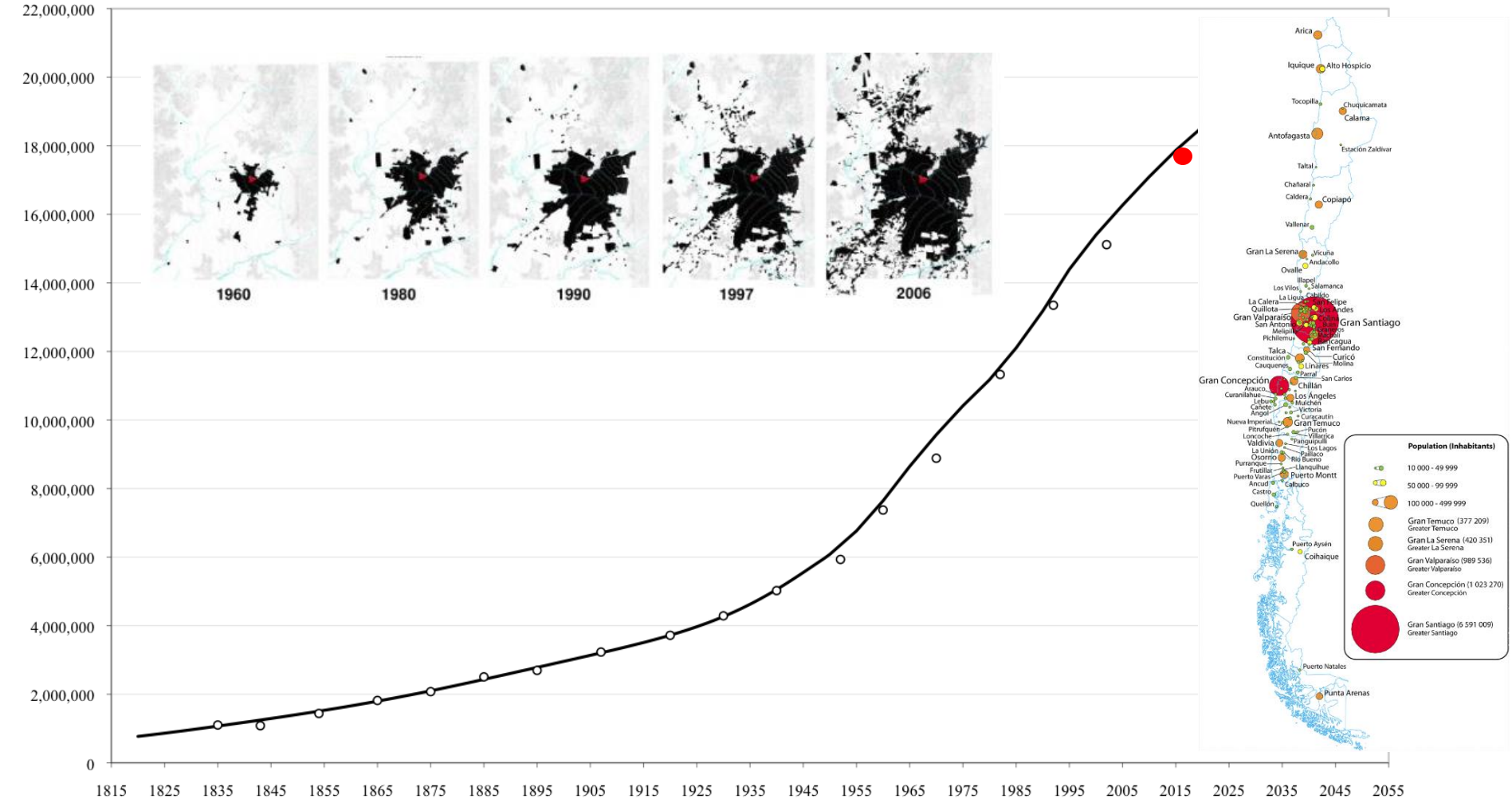
Ecosystem Services: From despair to hope



