

# Reexamining the tropical Atlantic influence on ENSO using perfect model predictability experiments

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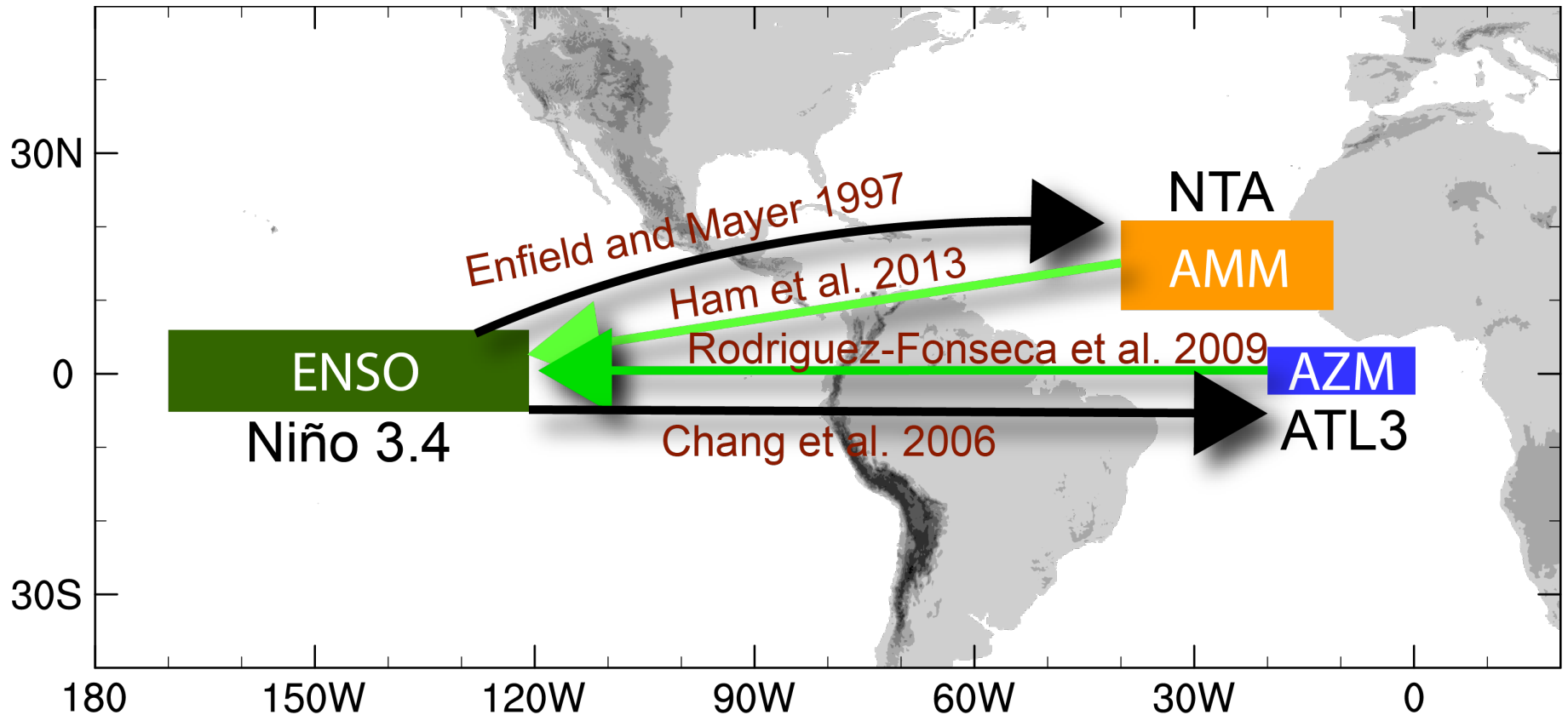


# Background

- influence of ENSO on tropical Atlantic variability (TAV<sup>1</sup>) well established
- more recent studies suggest influence of TAV on ENSO
- caveats
  - both ENSO and TAV tend to develop in MAM -> difficult to disentangle cause and effect
  - observational record is relatively short
- our approach: perfect predictability GCM experiments combined with SST restoring

<sup>1</sup> TAV includes the Atlantic zonal mode (aka Atlantic Niño) and the Atlantic meridional mode

