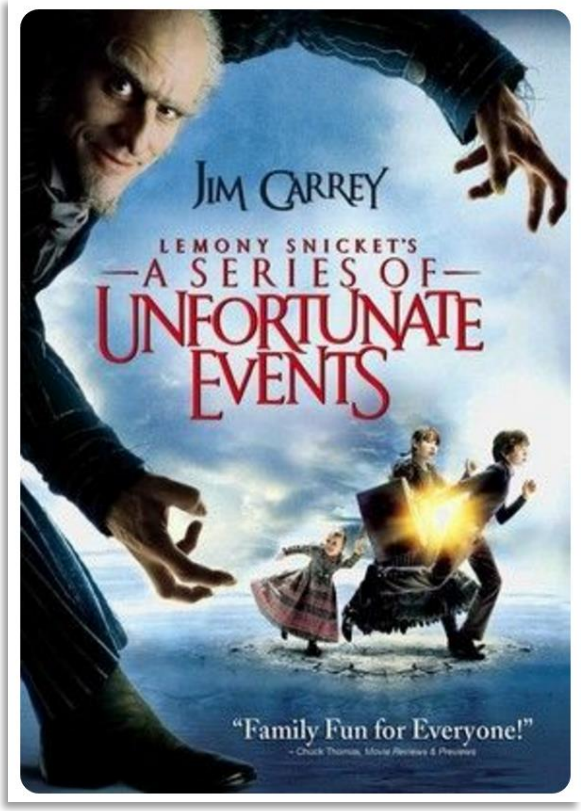
CR2 fifth aniversary

16 October 2017

A Series of Unfortunate Events

The role of climate change on recent high impacts events in Chile



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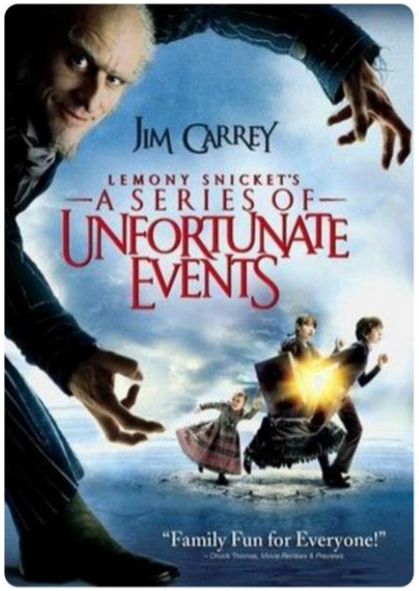
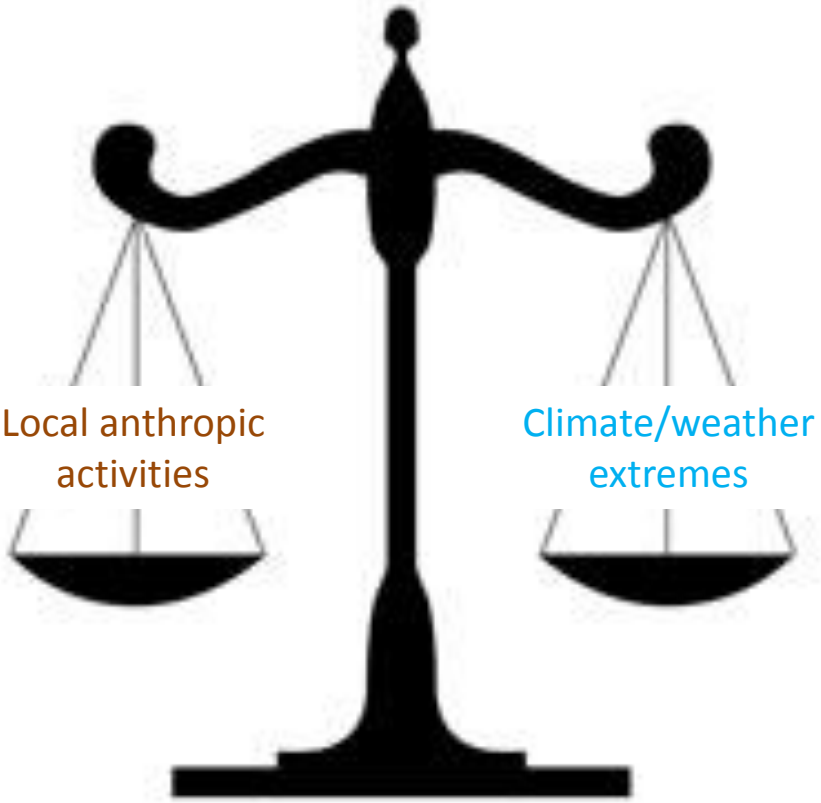
2. Departamento de Geofísica, Universidad de Chile
3. Dirección Meteorológica de Chile

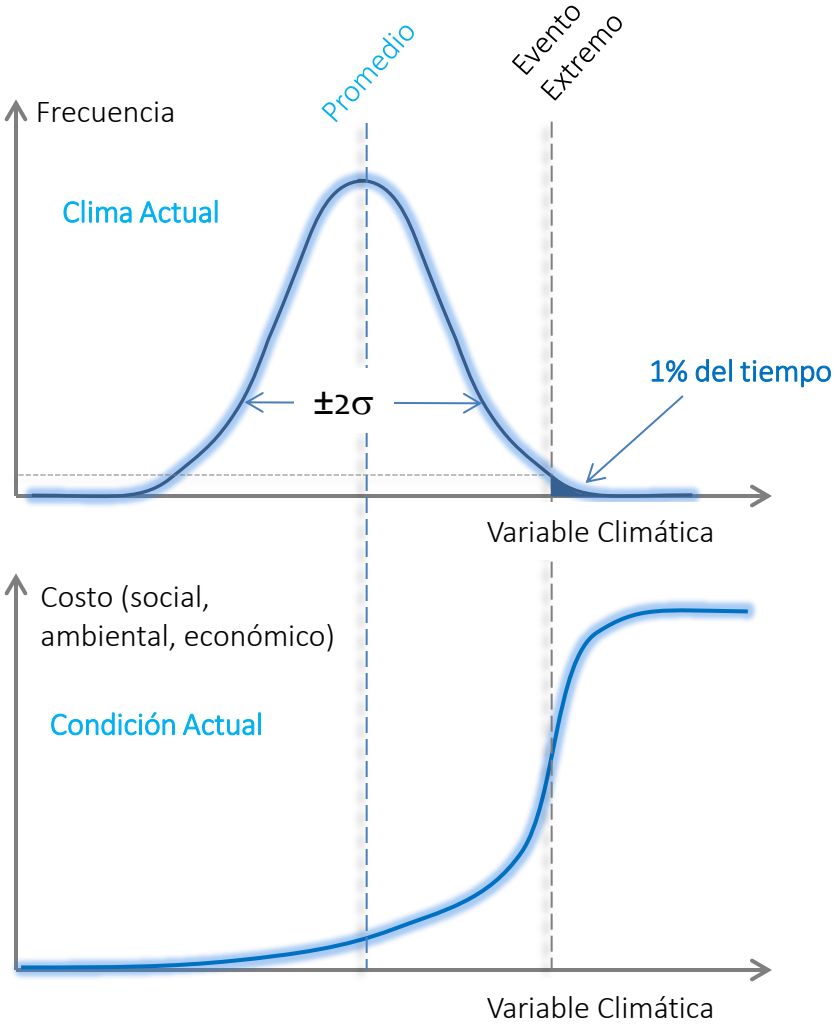
Extreme environmental events

→ Social tension and economical impacts





The disproportionate effects of climate extremes



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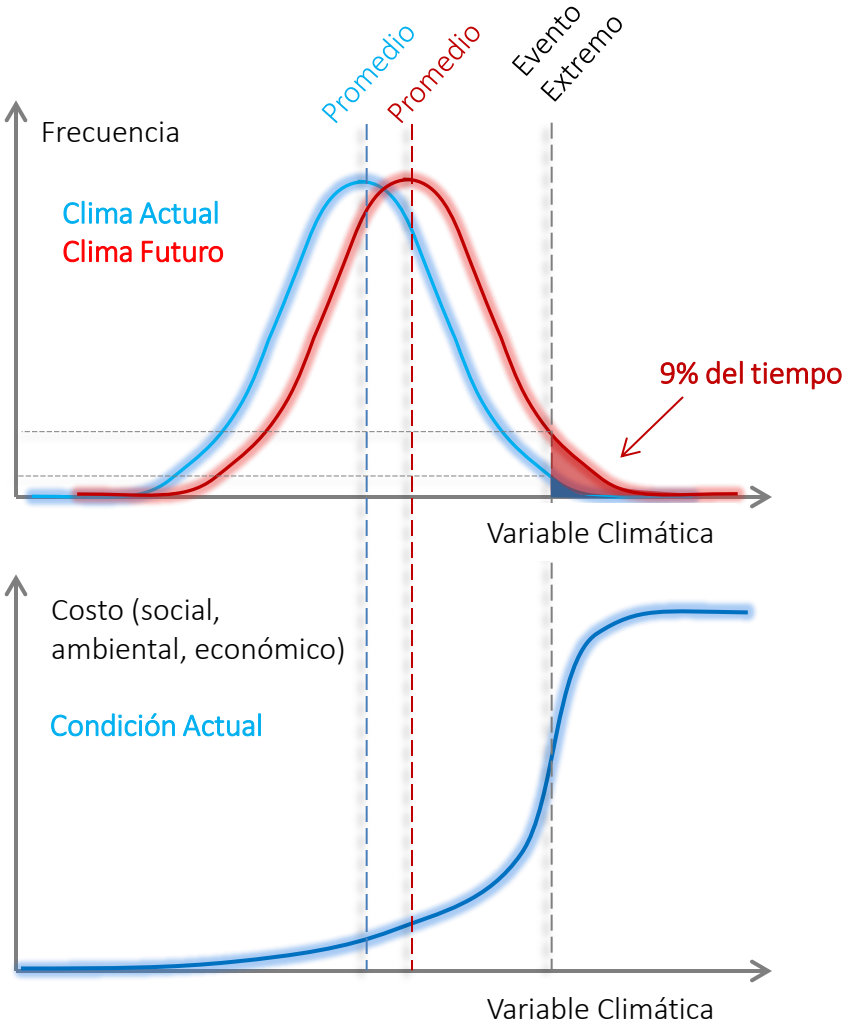

