

ITCZ SHIFT AND EXTRATROPICAL TELECONNECTIONS DRIVE ENSO RESPONSE TO VOLCANIC ERUPTIONS

Pausata Francesco S.R.

Davide Zanchettin, Christina Karamperidou
Rodrigo Caballero, David S. Battisti

Email: pausata.francesco@uqam.ca

MODEL DESCRIPTION & EXPERIMENTAL DESIGN

MODEL

Norwegian Earth System Model (NorESM1-M):

Atmospheric-ocean-chemistry coupled model

ATMOSPHERE: CAM4-OSLO, $1.9^\circ \times 2.5^\circ$ and 26 vertical level
(updated module that simulates the life cycle of aerosol particles,
primary and secondary organics)

OCEAN: MICOM, $1^\circ \times 1^\circ$

EXPERIMENTS

Tambora-like eruptions:

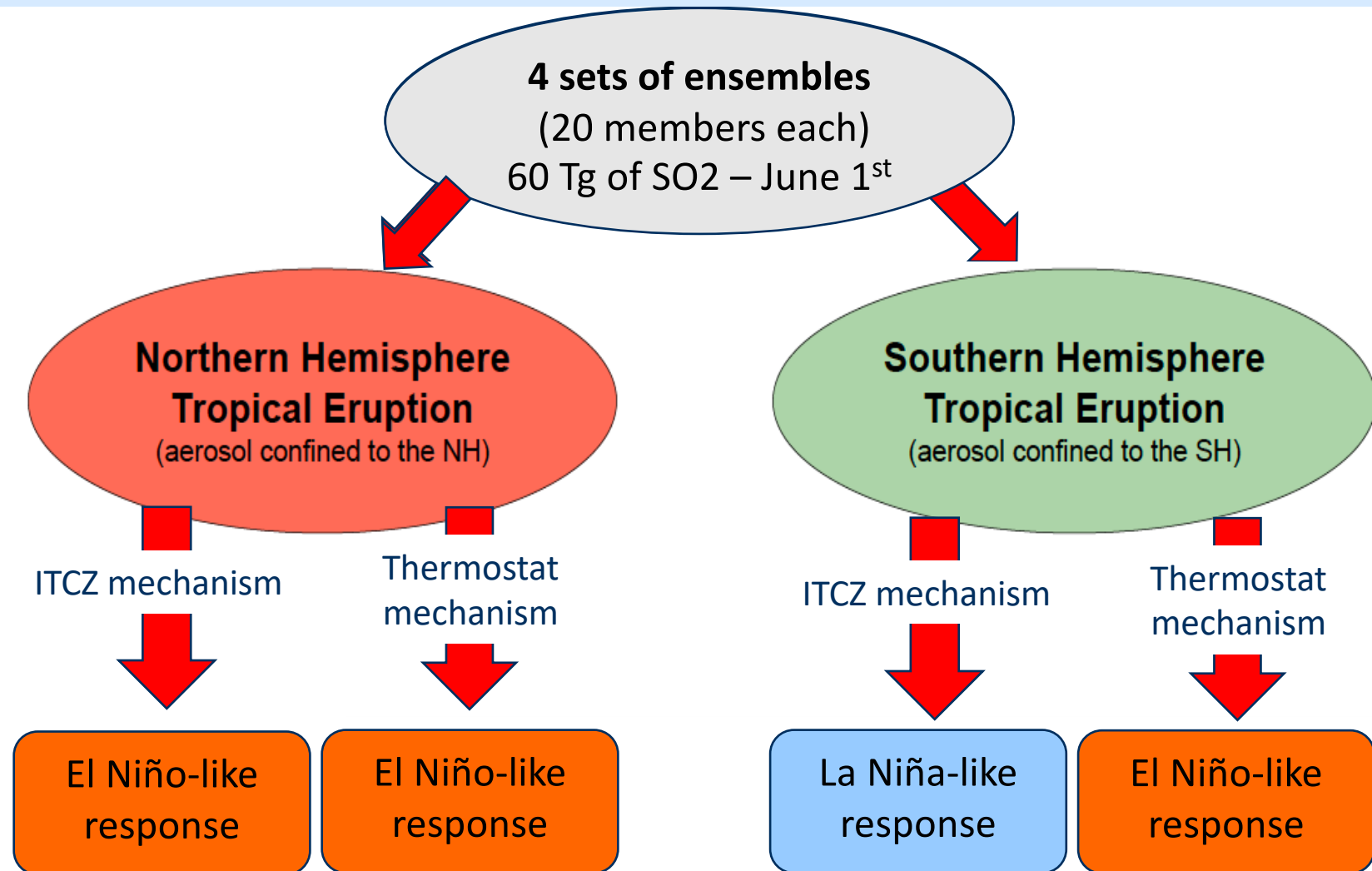
- 60 Tg of SO_2 in 3 days starting June 1st
- Injection height 15 - 21 km
- 17°N and 17°S