Lara et al. 2013

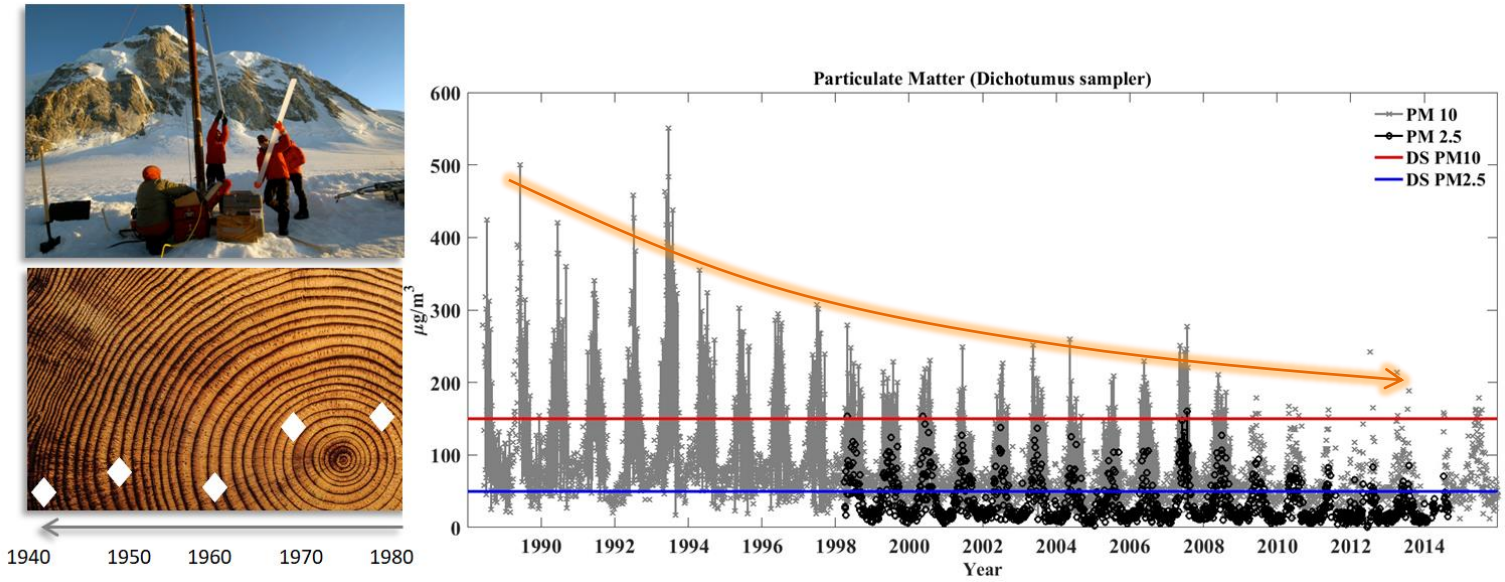
Human impacts: meet the *anthropocene*

Población total en Chile



Fuente: INE

Human impacts: meet the *anthropocene*



The evolution air quality over the past 30 years demonstrates the success of science-based policies, yet it also shows that **technological changes are not sufficient**.

Sustainable urban development requires **integrated science and policy that address complexity**, **emphasize behavioral changes**, and move beyond sectoral visions.

Gallardo et al. 2017

Climate Change Legislation

Ley de Cambio Climático

Climate Change Legislation

Ley de Cambio Climático?!

Climate Change Legislation

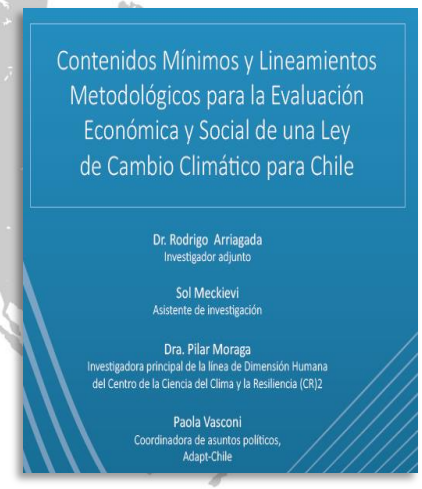
Mejorar la capacidad adaptativa de los sectores productivos y de la población al nuevo contexto normativo y biofísico definido por el cambio climático

