Understanding the climate signals recorded by proxy records through a combined analysis of an isotope enabled climate model and proxy system models

SLOAN COATS, GORDON WALKER, BRANDON DURAN (UCSD), SAM STEVENSON (UCSB), BRONWEN KONECKY (WASH. U.), GEORGY FALSTER (ANU)

This work was made possible by NSF awards 195041 and 1805480

Understanding the climate signals recorded by proxy records through a combined analysis of an isotope enabled climate model and proxy system models

SLOAN COATS, **GORDON WALKER,**
BRANDON DURAN (UCSD),
SAM STEVENSON (UCSB),
BRONWEN KONECKY (WASH. U.),
GEORGY FALSTER (ANU)

This work was made possible by NSF awards 195041 and 1805480

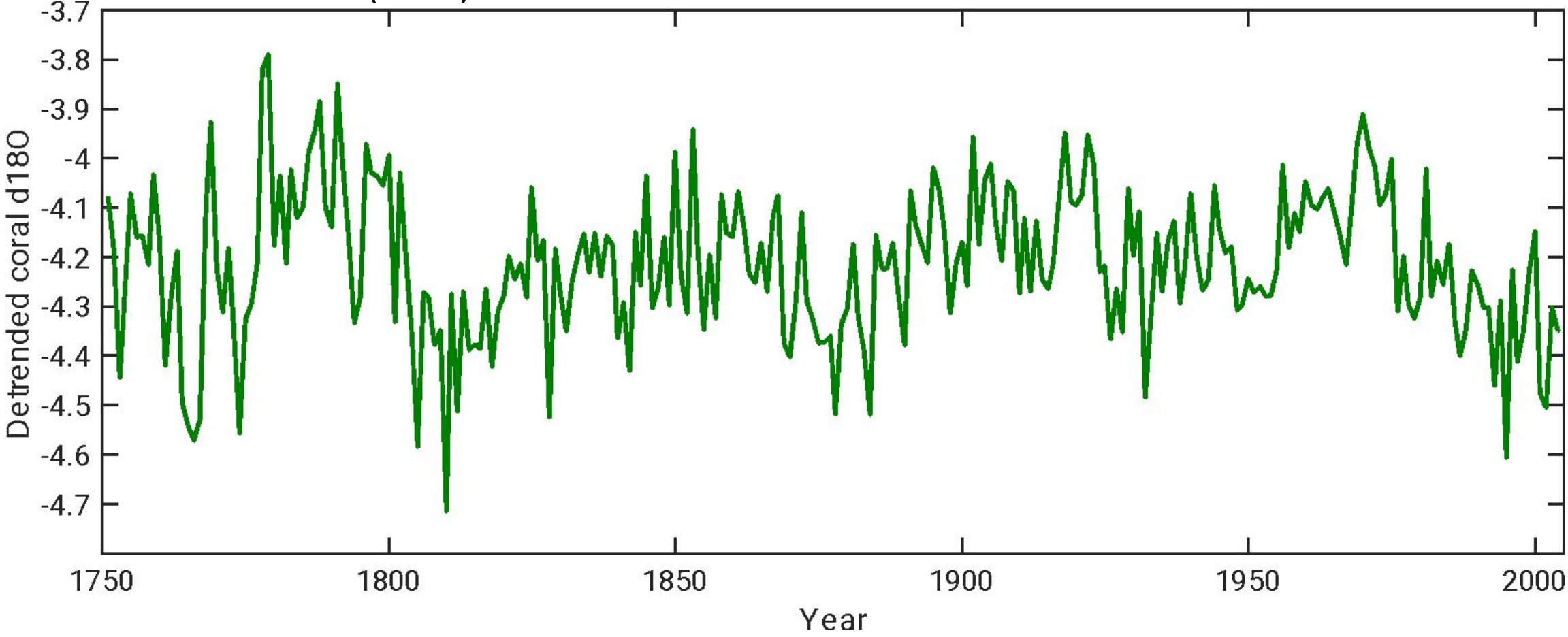
Protest on Antigua in 1850

Protest on Antigua in 1850

ANTIGUA

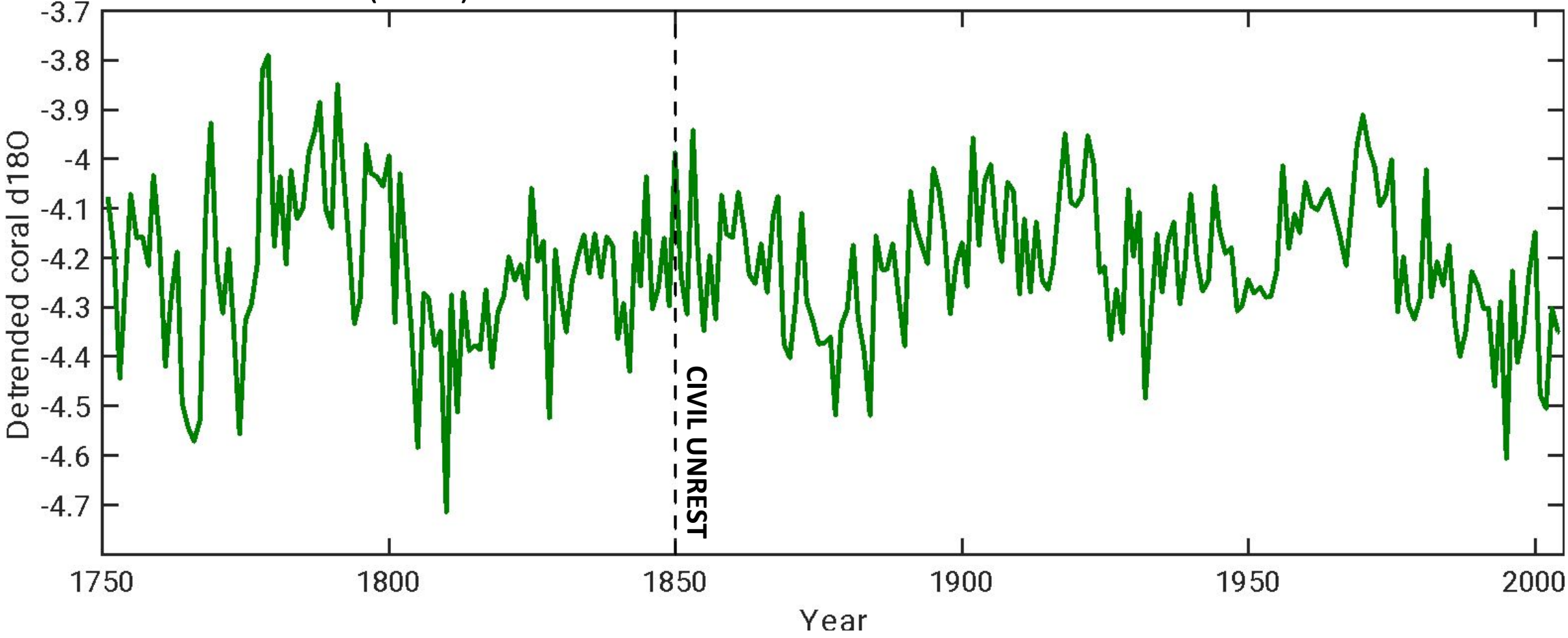
Protest on Antigua in 1850

Kilbourne et al. (2008)



