Effect of Increased Ocean Resolution on El Niño and La Niña Model Errors

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El Niño and La Niña

• Tropical Pacific sea surface temperatures fluctuate between warm *El Niño* and cool *La Niña*

• Global impact on climate variability

• Accurate models are required for seasonal prediction and understanding El Niño and La Niña in a changing climate

Data and Methodology

- HighResMIP compares models that differ only in their ocean and/or atmospheric resolution.
- We compare 4 models with a 1° ocean resolution to 8 models with a 0.25° ocean resolution.
- Dec–Mar (DJFM) ENSO sea surface temperatures
- Jan–Mar (JFM) 300 hPa z response in the North Pacific.
- Split in to El Niño, La Niña and Neutral with ±0.5 K Niño 3.4 threshold
- ENSO asymmetry measured using skewness of SST distribution: positive skewness = warm events are stronger but less frequent than cool events

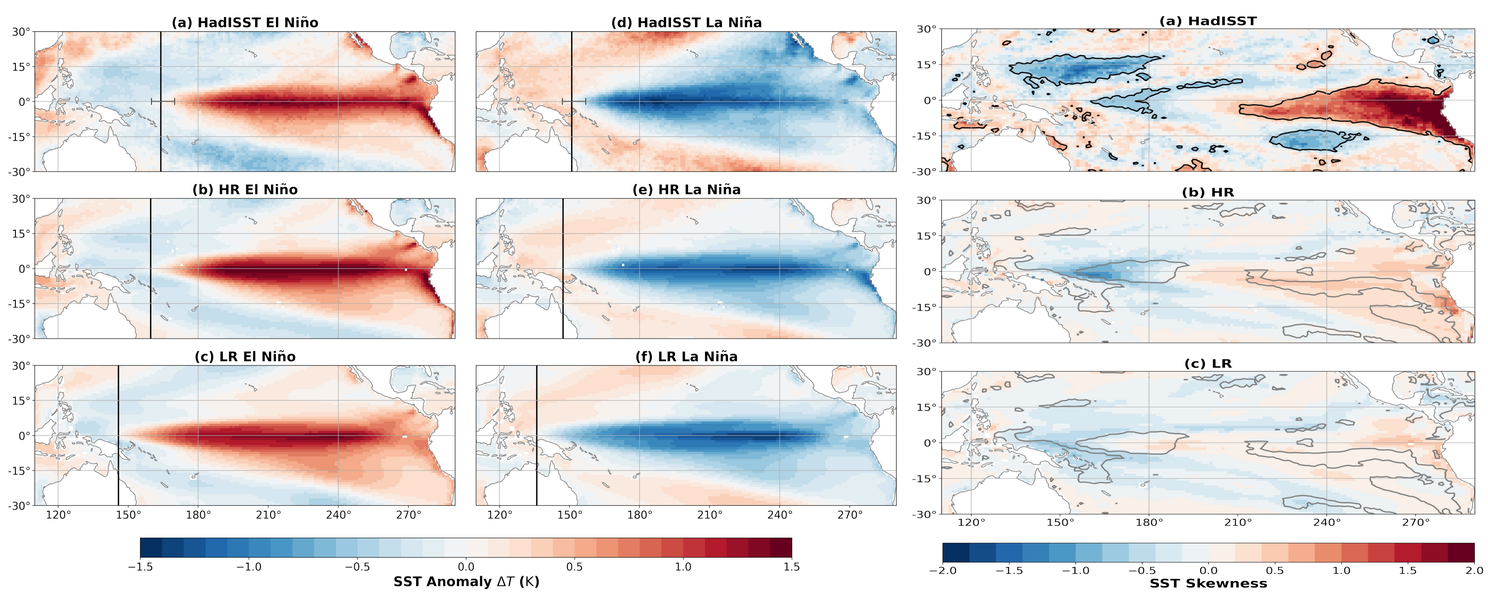
Increasing Ocean Resolution from 1° to 0.25° leads to major improvements in El Niño and La Niña simulation!

