**1. ABSTRACT**

- We apply a new global climate model supporting multi-resolution ocean grids with local, isotropic refinements (Sidorenko, Rackow et al., 2014; Rackow et al., 2014a, in preparation)

**KEY QUESTIONS:**

1) Does high spatial resolution in the tropical ocean (0.25°, Fig.1) improve the Equatorial Pacific simulation?

2) If so, is the improvement beneficial for ENSO simulations (index statistics, annual cycle representation, and monthly variance)?

**2. OCEAN MODEL SETUPS**

- Figure 1: Ocean grid for setup TRO (=0.25° tropical resolution) compared to REF (1°). Outside the tropics, both grids coincide. The atmospheric grid is fixed at 76×47, i.e. 1.85° with 47 levels. Both setups are run for 520 years with constant 1990 greenhouse gas and aerosol concentrations (Sidorenko, Rackow et al., 2014).

**3. IMPROVEMENTS DUE TO HIGHER RESOLUTION IN THE OCEAN**

- Figure 2: Differences (TRO - REF and REF - OBS) concerning annual mean sea surface temperature (SST, top panel) and interannual SST standard deviation (STD, bottom panel).

- OBS is referring to HadISST (Rayner et al., 2003).

  - The Pacific cold tongue bias does not extend as far to the West with high resolution. Thus warm pool SSTs are higher by up to 3 K.
  - The erroneous warm pool local maximum in STD (present in REF) is absent in TRO (see Fig.3).

**4. SPECTRA AND STATISTICS OF NIÑO INDICES**

- Figure 3: Top panel SST snapshot for TRO showing resolved Tropical Instability Waves (TIWs). Bottom panel improved interannual SST standard deviation in TRO.

- Figure 4: Meridional section of zonal velocities (m/s) at 155°W (20yr mean). The Eq. Undercurrent (EUC) is stronger in TRO (> 0.9 m/s core speed) compared to REF (0.5 - 0.6 m/s). TRO: Two distinguishable branches of South Eq. Current (SEC1 & SEC2) emerge.

**5. ANNUAL CYCLE / MONTHLY VARIANCE**

- Figure 5: Power spectral densities [K²/yr] for different Niño indices in TRO, REF and HadISST (1970 to 2012). The 520 model years have been subsampled resulting in 4 realizations for REF and TRO. 1K, 5K, 50K, 95K, and 99% quantiles of 10,000 HadISST fitted AR1-process PSDs are depicted. Insets show (range in) standard devs of TRO, REF, and HadISST.

**6. SUMMARY AND CONCLUSIONS**

- 1) Due to improved equatorial currents (Fig.4) in TRO, warm pool SST bias is reduced by 1 K; STD bias is reduced by up to 0.4 K (Fig.2) compared to REF; TIWs are better resolved in TRO (Fig.3).

- 2) ENSO statistics tend to improve with TRO (insets in Fig.5).

- N34 annual cycle: Equally good in TRO and REF. N34 monthly variance: TRO shows reduced local maximum in AMJ compared to REF and has a global maximum in NDJ (colored boxes in Fig.6).

- OUTLOOK: Investigate ENSO - annual cycle interaction (Rackow et al., 2014b, in preparation)