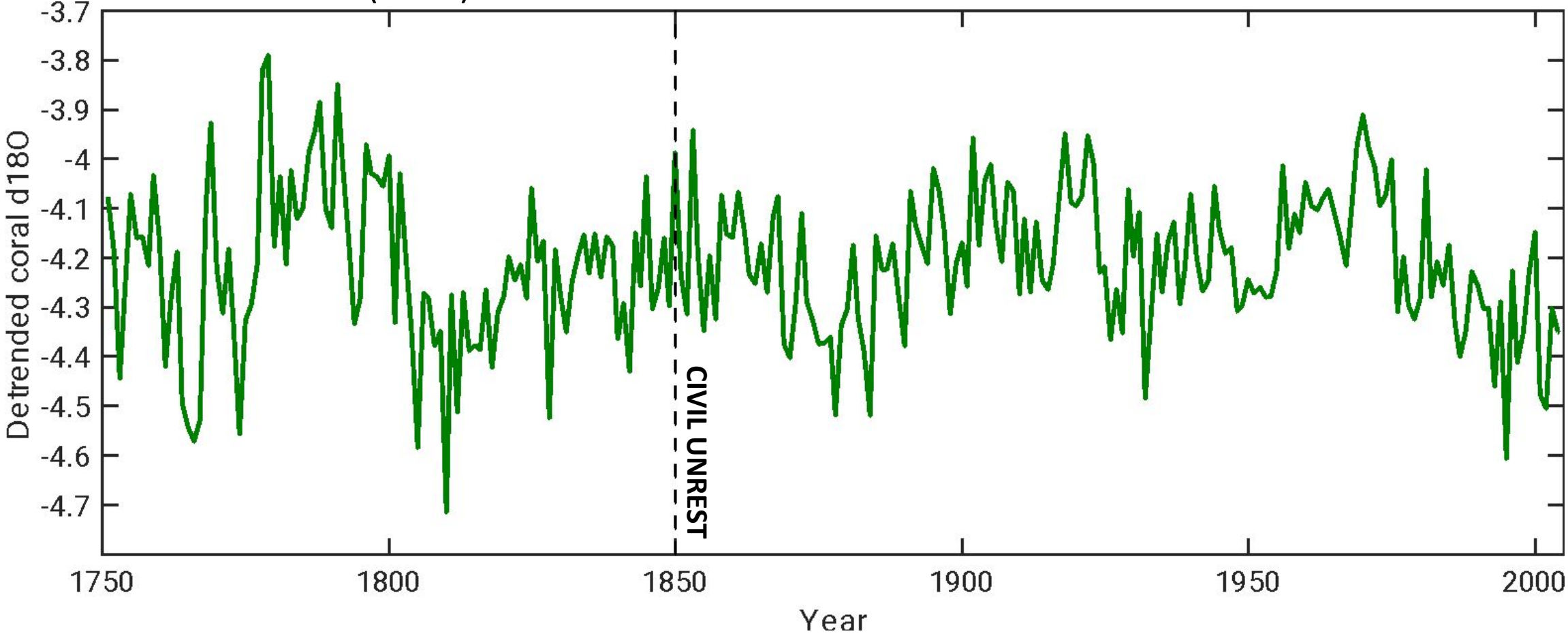
Protest on Antigua in 1850

Kilbourne et al. (2008)

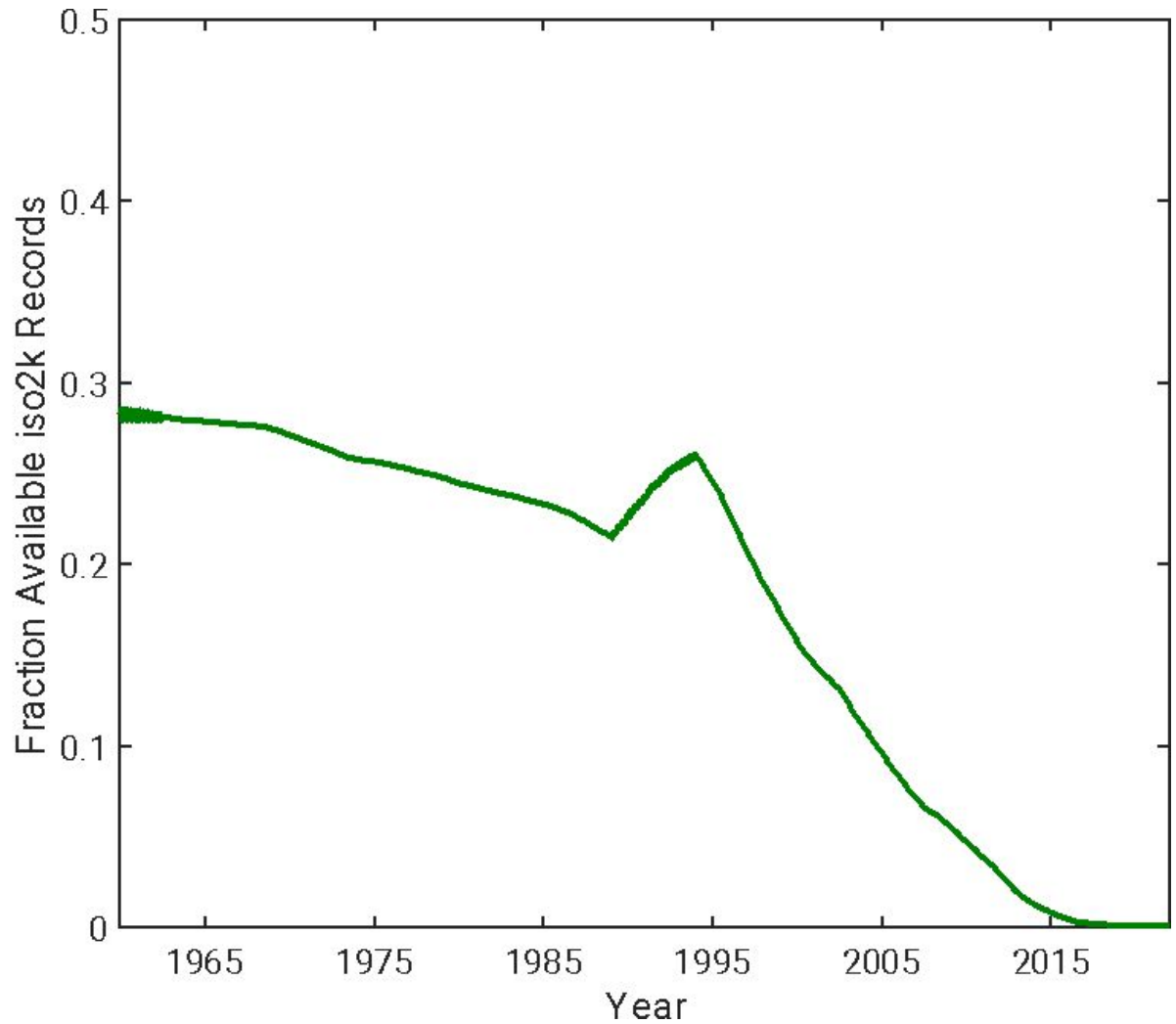


Why use iCESM? Data limitations…

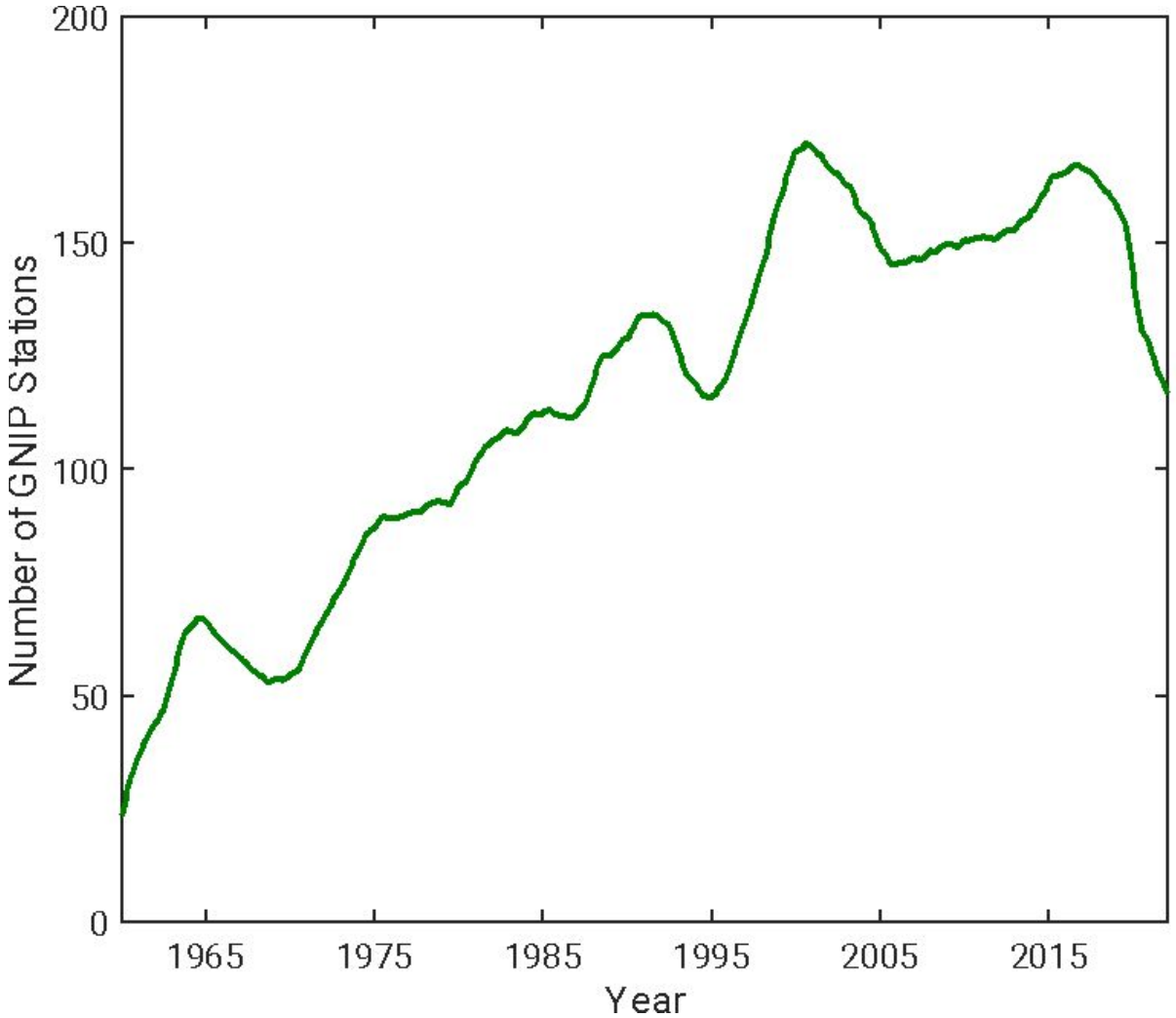
Kilbourne et al. (2008)