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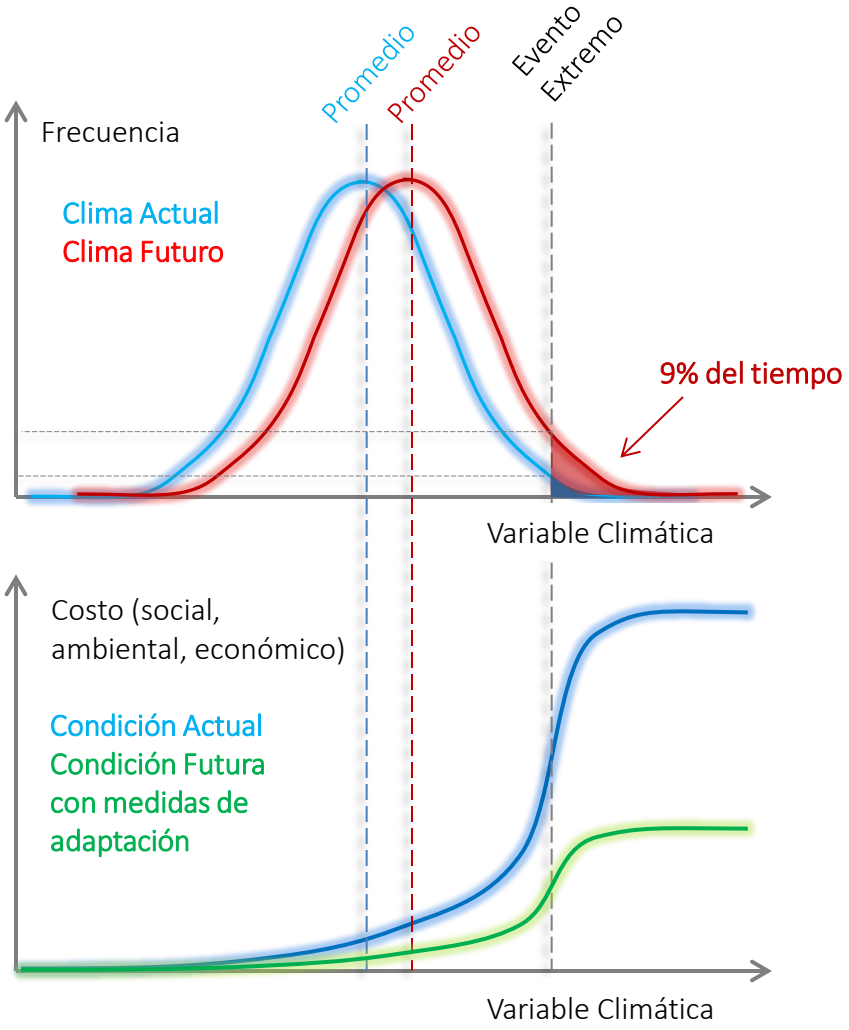
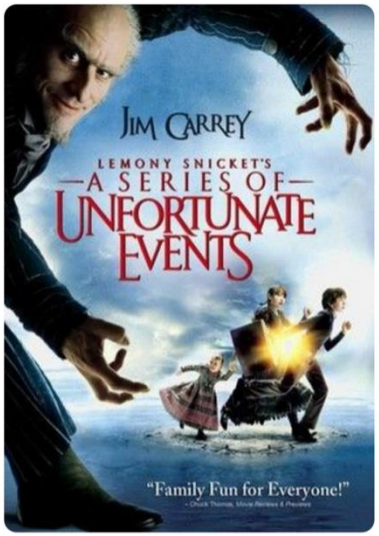
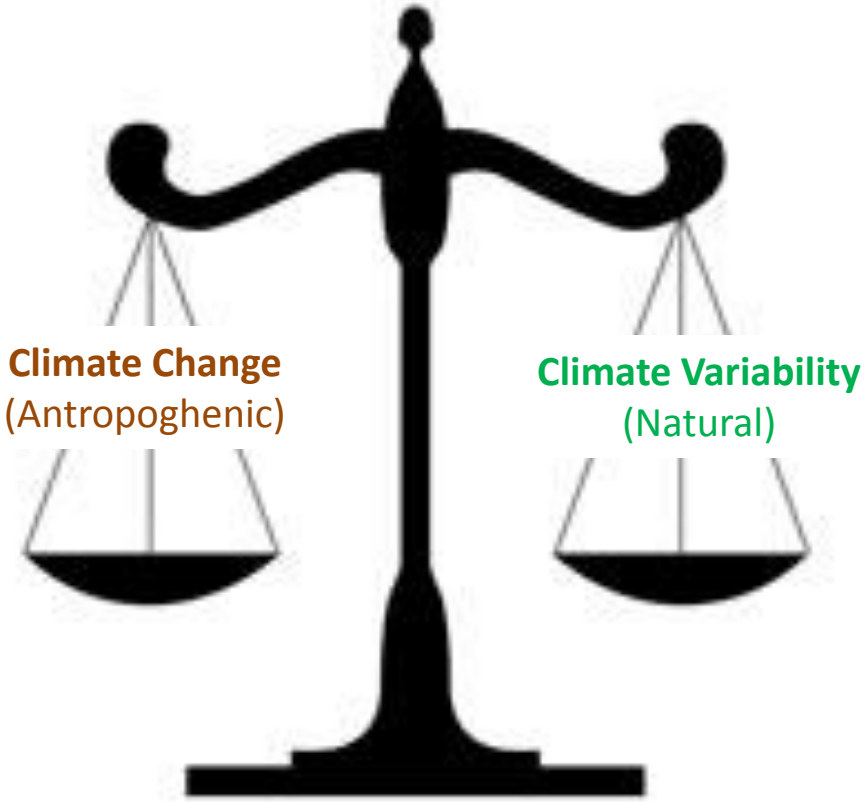


The previous balance is a major interdisciplinary issue…

…but climatologists have their own balance



Climate Extremes



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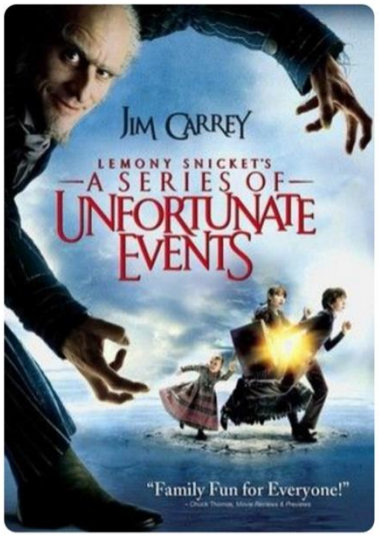
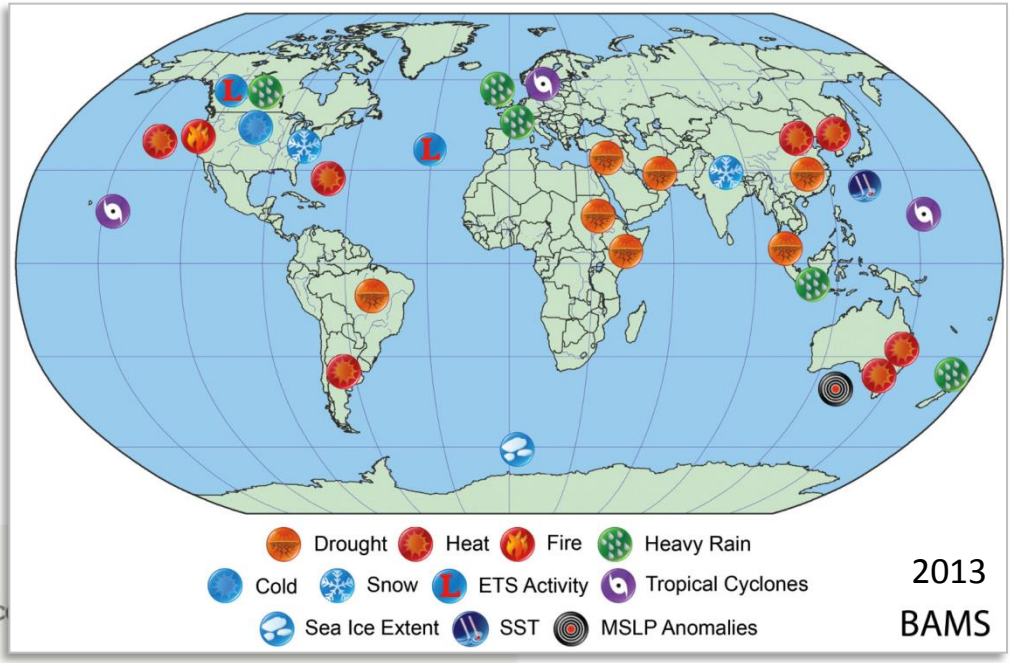
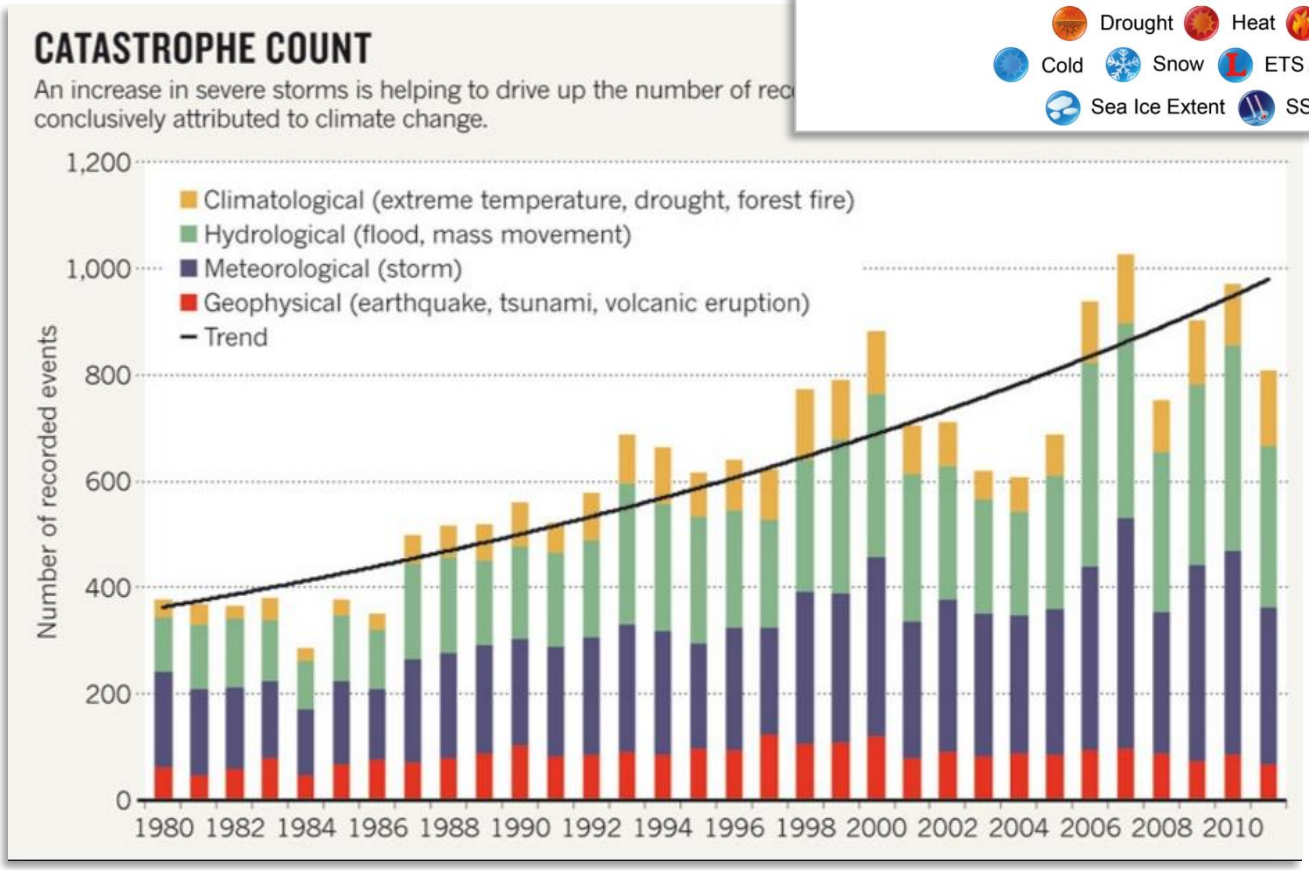


