Implications of self-modulated WWBs on ENSO variability

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While the oscillatory tendency of ENSO (El Nino - Southern Oscillation) may be fairly well understood today, debate exists about the relative importance of two popular mechanisms to explain the irregularity. The first is deterministic chaos within the interannually varying components of the coupled ocean-atmosphere system and the second is noise from uncoupled weather forcing. The component of this weather noise that is most important to ENSO variability is believed to be westerly wind bursts (WWBs), which can trigger El Nino events. Recent indications suggest that WWBs may be more prone to occur during certain configurations of the SST, thus controlled to some extent by ENSO. We have investigated the dynamical implications of internally modulated WWBs on ENSO stability and irregularity by examining the extreme case of WWBs that are completely determined by the SST, and thus part of the internal ENSO dynamics, in an intermediate complexity ENSO model.

We find that if WWBs are modulated by the SST, the inclusion of this coupling in stochastically forced models may be crucially important. When the deterministic WWB trigger is replaced in our linearly stable model with a purely stochastic trigger, ENSO variability is reduced by a factor of nearly two.

Results of this work also show that in terms of ENSO stability and irregularity, a strong analogy can be drawn between the occurrence of internally regulated WWBs and the enhancement of the ocean-atmosphere coupling strength. This implies that if WWBs are indeed modulated by the SST, the deterministic chaos and weather forcing mechanisms for ENSO irregularity may be largely equivalent.