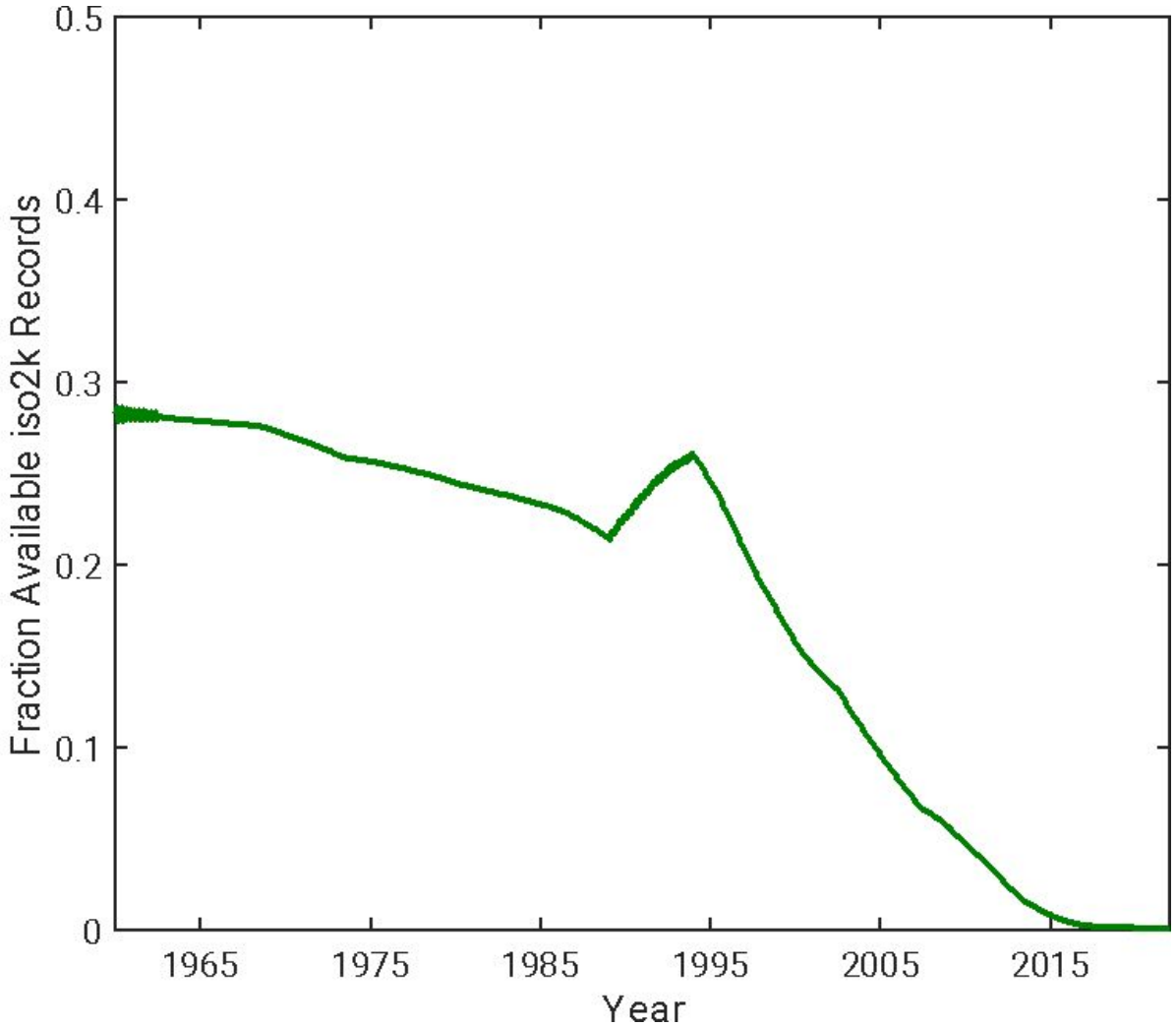


Why use iCESM? Data limitations…



Why use iCESM? Data limitations…





iCESM with a Proxy System Model

iCESM with a Proxy System Model

Utilize 7 forced transient last millennium simulations from iCESM

iCESM with a Proxy System Model

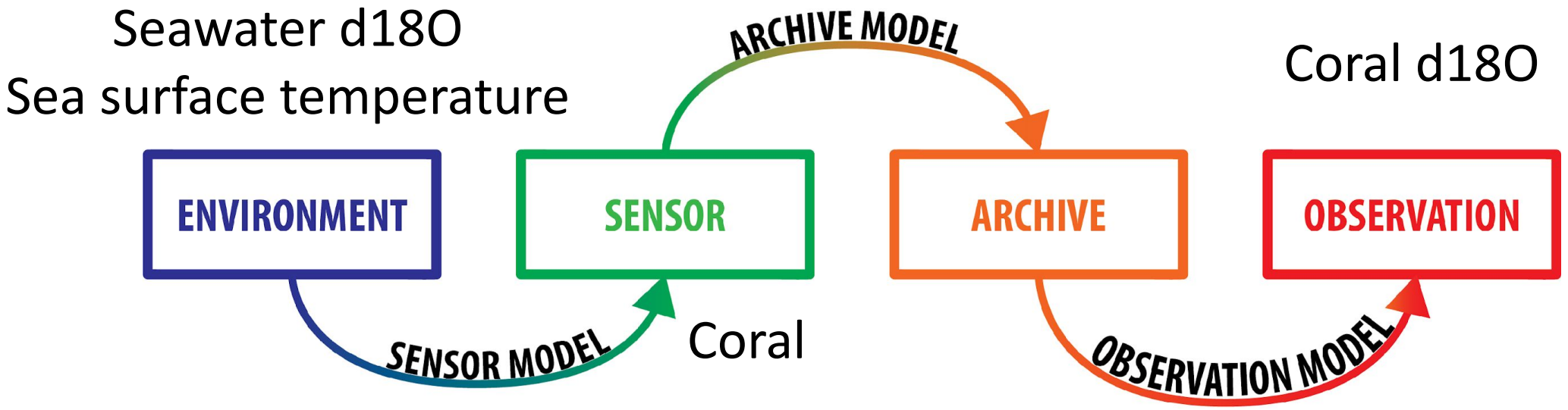
Utilize 7 forced transient last millennium simulations from iCESM

Seawater d18O

Sea surface temperature

iCESM with a Proxy System Model

Utilize 7 forced transient last millennium simulations from iCESM

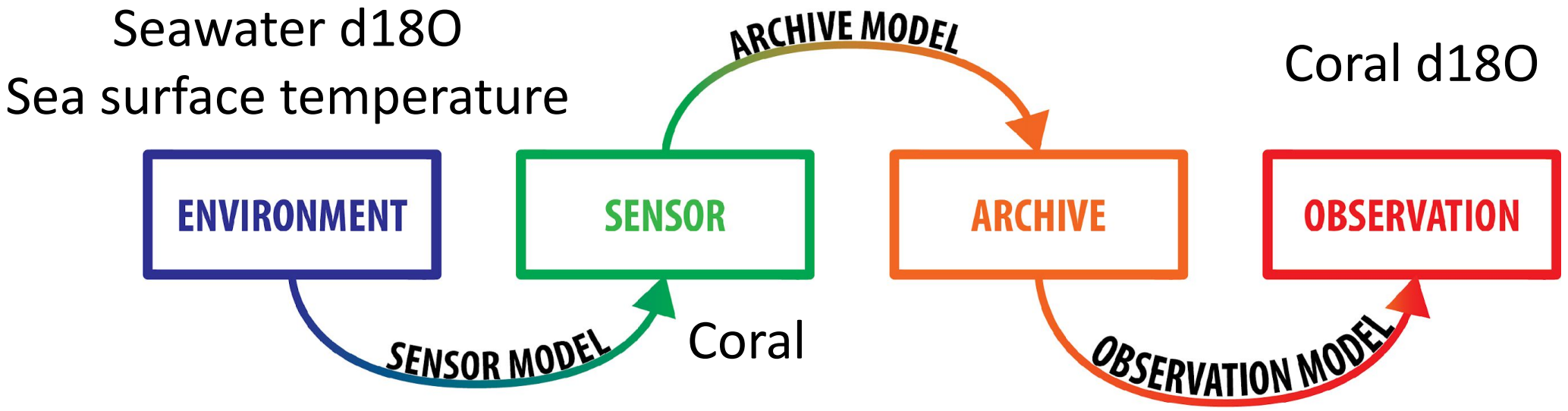


$$\Delta\,\delta^{18}\mathrm{O}_{\mathrm{coral}} = \alpha\Delta T + \Delta\,\delta^{18}\mathrm{O}_{\mathrm{sw}} + \xi_{\mathrm{m}}$$

