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Geophysical implications of presen-day and late Pleistocene ice melting across New Zealand

G. Ruggieri (1), R. Tenzer (2), G. Spada (1), and A. Fadil (2)

(1) Carlo Bo University of Urbino, Department of Basic and Fundamentals Science, Urbino, Italy (gabriella.ruggieri@gmail.com, +390722303399), (2) National School of Surveying, University of Otago, Dunedin, New Zealand

According to the estimation given by Chinn (2001) in total a 53 km3 of ice volume was accumulated over New Zealand during the Pleistocene covering an area of about 1160 km2 concentrated mainly along the South Island between 42 and 46 arc-deg of southern latitudes. Most recently a new mass balance monitoring program has been established with on-site support by the World Glaciers Monitoring Service (WGMS). Chinn (1996) suggests an increase retreating of glaciers with a net ice volume loss between 1977 and 2005 of about 11% (Unep, 2008). In this study we investigate the sensitivity of New Zealand's coastal regions to decadal glaciers melting (estimated by Chinn 1996) by means of sea level change and bedrock deformations. A regional present-day ice melting model, composed by disc loads with fixed positions spaced in order to minimize the overlaps, is developed and applied. We provide an estimate of the global patterns of sea level (fingerprints) associated with the melting of New Zealand's glaciers assuming an incompressible and elastic earth model. The predicted elastic deformation field is combined with the estimates of the visco-elastic deformation field associated with the melting of the late-Pleistocene ice sheets according to a set of plausible combinations of ice chronology and mantle viscosity. The total deformation field is then compared with GPS observations.