"Mt Pinatubo Eruption" by Wirraway

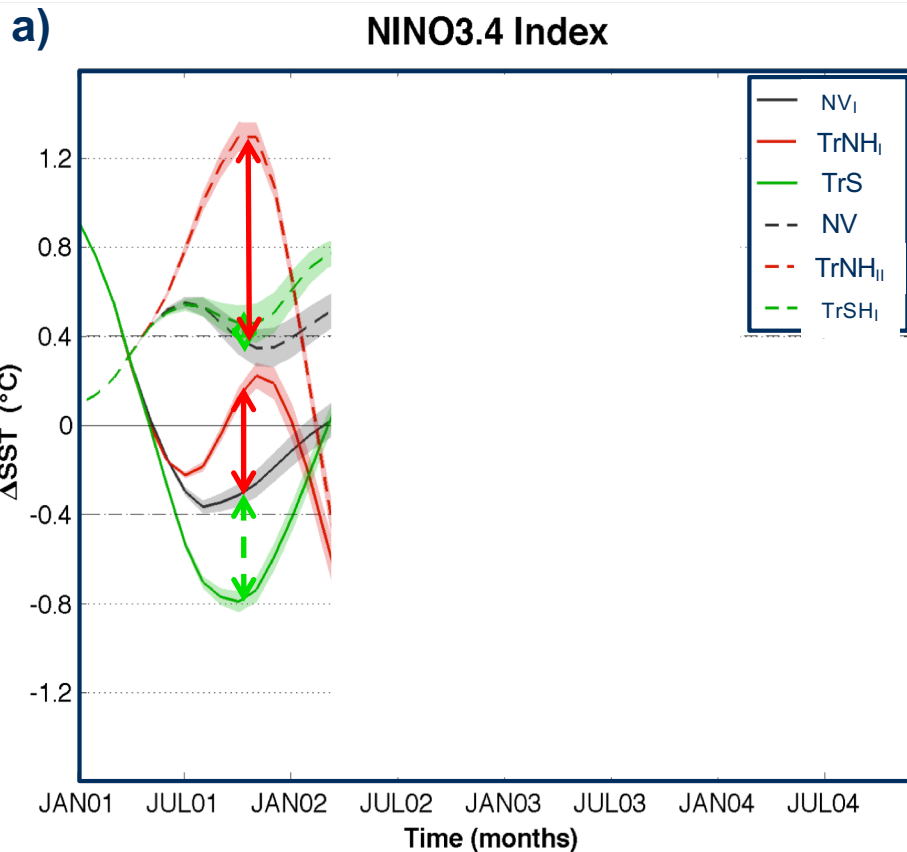
EXPERIMENT DESIGN: ENSEMBLE MEMBERS

Idealized tropical eruptions

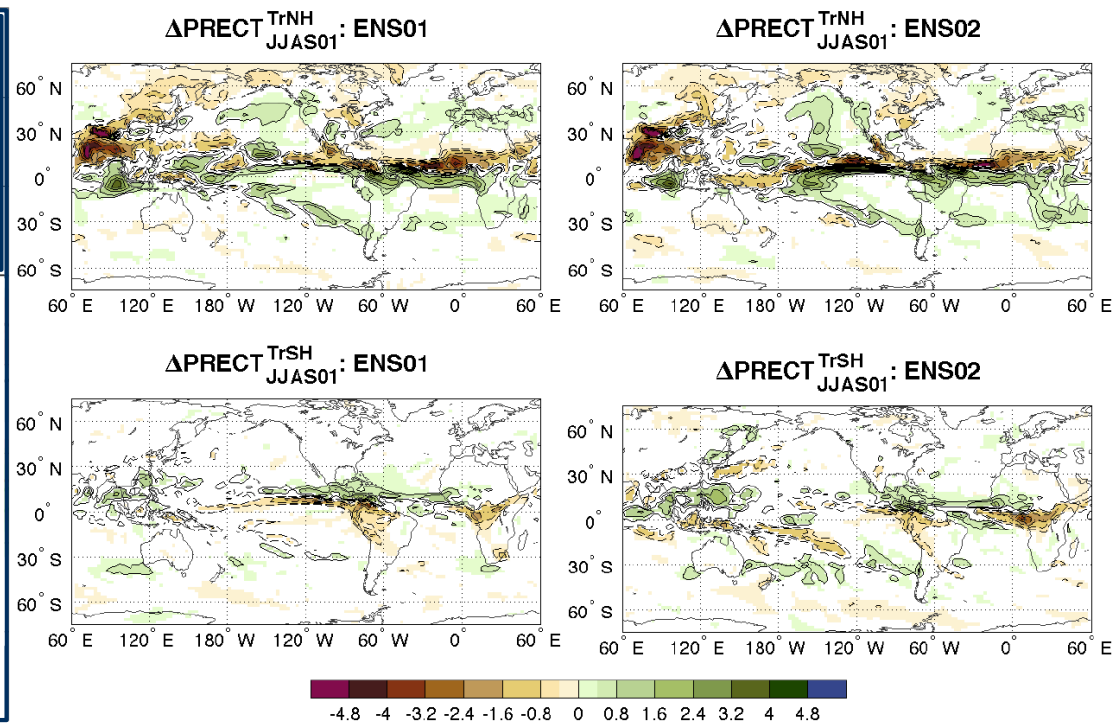