Thompson et al. (2011)
Dee et al. (2015)

iCESM with a Proxy System Model

Utilize 7 forced transient last millennium simulations from iCESM
P-E, SST, geopotential height, winds, ~20 modes of variability

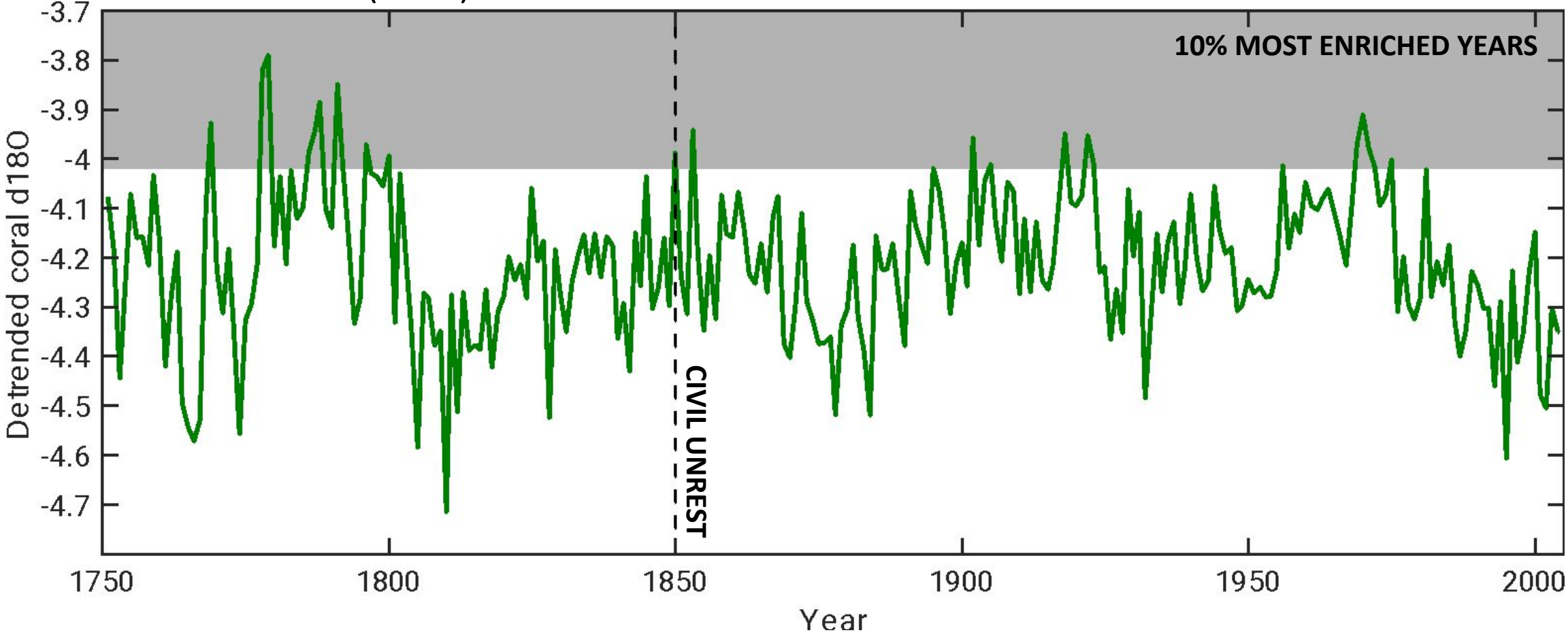


$$\Delta\,\delta^{18}\mathrm{O}_{\mathrm{coral}} = \alpha\Delta T + \Delta\,\delta^{18}\mathrm{O}_{\mathrm{sw}} + \xi_{\mathrm{m}}$$

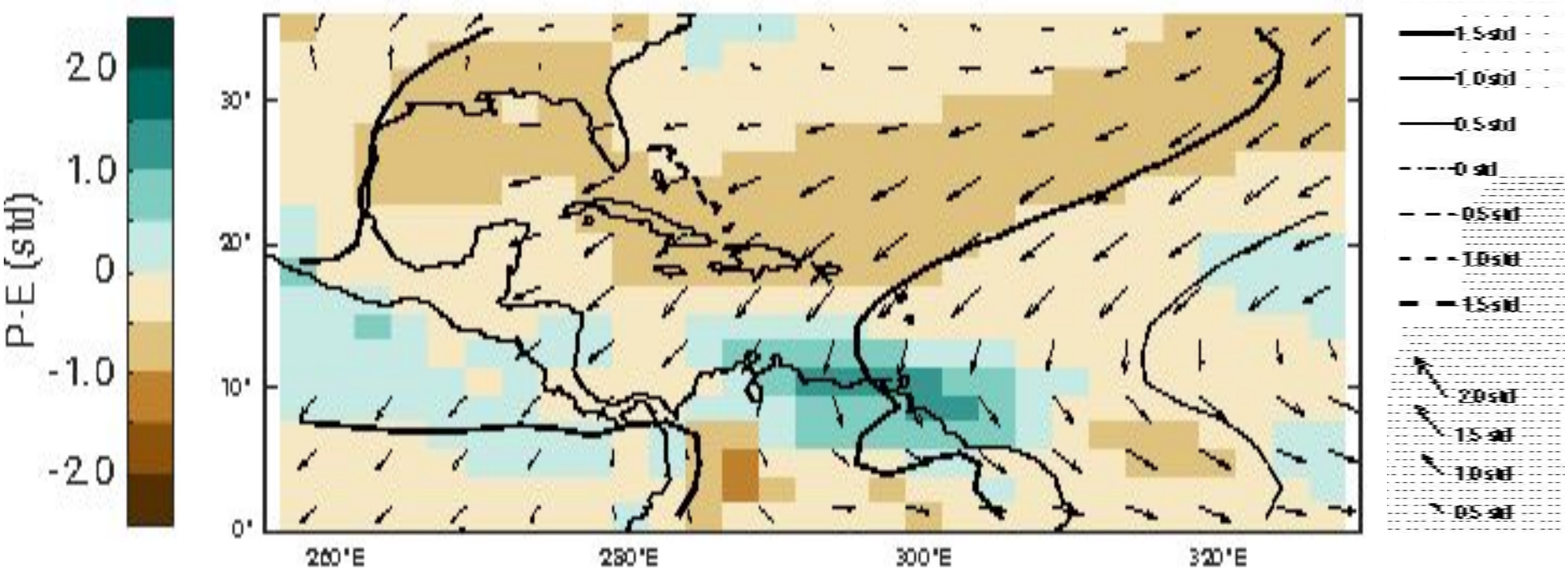
Thompson et al. (2011)
Dee et al. (2015)

Protest on Antigua in 1850

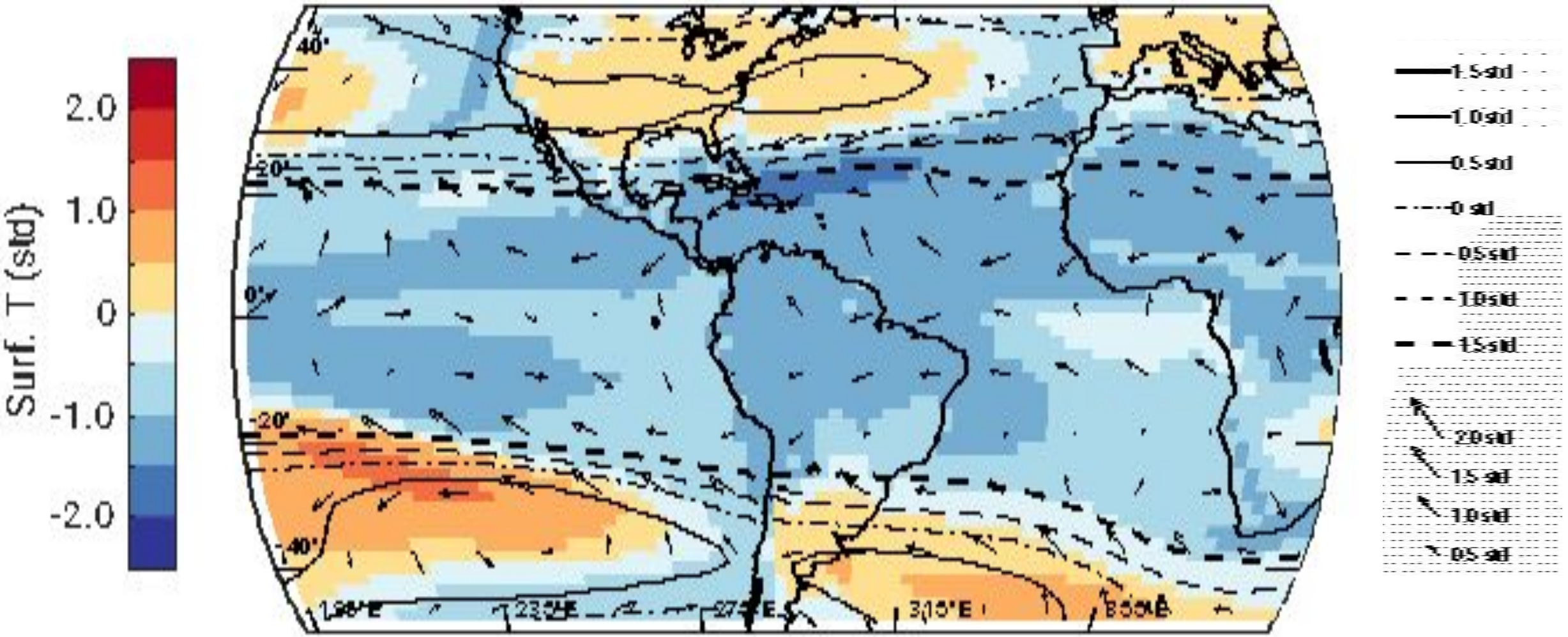
Kilbourne et al. (2008)