Climate Extremes

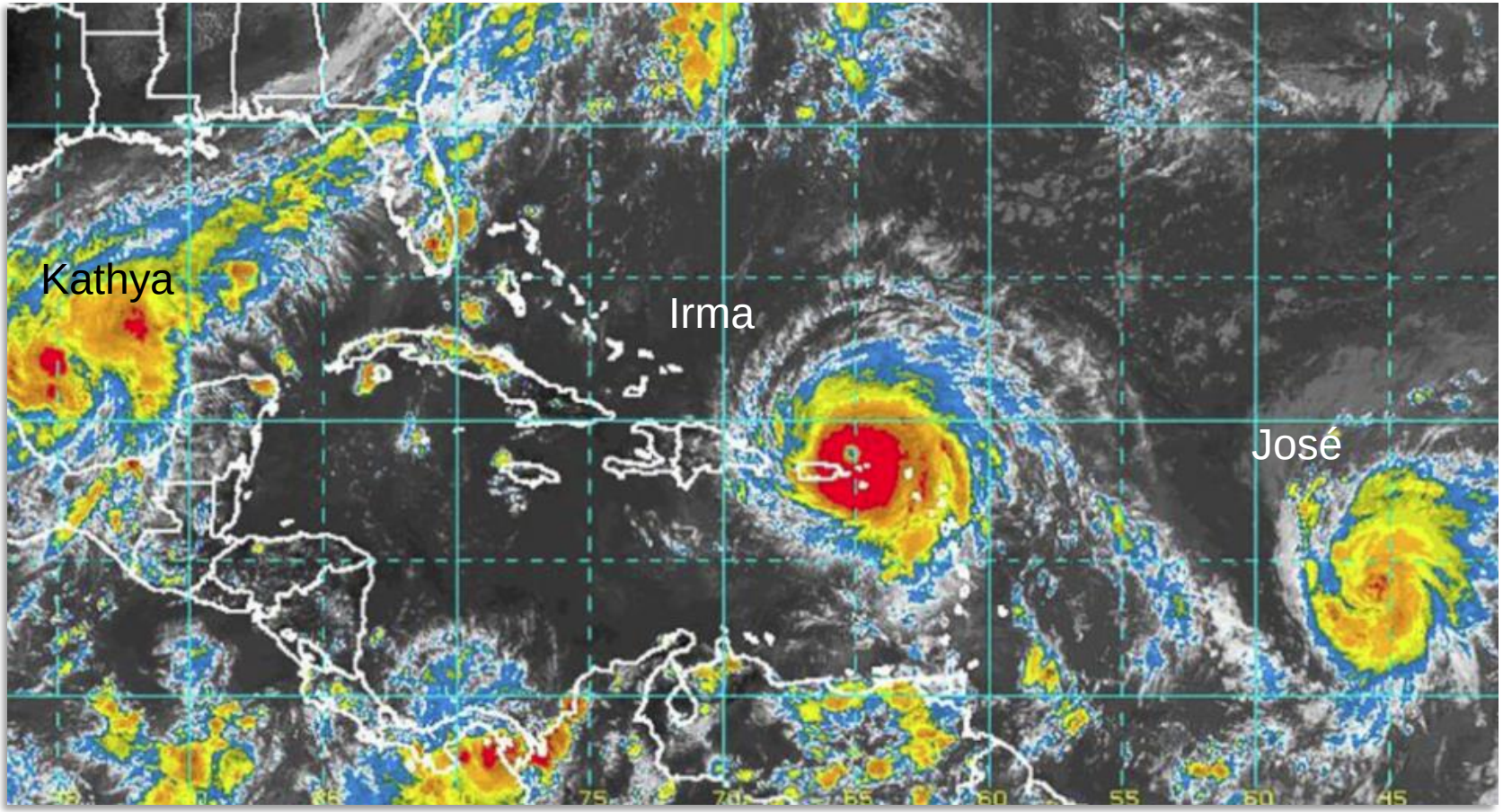
Global Perspective





Munich-RE, 2013

Global Perspective & media coverage



The scorching 2017 summer

Anomalías Tx Enero 2017

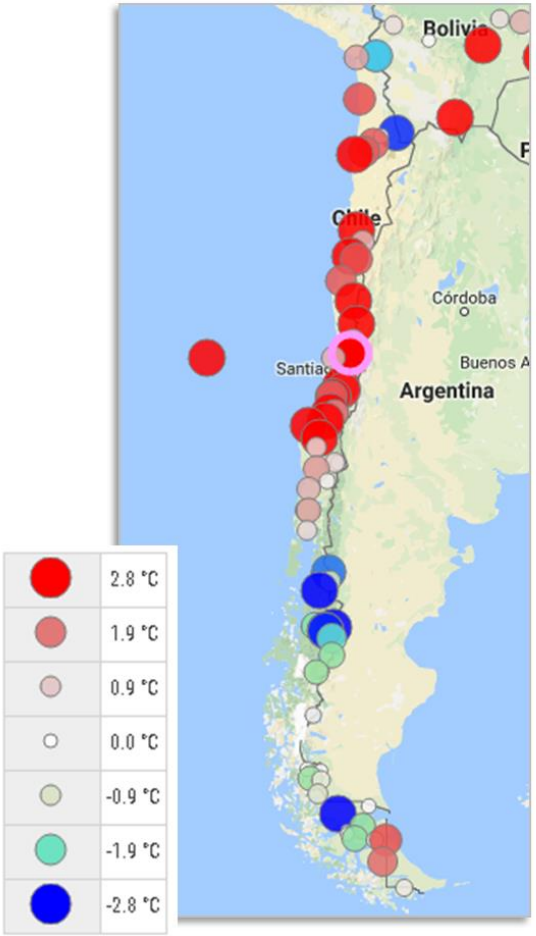
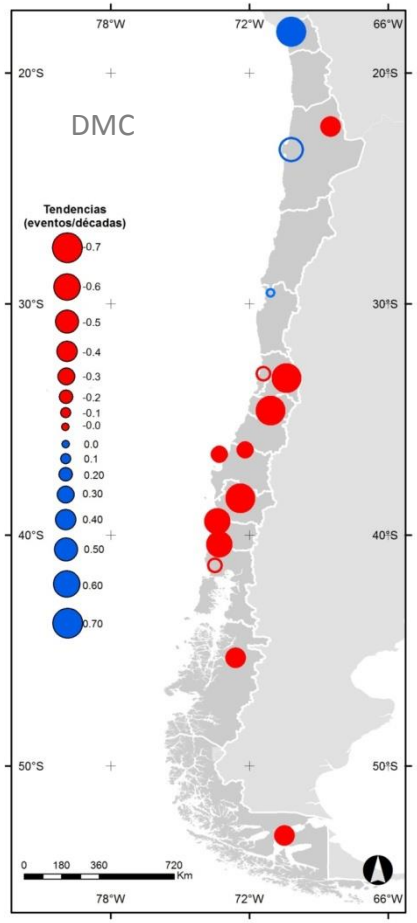


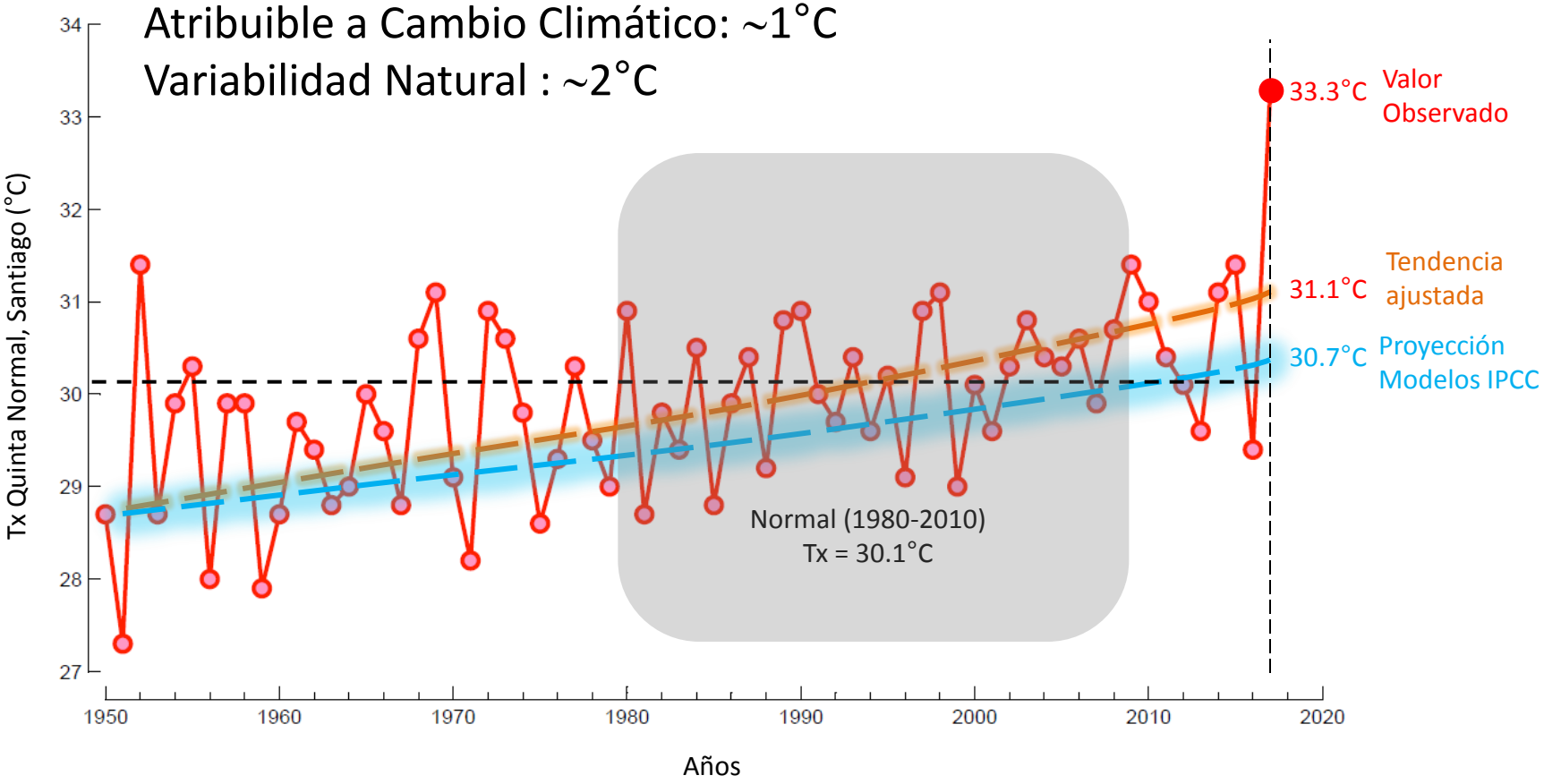
Imagen MODIS Visible 27-01-2017

Tendencias olas de calor

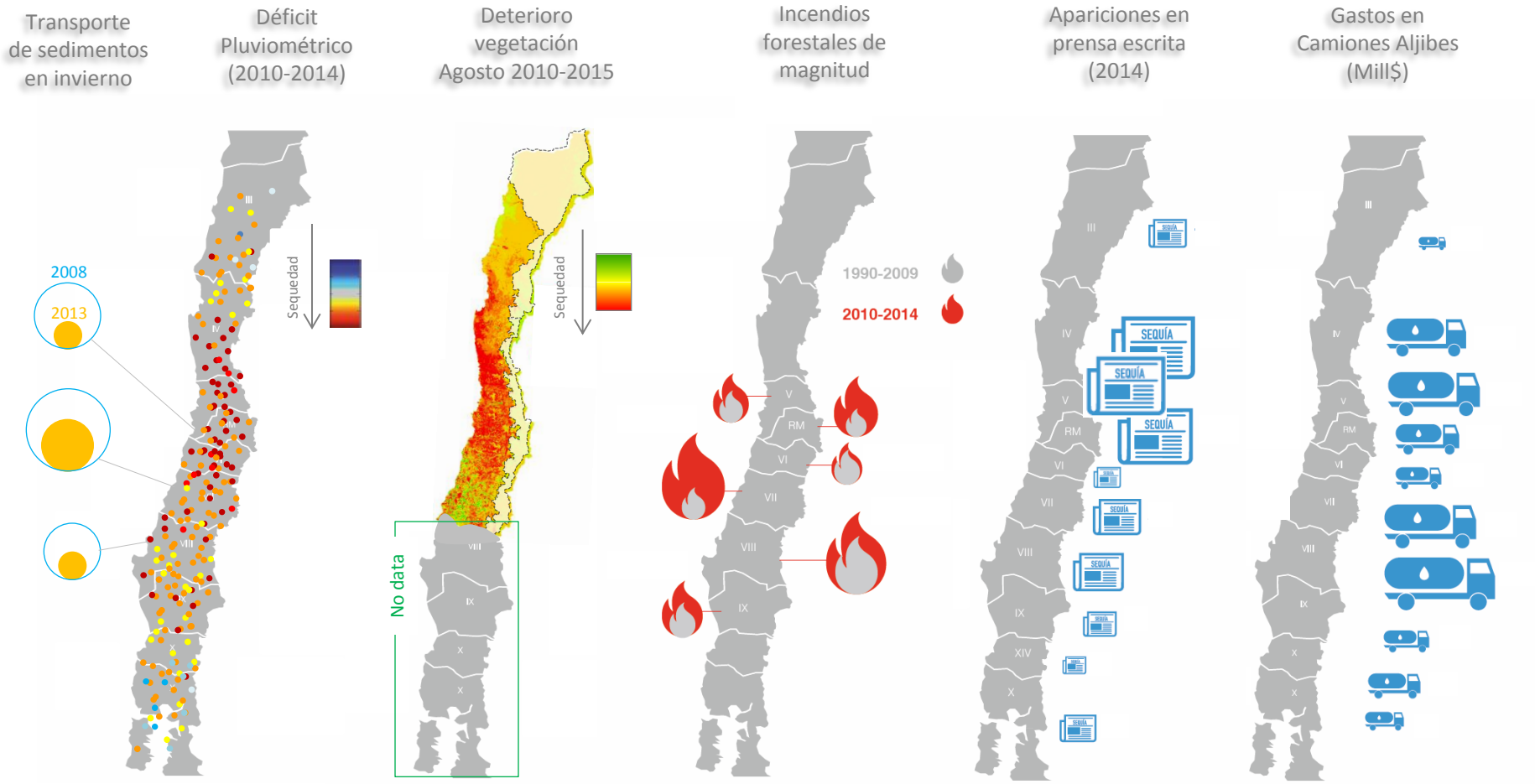


The scorching 2017 summer

TMax Stgo. Enero 2017: 33.1°C
Aumento por encima de la normal: +3°C
Atribuible a Cambio Climático: ~1°C
Variabilidad Natural : ~2°C

