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# Freeboard, sea level and dynamic topography during aggregation of a supercontinent

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The long-term evolution of sea level is a combination of eustatic mechanisms (tectono-eustatism, distribution of continental masses through orogenesis and sedimentation) and non-uniform processes (dynamic topography, geoid, wander of the Earth rotation pole). Given the potentially similar amplitude of both factors, there is a bias in the observation of absolute sea level. Moreover, over large time-scales, and more specifically over the Wilson cycle time-scale, plate aggregation and separation are associated both with (i) variations of the flow pattern and (ii) thermal state in the mantle, which in turn may induce specific vertical motions of the surface. By changing the size of the oceanic and continental water reservoirs, large-scale dynamic topography associated with subduction or the presence of mantle plumes controls rises or drops of sea level, which in turn controls part of the stratigraphic record. The Earth has known periods of continental aggregation and fragmentation that redistribute the location of plate boundaries, especially the location and the length of subduction zones, that could potentially affect sea level. The distribution of mass anomalies in the mantle with respect to continents may therefore have a significant impact.

To test the possible correlation between sea level changes and the Wilson cycle, we decide to first focus on the Pangea, which is known to be a period during which most subductions took place beneath continents. We run a set of Earth-like instantaneous flow model using the OEDIPUS (Origin, Evolution and Dynamics of the Interiors of Planets Using Simulation) tool, which allows spherical geometries with lateral viscosity variations. In these models, Pangea is modeled by a spherical continental cap, covering 29% of the planet surface, and floating above a two-layered viscous mantle. We vary parameters such as the dip of the subducting panel, the depth reached by the slab, the viscosity structure and the plate thickness within reasonable ranges to evaluate the volume of water reservoirs created by dynamic topography and its impact on the variations of sea level. In addition, we evaluate analytically the effect of an increase in temperature at the base of the lithosphere, as can be produced by thermal insulation above the convecting mantle during supercontinent aggregation, on the isostatic response of the continent, which modifies the continental reservoir shape and can produce sea level variations.