Results: Regional climate

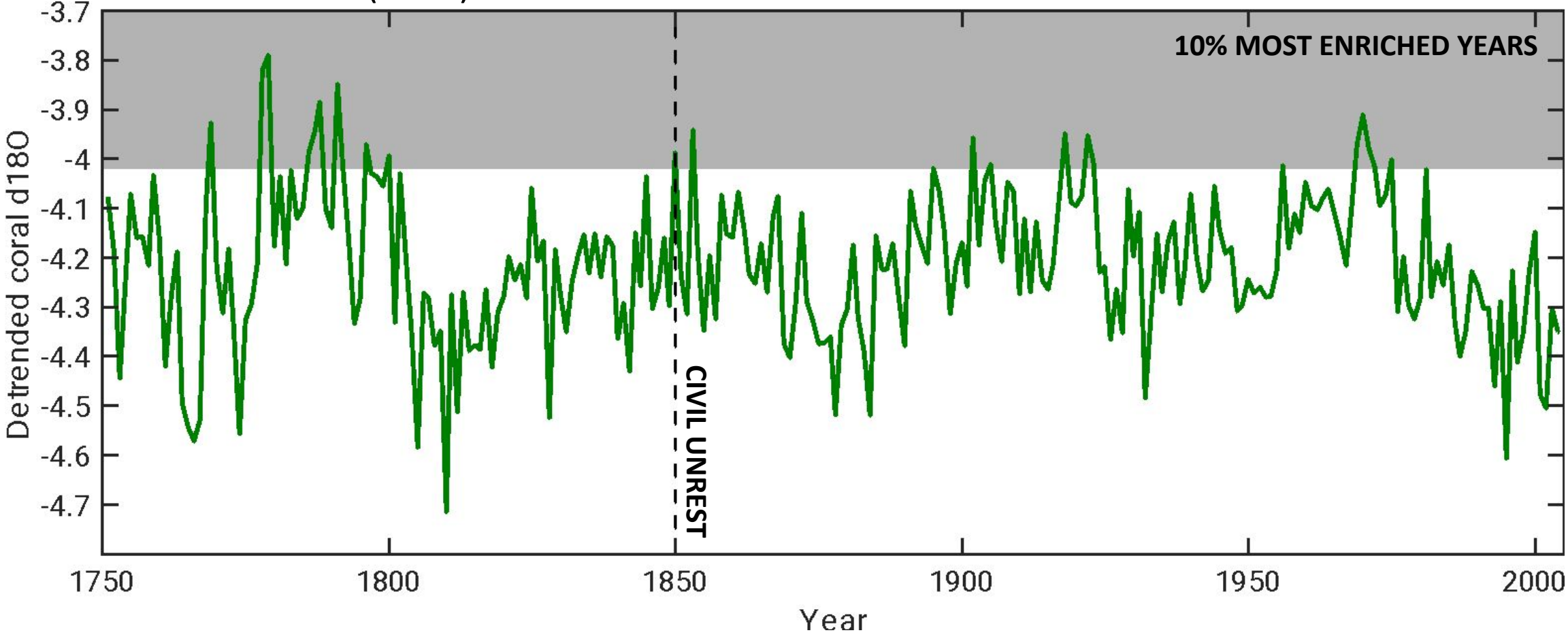


Results: Large-scale climate

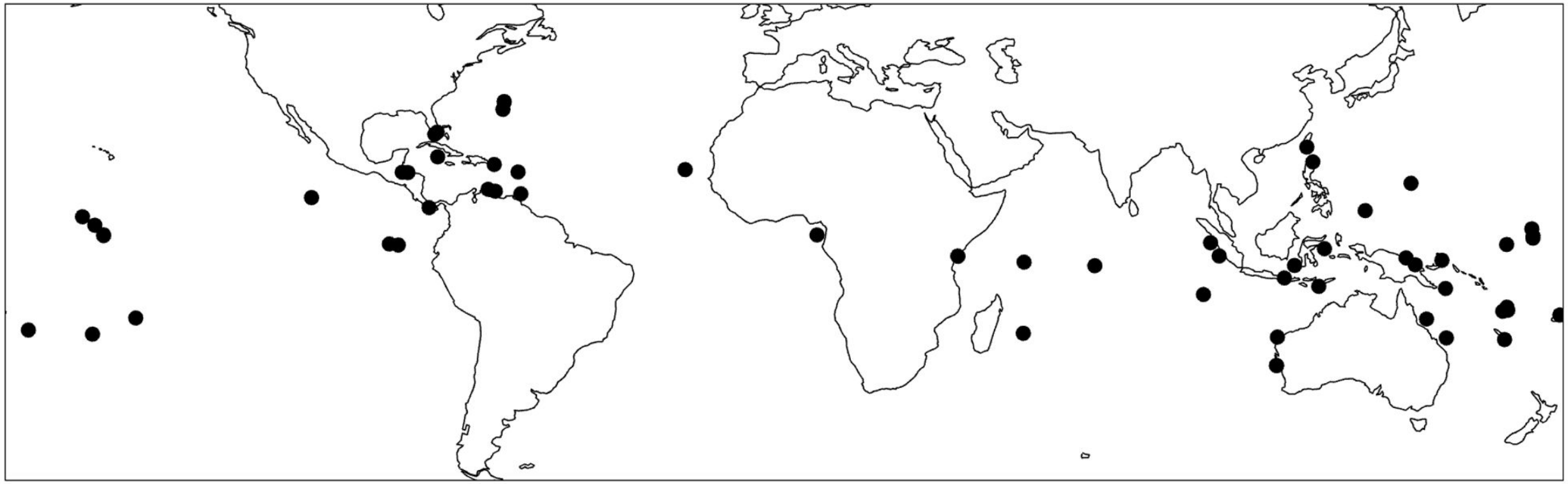


Protest on Antigua in 1850

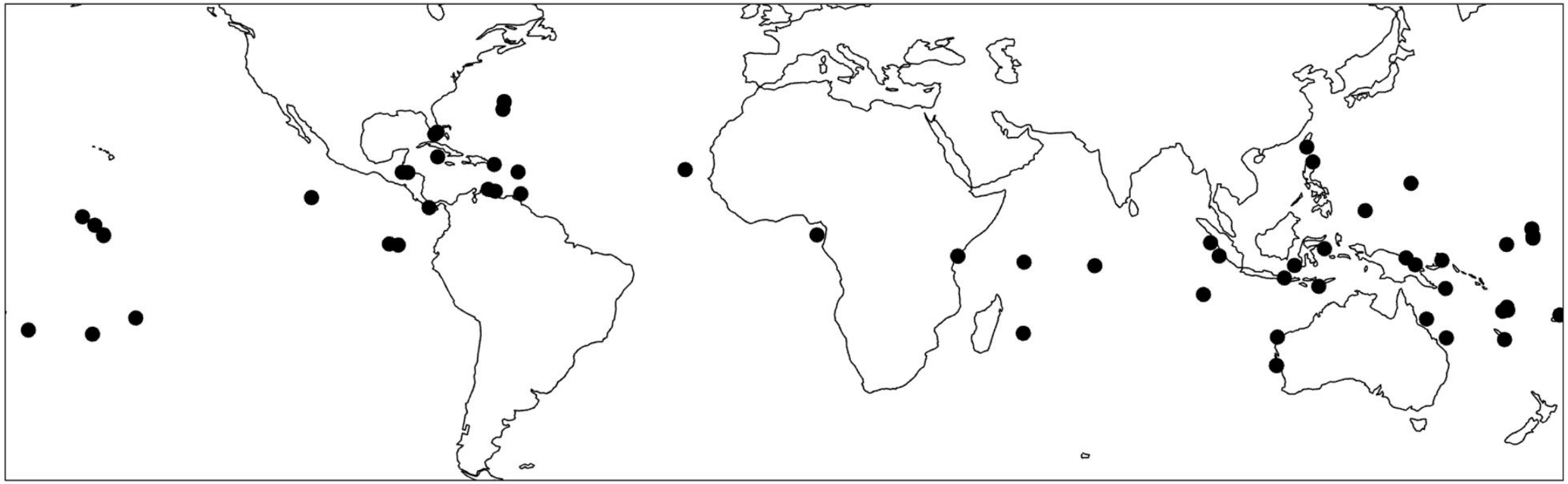
Kilbourne et al. (2008)



