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Coupling tidal interactions and internal dynamics of the early Earth-Moon system

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Tidal dissipation may have significantly influenced the early history of the Earth-Moon system. While tidal energy has presently a minor contribution to the internal energy budget, its magnitude was probably comparable to that of radiogenic heating when the Moon was hotter and closer to a faster rotating Earth. We are developing a numerical tool, CHEOPS-2D, that simultaneously compute tidal dissipation, heat transfer, and spin-orbit evolution of the system. The conservation equations for momentum and mass, in their anelastic formulation, are solved within a multigrid, finite volume framework, using the spherical annulus geometry. The tidal heating contribution to the internal heat budget of the mantle is evaluated by solving for the spheroidal displacements, stresses, and gravitational potentials induced by tidal forcing. We assess the influence of the compressibility and of various rheologies, both for mantle dynamics and tidal dissipation. Consequences for the coupled evolution of the early Earth-Moon system will be discussed.