# Atlantic-Pacific linkages



ENSO: El Niño-Southern Oscillation  
AMM: Atlantic Meridional Mode  
AZM: Atlantic Zonal Mode (aka Atlantic Niño)

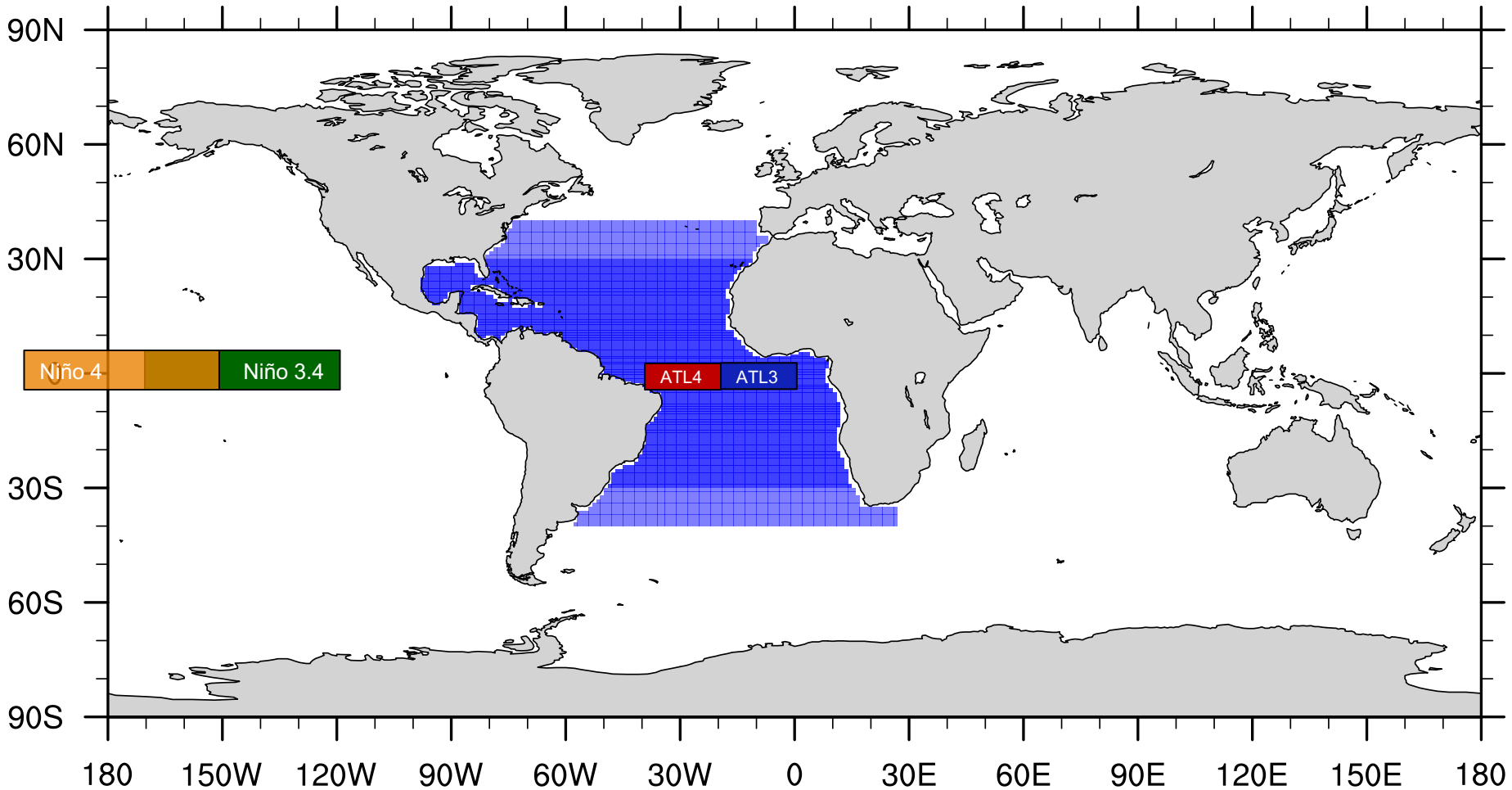
# Control experiment

- use GFDL CM 2.1
- starting point: 1000-year fully coupled control simulation
- pick years for which a negative AZM event in the equatorial Atlantic precedes El Niño by two seasons
- use these years for prediction experiments

