Anthropogenic climate change contribution to the Central Chile Mega Drought (2010-16)

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Subtropical west coast of South America (30-38S)

Bounded to the east of the Andes cordillera (>4000 m)

About 9 Mill inhabitants

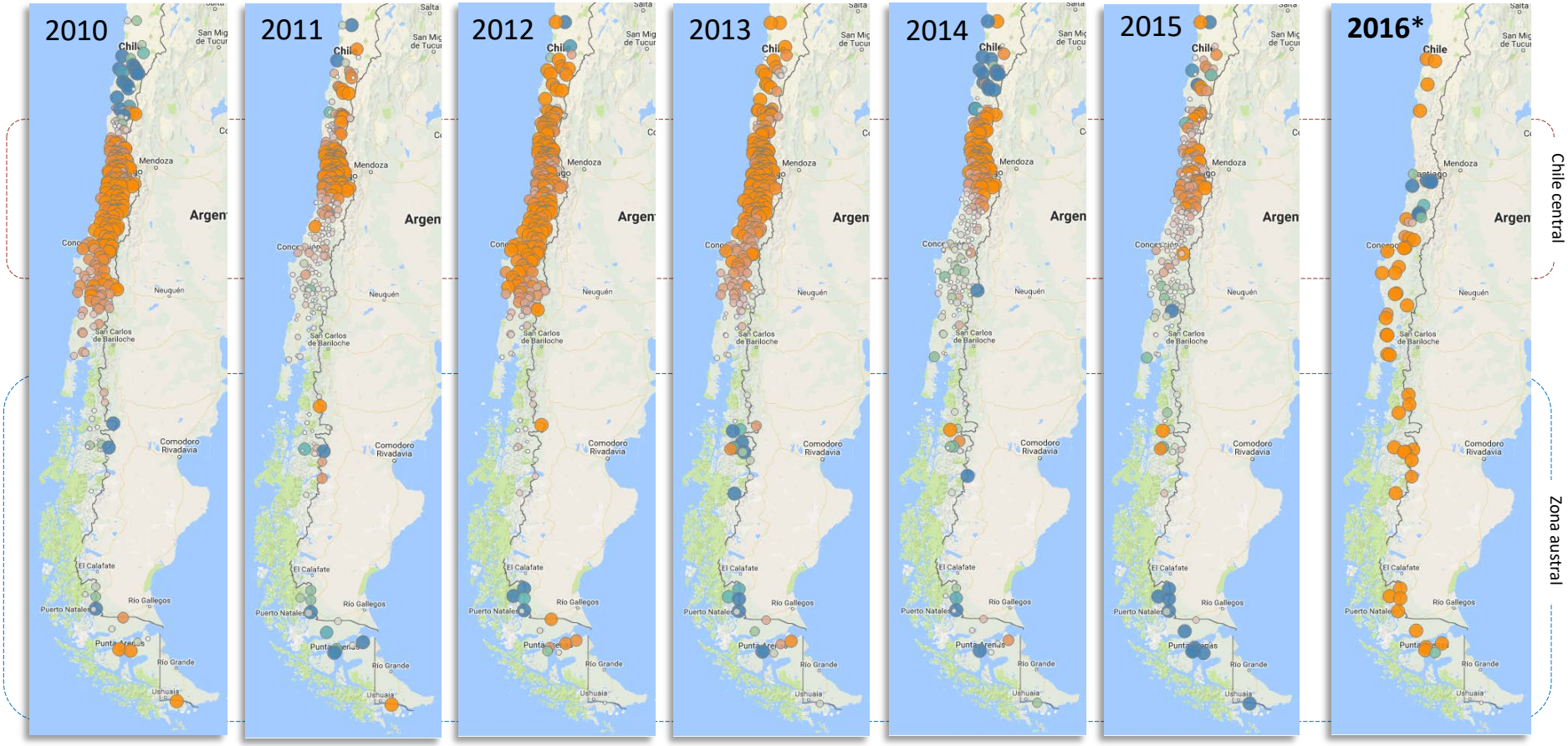
Mediterranean like climate (100-1000 mm/year)

