

The effect of doubled CO₂ and model basic state biases on the monsoon-ENSO system: the TBO and changing ENSO regimes

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An integration of a fully coupled GCM with flux corrections in the equatorial oceans is performed under $2 \times \text{CO}_2$ conditions. ENSO behaviour in the integration features distinct irregular and periodic (biennial) regimes. Simple theory identifies the regimes as irregular stochastically forced and limit-cycle oscillations respectively, which can be identified to some extent with SST and dynamical ENSO modes seen in the observed record. Periodic behaviour is also found in the Asian-Australian monsoon system, part of an overall biennial tendency of the model under these conditions. The tropospheric biennial oscillation (TBO) serves as a useful descriptor for the coupled monsoon-ENSO system in this case. During the biennial regime there is a marked increase in coupling between the monsoon-ENSO systems and the Indian Ocean dipole, lending remarkable predictability to the Asian summer monsoon. Together with a dramatic increase in correspondence between monsoon dynamics and precipitation, this potentially eases the task of seasonal prediction.