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Record of the Holocene relative sea level change along the Italian coastline and comparison with some instrumental data

S. Furlani (1), C. Braitenberg (2), A. Amorosi (3), F. Antonioli (4), A. Bondesan (5), L. Ferranti (6), A. Fontana (5), G. Fontolan (1), K. Lambeck (7), G. Mastronuzzi (8), C. Monaco (9), P. Orrù (10)

(1) Dip. di Scienze Geologiche, Ambientali e Marine, University of Trieste, Italy, (2) Dip. Scienze della Terra, University of Trieste, Italy, (3) Dip. di Scienze della Terra e Geologico-Ambientali, University of Bologna, Italy, (4) ENEA, Special Project Global Change, (5) Dip. di Geografia, University of Padova, Italy, (6) Dip. di Scienze della Terra, University of Napoli, Italy, (7) Research School of Earth Sciences, Australian National University, (8) Dip. di Geologia e Geofisica, University of Bari, Italy, (9) Dip. di Scienze della Terra, University of Catania, Italy, (10) Dip. di Scienze della Terra, University of Cagliari, Italy. (sfurlani@units.it / Fax: +390405582048 / Phone: +390405582079)

Sea-level change along the Italian coast is the sum of eustatic, glacio-hydro-isostatic, and tectonic factors. The first is global and time-dependent while the latter two also vary with location. The glacio-hydro-isostatic component has been predicted and compared with field data collected at sites affected and not affected by significant tectonic processes.

We aim to estimate the coastal tectonic movements along the Italian coastline through the comparison of published and unpublished new radiocarbon datings, well connected with the Holocene relative sea level, and using geomorphological and archaeological markers. Data are part of a new dataset quite complete for the whole Italian Peninsula that we compared with the Lambeck's model, in order to provide the tectonic rates and to test the coastal tectonic stability.

Moreover, we compare the late Holocene tectonic rates with the instrumental values,

retrieved from a number of different sources. We have selected two different coastal areas, Trieste (subsidence) and the Messina Straits (uplift). At the moment, our dataset is inhomogeneous, both because the parameters have not been measured and because ofty the data availability, so the direct comparison of the results between the two areas is very difficult. Our working hypothesis concerns the fact that the geologically determined movement rates should be observed nowadays, as the geological rates represent average persistent values. When the rates do not correspond to the instrumental values, the differences must be explained by instrumental direct or indirect (environmental noise) effects, anthropogenic effects or short-term tectonic effects (seismic cycle).

The Trieste area is considered to be aseismic, while the seismic band is located some tens of km to the East, bordering the Adria plate. The Messina Straits is one of the most active seismic areas in Italy: in this case, the discrepancies are liable to be found due to fault movements.

For the greater Trieste area, we consider up to 100 years of tide gauge measurements (PSMSL), 40 years of tilt measurements, 50 years of repeated leveling measurements, and 13 years of satellite altimeter data (Topex/Poseidon), 4 years of GPS data. For the Messina Straits we use satellite altimeter data and tide gauge observations (PSMSL and APAT), the only available data. In the Trieste area we find a partial agreement with the results predicted by the geology. The longest-term observations (tide gauge, tilt, levelling) reveal that there are considerable changes in the calculated rates in the time interval considered, which prevent the definition of one single rate value, though there is a general agreement with the subsidence and its northerly decrease in magnitude. The results on crustal vertical movement, which stem from the comparison of satellite altimetric observations and the tide gauge measurements, is still now controversial. This could be due to the relatively short-time period data available, or to the spatial variations of sea level change in the Adriatic, poorly resolved by the satellite tracks.

For the Messina Straits the tide gauge data show the pre- and post-seismic crustal movement tied to the 1908 Messina seismic event. Furthermore, the tide-gauges confirm an uplift rate of the coast of the order of 2 mm/yr. Joint analysis of tide gauge and satellite altimetric data agree to the fact that the coast is uplifting, although the shortness of the common data series gives little statistically weight to a linear interpolation of the yearly varying sea-level observations. We conclude that geological and instrumental observations are in agreement, considering the direction of the crustal movements.