# Pacemaker predictions

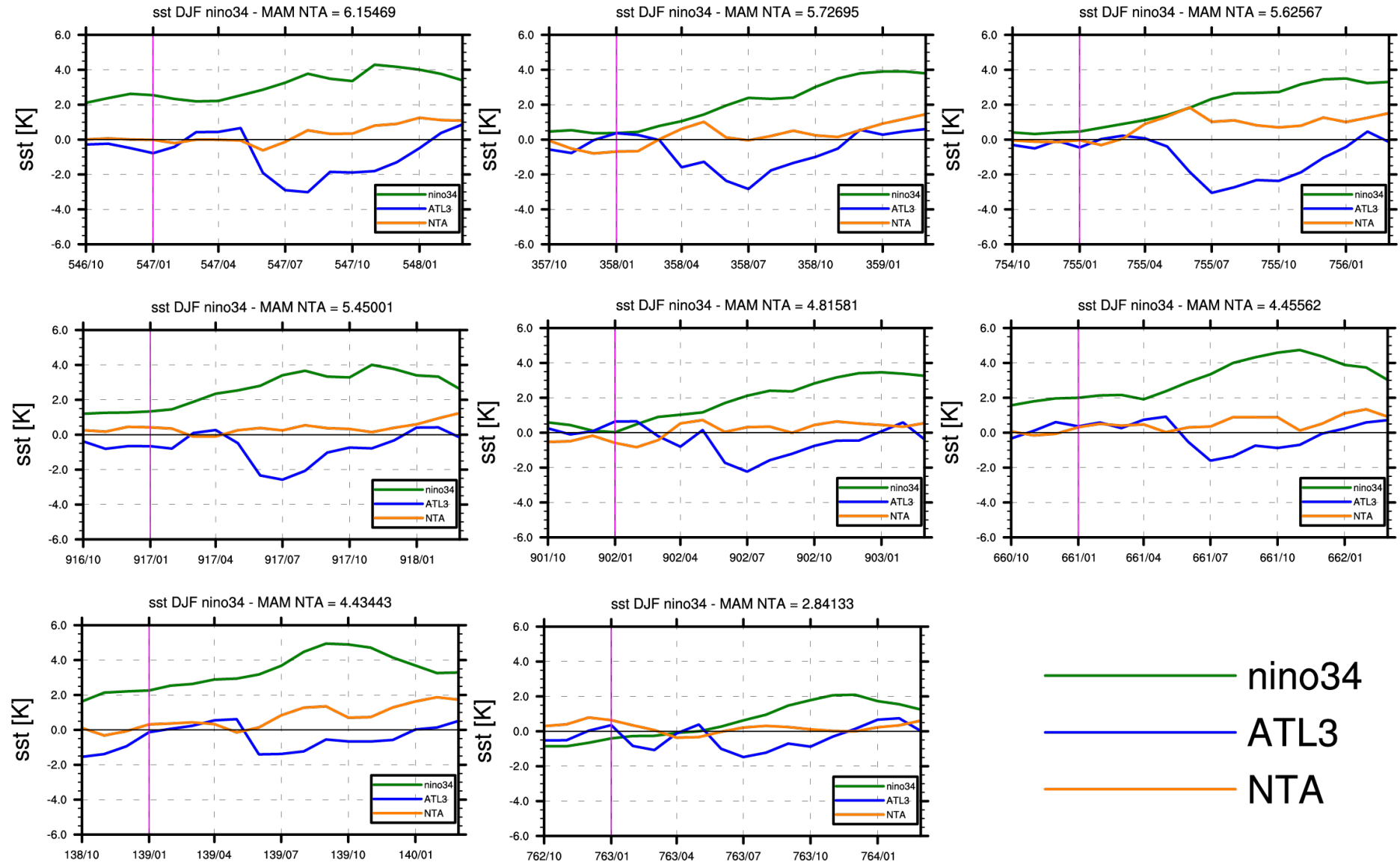
- use Jan 1 as our initial condition
- three 10-member experiments are performed:
- CTRL: model evolves freely
- noTATL: SSTs are restored to climatology in the tropical Atlantic; restoring strength is gradually ramped up until February 28
- noTPAC: the tropical Pacific counterpart to noTATL