ENSO related interannual rainfall variability

Projected warm (+3C) and dry (-30%) by 2080 under RCP8.5

Central Chile Mega Drought

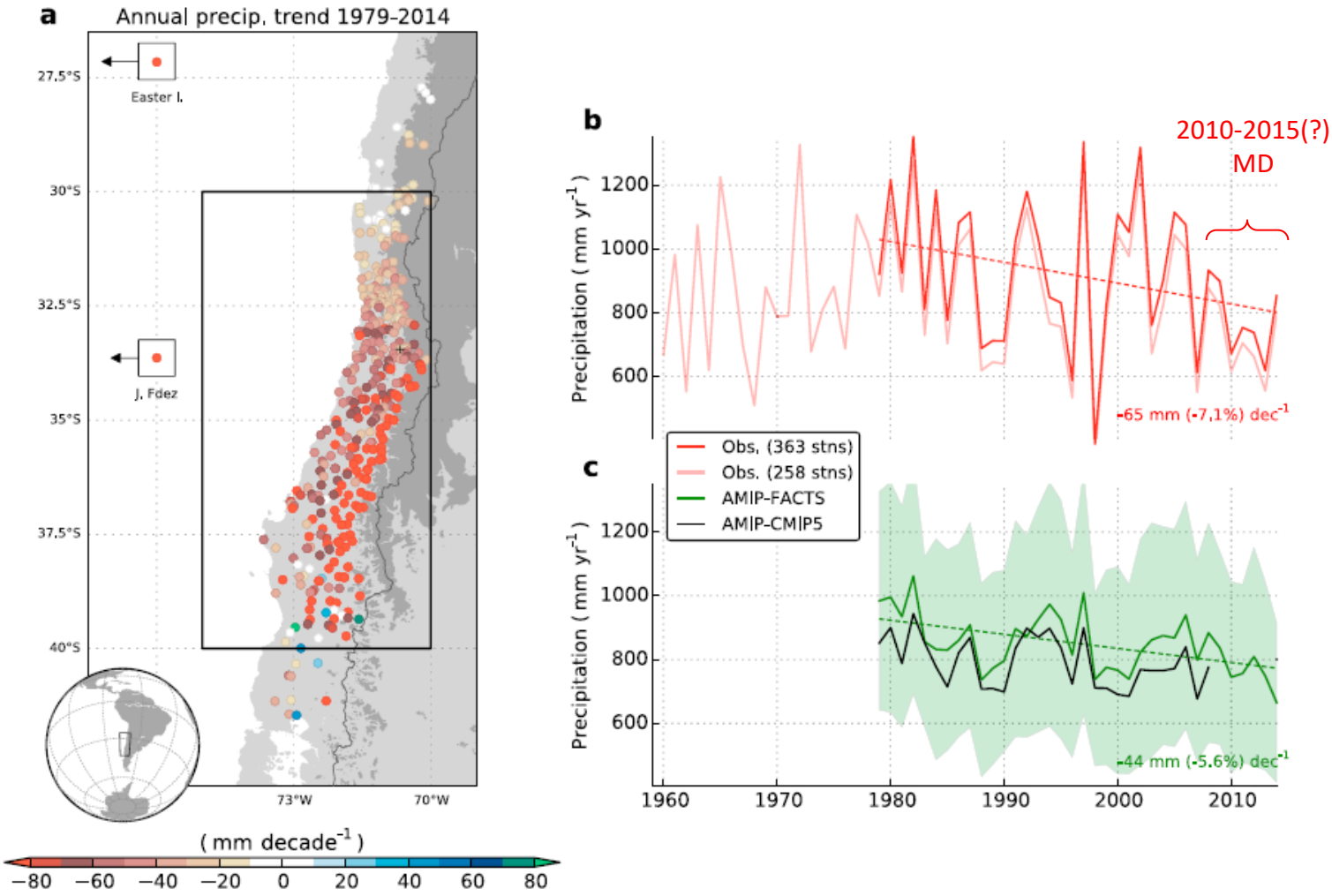
Winter (MJJAS) rainfall anomaly wrt LTM



Return period of the driest MD year: 10-20 years

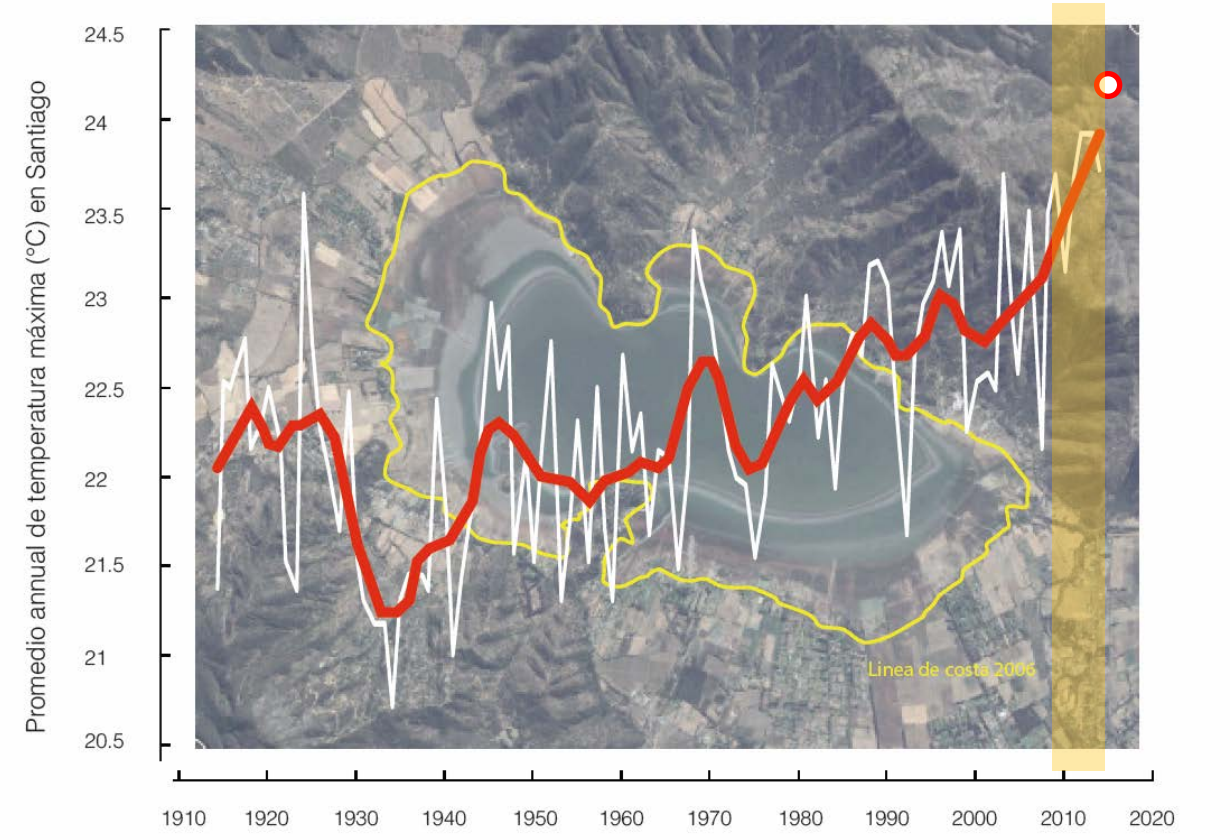
Interarrival interval of MD-like events: 50-200 years

Contemporaneous rainfall trends in central Chile



Boisier et al. 2016

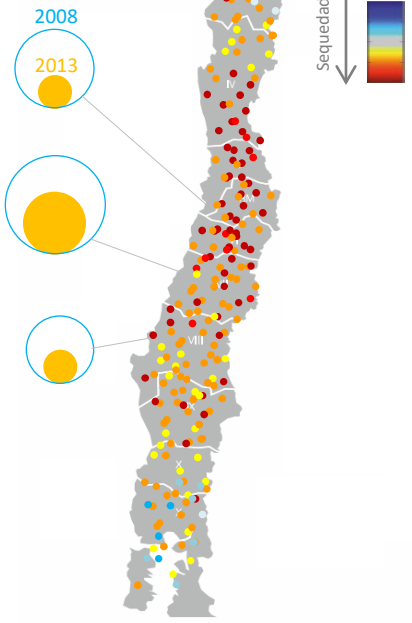
Dry and warm



Annual mean of daily maximum temperature in Santiago

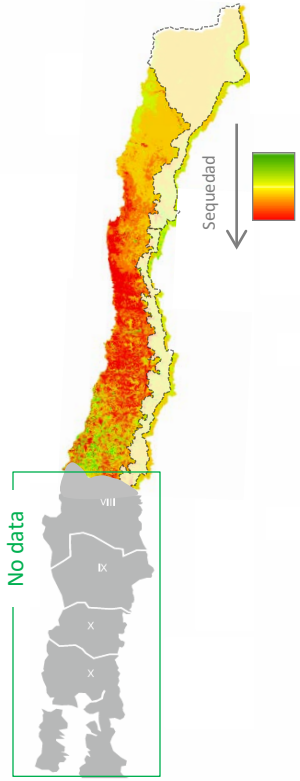
Central Chile Mega Drought (2010-2016)

