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# More than 70 years of continuous sea level records on the Santander Bay.

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The knowledge of sea level height is important for many different sectors as navigation, transport, building infrastructures, tourism, or maritime sports, between others. Tides are mainly composed of an astronomical part and a meteorological one. Sometimes, their joined action is the responsible of extreme behaviors in the sea level. Influence of pressure differences, as well as related winds, is important in the behavior of sea level to analyze. The first system for reading the sea level was a tide board attached at the pier. In Spain the first modern tide gauge was installed in the Port of Alicante, Mediterranean Sea, in 1873 depending of the National Geographic Institute (IGN). Just the following year, a similar tide gauge was installed at the entrance of the Santander Bay. "La Magdalena" tide gauge was working during two periods 1876-1928 and 1963-1975. Together with Cádiz, the IGN tide gauges were used to determinate the national datum for terrestrial cartography.
The Spanish Institute of Oceanography (IEO) tide gauge network was initiated in 1943 with the installation of tide gauges along the Spanish coast. One of them was located in Santander and has been working since then. At the beginning it was a float tide gauge connected to a graphical continuous recorder. Nowadays, it also has a digital encoder and a remote connection that allow using the recorded data for operational purposes. Later a Radar system was added. This tide gauge is referred to the Tide Gauge Zero and also calibrated to a benchmark in order to have a unique reference. This high quality sea level information is required for international and regional research activities, as Global Sea Level Observing System (GLOSS). In particular, long time series are widely used for climate change detection. The sea level long term variability studies require a very good quality data focus in the reference of the data along the whole period and also it will be more precisely if we can remove the crustal movements by monitoring the tide gauge benchmark. Increase in sea level detected in the Santander tide gauge is more than 2 mm/year. Annual and semi-annual cycles are detected in the monthly mean sea level. The amplitude of the annual cycle is 30 mm. and the semiannual 21 mm. Due to the good correlation between the NAO index and the monthly mean sea level we can assume that an important part of these cycles corresponds to the meteorological influence.
The historical original records on paper are also digitalized images in order to avoid loses by paper degrading, facilitate the access to them, and in the future, keep a higher frequency record for systematic studies of extreme events.