MECHANISMS FOR NIÑO RESPONSE

NINO3.4 INDEX

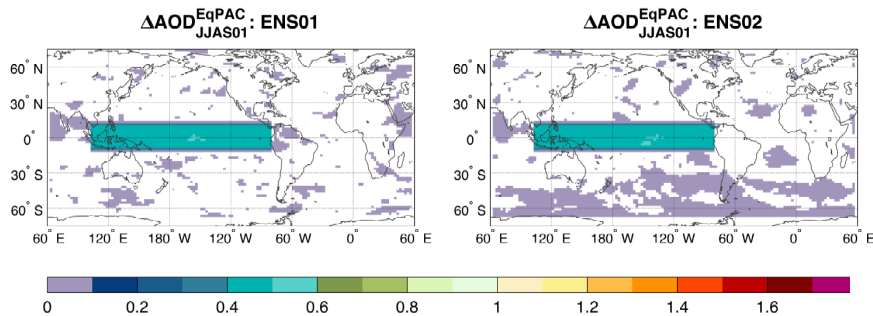


Precipitation Response – JJAS 01



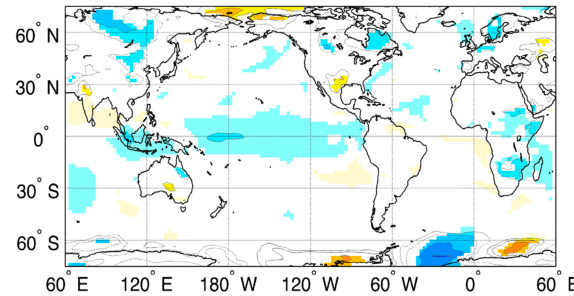
TR ERUPTIONS: MECHANISMS FOR NIÑO RESPONSE