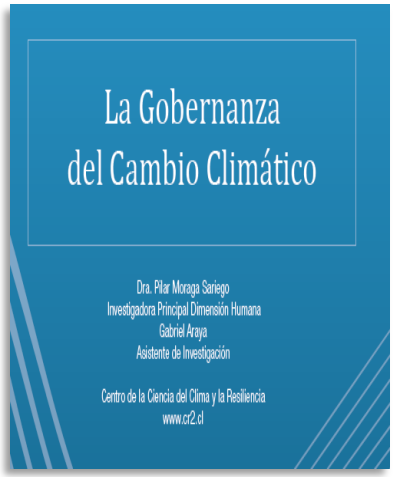
- ✓ **Disminuir la vulnerabilidad del país** y detener el avance de los impactos del cambio climático.
- ✓ **Disminuir emisiones de gases de efecto invernadero**, cumplimiento efectivo y eficiente de acuerdos internacionales
- ✓ **Disminuir pérdidas** en productividad de sectores económicos.
- ✓ **Creación de conciencia** social sobre cambio climático y sus impactos (sociales, económicos y ambientales) asociados.

Climate Change Legislation

Aunque en **Chile** hay **amplio conceso** respecto a los efectos del **cambio climático**, es necesario un marco institucional que permite hacer frente a los desafíos que plantea el cambio climático:

- ✓ Transversalidad de la agenda climática.
- ✓ Perspectiva de largo plazo.
- ✓ Asimetría de poder de las áreas a cargo de los temas climáticos frente a otras áreas de gobierno.

