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Seasonality of the ENSO Recharge Oscillator

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The recharge oscillator describes ENSO in terms of an oscillation between two variables, eastern equatorial Pacific sea surface temperature and mean equatorial thermocline depth. Fitting to observations, we obtain a period of the order of 4 years, and a decorrelation time scale of the order of 1.5 year. If we introduce seasonality, the oscillation parameters vary with the season. Both in March-April and July-November, the oscillator has unstable eigenvalues. In the first period, the phase also changes rapidly, leading to the well-known spring persistence barrier. In the second period, the solutions are non-oscillatory, so that perturbations grow almost linearly to the peak of the event. Non-linear aspects of ENSO modify this picture especially in boreal spring, when El Niño normally progresses into La Niña, but La Niña does not evolve strongly towards El Niño on average.