Transporte de sedimentos en invierno

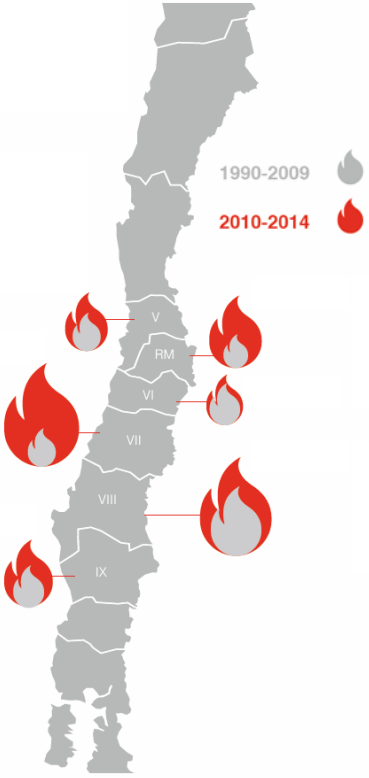


Déficit Pluviométrico (2010-2014)

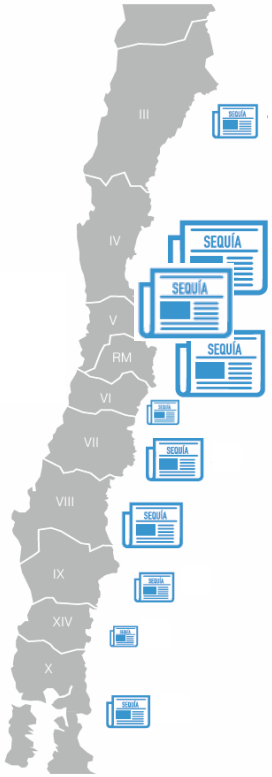
Deterioro vegetación Agosto 2010-2015



Incendios forestales de magnitud

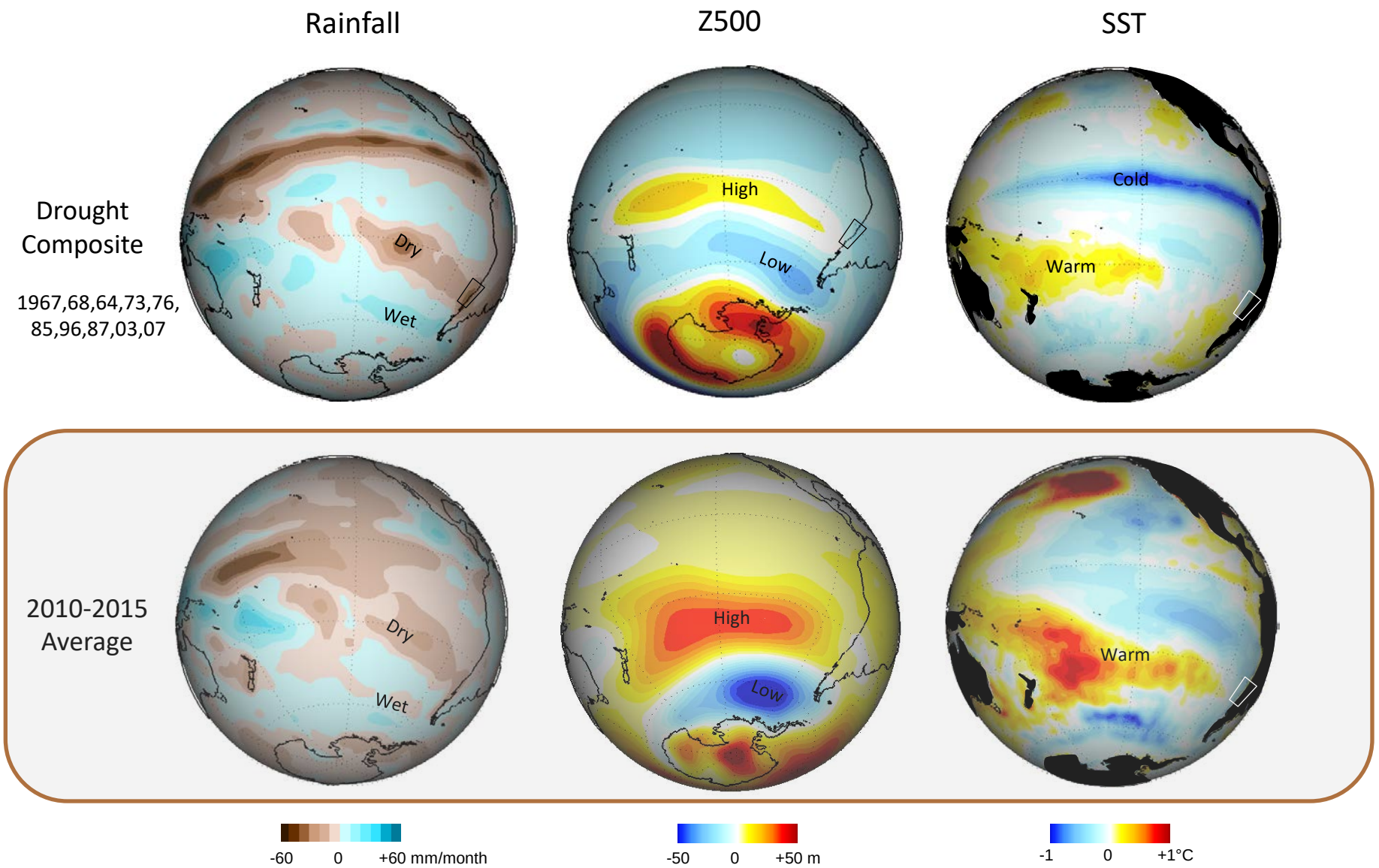


Apariciones en prensa escrita (2014)

