WHAT IF PINATUBO DIDN'T HAPPEN?

Impacts on Antarctic sea ice

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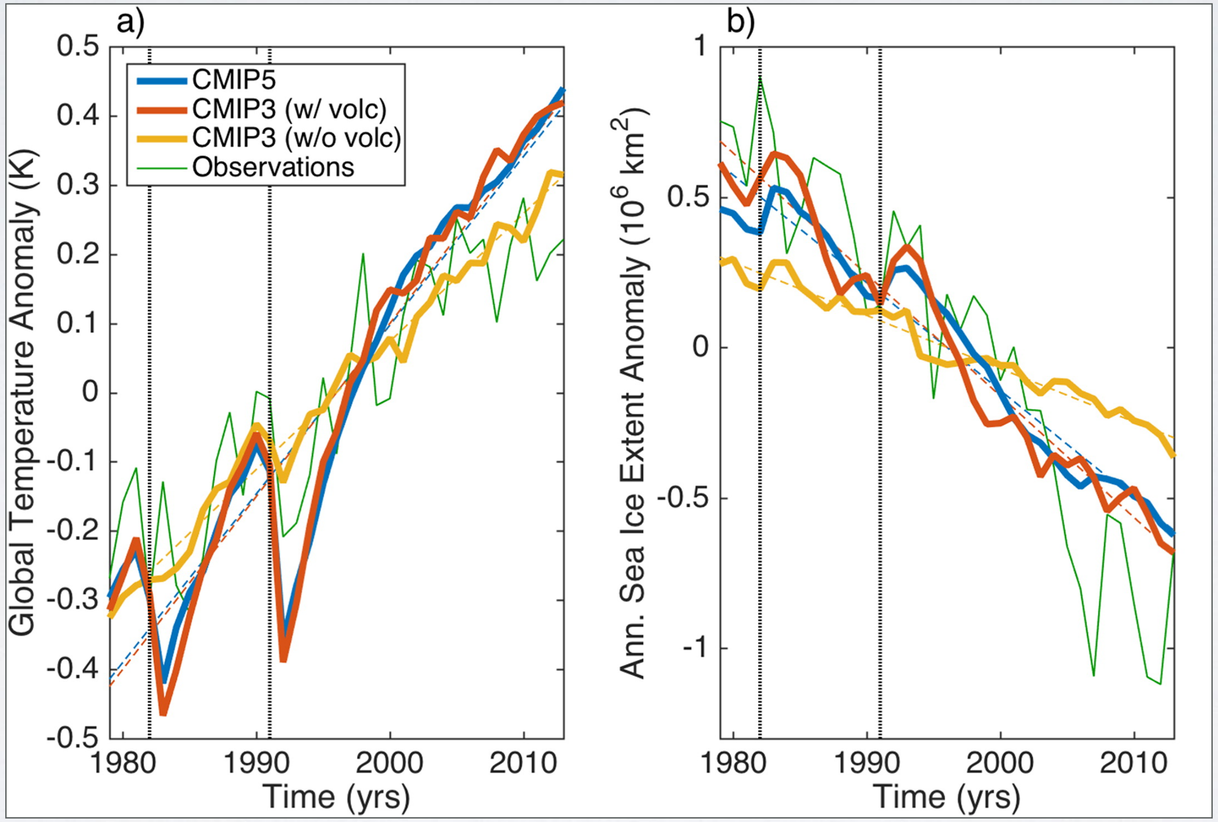
MOTIVATION

- Previous studies suggest that volcanic eruptions strongly impact Arctic sea ice (Rosenblum & Eisenman 2016, Gagné et al. 2017)