Additional Experiment: EqPAC

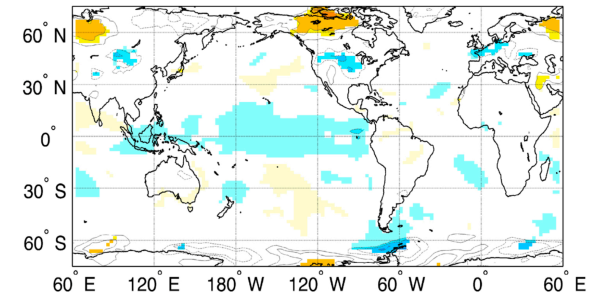


Surface Temperature Anomalies in Prescribed SO_4 EqPAC simulations

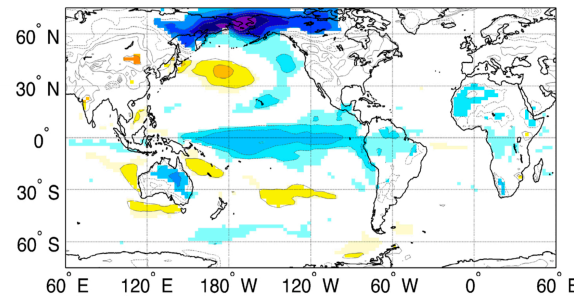
a) First Summer: Ensemble 1



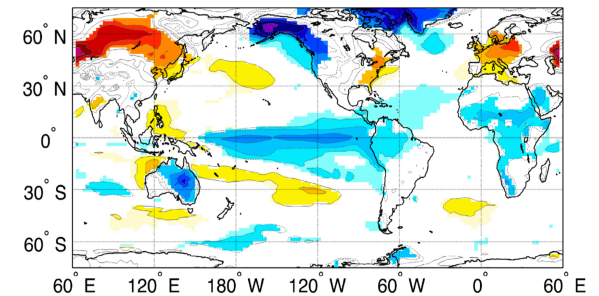
c) First Summer: Ensemble 2



b) First Winter: Ensemble 1



d) First Winter: Ensemble 2

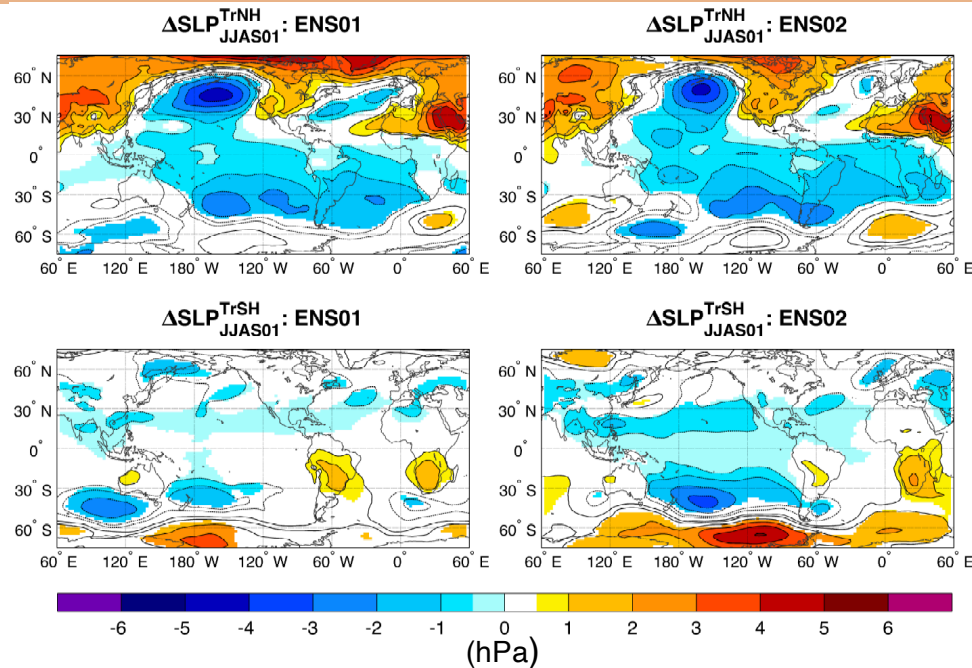


Ocean Thermostat where are you?