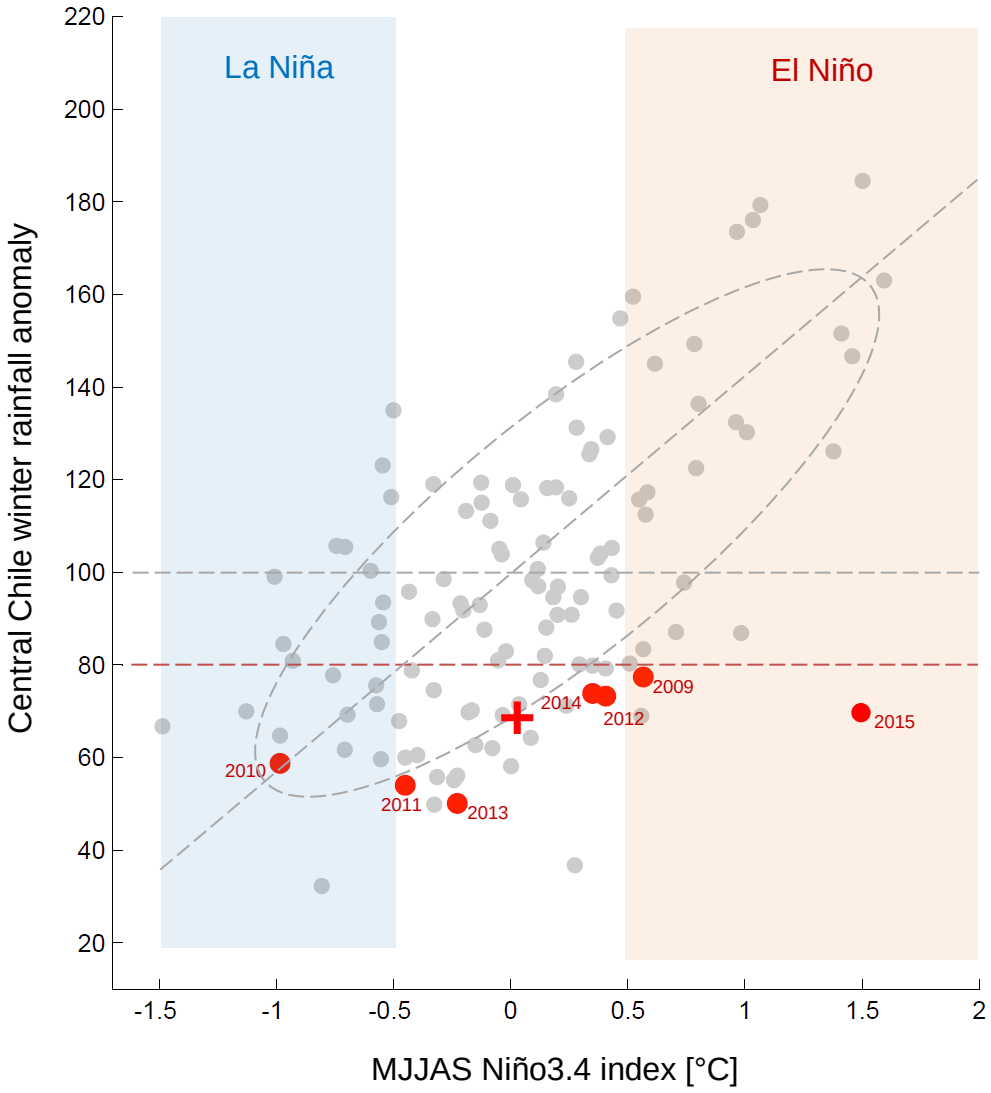


Gastos en Camiones Aljibes (Mill$)

The 2010-2015 drought in Central Chile



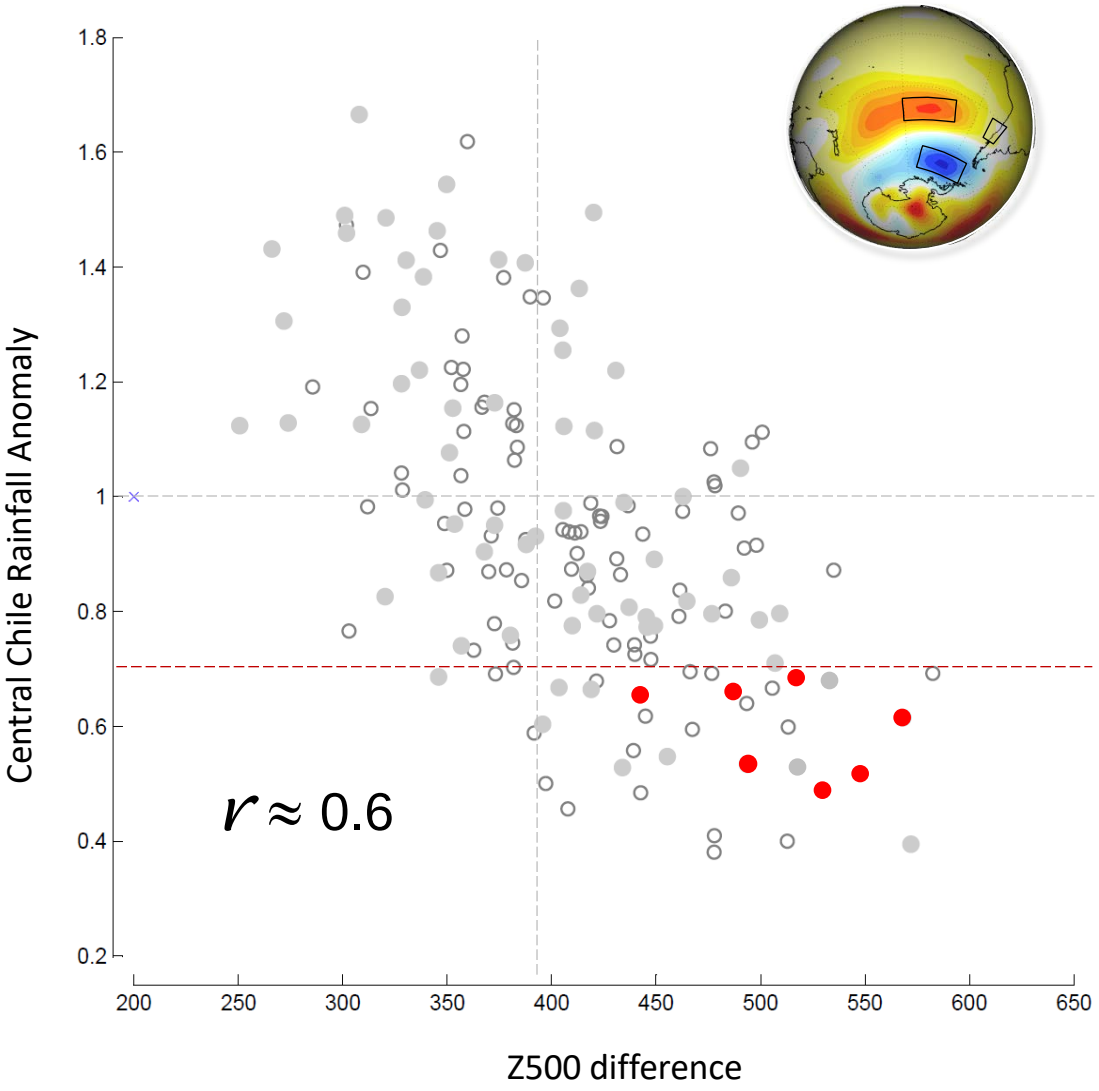
The 2010-2015 drought in Central Chile: ENSO