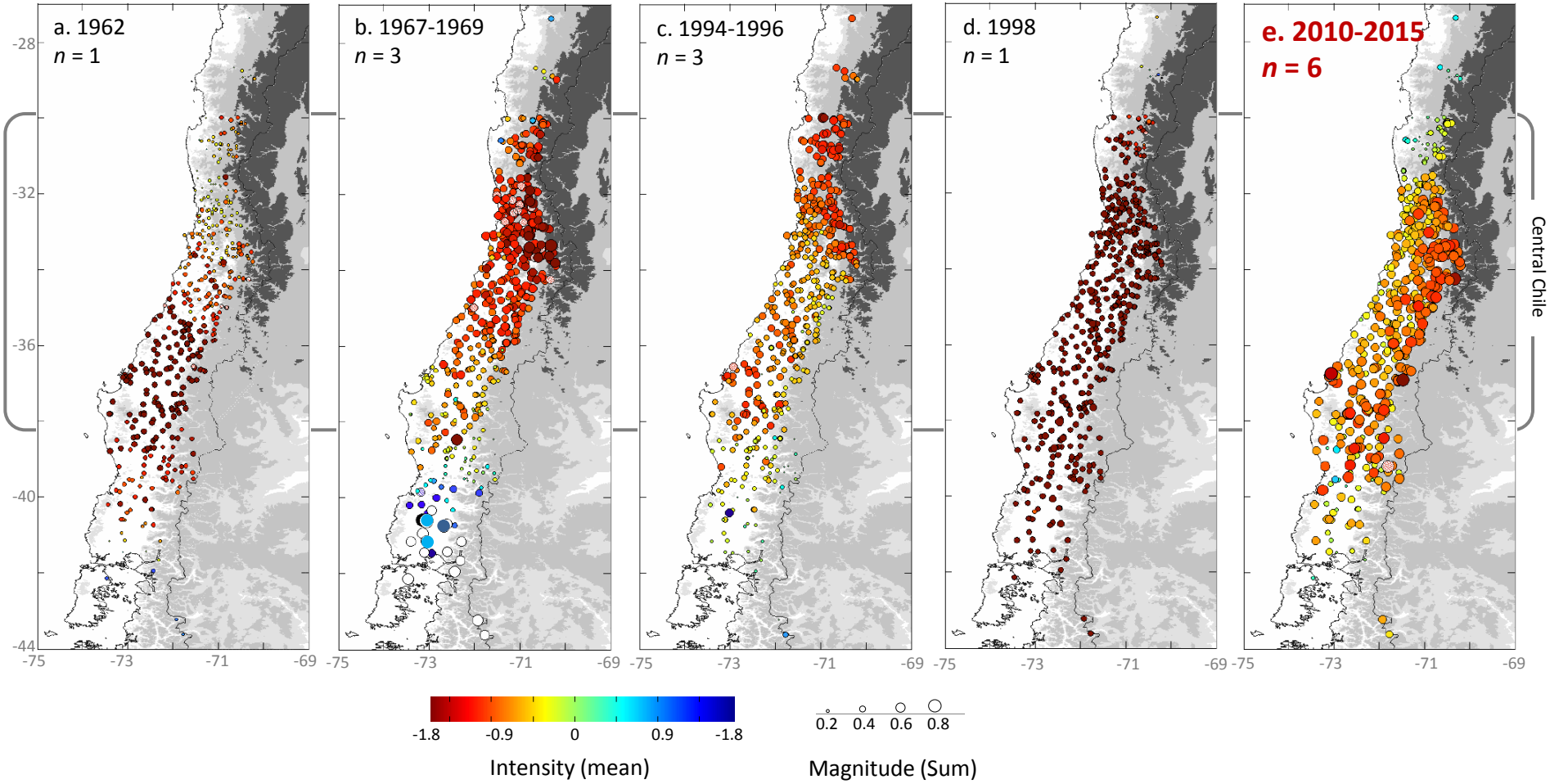




Moraga y colaboradores

Grandes sequía contemporaneas

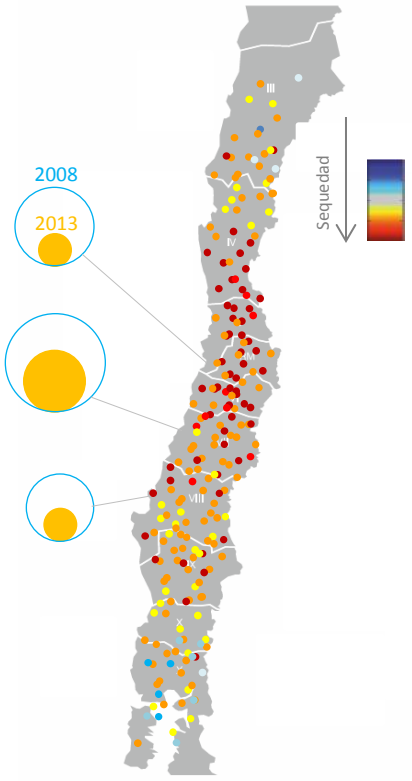
Indice Estandarizado de Precipitación (SPI-12, Dic)



Garreaud et al. 2017

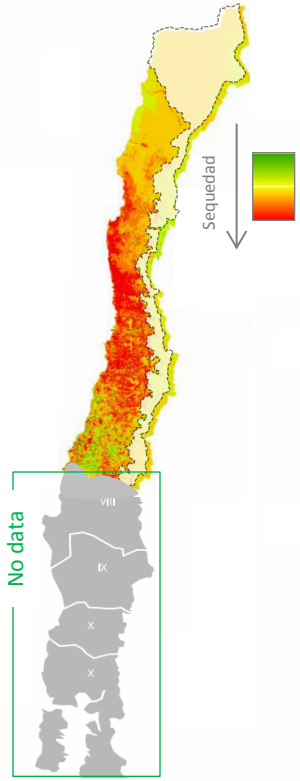
La Megasequía 2010-2015

Transporte de sedimentos en invierno

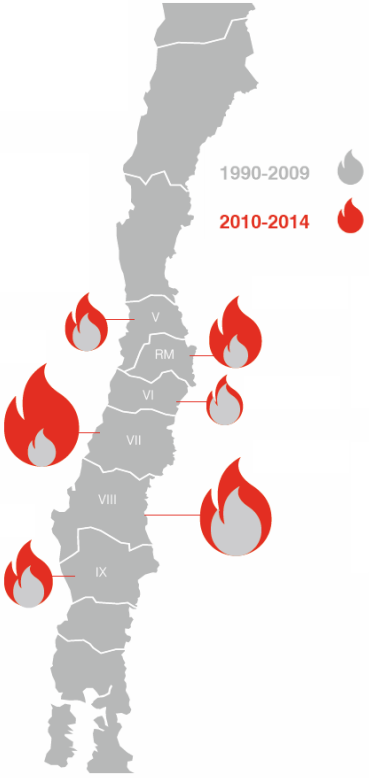


Déficit Pluviométrico (2010-2014)