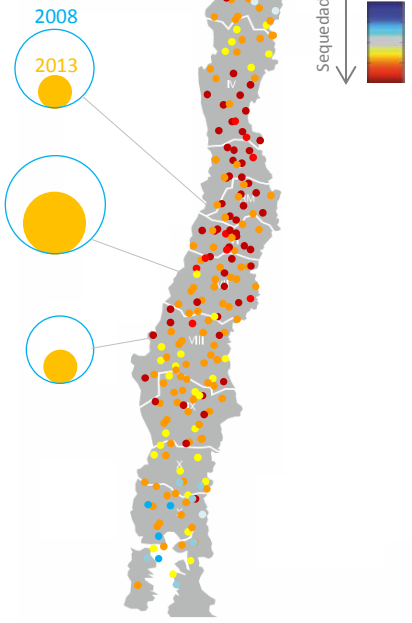


The central Chile megadrought 2010-2015



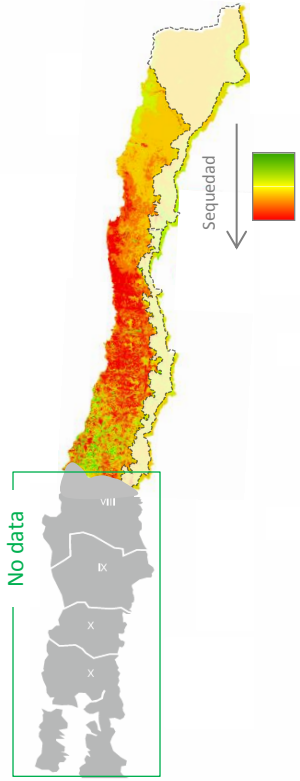
The central Chile megadrought 2010-~~2015~~ 2017

Transporte de sedimentos en invierno

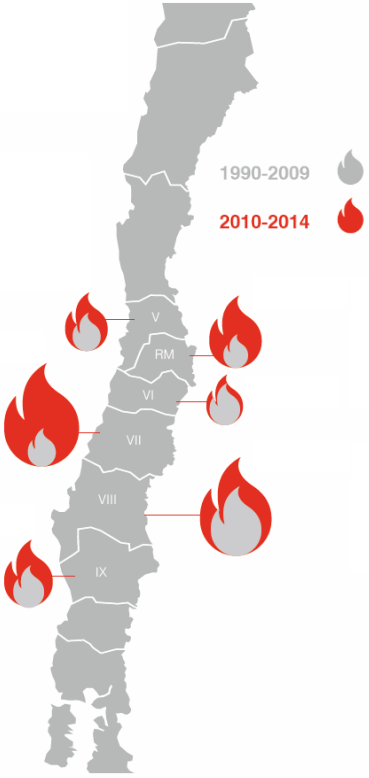


Déficit Pluviométrico (2010-2014)

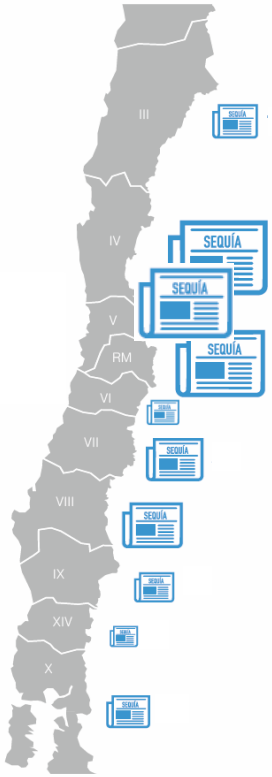
Deterioro vegetación Agosto 2010-2015



Incendios forestales de magnitud

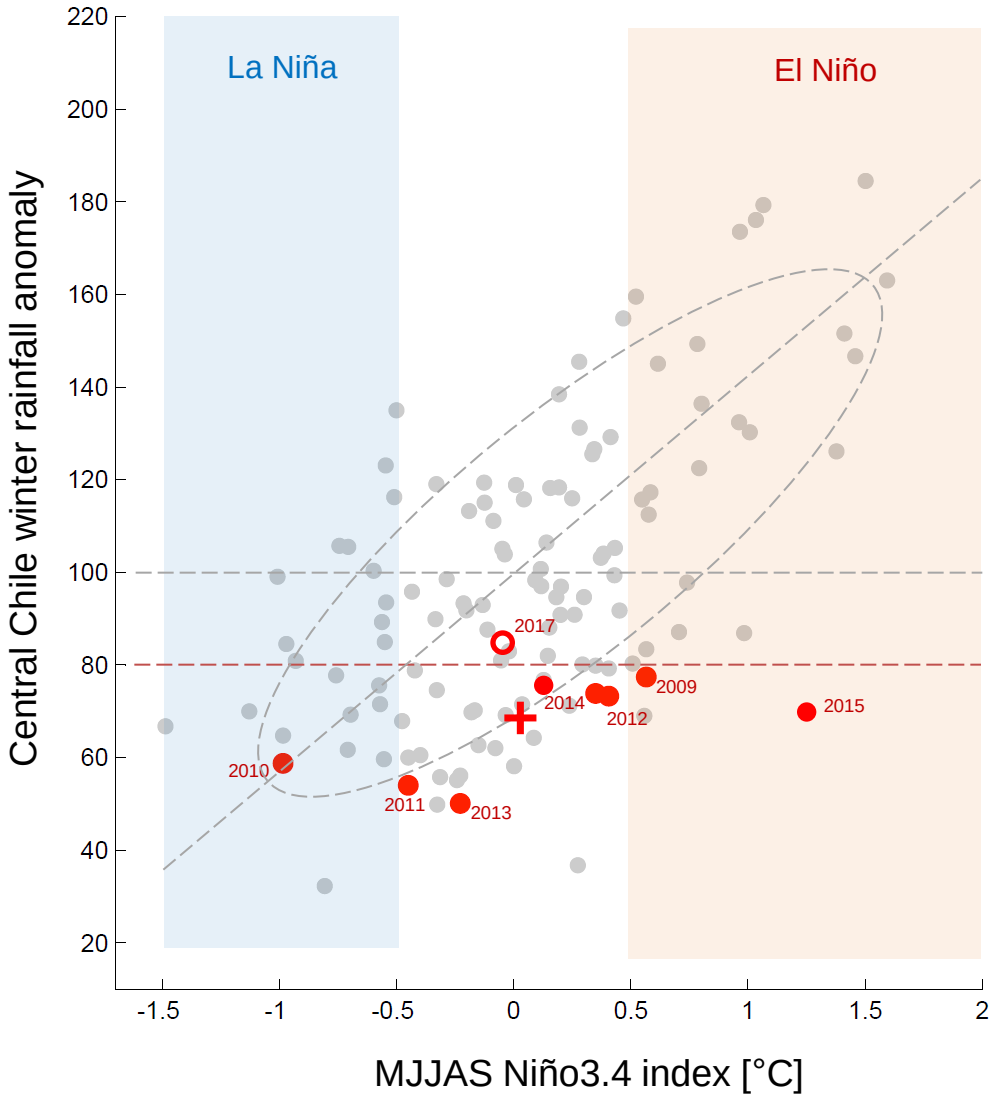


Apariciones en prensa escrita (2014)



Gastos en Camiones Aljibes (Mill$)

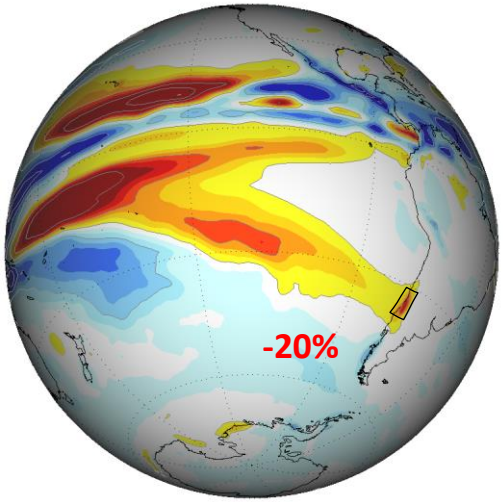
La Niña is not all…



The central Chile megadrought 2010-2015

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

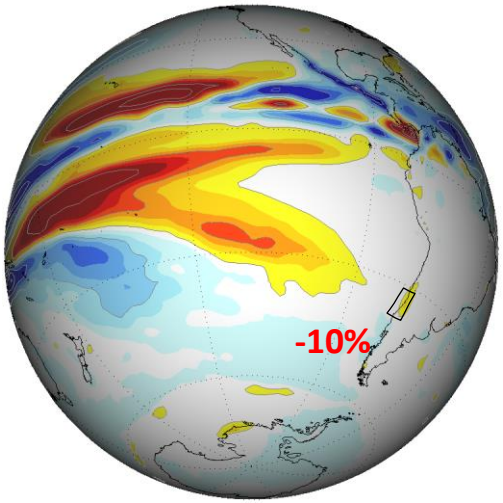
AMIP-ORF



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

NAT+ANTROP

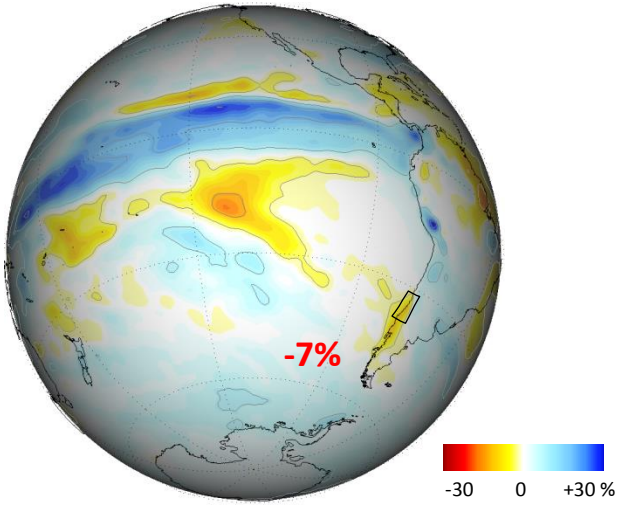
AMIP-NHF



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

NAT' (2/3)