# Restoring region for noTATL



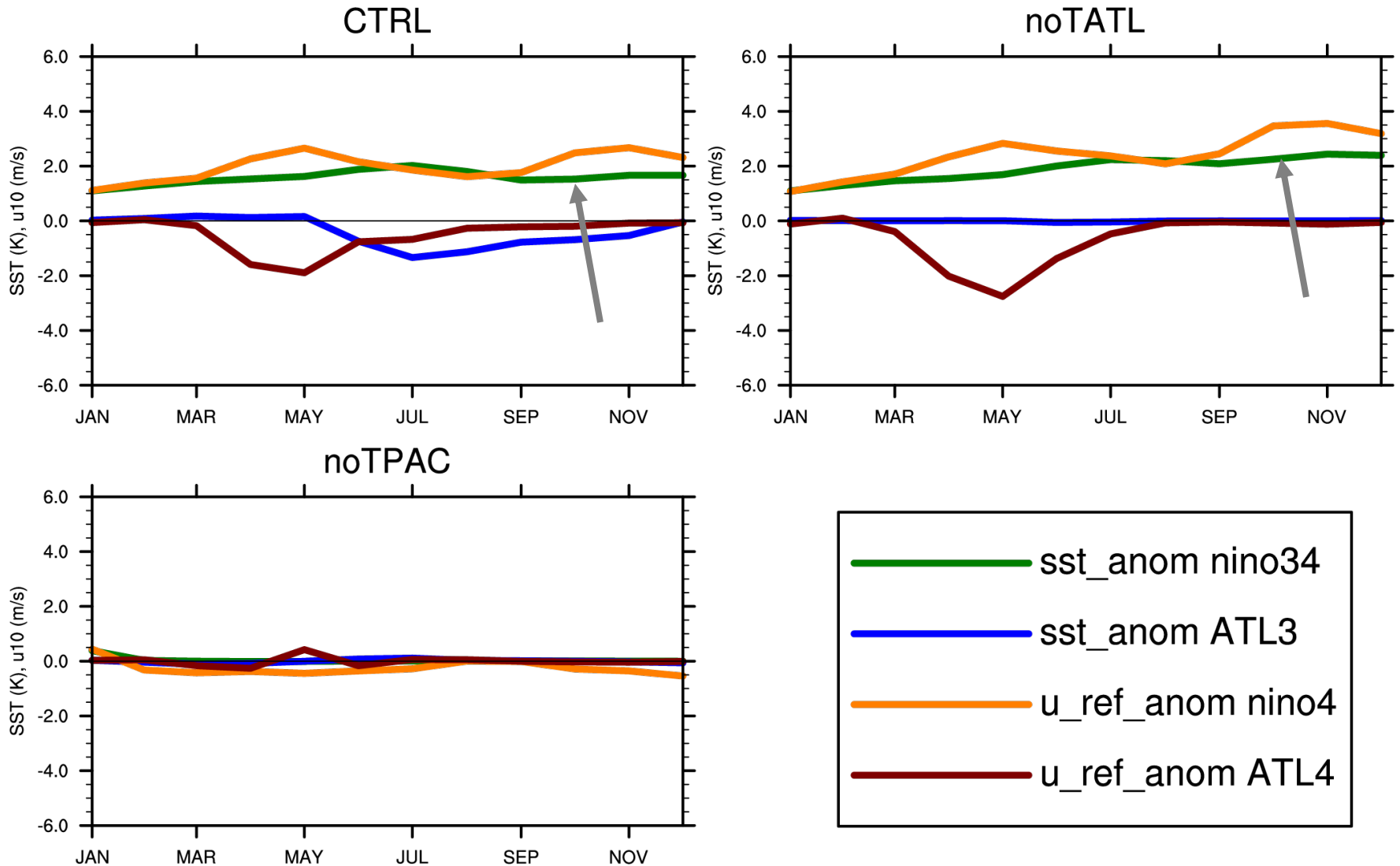
Dark shading: full restoring  
Light shading: transition zone