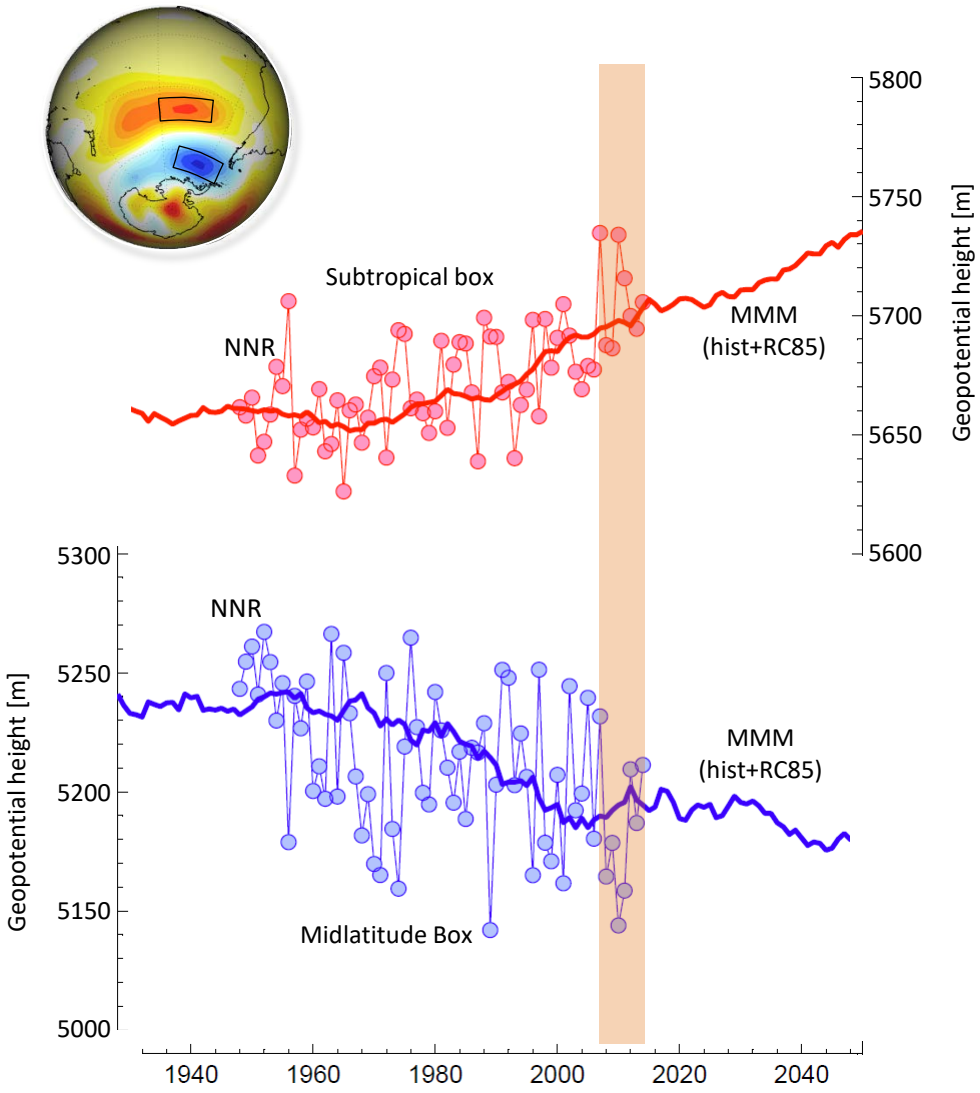
Monte Carlo Experiment:
5000 samples of 4 randomly chosen ENSO-neutral years

MD-like event < 1%

The 2010-2015 drought in Central Chile



The 2010-2015 drought in Central Chile



Attribution of the 2010-2016 mega drought

AMIP-ORF simulations (ECHAM5, CAM4, CAM5.1) forced by

- Observed SST & Sea Ice Distribution
- Observed Radiative Forcing (CO2, aerosols, O3,…)
- Ensemble mean isolates SST forced anomalies under current GHG/O3