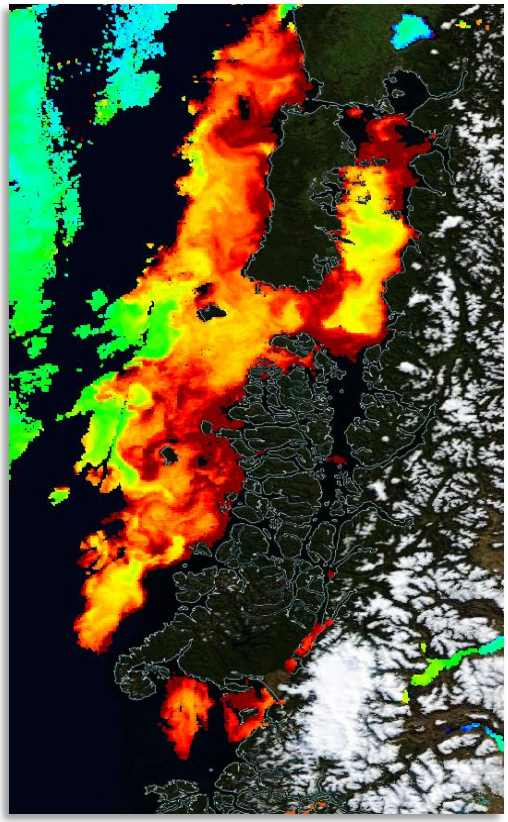
CMIP5/RCP8.5



TSM calculada
GEI actuales
Promedio muchos modelos revela forzamiento radiativo

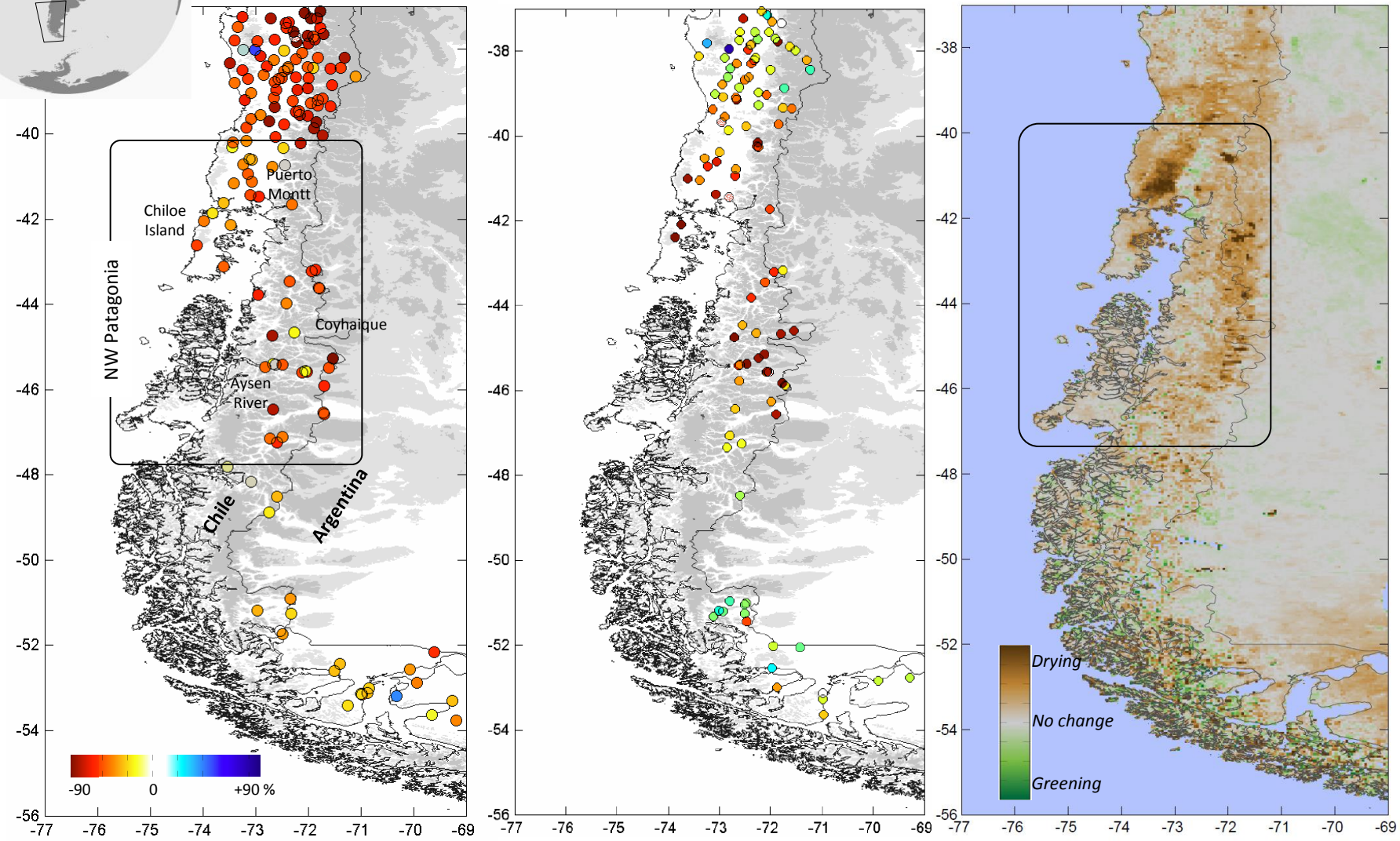
ANTROP (1/3)

The awful 2016 (JFM)

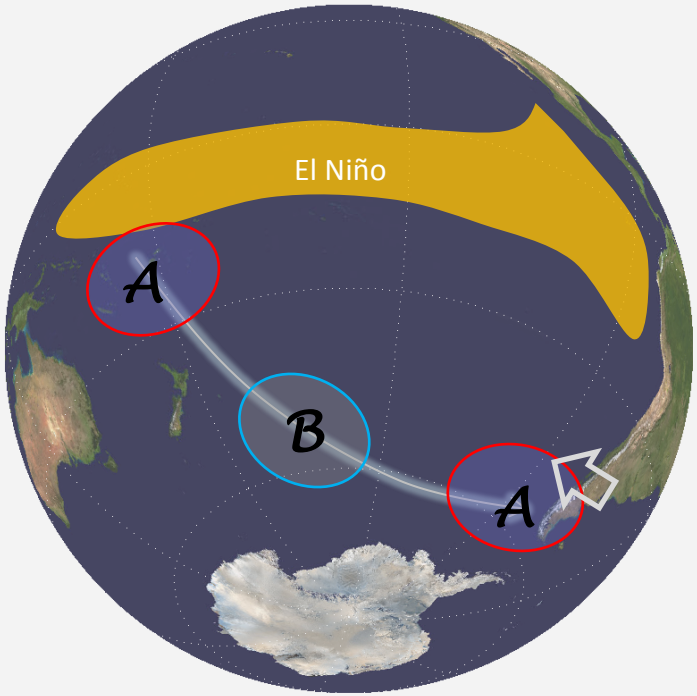


Clorfila, 03 Marzo 2016. MODIS

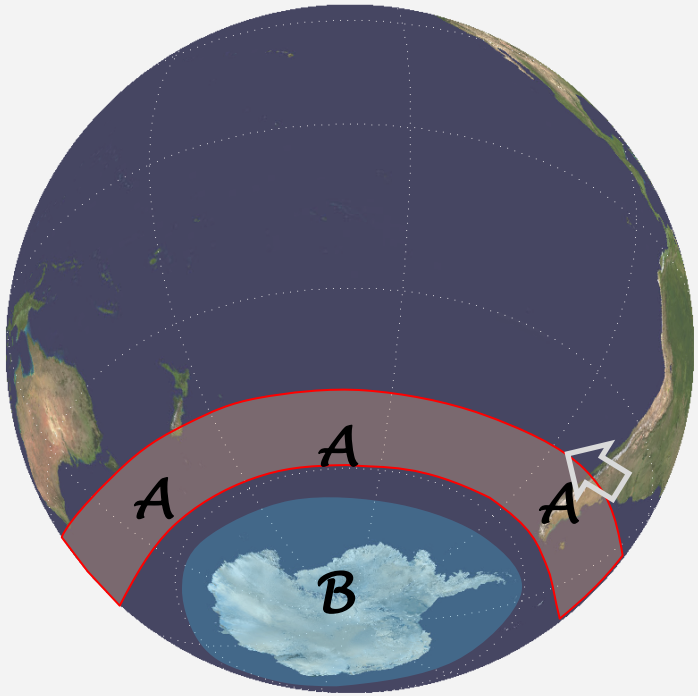
The awful 2016 (JFM)



ENSO and SAM impacts on Patagonia during summer



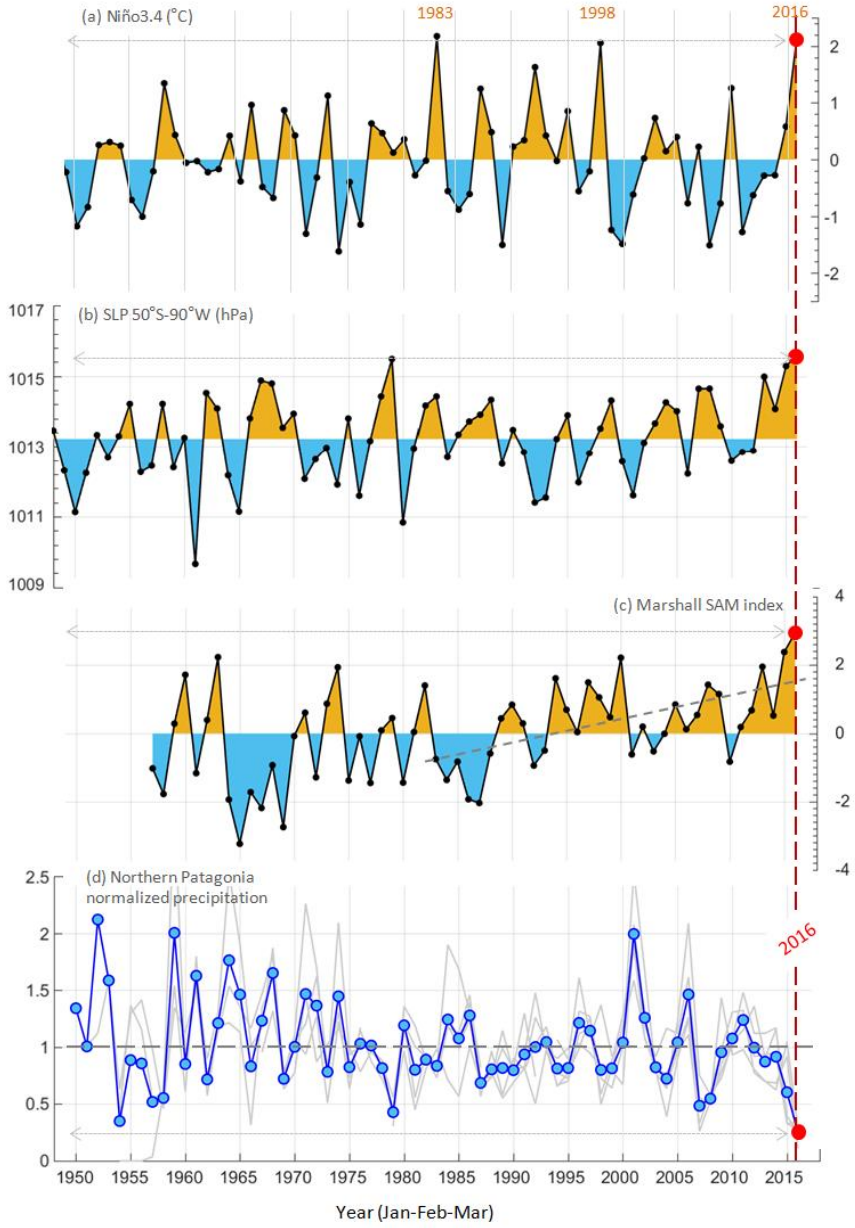
El Niño
(Variabilidad Natural)



SAM+
(Antrópico: GEI y O3)

Diferentes forzamiento, respuesta similar:
Condiciones anticiclonicas y sequia en Patagonia

The awful 2016 (JFM)

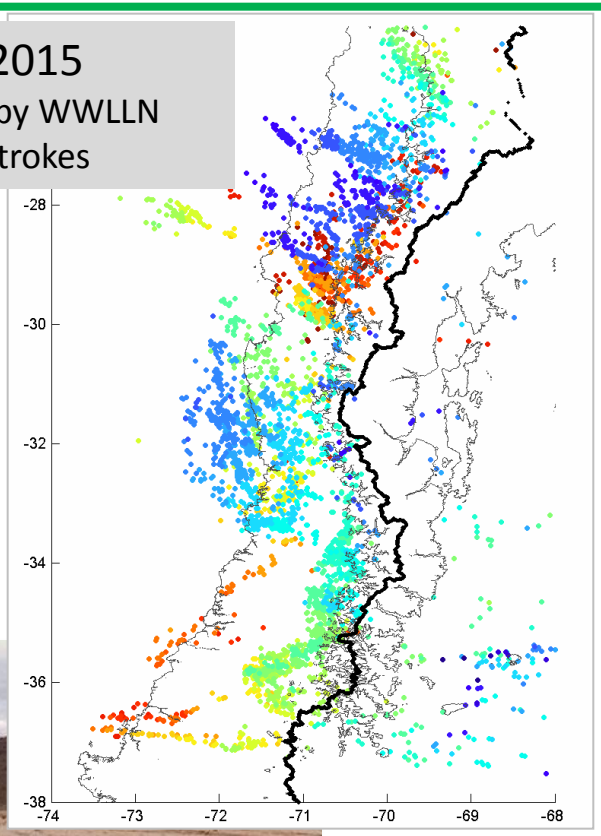


El Niño!
Natural….