# Selected years



# Average over 8 events

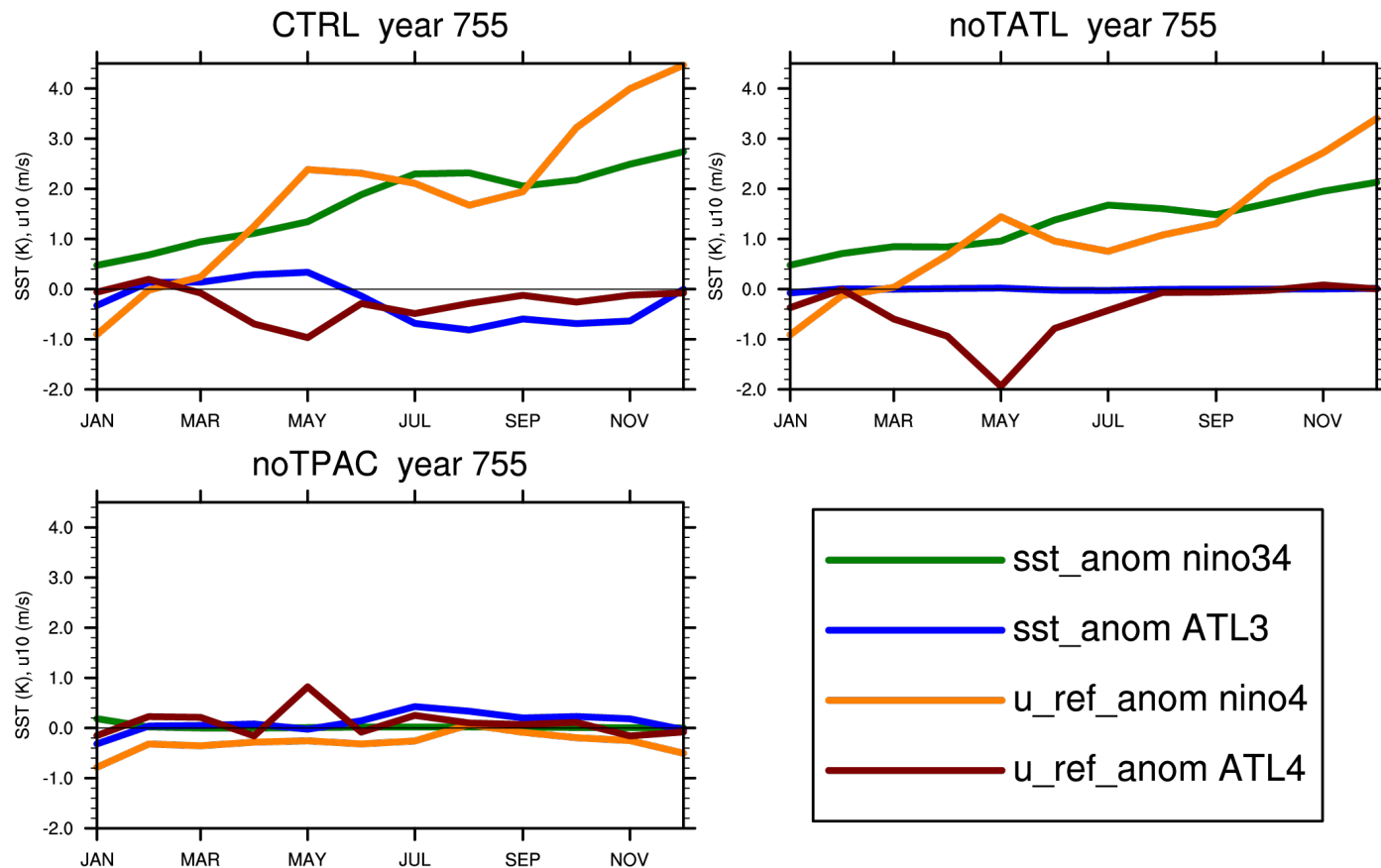
->El Niño slightly stronger without TATL