• Warm El Niño and cool La Niña sea surface temperature (SST) anomalies extend too far west

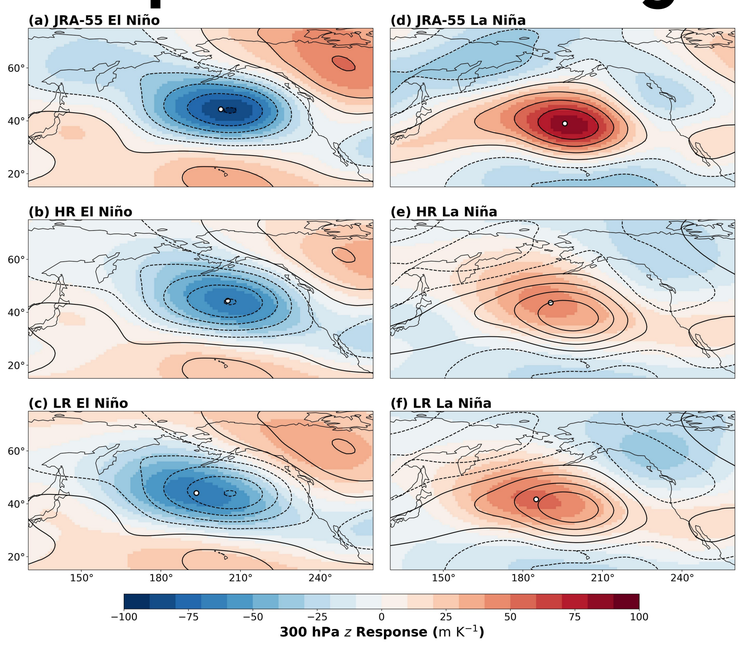
• This error is eliminated by increasing resolution!

• El Niño response along Peruvian coast also improves

• Asymmetry in East Pacific improves but remains weak.

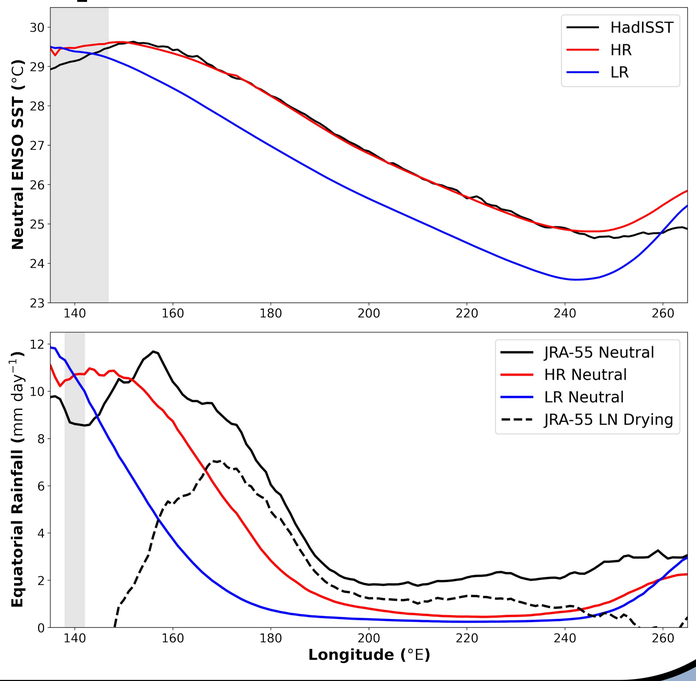


North Pacific response during El Niño improves... Weaker improvement during La Niña!



Improvement in La Niña SST anomalies conflicts with persistent tropical rainfall biases.

- Equatorial eastern/ central Pacific is too dry in all models
- Improved SST anomalies in HR models overlap less with wetter region
- La Niña response depends on drying, which is physically limited
- **Leads to weaker improvement in teleconnection position**



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