

Sea level budgets should account for ocean bottom deformation

Plain language summary

Sea level rise is expected to be one of the most severe consequences of climate change. A change in sea-level can be approximately explained by adding change in water mass (mass change) and change in water volume (steric change; due to rising temperature and declining salinity). This constitutes the conventional sea level budget equation that estimates the amount of sea level rise from the known mass and steric changes.

However, other physical processes are known to contribute to the observed change in the sea surface height. One such process is that the Earth's surface is known to deform when subjected to changes in mass loading. Hence an increasing ocean mass should deform the ocean bottom downwards. This is known as ocean bottom deformation (OBD).

This effect was negligible until early 2000s, when steric change was the dominant driver of sea level rise. However, in recent decades changes in ocean mass have overtaken steric change and are expected to continue to grow. Therefore, the resultant OBD can no longer be assumed to be negligible.

In this study we derive the sea level budget equation from fundamental principles to show that OBD should be included. We estimate the contribution of OBD to current sea level rise, and propose that it is at least as important as changes in the volume of the deep ocean, which have tended to be more studied.

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