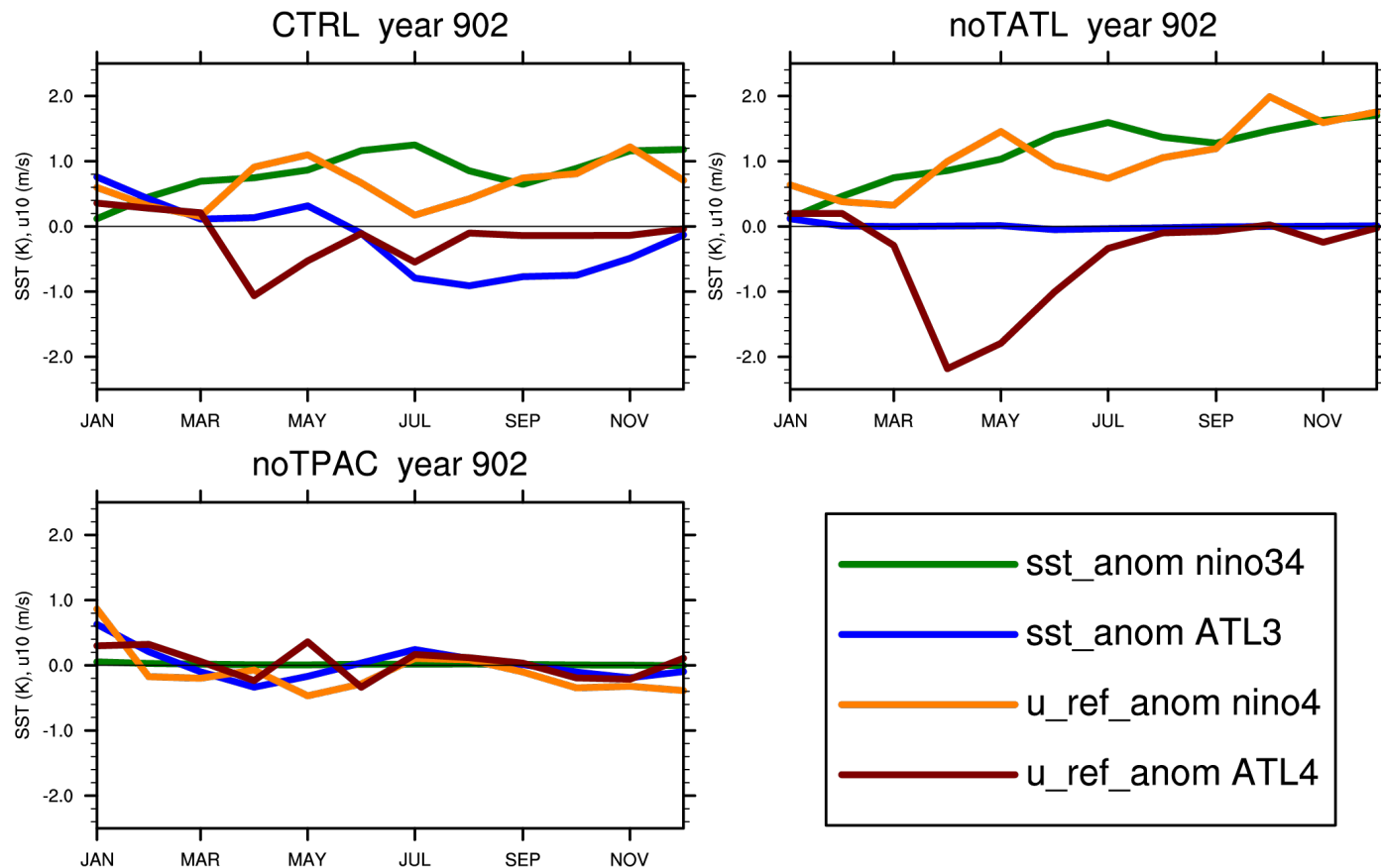
# Year 755: El Niño weaker in noTATL

- El Niño weakens in noTATL (~20%)
- Atlantic Niña does not develop in noTPAC
- easterly wind anomalies in ATL4 also depend on Pacific



