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Practical analysis of tide gauges records from Antarctica

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We have collected and analyzed in a basic way the currently available time series from tide gauges deployed along the coasts of Antarctica. The database of the Permanent Service for Mean Sea Level (PSMSL) holds relative sea level information for 17 stations, which are mostly concentrated in the Antarctic Peninsula (8 out of 17). For 7 of the PSMSL stations, Revised Local Reference (RLR) monthly and yearly observations are available, spanning from year 1957.79 (Almirante Brown) to 2013.95 (Argentine Islands). For the remaining 11 stations, only metric monthly data can be obtained during the time window 1957-2013. The record length of the available time series is not generally exceeding 20 years. Remarkable exceptions are the RLR station of Argentine Island, located in the Antarctic Peninsula (AP) (time span: 1958-2013, record length: 54 years, completeness=98%), and the metric station of Syowa in East Antarctica (1975-2012, 37 years, 92%). The general quality (geographical coverage and length of record) of the time series hinders a coherent geophysical interpretation of the relative sea-level data along the coasts of Antarctica. However, in an attempt to characterize the relative sea level signals available, we have stacked (i.e., averaged) the RLR time series for the AP and for the whole Antarctica. The so obtained time series have been analyzed using simple regression in order to estimate a trend and a possible sea-level acceleration. For the AP, the the trend is 1.8 ± 0.2 mm/yr and for the whole Antarctica it is 2.1 ± 0.1 mm/yr (both during 1957-2013). The modeled values of Glacial Isostatic Adjustment (GIA) obtained with ICE-5G(VM2) using program SELEN, range between -0.7 and -1.6 mm/yr, showing that the sea-level trend recorded by tide gauges is strongly influenced by GIA. Subtracting the average GIA contribution (-1.1 mm/yr) to observed sea-level trend from the two stacks, we obtain 3.2 and 2.9 mm/yr for Antarctica and AP respectively, which are interpreted as the effect of current ice melting and steric ocean contributions. By the Ensemble Empirical Mode Decomposition method, we have detected different oscillations embedded in the sea-level signals for Antarctica and AP. This confirms previously recognized connections between the sea-level variations in Antarctica and ocean modes like the ENSO.