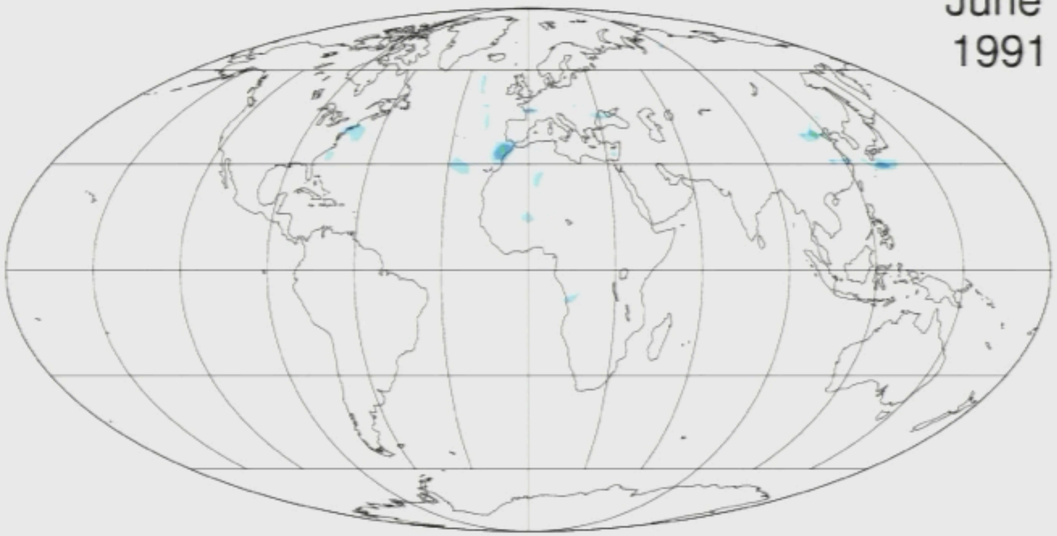
MOTIVATION

- To our knowledge, no-one has investigated the impact of volcanic eruptions on Antarctic sea ice

- Understanding the impact of a single volcanic eruption may have implications understanding recent sea ice variability and for geoengineering

http://www.cesm.ucar.edu/events/tutorials/2019/videos/2019_CESM_tutorial_yaga_richter.mp4 (3:55-4:45)

Natural SRM: Volcanoes



Volcanic Aerosol Column Burden (kg S m^{-2})

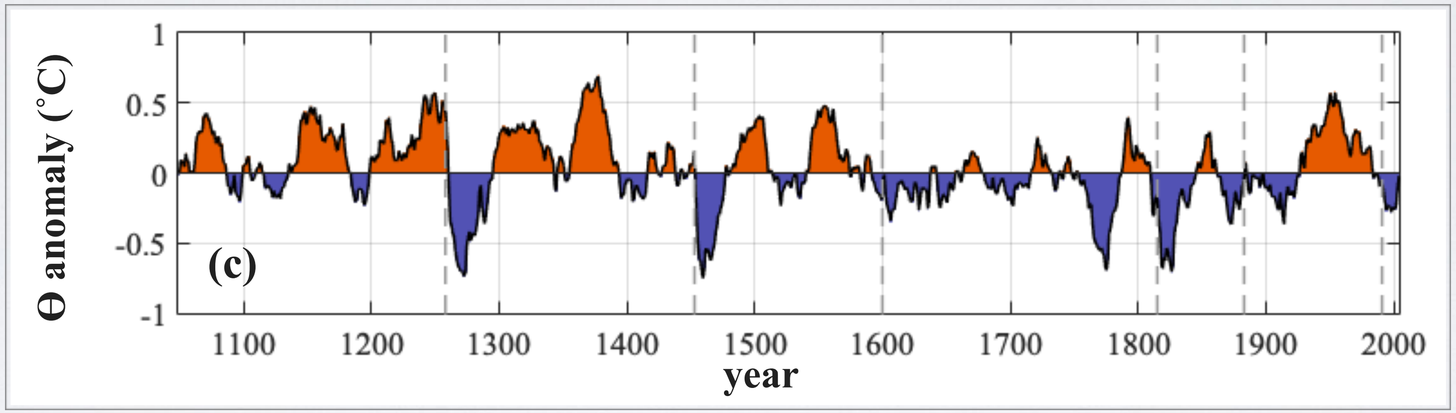
6e-07 1e-06 2e-06 3e-06 6e-06 1e-05 2e-05

Volcanoes inject sulfur gas into the stratosphere

Resulting aerosols blanket the earth and reflect sunlight back to space

WHAT IF PINATUBO DIDN'T HAPPEN?

