

# Enhanced atmospheric response to Gulf Stream SST anomalies in CAM6 simulations with 1/8° regional grid refinement over the North Atlantic

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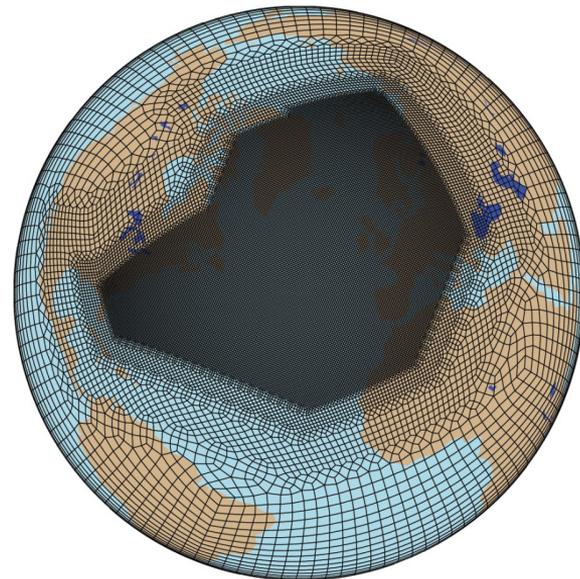
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## Motivation:

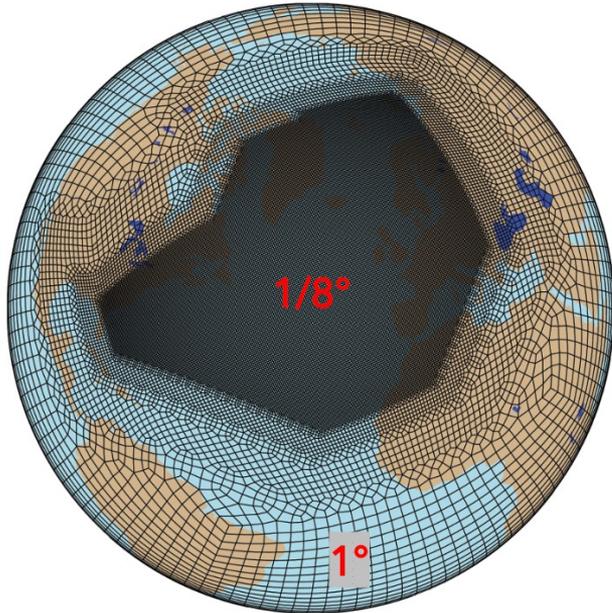
- Models underestimate the atmospheric response to extratropical SST anomalies and the associated multi-decadal variability of atmospheric circulations (*Simpson et al. 2018; 2019; O'Reilly et al. 2021*)
- Resolving atmospheric mesoscale processes over ocean frontal zones may help to simulate the full atmospheric response to extratropical SST anomalies (*Smirnov et al. 2015; Czaja et al. 2019*)

Variable Resolution North Atlantic Grid

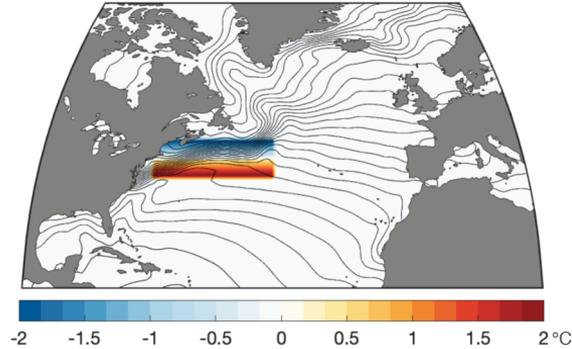


# Idealized experiments with Gulf Stream SST anomalies in a variable resolution version of CAM-SE

Variable Resolution North Atlantic Grid



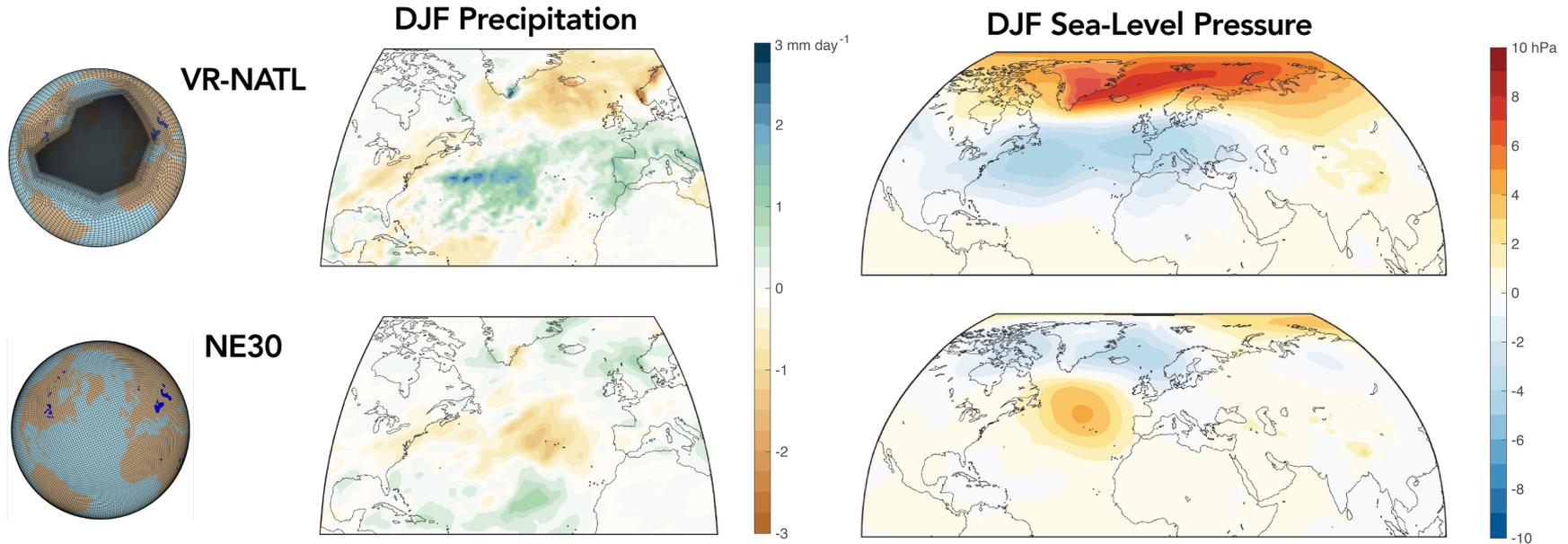
SST Anomaly



**Reference:** Atmosphere-only (CAM6-SE) simulations with specified seasonally varying climatological SSTs (1° res.)  
**Experiment:** Added SST anomaly pattern in the Gulf Stream, strengthened SST gradient

- Both simulations run with the VR-NATL grid and with a 1° reference grid (NE30), each simulation run for 8 years
- Cost of VR-NATL is ~35x cost of NE30
- Other planned experiments include full AMIP run, uniform SST anomaly in Gulf Stream, response to realistic modes of decadal SST variability

# Enhanced precipitation over warm Gulf Stream SSTs leads to NAO-like large-scale circulation response



- Large wintertime NAO-like response to Gulf Stream SST anomalies
- Mesoscale atmospheric processes increase precipitation over anomalously warm SSTs, leading to a large-scale circulation response through influence on free tropospheric latent heating (work in progress to characterize influence on individual storms)