Sea level change due to Marinoan snowball deglaciation

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The Marinoan snowball Earth, which ended at ~635 Ma, offers us a set of sedimentary and geochemical records for studying a relative sea level (RSL) history of Earth system response to a large perturbation and its accompanied changes in the atmosphere and biosphere. An accurate perdition of post-Marinoan RSL changes would set independent constraints on the rate of recovery of the Earth system from a snowball state. Here we examine RSL changes due to glacial isostatic adjustment (GIA) associated with Marinoan snowball deglaciation by chiefly considering two RSL change patterns, (i) an RSL drop followed by RSL rise in the syn-deglacial phase (melting phase) inferred from the cap dolostones deposited on the continental slope in Namibia, and (ii) an RSL drop followed by RSL rise in the post-deglacial phase (time after the complete melting) inferred from the cap dolostones deposited on the continental shelf in South China, West Africa and Canada. We show that the physical mechanisms responsible for (i) and (ii) mainly depend on the coastline geometry, the syn-deglacial duration and mantle viscosity structure. Our modeling suggests that the RSL change patterns (i) and (ii) are explained by adopting the coastline geometry like a peninsula, a syn-deglacial duration of 10–20 kyr and a viscosity of ~10^{23} Pa s in the deep mantle. The deep mantle viscosity of ~10^{23} Pa is roughly equal to that inferred from the recent analyses using GIA data sets due to the last deglaciation.

Keywords: Snowball Earth, Sea level, Glacial isostatic adjustment