AMIP-NHF simulations (CAM5.1) forced by

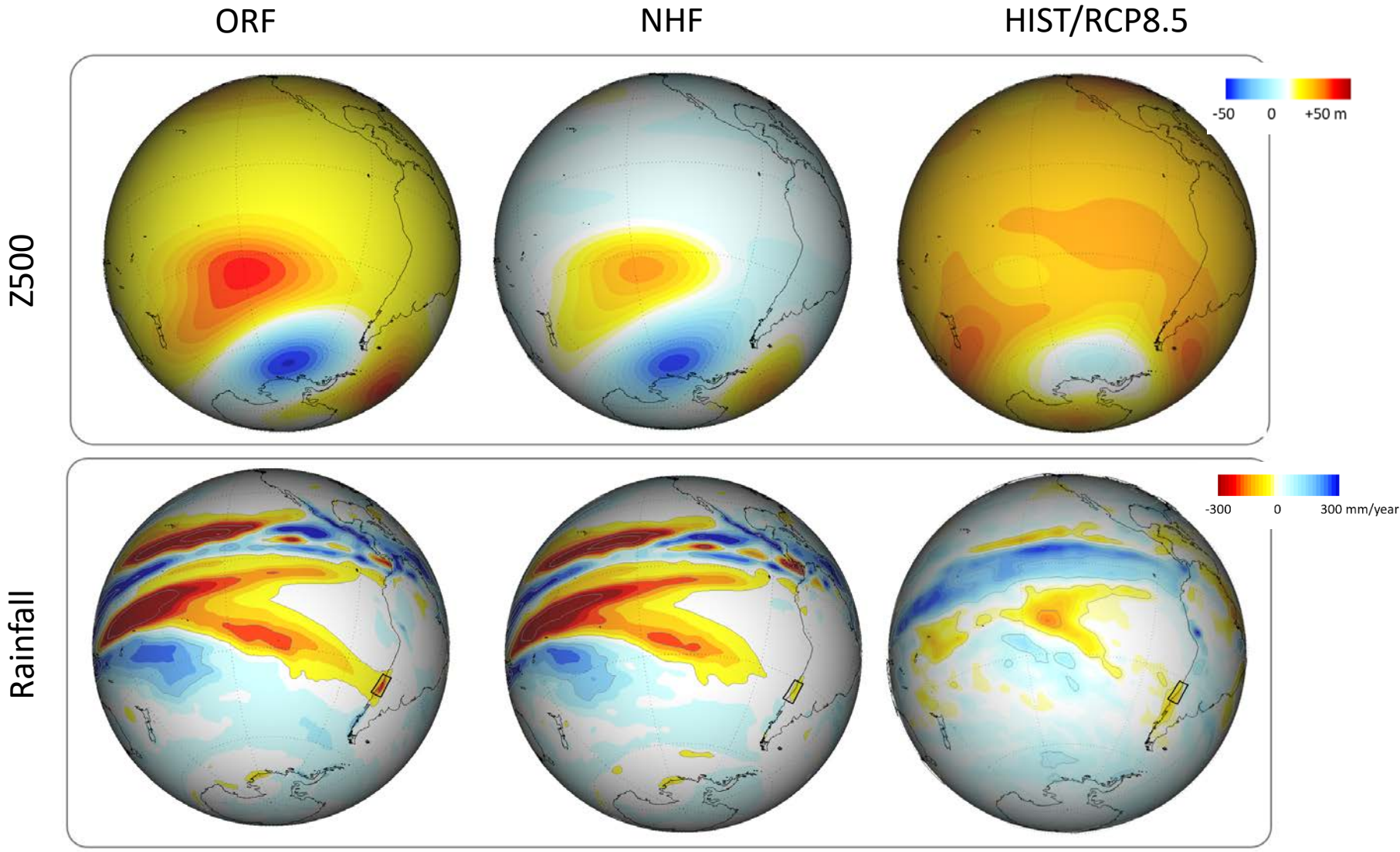
- "Near" observed SST & Sea Ice Distribution
- Natural Radiative Forcing (CO2, aerosols, O3 from 1800s)
- Ensemble mean isolates SST forced anomalies without antrop. influence

CMIP3/5 simulations: Coupled Global Circulation Model (AOGCM) forced by

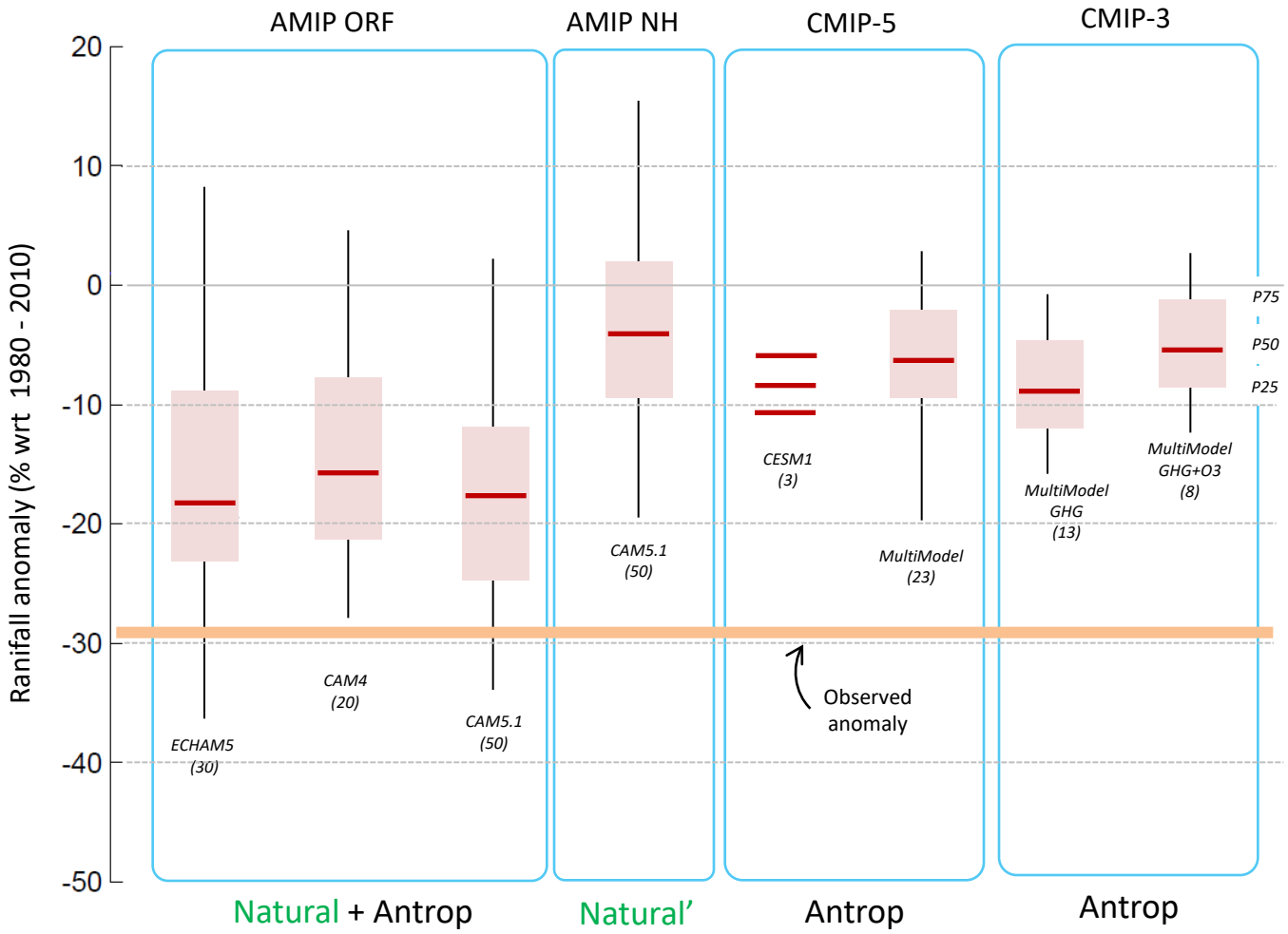
- Observed + projected RF (CO2, aerosols,…)
- O3 fixed or variable (in CMIP3)
- Multi-model, multi-run mean reveals the RF forced response