SAM!
Antropogénico

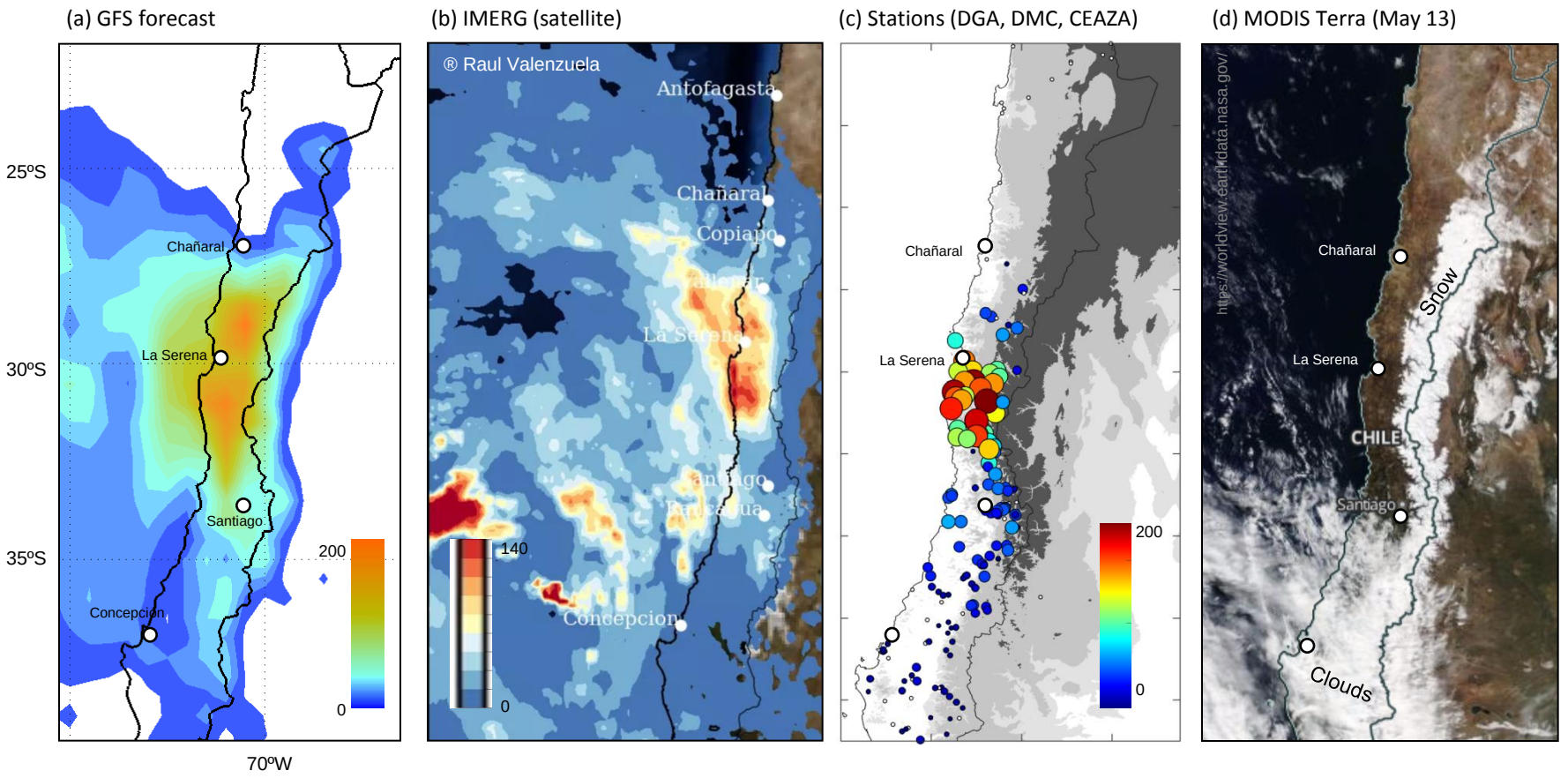
Northern Chile Storms

March 24, 2015
Lightning detected by WWLLN
One every 10 strokes



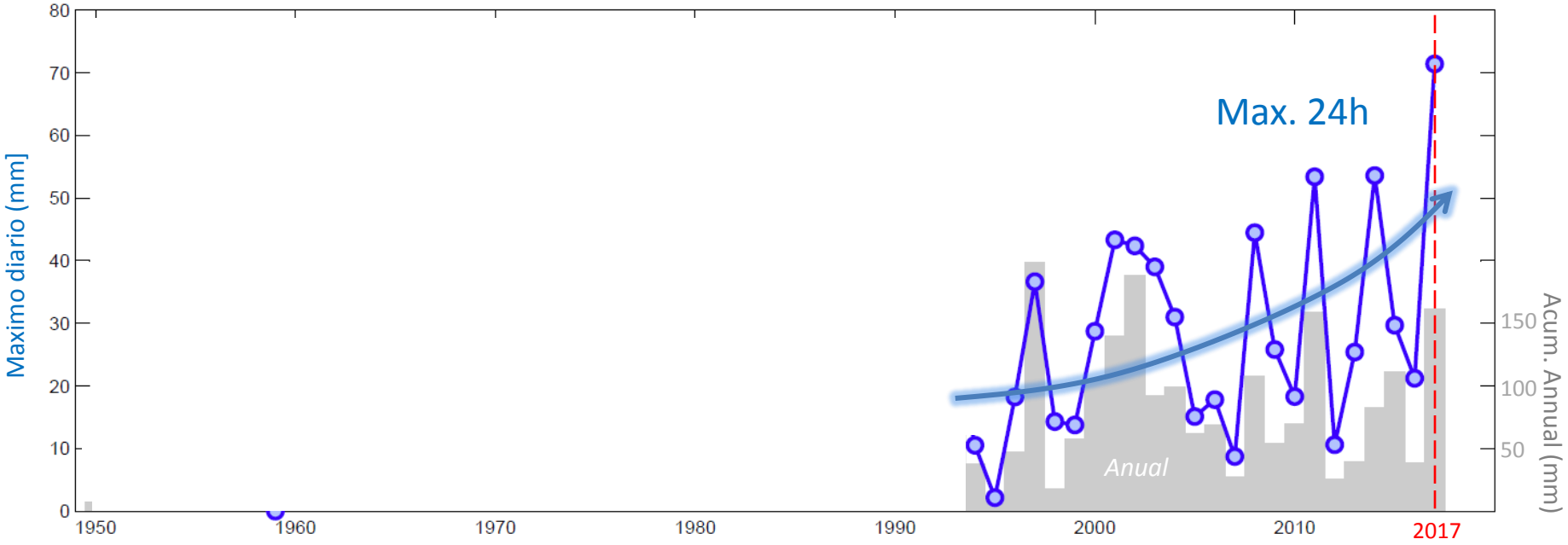
Northern Chile Storms

72 hr accumulated precipitation in mm (May 11-12-13, 2017)



Northern Chile Storms

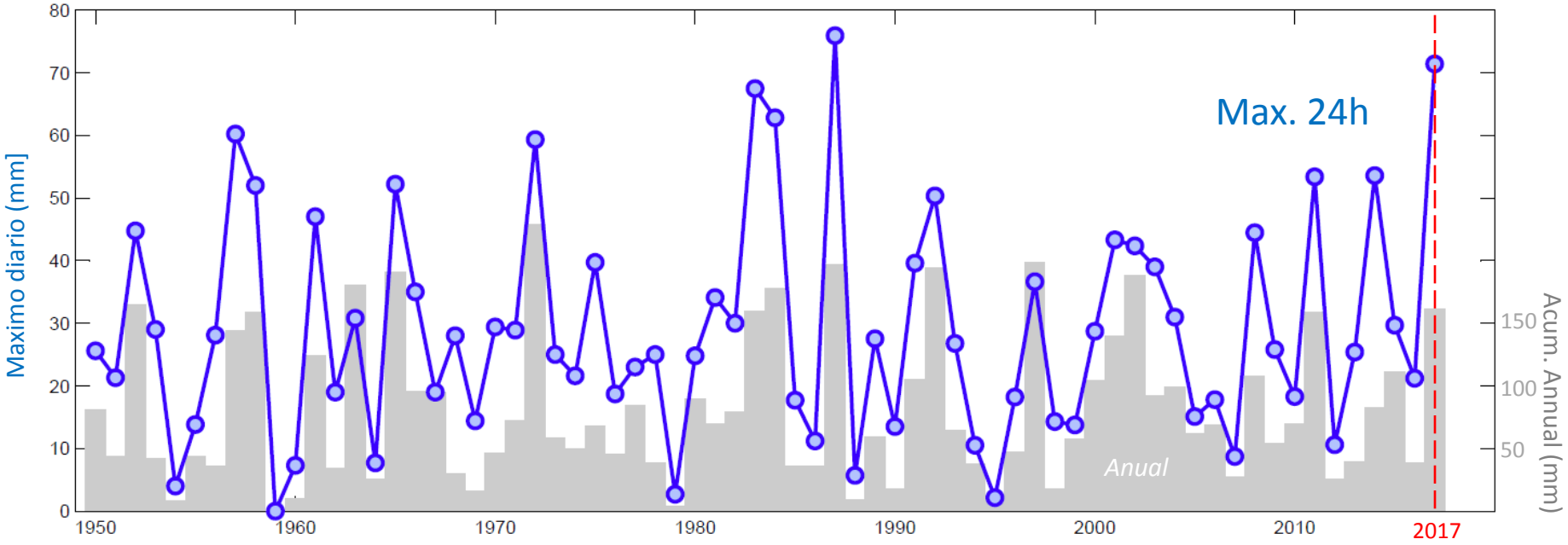
Extremos de precipitación en La Serena



Now you see it….

Northern Chile Storms

Extremos de precipitación en La Serena



Now you don’t….

Conclusions I

- Extreme climate events occur by a combination of weather, natural variability, and climate change
- Extreme events in Chile follows a distinctive trend from global pattern
- To face the worst we need the best (strengthen forecast, nowcast system and use this information in emergency management)

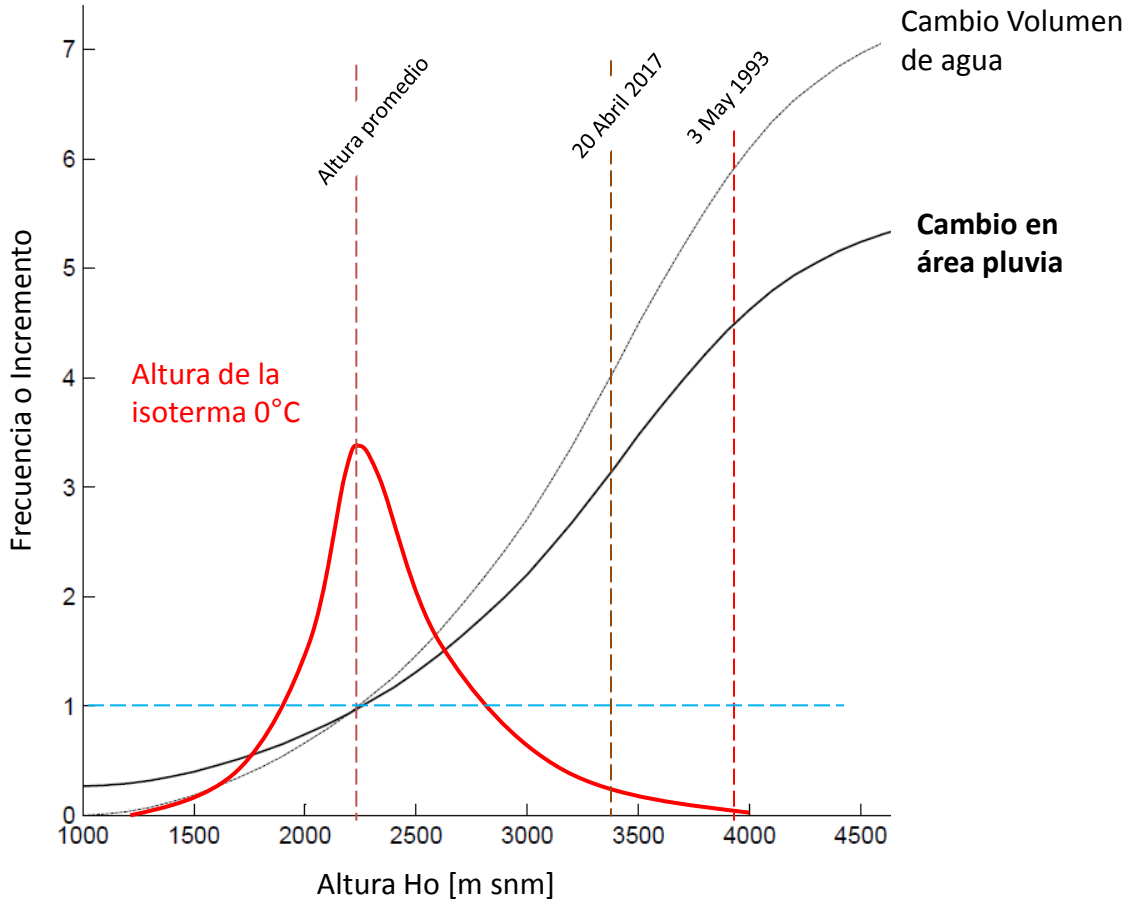
Conclusions II

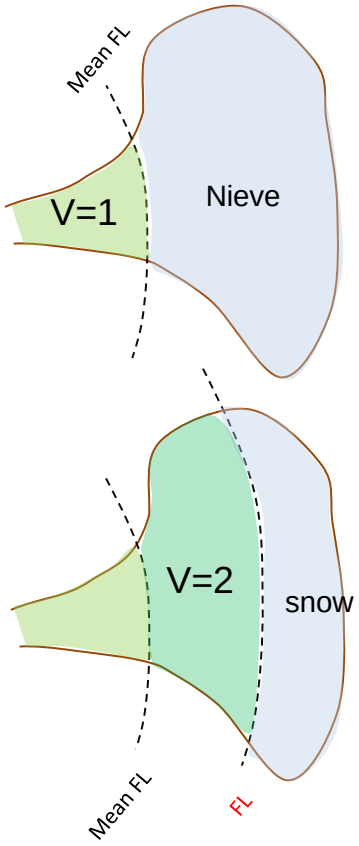
- Climate change related circulation anomalies have contributed to recent drought and heat waves in Chile
- There is a potential increase in frequency of those event in a warmer world.
- No much is now about winter and summer storms (but we will work on that)
- Future ENSO variability is key but unkown.