Methods: iso2k corals

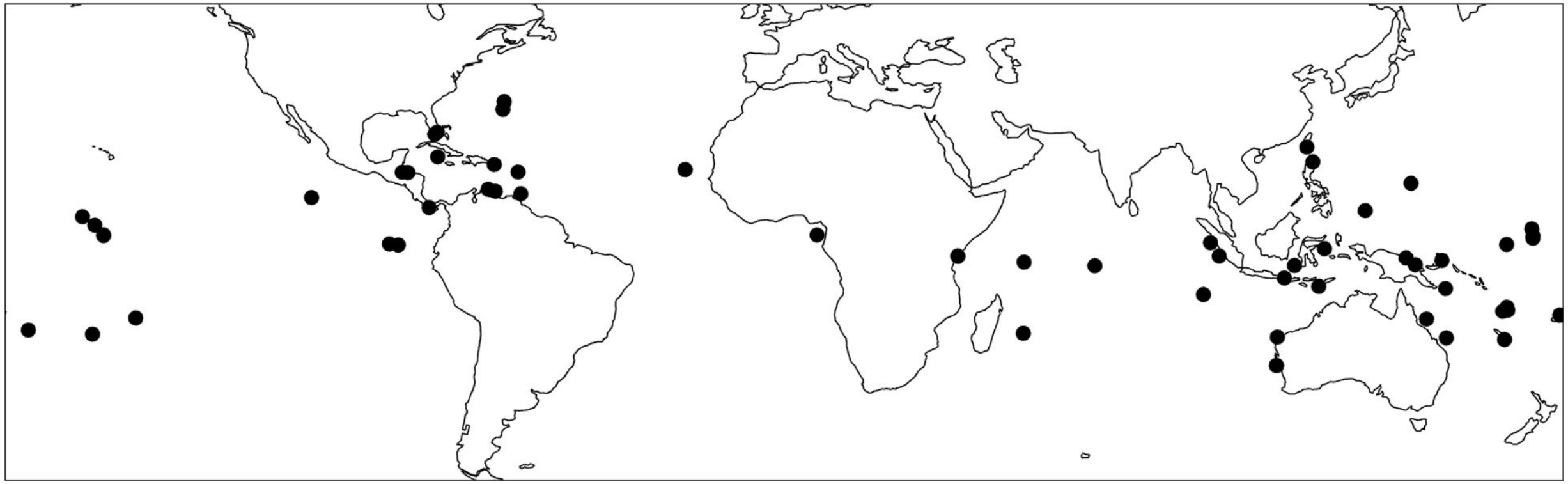


Methods: iso2k corals



Which of the ~20 modes of variability have a significant association with each record?

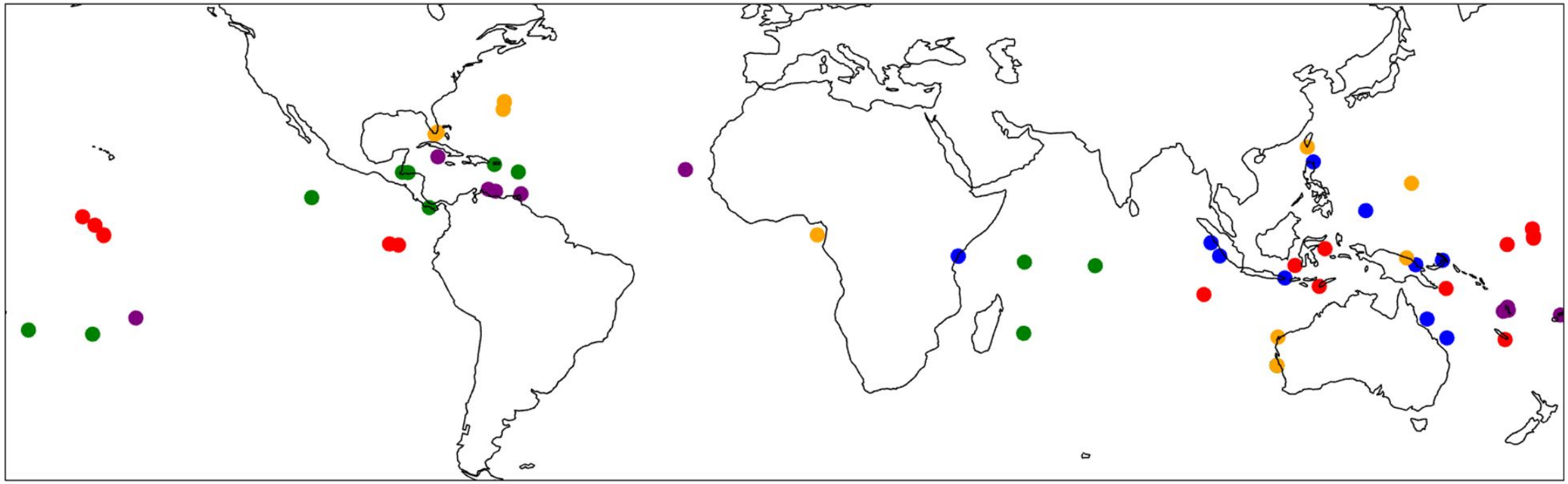
Methods: iso2k corals



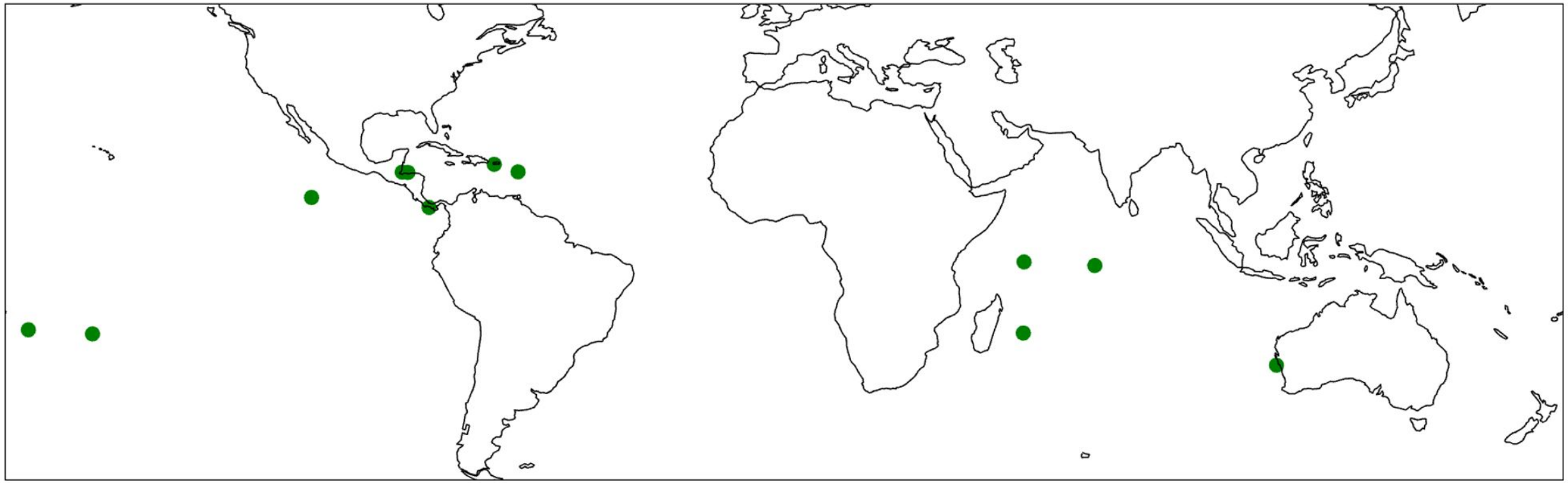
Which of the ~20 modes of variability have a significant association with each record?