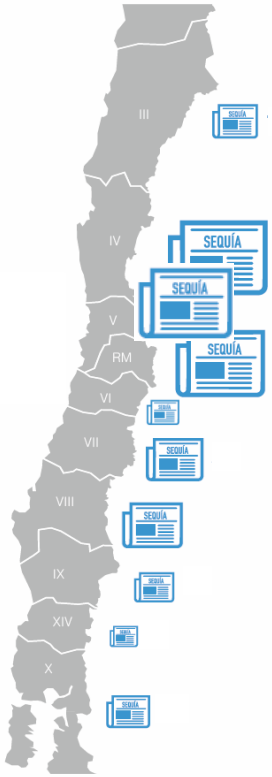
Deterioro vegetación Agosto 2010-2015



Incendios forestales de magnitud



Apariciones en prensa escrita (2014)



Gastos en Camiones Aljibes (Mill$)

La Megasequía 2010-2015

Que funcionó? Que no? Percepción de las personas…

Aldunce et al. 2016

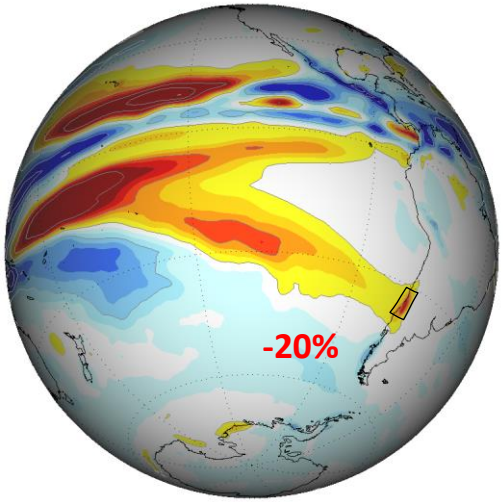
La Megasequía 2010-2015
Una lección para el futuro

Center for Climate and Resilience Research
www.CR2.cl

La Megasequía 2010-2015

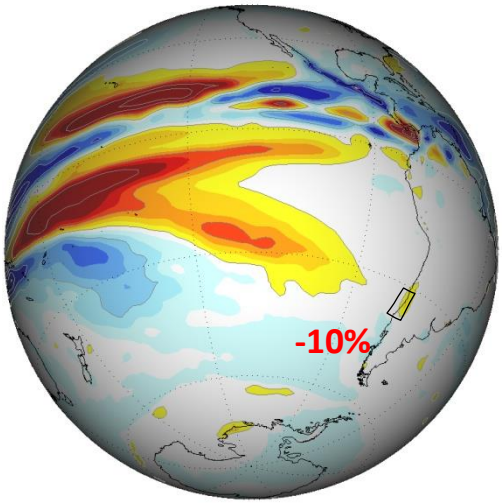
Anomalías de precipitación, MJJAS, 2010-2015
simuladas por diversos modelos. Defict observado ~**30%**

AMIP-ORF



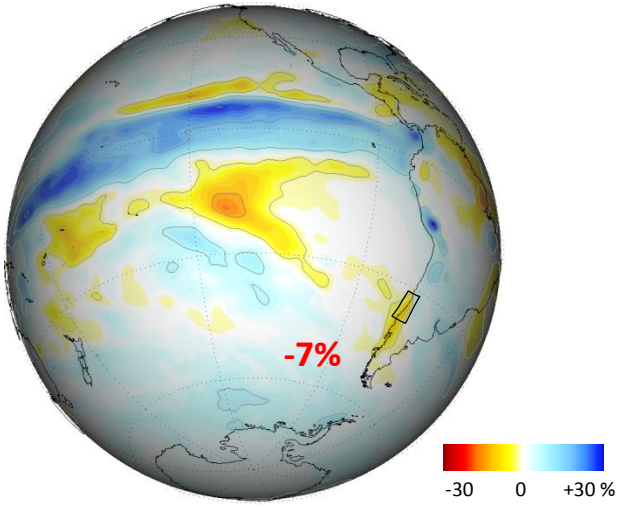
TSM prescrita
GEI actuales
Promedio muchas corridas revela forzamiento del oceano en clima
NAT+ANTROP

