Post-glacial rebound in North America: ice load parameters from inverse problems

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The influence of ice load evolution on glacial isostatic adjustment (GIA) has been widely recognized. In the past decades, inference of ice load parameters has often been derived from a suite of surface geophysical observables (e. g. relative sea-level, RSL, curves) associated with the post-glacial deformation of the Earth. Geophysical inversion techniques have been used to constrain ice time-hystory and to examine the link between data-sets and geophysical models. These models include an ice-load component, mostly based on geological and glaciological evidence, and a rheological component, specified by a viscosity profile for the Earth's mantle. Usually the ice thickness is partly undetermined and a great deal of uncertainty can also be found in the lateral extent of the large ice sheets. As a consequence, very different ice models can be generated from the same glaciological data. Here, we show the results of a non-linear, global directed, inversion applied to this geophysical problem. At this purpose, we introduce a new ice load model for the Laurentide ice sheet, based on principles from the ice flow. Our ice model consists of 7 different parabolic ice domes covering the area of the North America, Innuitian and Greenland regions. Isochrons for ice retreat as well as the ice thickness at the center of each dome are assumed *a priori* in the model based on Tushingham and Peltier (1991), i.e. ICE-3G ice model. An ice-sheet scaling parameter is introducted for each dome and the Neighbourhood Algorithm inversion technique is applied to constrain these scaling factors, using 128 RSL as observed data–set.

RSL synthetic predictions are computed solving the sea-level equation for a viscoelastic spherically symmetric incompressible Earth according to Farrel and Clark (1976) formulation in which the eustatic, the glacio-isostatic and hydro-isostatic terms are taken into account. The viscosity profile has been chosen as in Tushingham and Peltier (1991).

Our prefered model, compared with ICE-3G model, shows (1) a huge ice thickness reduction over most of the ice covered region and (2) a less peaked distribution of the ice dome in the Hudson Bay region.