- Pinatubo went off in 1991 – major stratospheric aerosol injection
- In ALL-FORCING simulations, there is a clear response in subsurface water temperature in the Weddell Sea (Tonelli et al. 2019)



- We want to isolate the impact of the volcano and understand the regional mechanisms that may lead to sea ice change

EXPERIMENTAL SETUP - USING BHIST

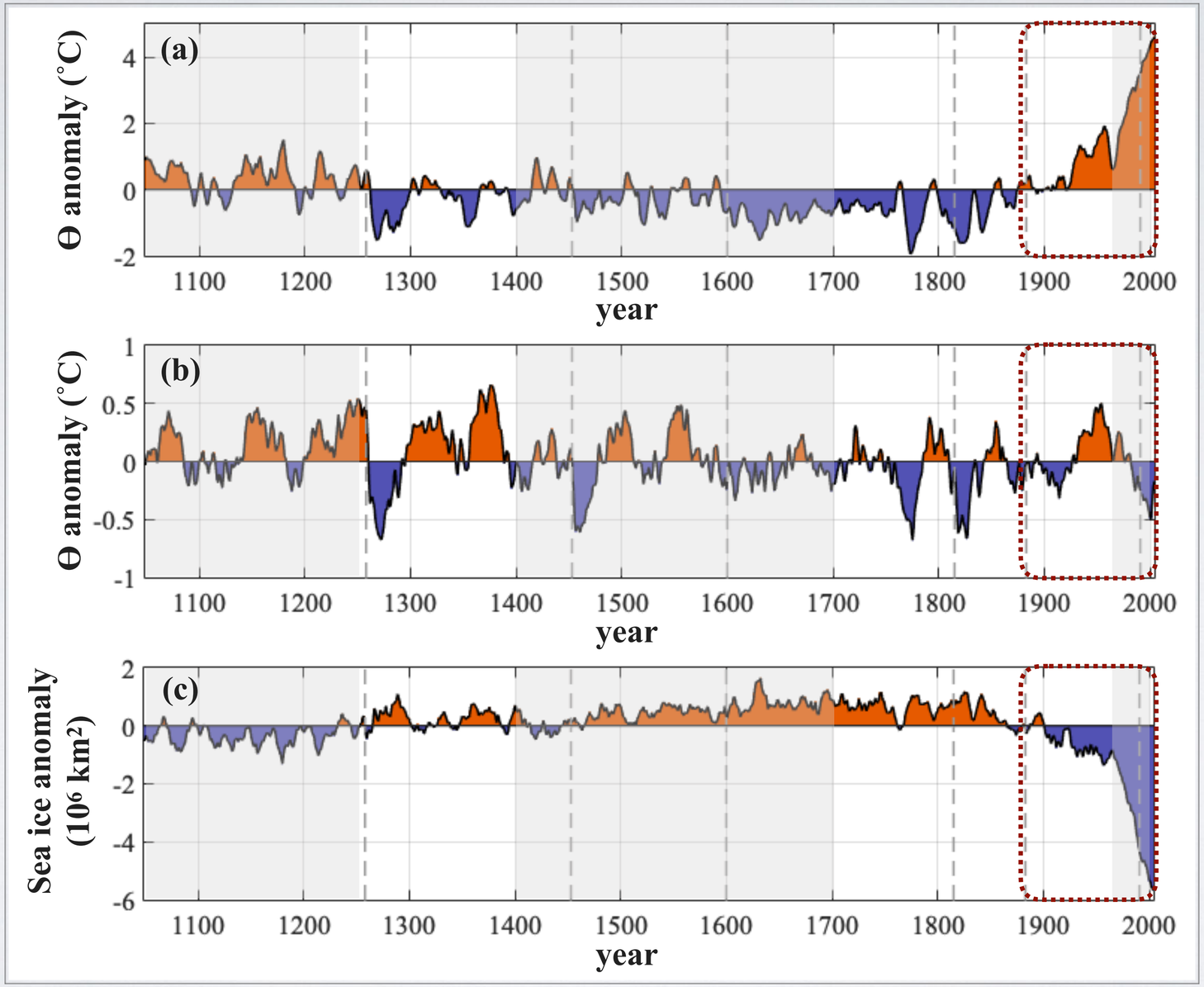
- Control: CMIP6 fully-coupled historical runs – 11 members plus more soon – already available over 1850-2014
- Comparison: Exactly the same experimental set-up, but remove the aerosol forcing associated with Pinatubo – 20 members – conduct for 1991-2000
- Computational cost: 200 model years = 686,340 PE hours
- Major considerations:
  - Signal-to-noise: how many ensemble members do we need?
  - Initialization: one from each existing run?

THE LAST MILLENNIUM ENSEMBLE

WS surface

WS subsurface

WS sea ice extent



Tonelli et al. 2019