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Evaluating the ENSO-dynamics in CMIP simulations in the framework of the linear recharge oscillator model.

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The CMIP model simulations show wide spread uncertainties in ENSO statistics and dynamics. In this study we use the concept of the linear recharge oscillator (ReOsc) model to diagnose the ENSO-dynamics in all CMIP3 and CMIP5 model simulations. The ReOsc model parameters allow to quantify SST and thermocline damping, SST coupling to thermocline and vice-versa , sensitivity to wind stress and heat flux forcings and separate atmospheric from oceanic processes. Our results illustrates that the ENSO-dynamics and their diversity within the CMIP ensemble can be well represented with the linear recharge oscillator model diagnostics. The results illustrate that the ENSO dynamics show larger biases relative to observations and spread within the models than simple large-scale statistics such as SST standard deviation would suggest. The CMIP models underestimate the atmospheric positive and negative feedbacks, they have compensating atmospheric and oceanic errors, the thermocline damping is too strong and stochastic noise forcings in models is too weak. The CMIP5 models show only marginal improvements relative to CMIP3. The positive finding is that models can still be significantly improved and our analysis gives directions to what needs to be improved.