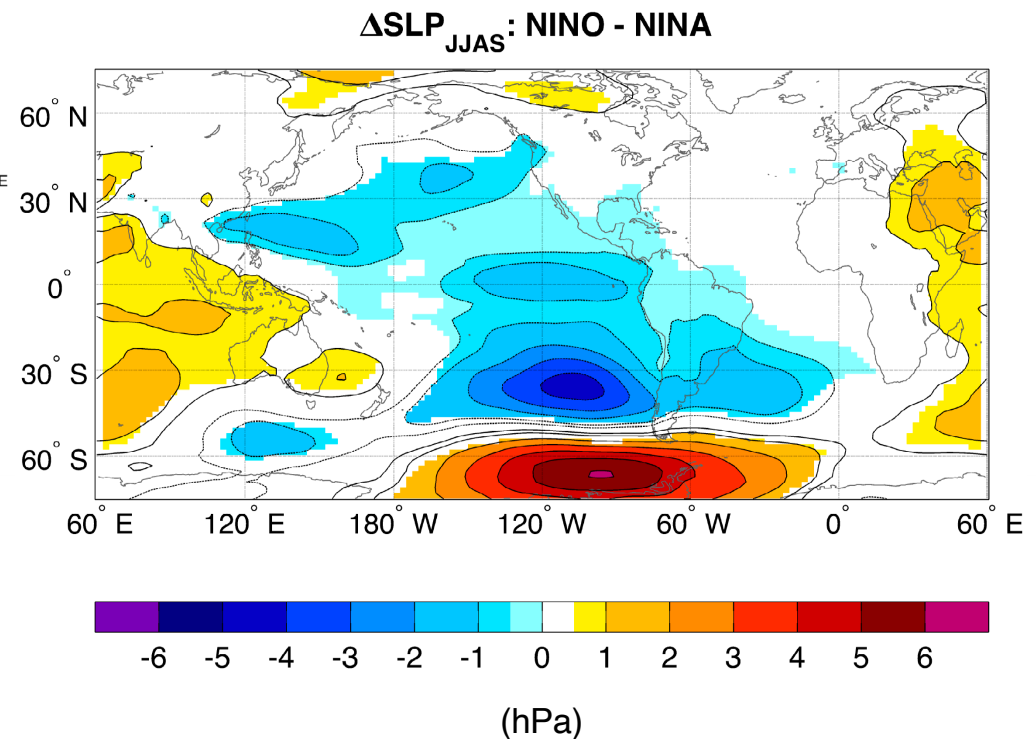
Not seen in the second winter either

TR ERUPTIONS: MECHANISMS FOR NIÑO RESPONSE

New Mechanism? High latitude teleconnections



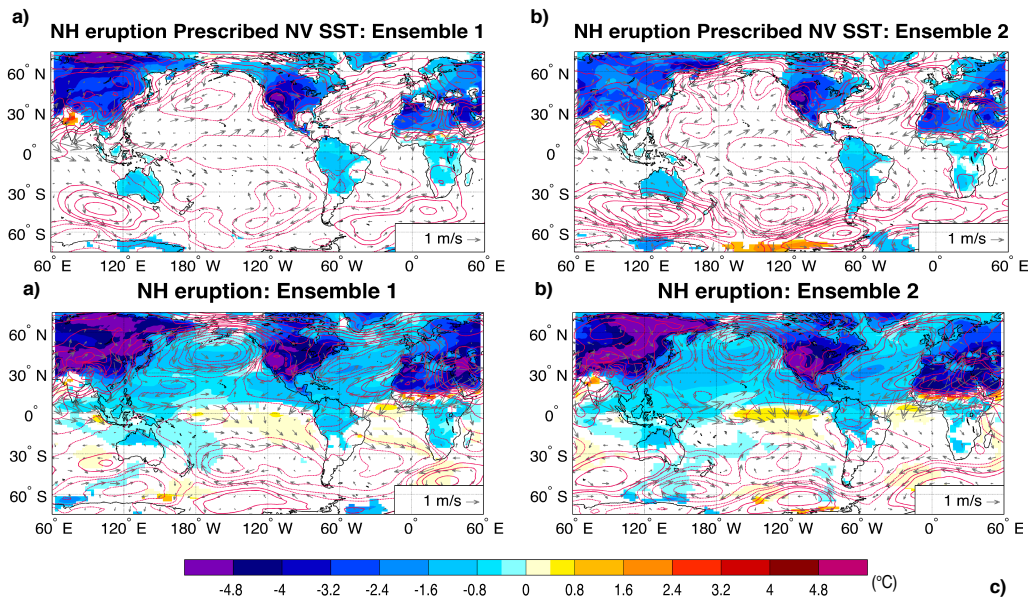
