

## **A MATHEMATICAL APPROACH TO THE EL NINO PHENOMENON.**

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El Niño-Southern Oscillation (ENSO), the occasional overwarming of the eastern equatorial Pacific, is believed to be the result of a complex dynamical coupling between the atmosphere and the ocean. In spite of the remarkable theoretical progress in recent years, it is not yet clear what determines the phenomenon. Here we introduce an approach for describing El Niño general features based on its essential physics as a self-sustained oscillation of a massive pool of warm water affecting, and being affected by, the superficial winds. A double well potential is used to represent both, the competition between the two atmospheric convection cells, which tend to take the warm pool away from its equilibrium position, and the land mass barriers to the warm pool motion. The seasonal trade winds are represented by an external periodic force and a dissipative term is included to represent the energy losses. The model leads to the Duffing equation, a well known nonlinear differential equation of Chaos Theory, through which some of the very peculiar El Niño characteristics can be explained. Under a wide range of parameters, the numerical integration of that equation can reproduce the aperiodic sea surface warming, the seasonal phase locking for the beginning of the phenomenon and long term climate changes.