Simulated 2010-2015 anomalies

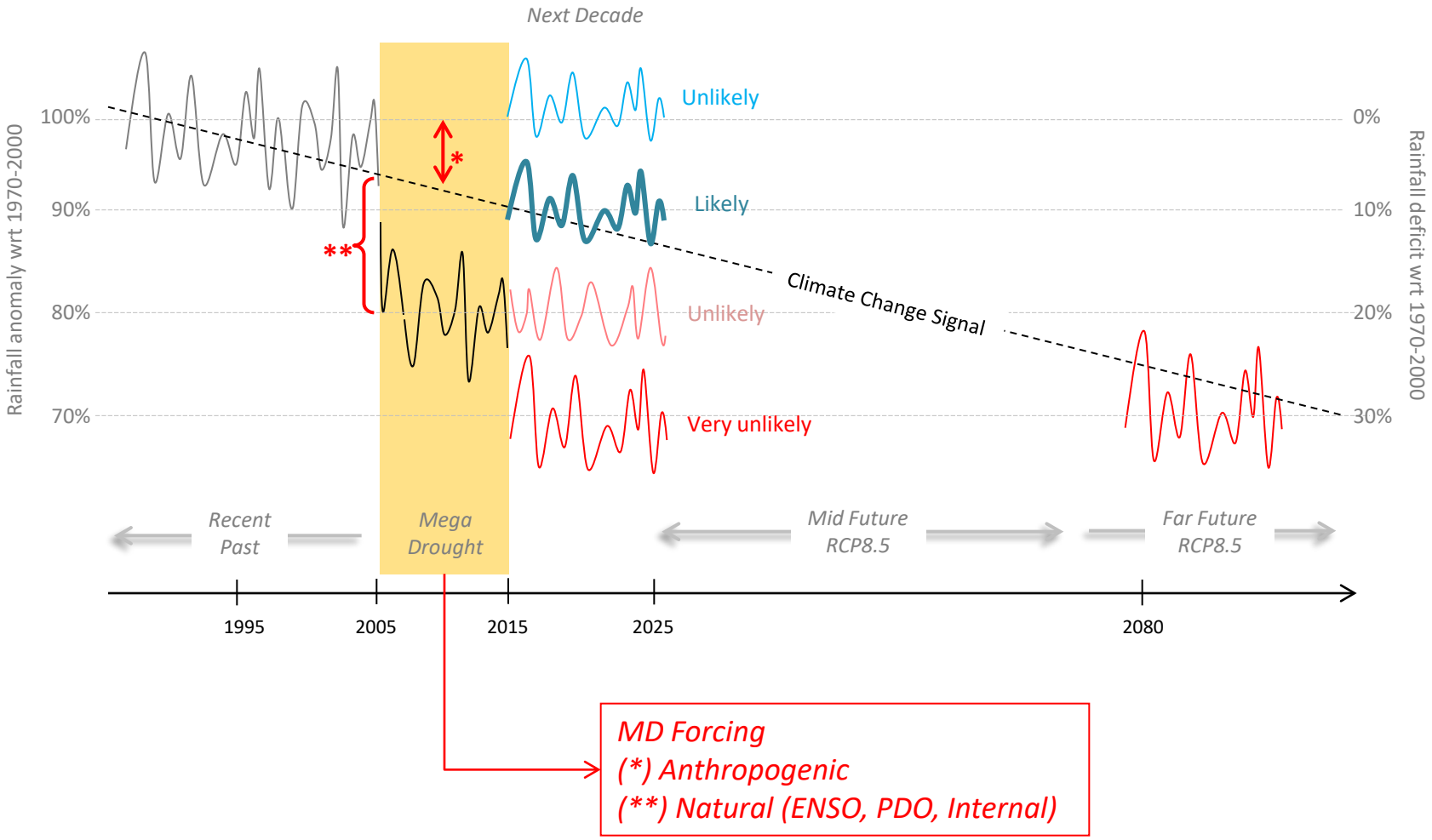
Ensemble mean / multimodel mean



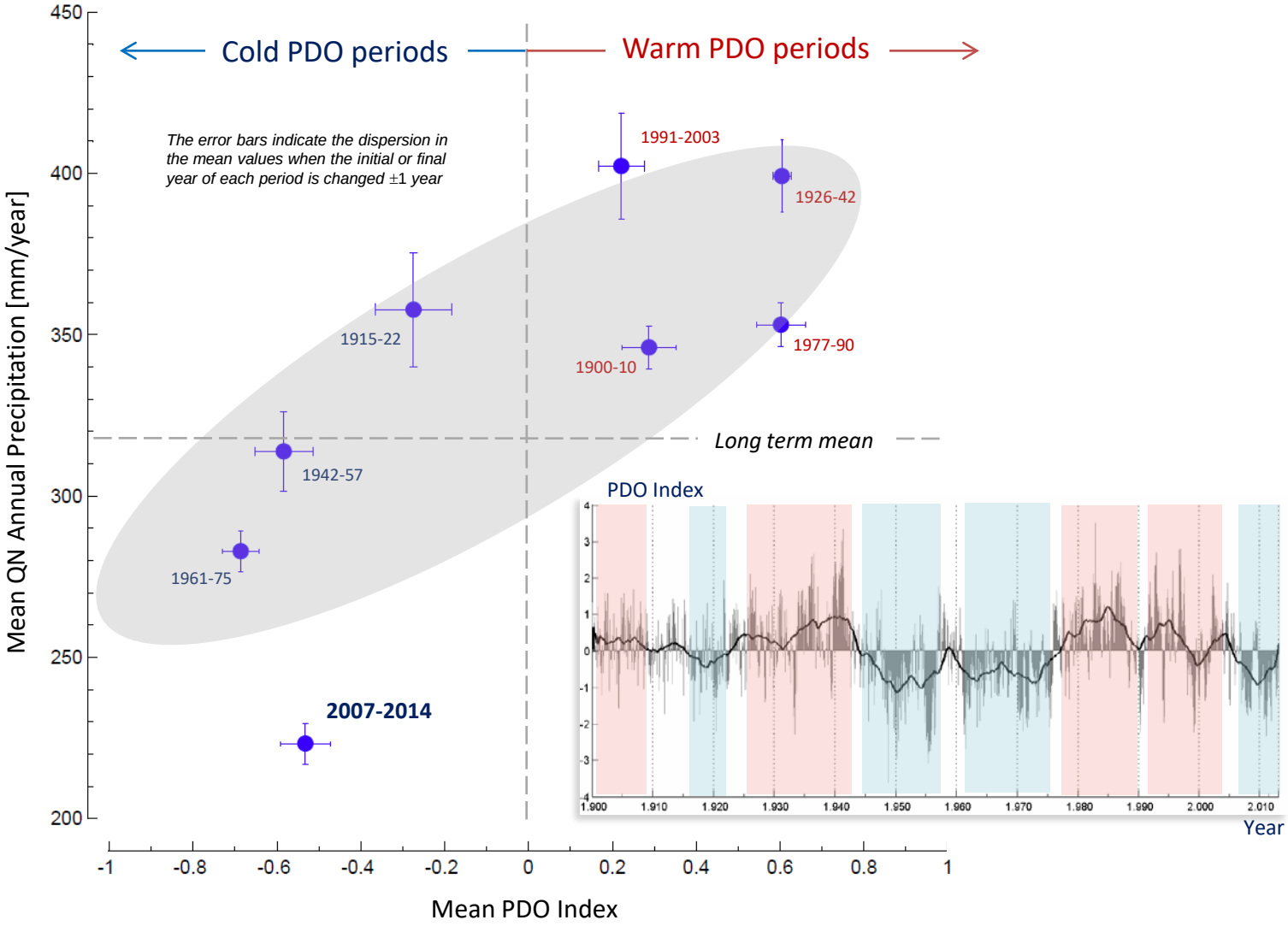
Central Chile (33-36°S) winter (MJJAS) rainfall anomalies during mega drought (2010-2014)



