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A Conceptual ENSO Model under Realistic Noise Forcing

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We investigated the influence of atmospheric noise on the generation of interannual El Niño variability. Therefore we disturbed a conceptual ENSO delay model by surrogate windstress data generated from tropical windspeed measurements. The effect of the additional stochastic forcing was studied for various parameter sets including periodic and chaotic regimes. The model runs were evaluated based on spectrum and amplitude/period relation in comparison to measured sea surface temperature data. The additional forcing turned out to increase the variability of the model output in general. Under all parameter sets the noise free model runs are unable to reproduce the observed spectral bandwith. On the contrary, the stochastically forced model is capable of producing a realistic spectrum. The weakly nonlinear regimes of the model exhibit a proportional relation between amplitude and period matching the relation derived from measurement data. The chaotic regime, however, shows an inverse proportional relation. A stability analysis of the different regimes revealed that the spectra of the weakly nonlinear regimes are robust against slight parameter changes representing disregarded physical mechanisms, whereas the chaotic regime exhibits a very unstable realistic spectrum. We conclude that the model including stochastic forcing in a parameter range of moderate nonlinearity best matches the real conditions. This suggests atmospheric noise playing an important role in the coupled tropical pacific ocean atmosphere system.