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Nonlinear long-period tidal forcing with application to ENSO, QBO, and Chandler wobble

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Apart from its known impact to variations in the Earth's length-of-day (LOD) variations, the role of long-period tidal forcing cycles in geophysical behaviours has remained elusive. To explore this further, tidal forcing is considered as a causative mechanisms to the following cyclic processes: El Niño Southern Oscillation (ENSO), Quasi-Biennial Oscillation (QBO), and the Chandler wobble. Annualized impulse reponse formulations and nonlinear solutions to Navier-Stokes-based Laplace's Tidal Equations are required to make the connection to the observed patterns as the underlying periods are not strictly commensurate in relation to harmonics of the tidal cycles. If equatorial climate phenomena such as QBO and ENSO can be explained as deterministic processes then the behavior that may be predictable. This paper suggests that QBO, ENSO, and the Chandler wobble may share a common origin of lunar and solar tidal forcing, but with differences arising due to global symmetry considerations. Through analytical approximations of nonlinear fluid dynamics and detailed time-series analysis, matching quantitative models of these behaviors can be shown.