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Estimating Vertical Land Motion in Northern Adriatic Sea with Coastal Altimetry and In Situ Observations

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The European Space Agency, in the framework of the Sea Level Climate Change Initiative (SL_CCI), is developing consistent and long-term satellite-based data-sets to study climate-scale variations of sea level globally and in the coastal zone. Two altimetry data-sets were recently produced. The first product is generated over a grid of 0.25x0.25 degrees, merging and homogenizing the various satellite altimetry missions. The second product that is still experimental is along track over a grid of 0.35 km. An operational production of climate-oriented altimeter sea level products has just started in the framework of the European Copernicus Climate Change Service (C3S) and a daily-mean product is now available over a grid of 0.125x0.125 degrees covering the global ocean since 1993 to present.

We made a comparison of the SL_CCI satellite altimetry dataset with sea level time series at selected tide gauges in the Mediterranean Sea, focusing on Venice and Trieste. There, the coast is densely covered by civil settlements and industrial areas with a strongly rooted seaside tourism, and tides and storm-related surges reach higher levels than in most of the Mediterranean Sea, causing damages and casualties as in the recent storm of November 12th, 2019: the second higher water registered in Venice since 1872. Moreover, in the Venice area the ground displacements exhibit clear negative trends which deepen the effects of the absolute sea level rise.

Several authors have pointed out the synergy between satellite altimetry and tide gauges to corroborate evidences of ground displacements. Our contribution aims at understanding the role played by subsidence, estimated by the diffence between coastal altimetry and in situ measurements, on the local sea level rise. A partial validation of these estimates has been made against GPS-derived values, in order to distinguish the contributions of subsidence and eustatism. This work will contribute to identify problems and challenges to extend the sea level climate record to the coastal zone with quality comparable to the open ocean, and also to assess the suitability of altimeter-derived absolute sea levels as a tool to estimate subsidence from tide gauge measurement in places where permanent GPS receivers are not available.