AMIP-NHF



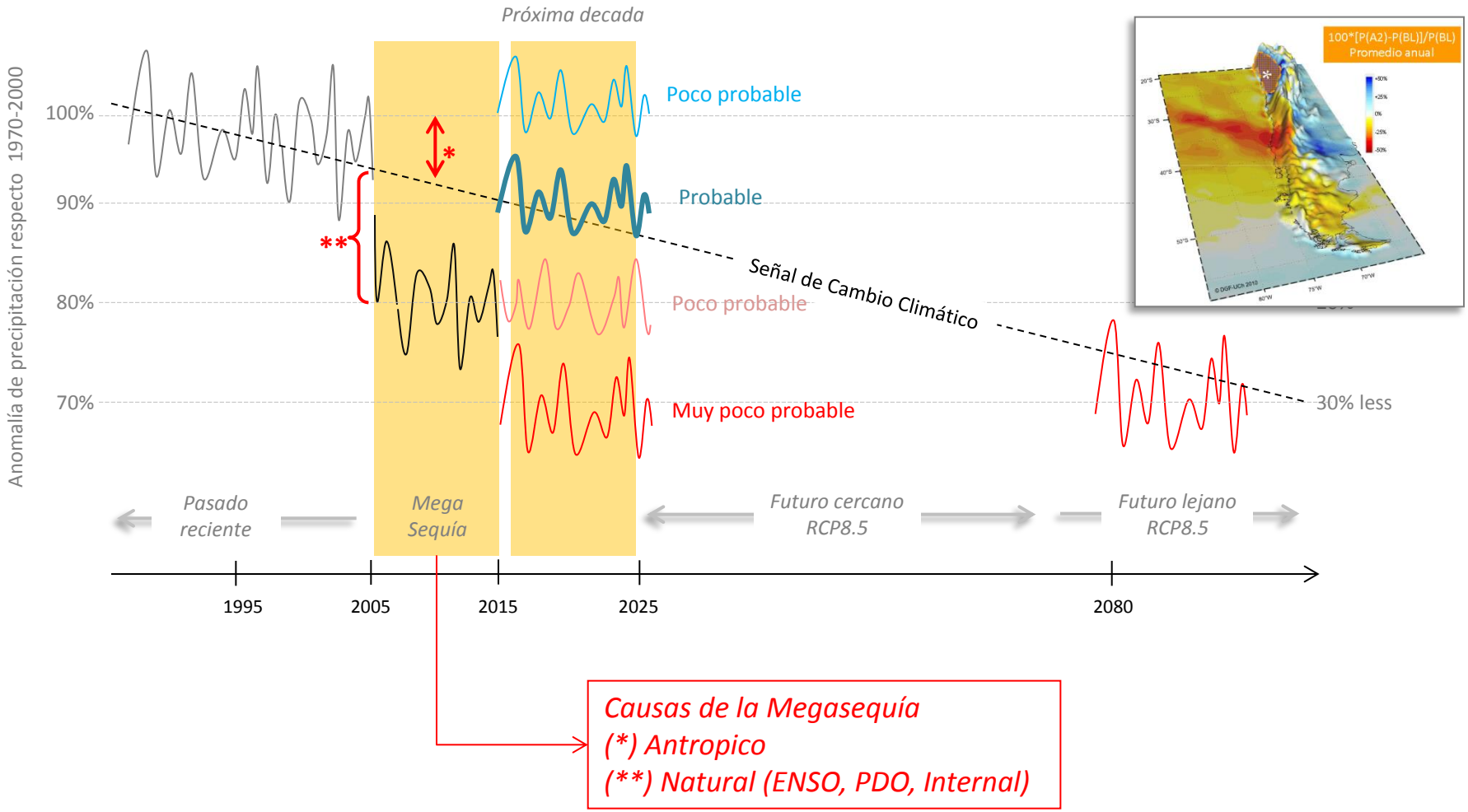
TSM prescrita
GEI historicos (1800)
Promedio muchas corridas del mismo modelo (CAM5.1)
NAT'

