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Long-term trends and variability of tidal levels and constituents at Buenos Aires and Mar del Plata, Argentina

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Changes in the tides have been reported globally with large-scale ocean processes appearing to be the cause. Nevertheless, different trends in both tidal levels and constituents have been observed in different regions, suggesting that regional and local factors can play an important role. We present an analysis of the long-term trends and variability of tidal levels and the main tidal constituents using long-term records from two tide gauges in the wider region of the Rio de la Plata estuary: Buenos Aires (1905–2013) and Mar del Plata (1956–2013). We find significant long-term trends in both tidal levels and the main tidal constituents (M2, S2, K1, O1, and the overtide M4) from a running harmonic analysis in both locations. The tidal range decreased on average by 0.63mm y^{-1}, as a result of an increase of low water levels and a decrease of high water levels. We also find a secular decrease in the amplitude of the semi-diurnal constituents and an increase of the diurnal ones, but of different magnitudes at each location, which suggests that different processes are producing these changes. Specifically, in Buenos Aires, an increase of river discharge into the estuary seems to reduce the tidal range by hampering the propagation of the tidal wave into the estuary; whereas no influence of river discharge on water and tidal levels can be detected in Mar del Plata. We believe that other factors such as thermohaline changes or the rise of mean sea-level may be responsible for the observed tidal range decrease there.