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Laplace tidal equation over a sphere: New solutions derived from an approximate Schrödinger equation

Abstract:

Little progress was achieved in finding solutions to Laplace Tidal Equations (LTE) over a sphere since these equations were properly formulated by Jean-Pierre Laplace in 1976. For zonally propagating waves the LTE set of Partial Differential Equations was first formulated as an eigenvalue equation by Michael Selwyn Longuet-Higgins in 1968, but this formulation has not yielded explicit expressions for either the phase speeds or the latitude-dependent amplitudes of the waves. In recent years I've developed an exact Schrödinger equation formulation for wave solutions of LTE in Cartesian Coordinates and this formulation could also be applied to spherical coordinates where it yields an approximate Schrödinger eigenvalue equation. The solutions of this approximate equation yields highly accurate explicit expressions for the zonally propagating waves solutions of LTE. The new wave solutions can be applied in various areas of Dynamical Meteorology and Physical Oceanography, including the construction of new bases for spherical global scale models and the analysis of satellite derived data on the variation of Sea Surface Height Anomalies.