Two centuries of shoreline evolution and storm events in Dundrum Bay, Northern Ireland.

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The shoreline evolution and the occurrence of storm events are analysed for the last two centuries in Dundrum Bay, Co. Down in the SE coast of Northern Ireland (U.K.) as part of the INTERREG MarPAMM project. The study site is a macrotidal beach (5.5 m max spring tidal range) predominantly sandy and characterised by multiple intertidal bars ('ridge and runnels'). The study site is characterised by a slightly embayed coastline, 8 km long and SW-NE oriented, interrupted by a tidal inlet that links the inner bay with the ebb tidal delta. The shoreline, described here as the dune vegetation line, has been digitised using a dataset of historical maps, aerial photographs and RTK-DGPS surveys from 1833 to 2019 (186 years). Sixteen shorelines have been digitised and a quantitative assessment of the uncertainty associated with each shoreline position has been performed. Shoreline changes statistics have been computed by means of ArcGIS extension DSAS 5.0 using a confidence interval of 99.7% on 325 cross-shore transects 25 m spaced. Storm events were identified across 194 years using historical news from local newspaper articles (1825-2019) and hind-casted wave data (1948-2019). The total change in shoreline movement, with no reference to the period, ranged between 7 to 253 m, with both these values located in the inlet and related to the generation and growth of a sand spit. An erosional trend affected the SW part of the study site (Newcastle-Murlough beach) with peak values of -55 m between the oldest and the most recent shoreline available (1833-2017): negative values increased towards the inlet and 90% of transects showed an erosive trend in this area. Accretion characterised the NW part of the bay (Ballykinler) with maximum values up to +209 m, again in proximity to the inlet: 87% of the computed transects showed an accretional trend in this area. In the Newcastle-Murlough area, the erosional trend lasted from 1859 to 1962, transited through a stable situation between the 1962 and 2012 and restarted erosion after 2012 up to a stabilisation in most recent years. Considering the entire analysed period, the maximum shoreline loss per year at Newcastle-Murlough was 0.30 m/year. In Ballykinler, the accretional trend lasted from 1859 to 2012 and except from a slight decrease in 2014, it is still ongoing. Considering the entire period, at Ballykinler the maximum gained was 1.3 m/year. The shoreline experienced the highest variations around the inlet area, driven by the generation and growth of a sand spit. Considering the high rate of changes in the inlet area, a further counter-clockwise movement is expected for the seaward part of the inlet channel. Since the accretion rate in Ballykinler beach is, in some places, four times that of the erosional rate of Newcastle-Murlough beach, differences in nearshore bathymetry, storm exposure and ridge and runnel dynamics between the two sites require further investigation. The study also aims to highlight the importance of combining multi-temporal geographic data with...
historical information in documenting long-term coastal changes within Marine Protected Areas of the UK.