Apply clustering algorithm to the results

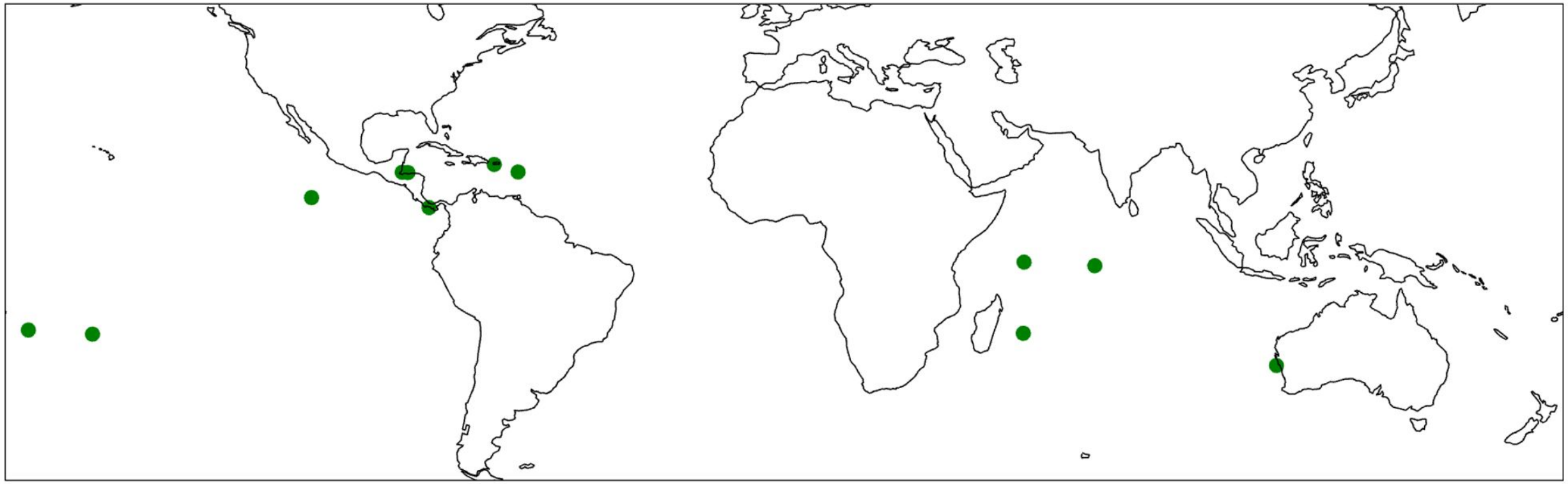
Results: 5 clusters of iso2k corals



Results: Parguera cluster (green)

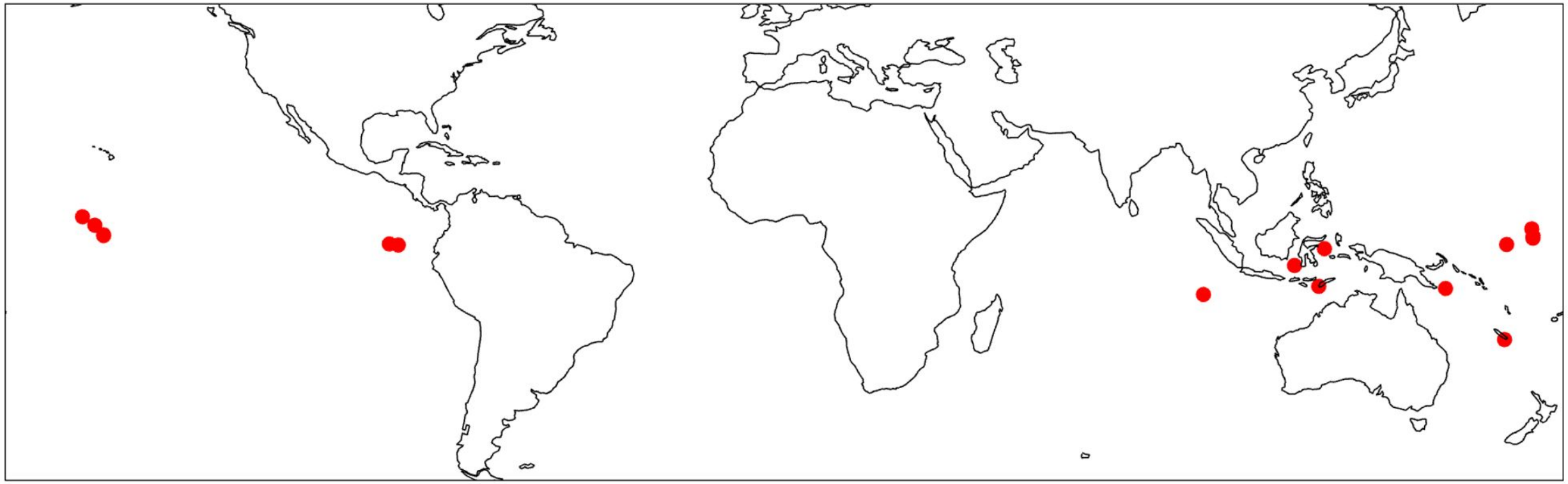


Results: Parguera cluster (green)



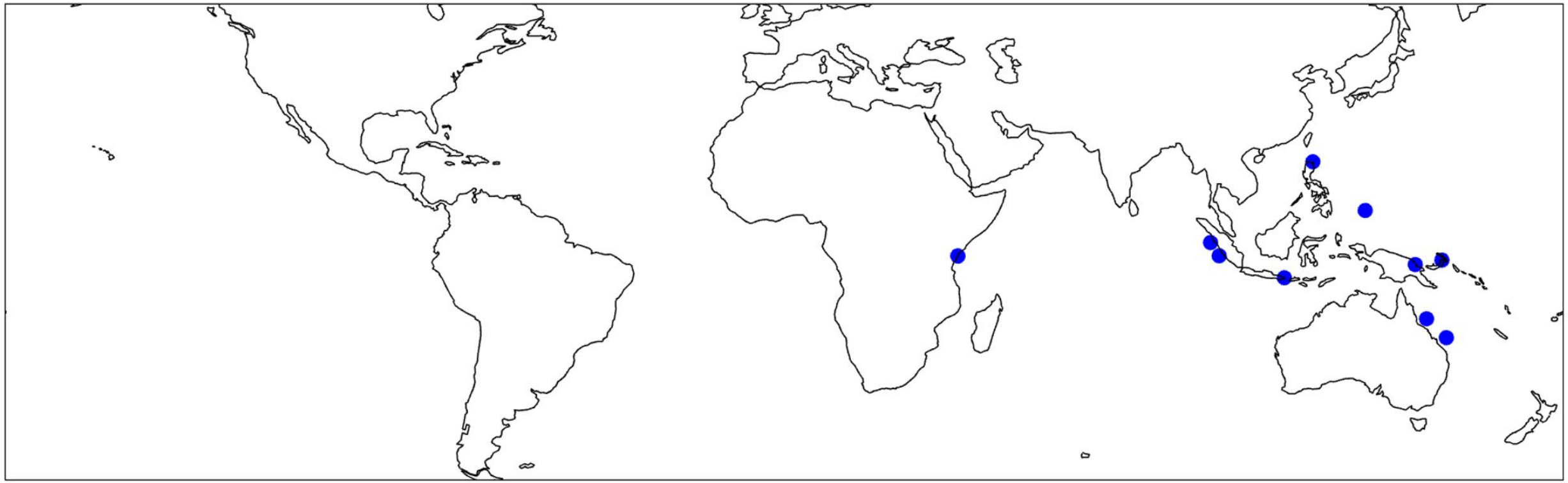
ITCZ strength, width, location, and area; ENSO; PDO; IOD; IOBM; NAM; PNA