Material suplementario

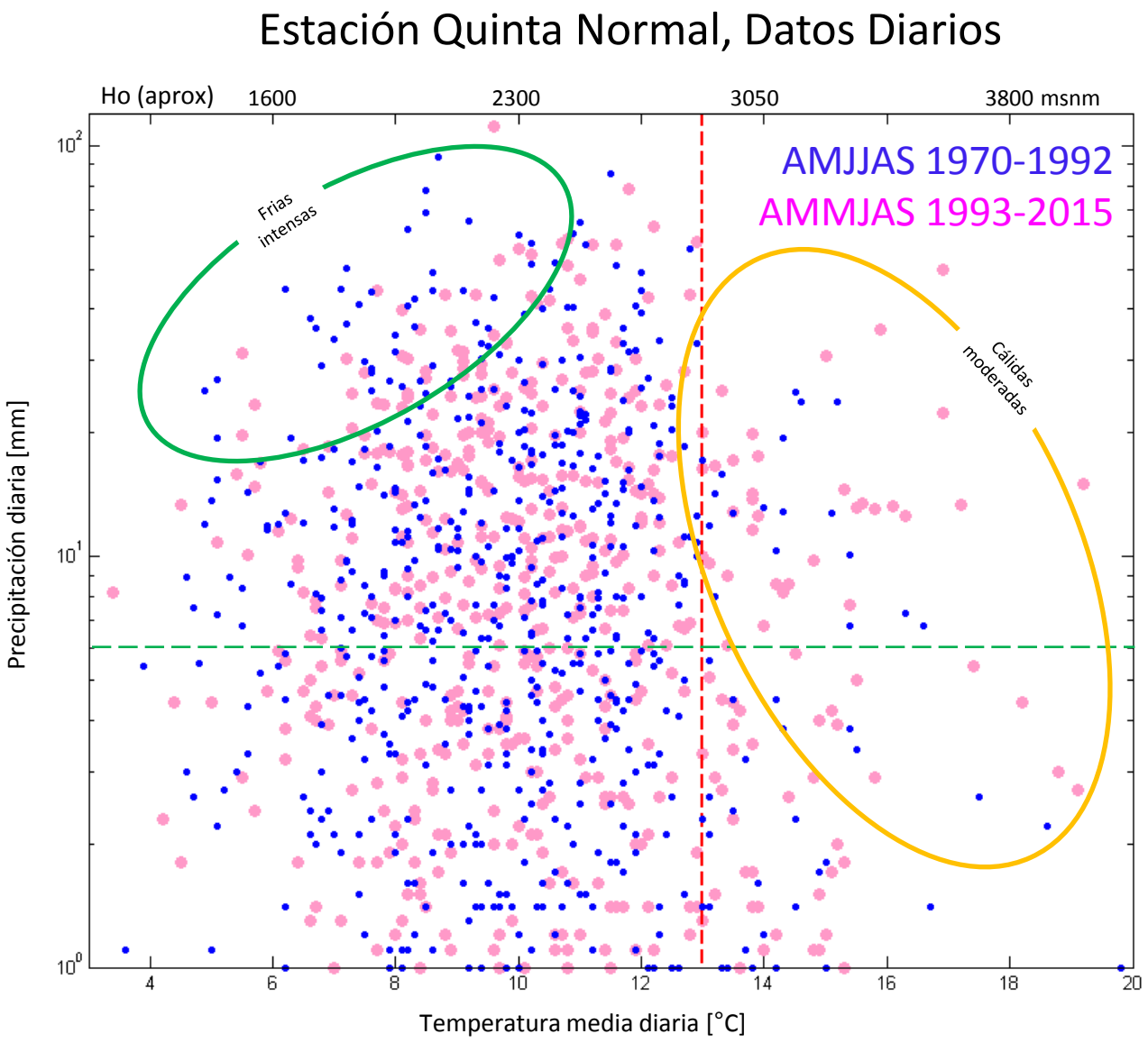
Hydrological Impacts

Cuenca del río Maipo en el Manzano





Estan cambiando las tormentas sobre Chile central?



Estan cambiando las tormentas sobre Chile central?

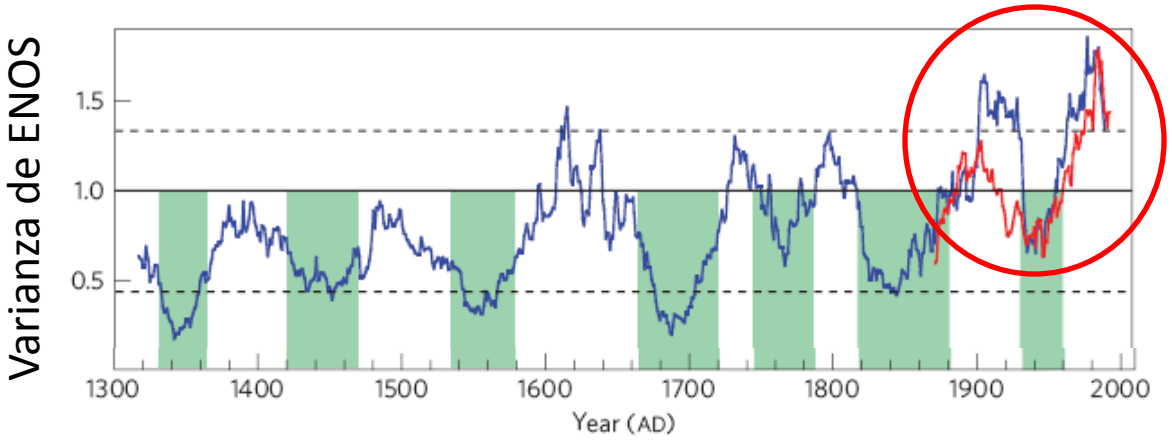
Estación Quinta Normal, Datos Diarios

Number of days (4920 total)	1970-1992	1993-2015	Difference*	Sig. level**
Dry days (P==0)	4052	4190	+138 (3%)	1%
Light precipitation (P: 1-10 mm)	338	282	-56 (-16%)	2%
Moderate precipitation (P: 10-30 mm)	184	175	-9 (-5%)	30%
Heavy precipitation (P>30 mm)	58	43	-15 (25%)	5%
Dry, warm days (T≥13ºC)	1484	1648	+164 (+10%)	0.5%
Rainy (P≥5 mm), Warm days (T≥13ºC)	19	36	+17 (90%)	4%

Santiago se esta calentando y secando… ya lo sabiamos!

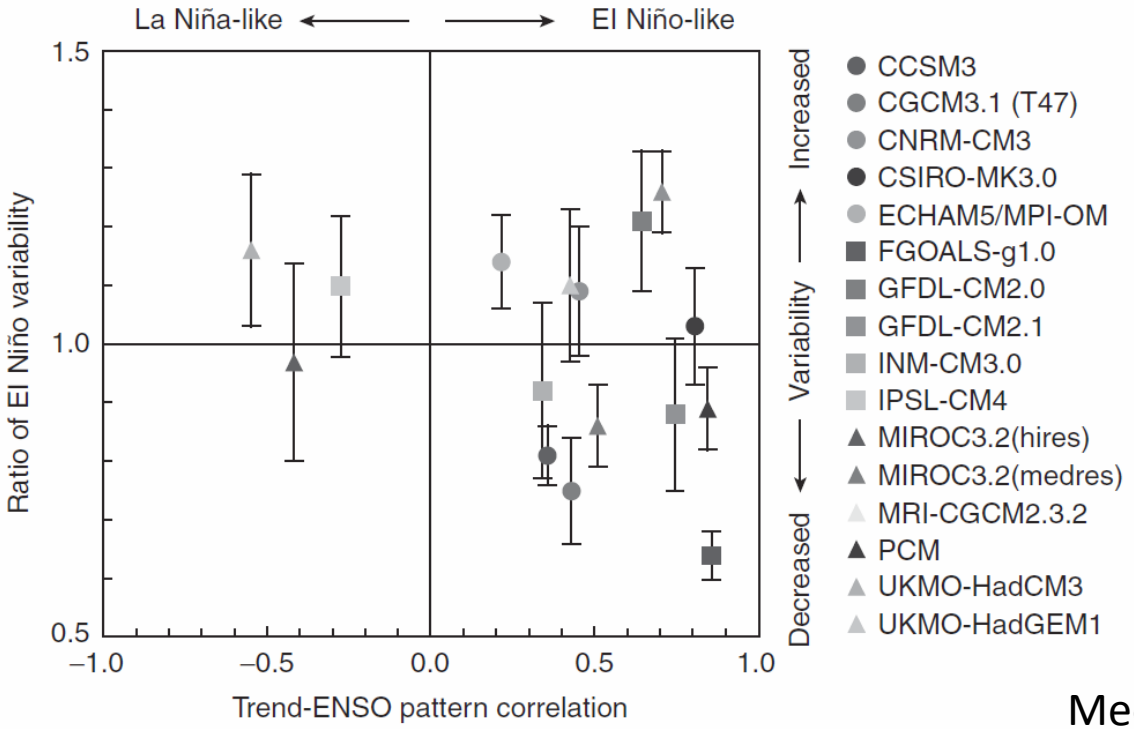
Más tormentas cálidas
Esto parece novedoso

Perspectiva Global. Que pasa con ENOS?



Niños y Niñas más intensos en el sXX

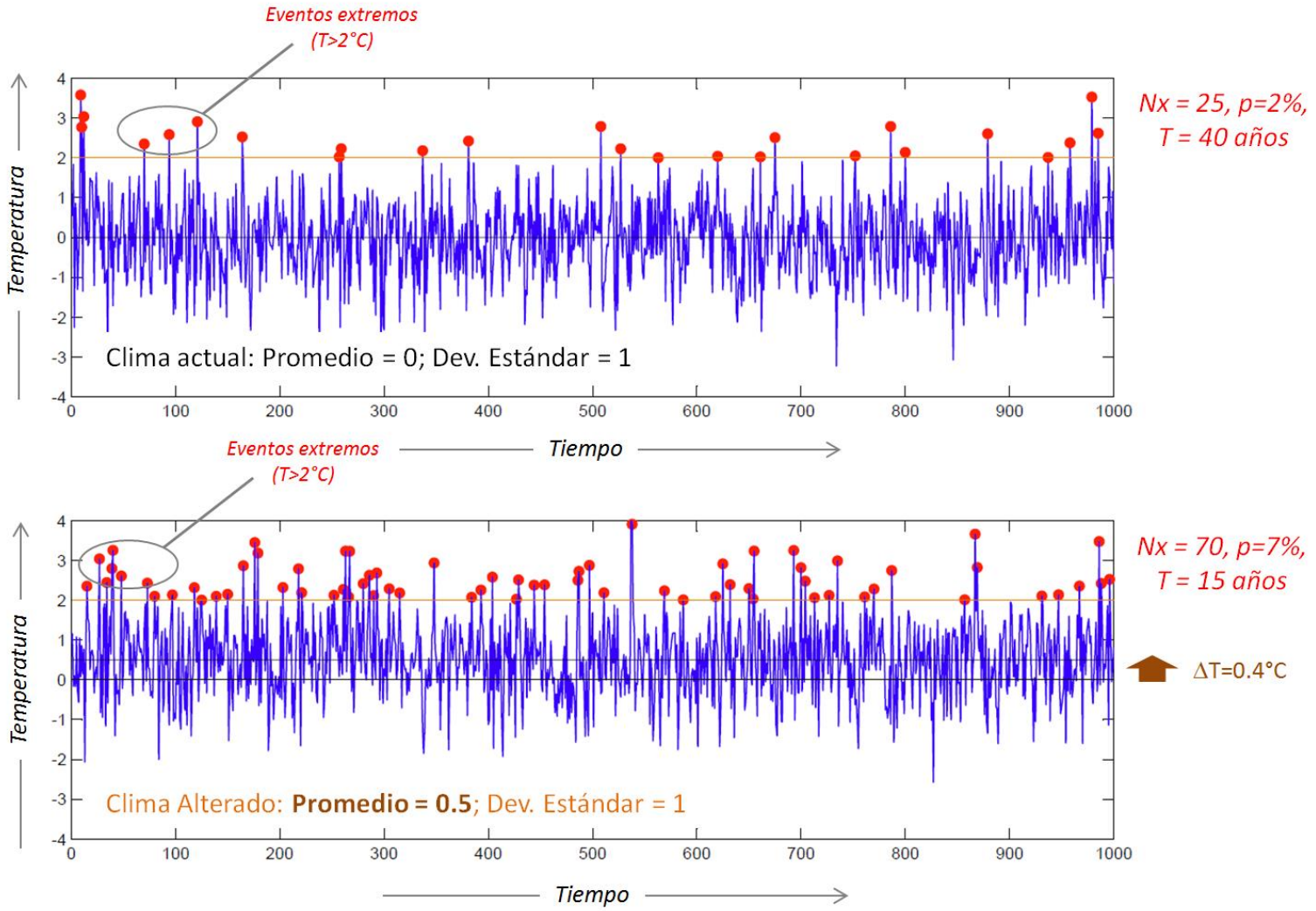
Li et al. (2013)



