SESSION: (B2) Modelling issues in S2D prediction

(B2-03)

Diagnosing the sources of systematic SST biases in CESM using ensemble seasonal hindcasts

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In this study, we investigate the emergence and growth of systematic SST biases in ensemble seasonal hindcasts from the Community Earth System Model (CESM) version 1. Six-month long, twenty-four member ensemble hindcast simulations covering the period 2001-2005 are performed, with initial conditions derived from ERA-Interim for the atmosphere and from NCAR-DART for the ocean. The equatorial Pacific and northern subtropical Pacific and Atlantic oceans develop a cold bias after two to three months, reaching comparable magnitudes to climatological biases within six months of lead-time. Further analysis of the equatorial Pacific cold bias reveals that hindcasts with start dates during the upwelling period (boreal summer to fall) exhibit a strong drift from the reanalyses and observations as well as a large ensemble spread. In contrast, those with start dates outside of the upwelling period show minimal drift and spread. This implies that the cold bias develops quickly during the upwelling period, but takes longer than six months to emerge outside the upwelling period. An upper ocean heat budget analysis confirms that the anomalous cooling comes from too strong vertical advection in the ocean. The vertical advection bias is associated with easterly wind stress anomalies, which emerge as early as the first two months of lead-time, preceding the onset of the cold SST bias. The too strong easterlies are accompanied by excessive precipitation north of the equator. The sensitivity of the wind and precipitation biases to the representation of low-level circulation and moist convection in the model are further explored.

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