Results: Red cluster



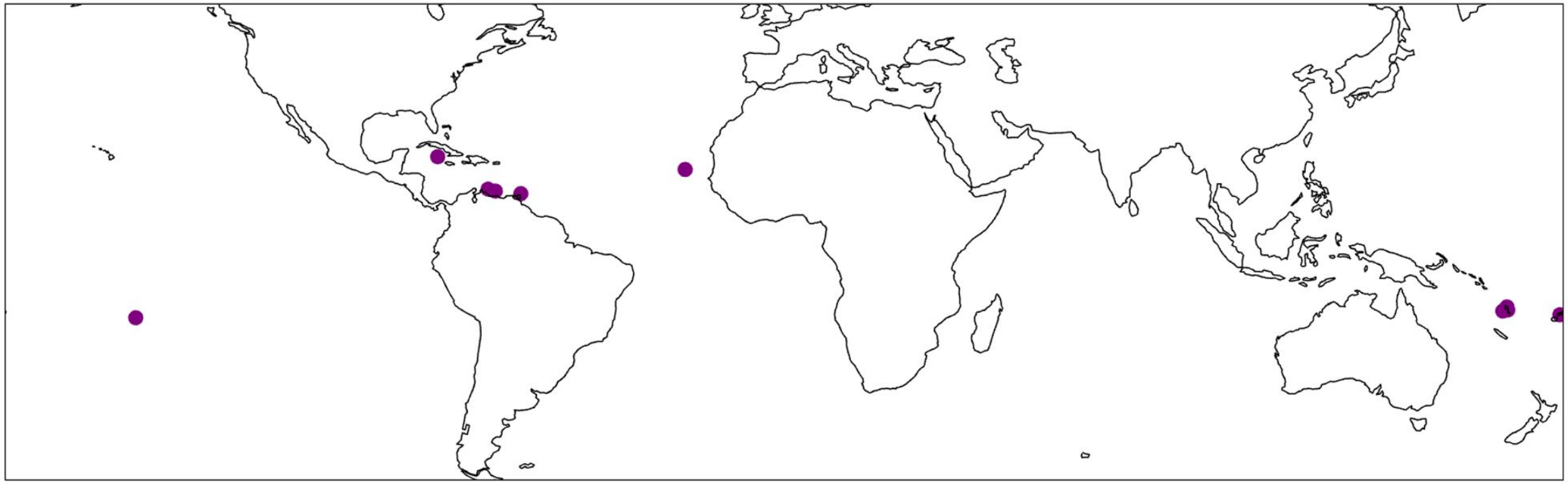
ITCZ strength, width, and area; ENSO and Modoki; PDO; IOD; NAM; PNA

Results: Blue cluster



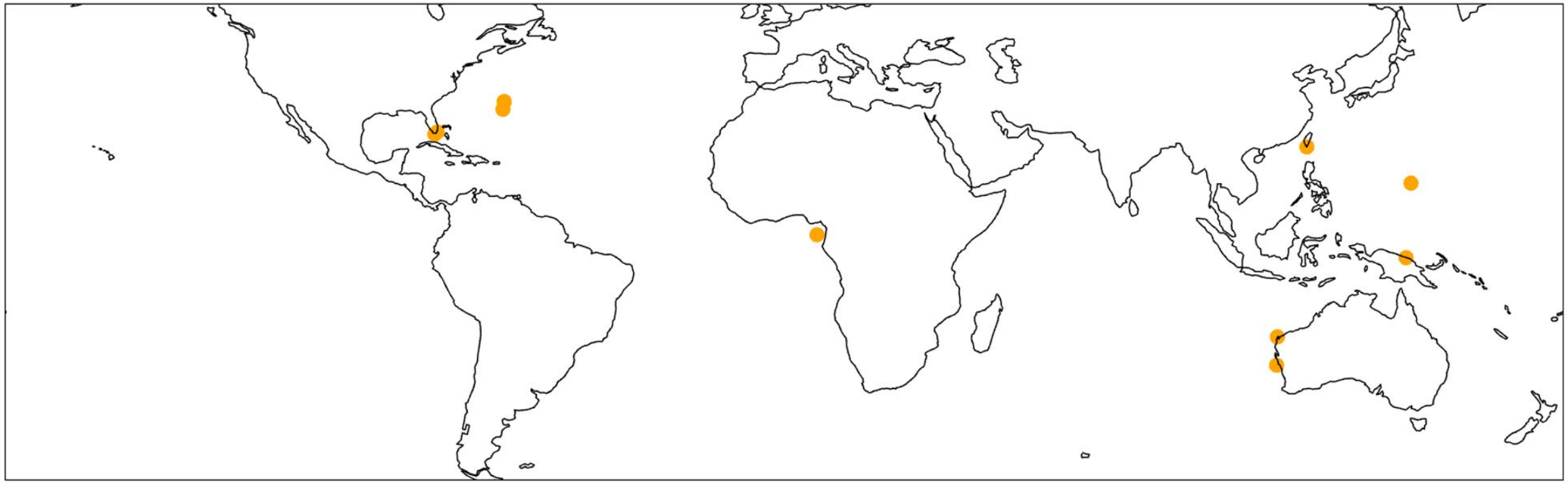
IOD

Results: Purple cluster



ITCZ strength; ENSO

Results: Orange cluster



None

Results: All clusters (no noise)

ITCZ strength, width, location, and area; ENSO; PDO; IOD; IOBM; NAM; PNA

ITCZ strength, width, and area; ENSO and Modoki; PDO; IOD; NAM; PNA

IOD

ITCZ strength; ENSO

None

Results: All clusters (low noise)

ITCZ strength and area; ENSO; PDO; IOD; PNA

ENSO and Modoki; PDO; IOD; NAM; PNA

None

ITCZ strength

None

Results: All clusters (high noise)

ENSO; IOD

IOD

None

None

None

PIDGM

pidgm.github.io/index.html

PIDGM — ISO2K DATABASE

Generate Customized Fi

PROXY LOCATIONS

Each proxy location has a maximum of 28 different figures available to download, dependent on the season and timescale selected.

FILTERS

Proxy Location

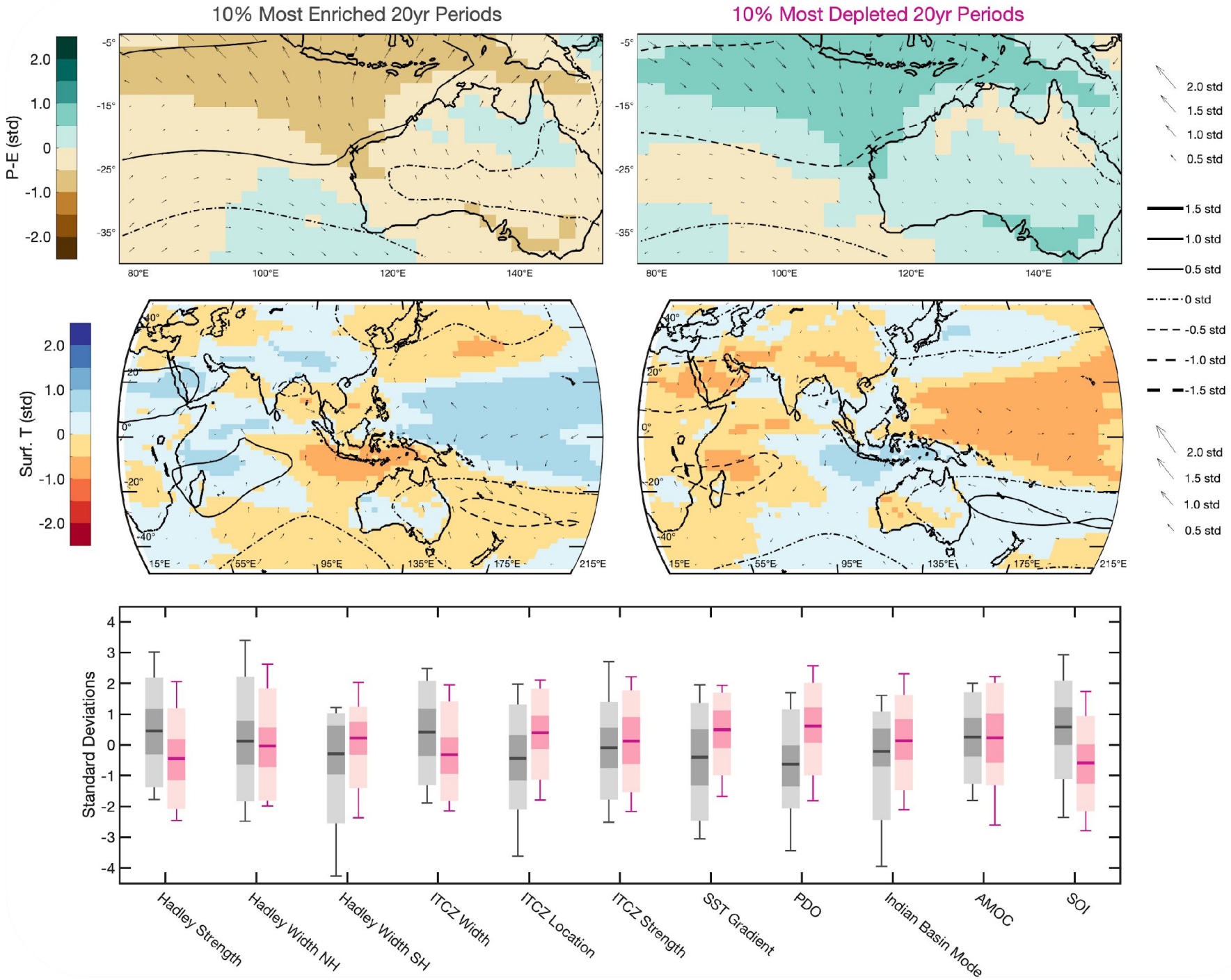
Timescale

Seasonality

Download

Figures can be downloaded for 1 location at a time.

PALEO
ISOTOPIC
DYNAMICS
with a
GLOBAL
MODEL



Regional and large-scale climate conditions

Modes of climate variability