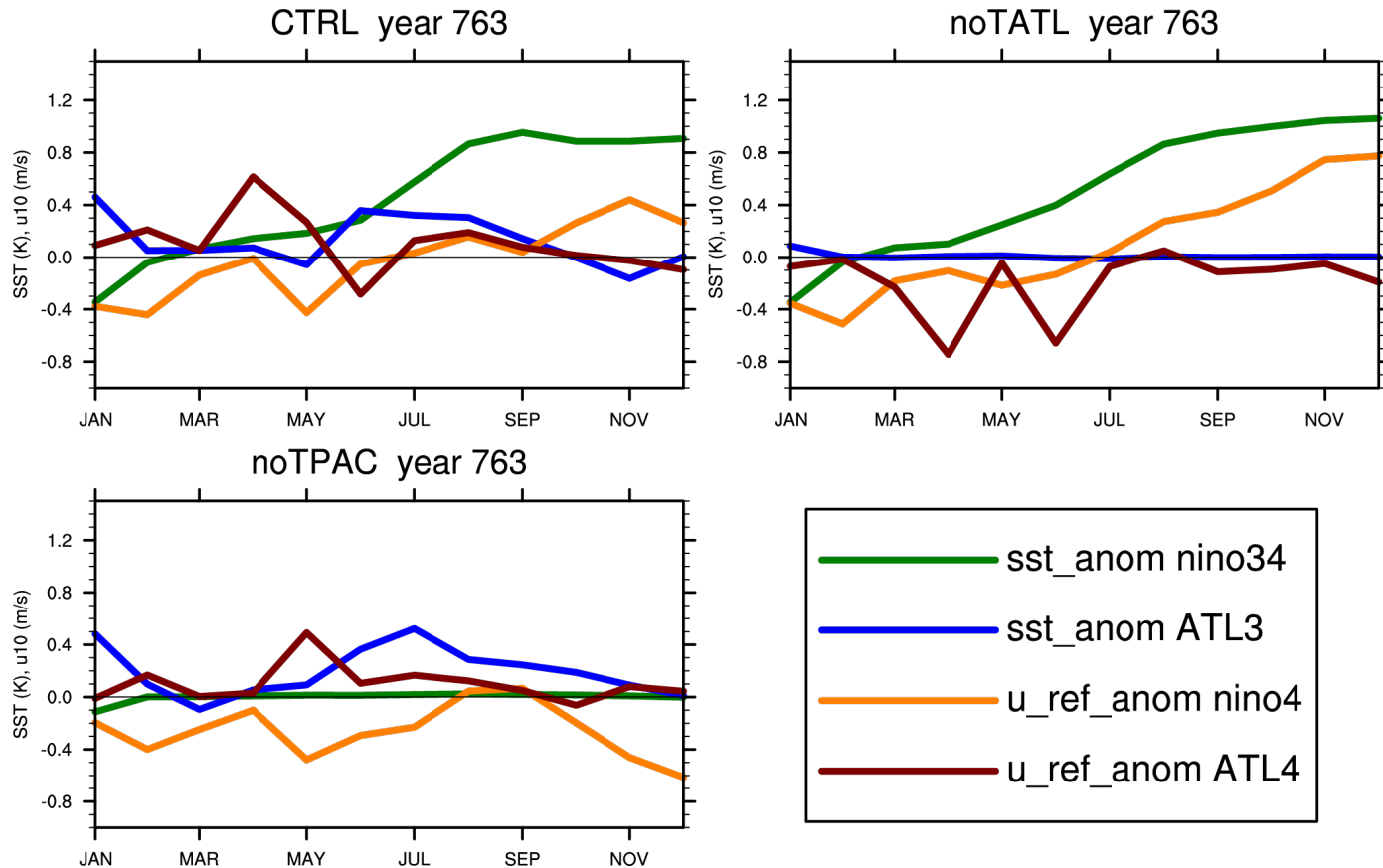
# Year 902: El Niño stronger in noTATL

- El Niño strengthens in noTATL (~30%)
- ATL4 wind anomalies much stronger in noTATL than in CTRL
- no Atlantic Niña without tropical Pacific anomalies



# Year 763: “failed” experiment

- example of a “failed” experiment
- Atlantic Niña fails to develop even in CTRL
- origin of westerly anomalies in ATL4 unclear



# Conlusions

- conducted perfect model predictions with/without SST restoring; model: CM 2.1
- Atlantic Niñas may moderately strengthen or weaken El Niño
- however, Atlantic Niñas themselves depend on early ENSO anomalies
- -> Atlantic has only moderate impact on ENSO and mostly acts as a delayed feedback rather than an initiator

# Caveats

- model dependence; e.g. excessive variability in GFDL CM 2.1  
-> coordinated multi-model experiments desirable
- decadal modulation of Atl-Pac linkage not addressed yet
- substantial event-to-event variability
- larger ensemble size needed