High-latitude similarities in both hemispheres with SLP anomaly pattern preceding an El Niño event



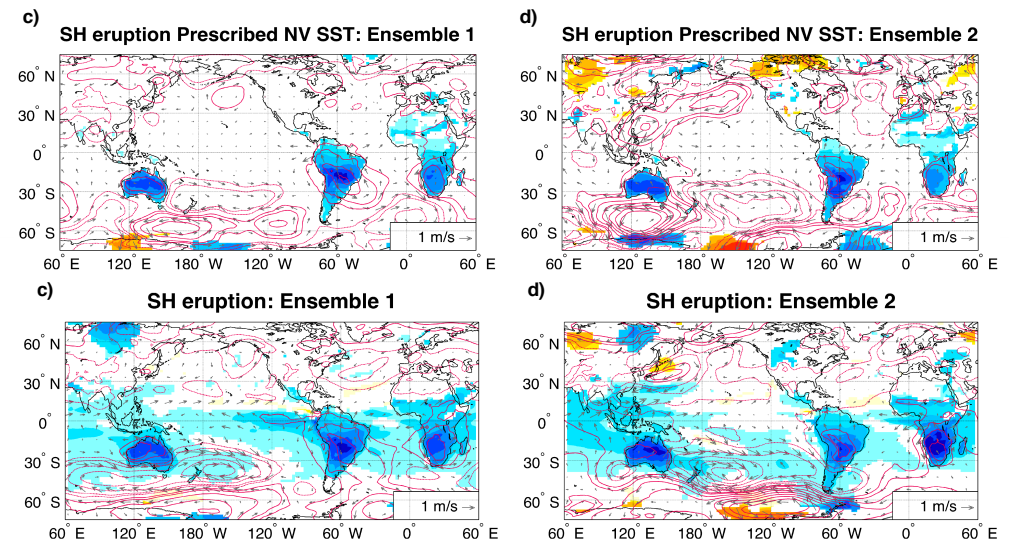
TR ERUPTIONS: MECHANISMS FOR NIÑO RESPONSE

