During previous glacial cycles the redistribution of ice and water across the Earth's surface has produced substantial changes in Relative Sea Level (RSL). The change in RSL is a complicated function of the changes in ocean volume, rotation, gravitation, and vertical deformation caused by the change in the ice-water load. A sophisticated mathematical theory for the calculation of these various effects has been developed, and with the increase in available computational resources has become a powerful tool for modelling post-glacial rebound and sea-level change.

The classical formulation of the sea-level equation treats the redistribution of ice and melt-water as a direct, instantaneous exchange of water between the ice sheets and the oceans, ignoring the formation of peri-glacial lakes. Further, the identification of the “ocean basins” is not straightforward and for reasons of computational simplicity is generally limited to those regions that lie below contemporary sea-level. As a consequence, within numerical calculations of sea-level change, water-levels in isolated depressions rise and fall in unison with global sea-levels, rather than remain independent, as would be the case in a more physically accurate simulation.

In this study we present a methodology for correcting these limitations of the classical theory, and examine several case studies which demonstrate that peri-glacial lakes and isolated catchment basins can accommodate large volumes of water. Their inclusion significantly alters local RSL curves, the magnitude of on-going relaxation processes, and regional patterns of RSL change.