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# Analysis of the atmospheric pressure loading in New Zealand

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We investigate the atmospheric loading crustal displacements in New Zealand. The atmospheric loading is computed using the global and regional air-pressure data collected over a period of 50 years (1960-2009) with a 6 hour sampling interval. The global meteorological data of air-pressure are provided by the National Centre for Environmental Prediction - National Centre for Atmospheric Research (NCEP/NCAR) of the National Oceanic and Atmospheric Administration (NOAA). The regional data of air-pressure used in this study are obtained from the UV Atlas version 2.2 compiled by the National Institute of Water and Atmospheric Research (NIWA) in New Zealand. The elastic response of the Earth to atmospheric loading is calculated adopting the mass loading Love numbers defined based on the parameters of the Preliminary Reference Earth Model (PREM). The ocean response to atmospheric loading is computed utilizing the theory of Inverted Barometer. The numerical realization is conducted on a $5\times5$ arc-min geographical grid at the study area of New Zealand. Moreover, the atmospheric loading time series at five tide-gauge stations (Dunedin, Lyttelton, Wellington, Auckland, New Plymouth) are computed and analyzed. The results reveal that the atmospheric loading vertical displacements are typically smallest along coastal areas, while gradually increase towards inland with the maxima of 7.7 mm (over the study period of 50 years). The largest horizontal displacements are found along coastal areas, where their maxima reached 1.8 mm over that period. The vertical displacements have a high spatial correlation, whereas a spatial correlation of the horizontal displacement components is much smaller. A spectral decomposition of the atmospheric loading time series shows that the signal mostly consists of the long-wavelength harmonic terms with periods from one week to one year. The largest amplitudes in the atmospheric loading time series have an annual and semi-annual period. This is in contrast to the ocean-tide loading time series, where the largest contribution comes from the semi-diurnal tidal harmonics, and the amplitudes of the ocean-tide loading decrease with an increasing period.