High latitude teleconnections: Fixing SSTs to NO-VOLC

Surface Temperature, Wind & SLP Anomalies in the First Summer



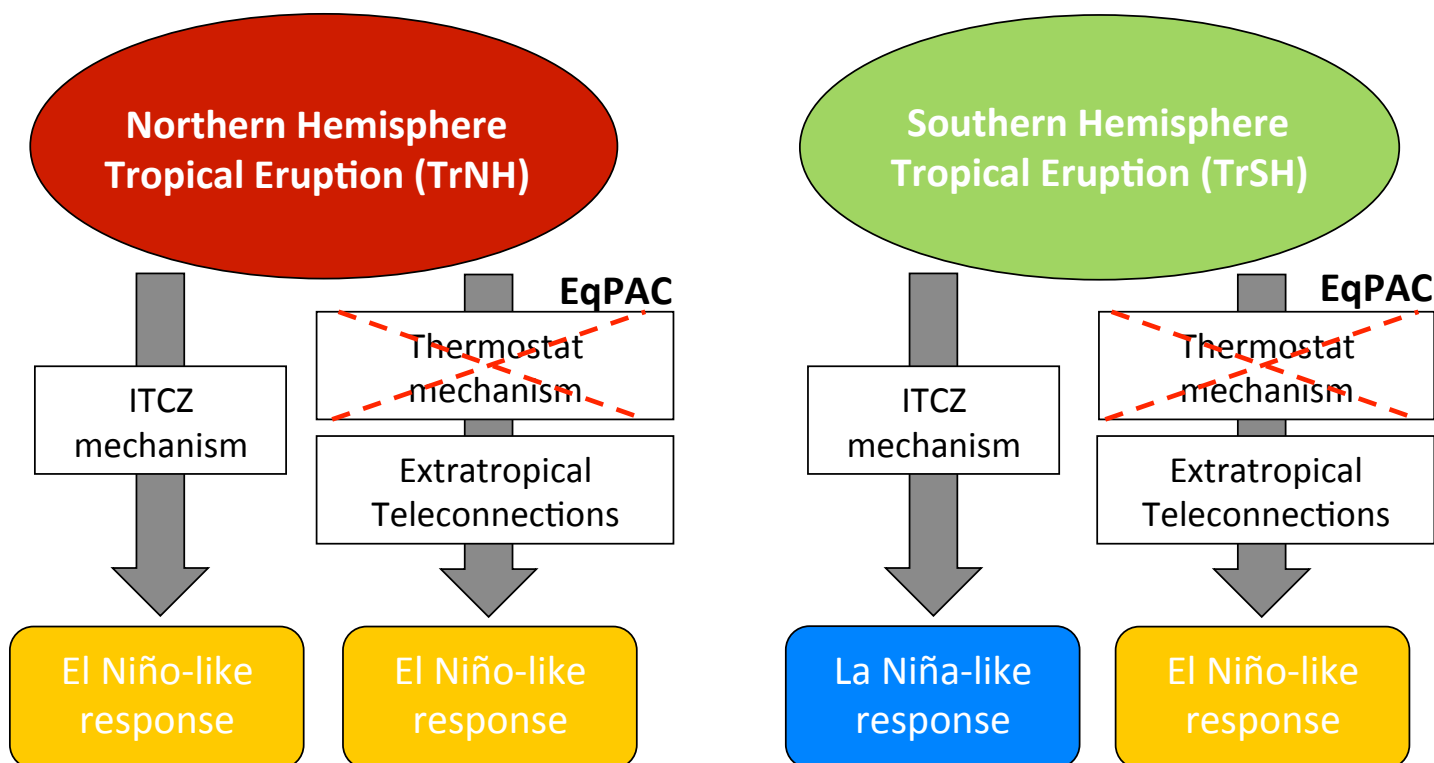
Surface Temperature, Wind & SLP Anomalies in the First Summer



It shows it is the atmosphere driving those anomaly patterns through changes in the temperature gradient aloft

SUMMARY & CONCLUSIONS

Experiment	Ensemble 1 Background state	Ensemble 2 Background state	Volcanic Aerosols
Northern Hemisphere Tropical Eruption (TrNH)	Neutral ENSO (going towards negative)	Neutral ENSO (going towards positive)	Interactive & confined to NH
Southern Hemisphere Tropical Eruption (TrSH)			Interactive & confined to SH
Equatorial Pacific Volcanic Forcing (EqPac)			Prescribed & confined to Equatorial Pacific



Photograph by Sigurdur H. Stefniðsson

pausata.francesco@uqam.ca

THANKS

Pausata, F.S.R., Zanchettin, D., Karamperidou, C., Caballero, R., and Battisti, D.S.: **ITCZ shift and extra-tropical teleconnections drive ENSO response to volcanic eruptions**, *Science Advances*, in press.