# Post-glacial rebound, transient creep and phase changes

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Our inferences from past sea-level data concerning the volume of ice-sheets at the LGM, the mantle viscosity and the present-day gravity variations or horizontal velocities linked to PGR can be affected quite significantly by the type of rheology used (Burger viscoelastic vs Maxwell viscoelastic) or the assumptions concerning the kinetics of phase transformations.

A best fit solution to a large dataset of past sea-levels is searched, inverting simultaneously for the viscosity structure and the volume of each of the major holocene ice-sheets for various viscoelastic rheologies. The burger rheology permits a higher viscosity in the lower mantle and at the base of the lithosphere and a larger volume for Canadian and Scandinavian ice-sheets.

The total volume of LGM ice-sheets being constrained by the far-field sea-level data, increasing the LGM ice volume over Canada and Fennoscandia imposes decreasing the LGM ice volume elsewhere, most likely over Antarctica. PGR corrections to GRACE data in order to retrieve the hydrologic signal are in turn significantly affected.

Phase transformation can be the cause of a retarded compressibility, which, integrated over the upper mantle, is larger than the elastic compressibility. Various mechanisms affect the kinetics of phase transitions: the local phase transformation volume variation can only be accomodated if the matter in the surrounding mantle has time to deform. This may delay the phase transformations which occur over a short pressure range (olivine polymorphs). Diffusion may also retard the phase transformation, in particular in the pyroxene and its high-pressure phases. Taking into account the volume variations linked to phase transformations can affect the vertical displacements and gravity over topography ratios by as much as 10%. The predicted tangential displacements are also strongly perturbed.