CMIP5/RCP8.5

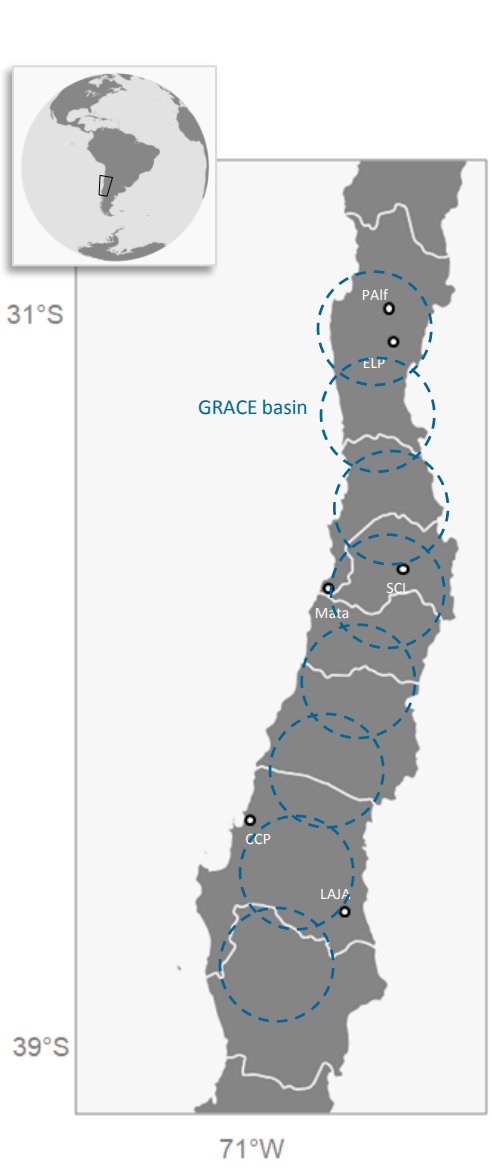


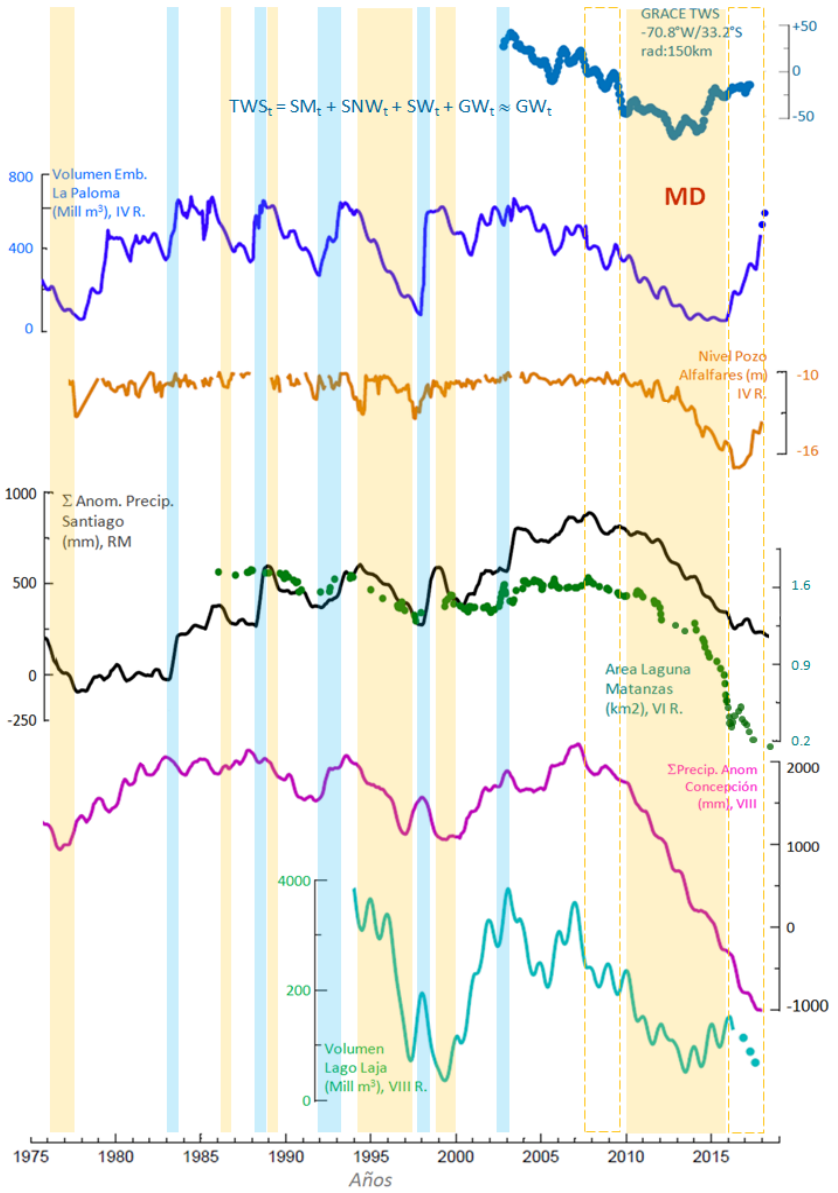
TSM calculada
GEI actuales
Promedio muchos modelos revela forzamiento radiativo
ANTROP