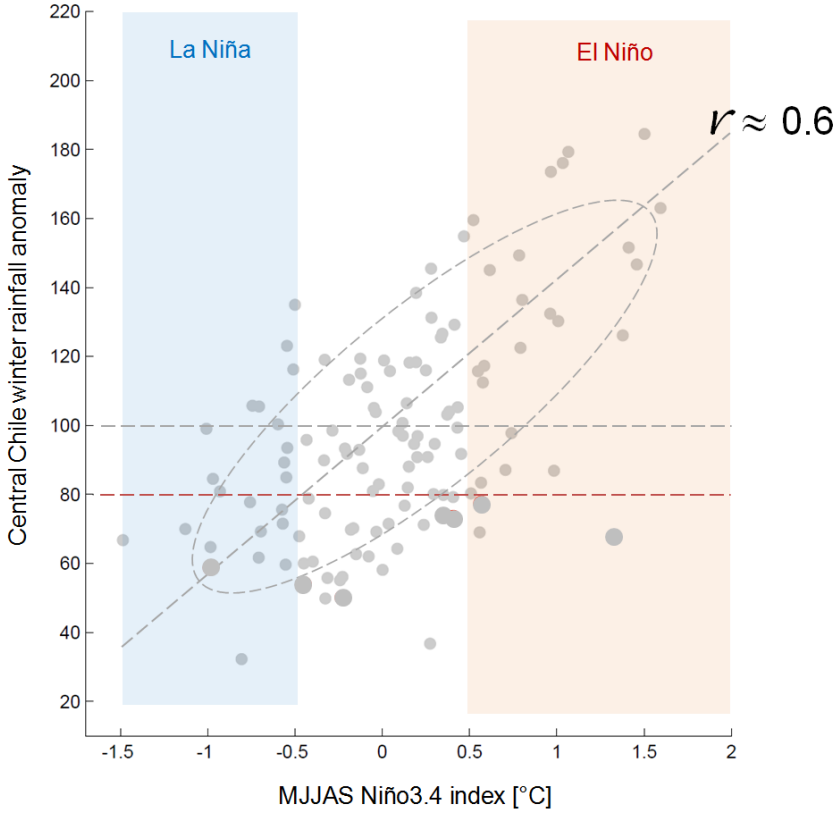
Meehl et al. (2007)

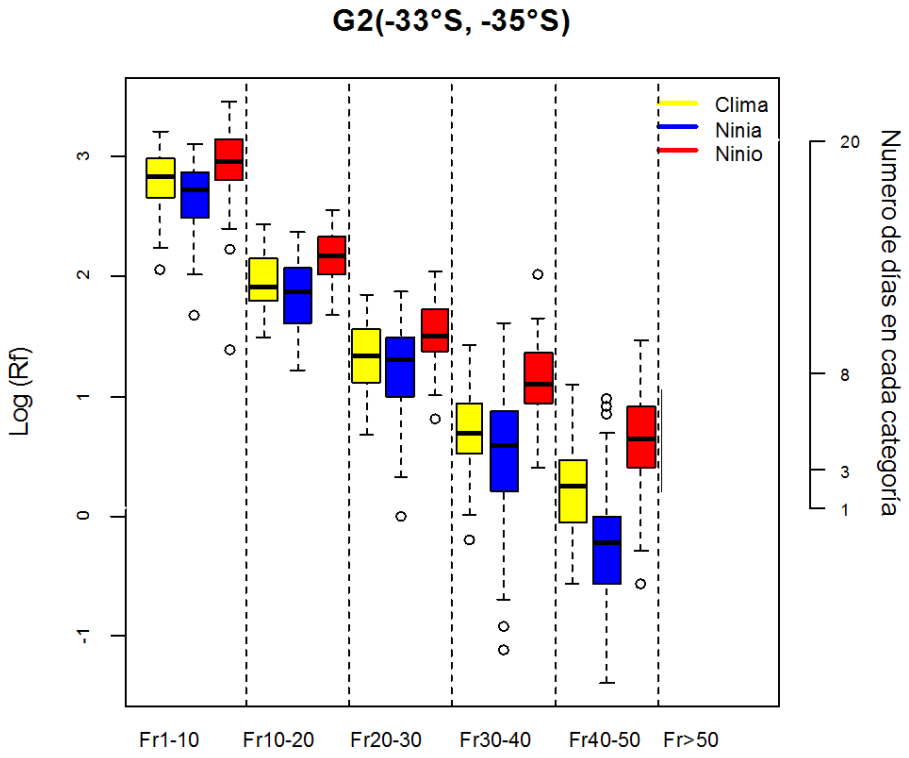
Un modesto cambio en el promedio produce grandes cambios en los extremos

Consideramos una variable “normal”

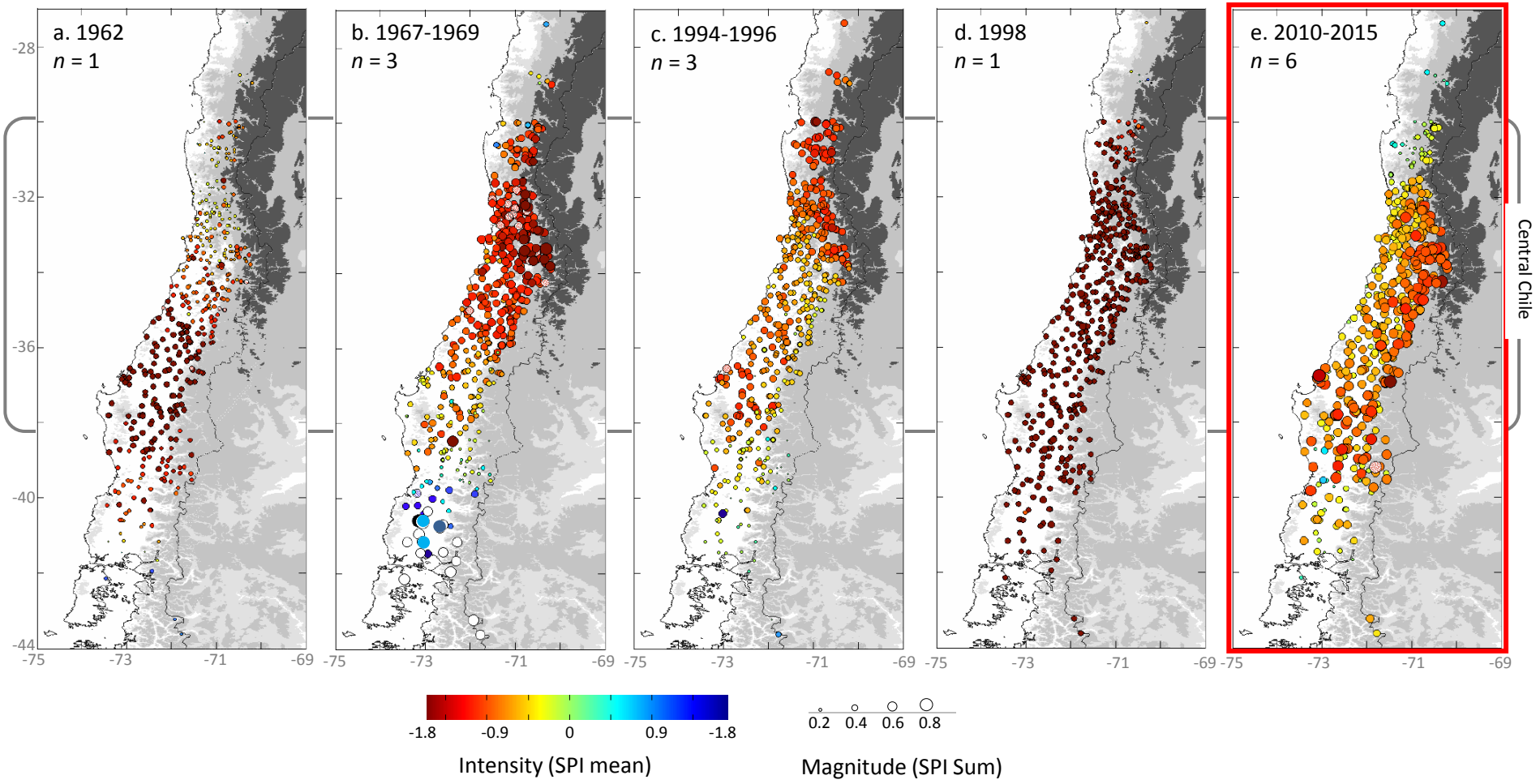


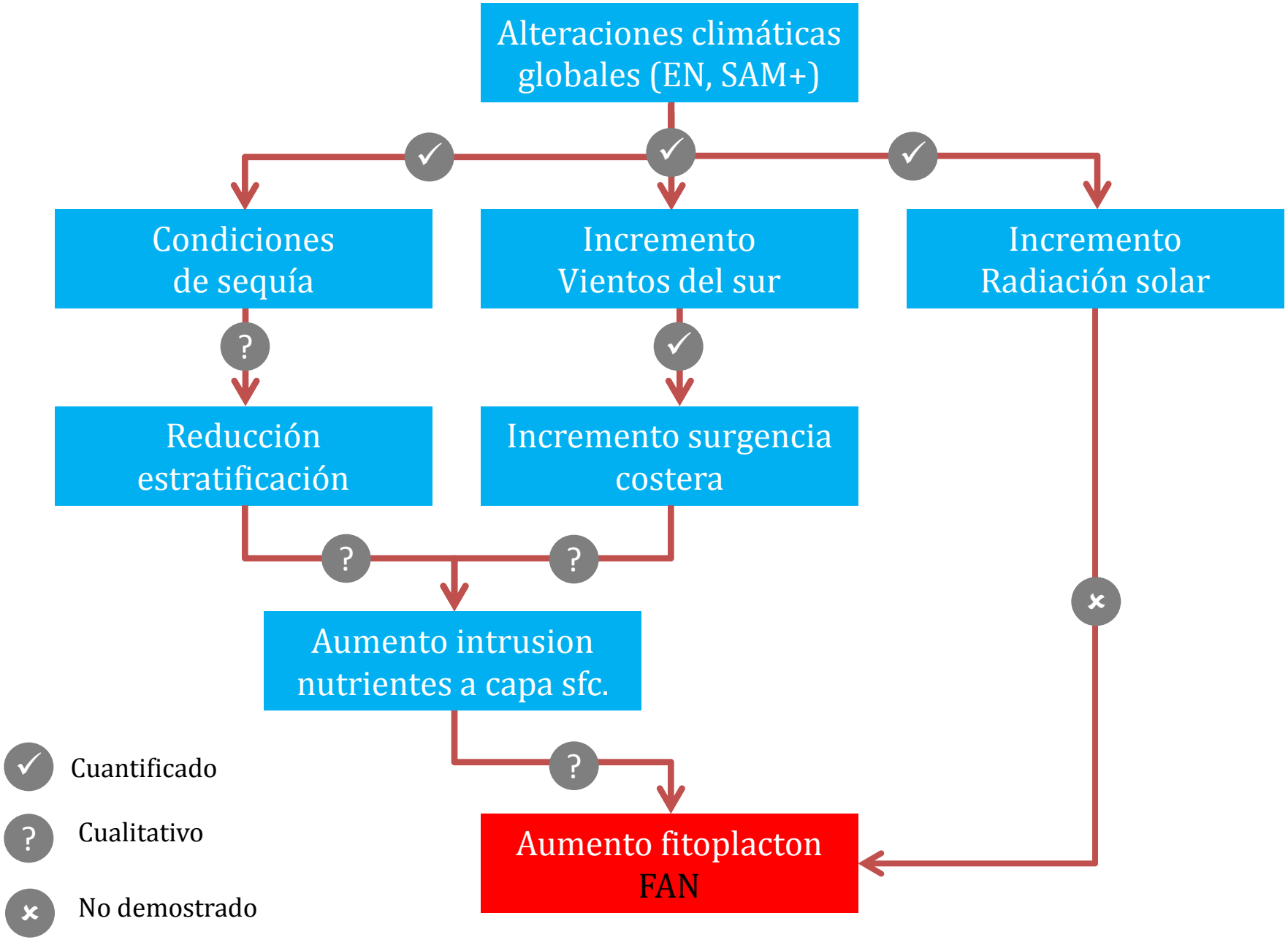
IMPACTO DE ENSO SOBRE LA LLUVIA EN CHILE CENTRAL





La Megasequía 2010-2015





Leon et al. submitted