Conclusions
(The Next Decade Challenge)



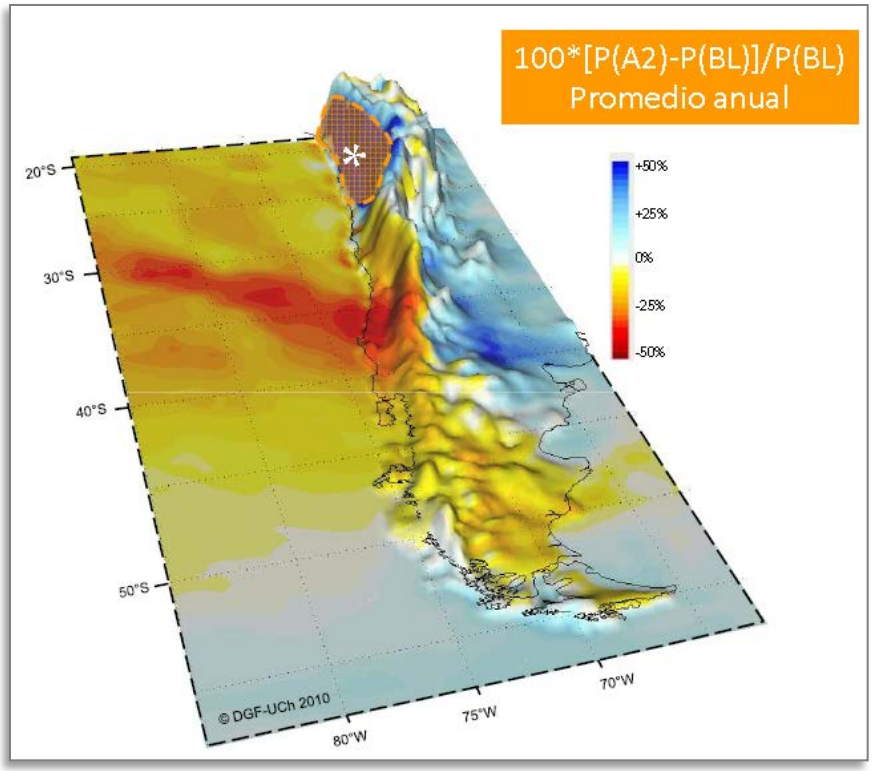
The 2010-2015 drought in Central Chile: PDO

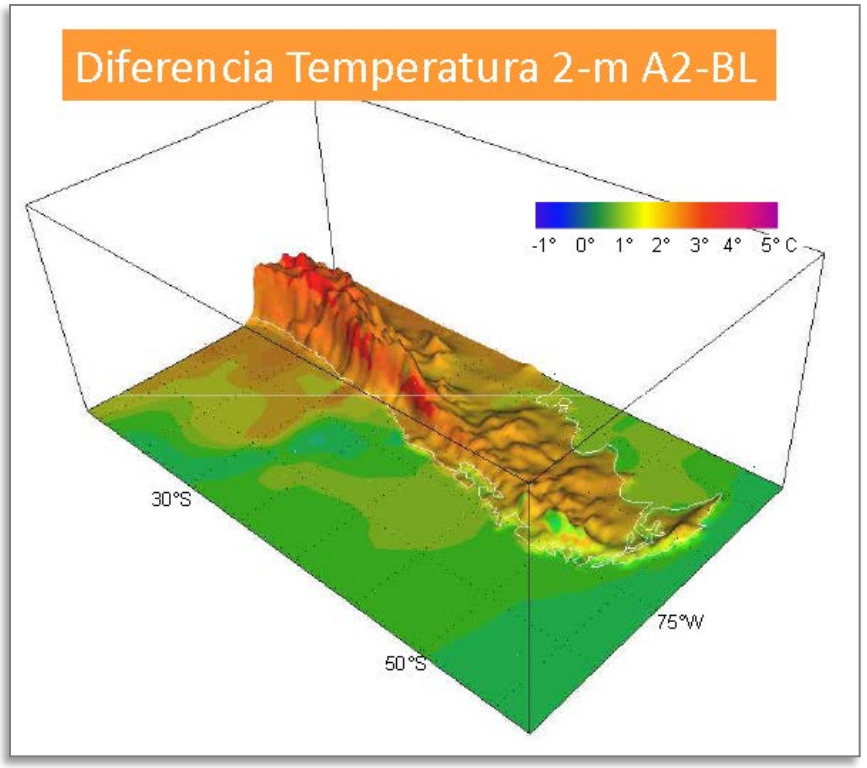


Central Chile Climate Change Projections

Towards the end of century under A2 (RCP8.5)

- Temperature increase 2.5-3.5ºC
- Rainfall decline 25-35%





Estudio DGF/UCh-CONAMA 2007 empleando PRECIS