

Morpho-sedimentary signals of disequilibrium status in a small natural inlet, northern Adriatic, Italy

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S. Andrea Inlet is one of the two natural openings located in the Marano and Grado Lagoon, a multi-inlet system placed in the North East of Italy, consisting by a barrier islands system with six tidal inlets, more or less reinforced. The tide is semi-diurnal with a maximum spring-tide around 1.10 m. Mean significant wave height is lower than 0.5 m. Longshore drift in the area occurs from both directions, causing an asymmetry of the inlet channel. On maps, S. Andrea Inlet appears already since 1600s but its persistence is under observation. In fact it is placed between the most efficient inlets in the lagoon, Lignano and Buso Inlets, whose artificial stabilization began in the 1960s, to permit a better and safer navigability. This fact led to an increase of their efficiency at the expense of the S. Andrea Inlet one, carrying it toward atrophy.

A series of topo - bathymetric surveys were carried out and the data were later interpolated and compared using ESRI ArcGisTM 10.3.1 software to produce Digital Elevation Models (DEMs). Information as minimum cross-sectional area (A_c) and maximum depth on it ($MaxD$) were extracted from the maps; tidal prism was computed using the North Adriatic empirical relationship of literature. From the comparison, it results that the northern section of the main channel is translated westward while the southern one toward the east. Furthermore, a general decreasing in depth is recorded, denoting a progressive infilling of the channel and, as a consequence, the tidal prism almost halved from the '60s to today (2016), also for the expansion of the tidal prism of the nearby inlets of Lignano and Buso. A classical paradigm relates the size of the ebb tidal delta to the tidal volume discharge. For this reason, the delta volume was also computed. Against all expectations, an increase in ebb-tidal delta volume is recorded. This could be explained by a greater inertia of the sedimentary body to adapt to changes, being in a poorly or no wave dominated regime that struggles to dismantle the delta. In addition, the continuous sediment contributions transported by the longshore currents and the strong downdrift offset that limits the accommodation could further enhance local sedimentation, thus increasing the sedimentary body of the terminal lobe of the outer ebb-tidal delta. S. Andrea inlet is one of the examples where human needs are influencing the natural evolution of an inlet.