A new method for forward and inverse modelling of glacial isostatic adjustment in laterally varying earth models

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Measurements of post-glacial sea level change can be used to investigate the structure of the Earth, in particular, the viscosity structure. The dependence of such measurements on viscosity can be quantified using sensitivity kernels, which are the derivatives of measurements with respect to the structure. Typically, these kernels are calculated using a method of finite differencing; however, such a method becomes prohibitively time consuming in the case of three-dimensional Earth structures. We would expect the Earth to have considerable lateral variations in viscosity and so require another method for calculating the kernels.

In this presentation, we give a new and efficient gravitationally self-consistent method for modelling glacial isostatic adjustment in models with lateral structure variations. We further demonstrate how the adjoint method can be used to calculate three-dimensional viscosity sensitivity kernels with respect to such earth models. We show numerical examples of forward calculations and sensitivity kernels calculated using three-dimensional viscosity models.