Precipitación en Chile Central
El desafío de la próxima década



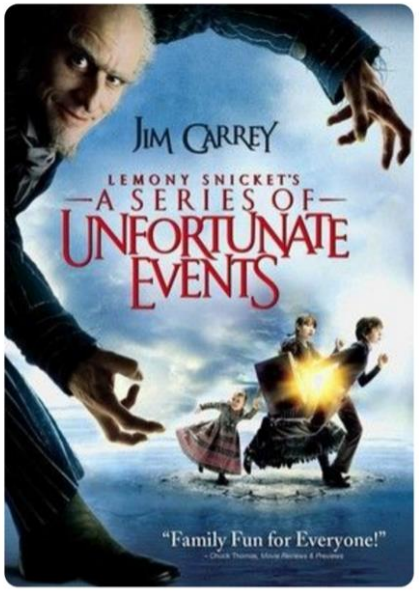
De la mega-sequía a la media-sequía

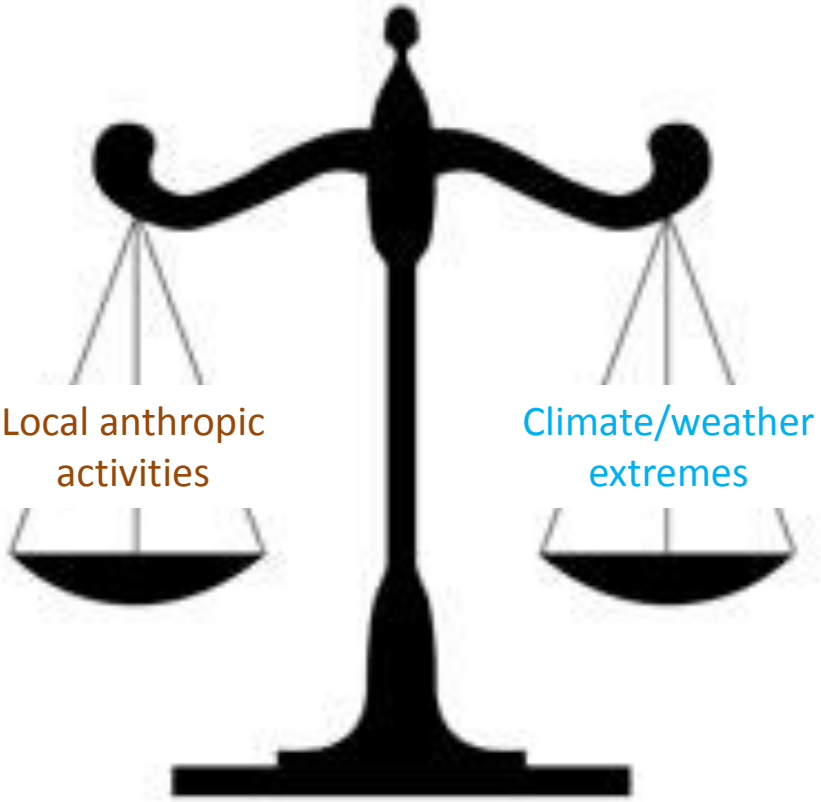




Extreme environmental events

Social tension and economical impacts





CR2-2.0 We are ready!