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Geodetic signals from numerical modelling of recent mountain deglaciation

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Sea-level has been rising since the end of the 19^{th} century at a rate of 1-2mm per year. According to the IPCC report 2001, the melting of mountain glaciers with a rate of 0.2-0.4mm per year is the second largest contributor to sea-level rise after thermal expansion. Our global model of recent mountain deglaciation based on modelled climatic data sets confirms this number. Furthermore, the modelled ice-volume loss for the period 1961-1990 is of the same order as a compiled data set of glacier mass balances based on observations. The match of modelled and observed numbers of recent ice-volume changes of mountain glaciers results in a confident estimation of future mountain deglaciation.

However, sea-level changes do not occur equally around the globe. The sea-level response due to mountain deglaciation can be divided into three parts. The deformational component due to the deformation of the solid Earth and the gravitational component due to the change in gravitational attraction of the earth-ice-ocean system cause relative sea-level changes mainly in the vicinity of the changing ice-load. The third component is the addition of melt-water into the oceans causing relative sea-level changes mainly in the far-field. The resulting global pattern of geodetic signals due to recent mountain deglaciation show significant signals in four regions, which are Alaska, Patagonia, central Asia and the Arctic Sea.

A more detailed representation of glacial area is needed, in order to be able to predict the rebound and the change in gravitational attraction due to mass redistribution at specific sites. Furthermore, confirmation of our modelled estimates of ice-volume changes of individual glaciated areas with observations is necessary to determine accurate estimates of relative sea-level changes at existing tide gauge stations and vertical land movements at GPS and VLBI sites.