ITCZ SHIFT AND EXTRATROPICAL TELECONNECTIONS DRIVE ENSO RESPONSE TO VOLCANIC ERUPTIONS

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MODEL DESCRIPTION & EXPERIMENTAL DESIGN

MODEL
Norwegian Earth System Model (NorESM1-M):
Atmospheric-ocean-chemistry coupled model

ATMOSPHERE: CAM4-OSLO, 1.9° x 2.5° and 26 vertical level
(updated module that simulates the life cycle of aerosol particles,
primary and secondary organics)

OCEAN: MICOM, 1° x 1°

EXPERIMENTS
Tambora-like eruptions:
- 60 Tg of SO₂ 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

4 sets of ensembles
(20 members each)
60 Tg of SO2 – June 1st

Northern Hemisphere Tropical Eruption
(aerosol confined to the NH)

ITCZ mechanism
Thermostat mechanism

El Niño-like response
El Niño-like response

Southern Hemisphere Tropical Eruption
(aerosol confined to the SH)

ITCZ mechanism
Thermostat mechanism

La Niña-like response
El Niño-like response

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MECHANISMS FOR NIÑO RESPONSE

NINO3.4 INDEX

Precipitation Response – JJAS 01

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Additional Experiment: EqPAC

Ocean Thermostat where are you?

Not seen in the second winter either

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New Mechanism? High latitude teleconnections

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

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High latitude teleconnections: Fixing SSTs to NO-VOLC

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

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SUMMARY & CONCLUSIONS

<table>
<thead>
<tr>
<th>Experiment</th>
<th>Ensemble 1 Background state</th>
<th>Ensemble 2 Background state</th>
<th>Volcanic Aerosols</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northern Hemisphere Tropical Eruption (TrNH)</td>
<td>Neutral ENSO (going towards negative)</td>
<td>Neutral ENSO (going towards positive)</td>
<td>Interactive &amp; confined to NH</td>
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<tr>
<td>Southern Hemisphere Tropical Eruption (TrSH)</td>
<td></td>
<td></td>
<td>Interactive &amp; confined to SH</td>
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<tr>
<td>Equatorial Pacific Volcanic Forcing (EqPac)</td>
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<td></td>
<td>Prescribed &amp; confined to Equatorial Pacific</td>
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</tbody>
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Northern Hemisphere Tropical Eruption (TrNH):
- ITCZ mechanism
- Extratropical Teleconnections
- El Niño-like response

Southern Hemisphere Tropical Eruption (TrSH):
- Extratropical Teleconnections
- La Niña-like response