RU S1_1.01: Vertical Crustal Movement from Tide Gauges and Satellite Altimetry

Braitenberg C.[1], Grillo B.[2], Mariani P.[3], Tunini L.[4], Nagy I.[5]

Dipartimento Scienze della Terra, Universita' di Trieste, Via Weiss 1, 34100 Trieste
[1]berg@units.it, [2]radi587@yahoo.it, [3]patrizia_mariani1979@yahoo.it [4]lavy_tun@yahoo.it, [5]inagy@units.it,

The goal of our study is to determine crustal movement rates along the Italian coast. The method consists in studying tide gauge and satellite altimetric data jointly. The sea level change measured by tide gauges is the sum of the sea surface height variation and the vertical crustal movement. Tide gauge data therefore contain the vertical crustal movement rates, but the problem consists in separating this signal from the sea level observations. Satellite altimetric observations give the geocentric sea surface height and can therefore in principle be used to determine the sea surface height rates and separate the sea surface from the crustal signal in tide gauges. Along the Italian coastline 26 tide gauge stations with 10-years of continuous data are available. We have explored the sea level data statistically, including a study of the space-time variation of rates, of the optimal way of calculating rates and of the correlation-coefficients between stations. The tidal sea level change rates have a relatively large variability, greatly ascribable to the short time interval of analysis (10 years), and are comprised between -5 and +9 mm/yr with an approximate uncertainty of 0.5 mm/yr. The satellite altimetric data pose a challenge to the joint analysis, due to very different time resolution (10 days versus hourly sampling of tide gauges), sparse spatial sampling of the Mediterranean due to track distances, and the difficulty in acquiring altimetric data in the vicinity of the coast. We have analyzed the satellites Topex/Poseidon and Jason1, the study of satellite ENVISAT is under way. We explore also the satellite altimetric data statistically, investigating the correlation matrices of the data and the time-space variation of the sea surface change rates. We find that the sea surface change rates derived from the altimeter have an even greater variability compared to the tide gauges for the same years, showing that changes far from the coast are greater than near the coast. We discuss the problem of how to use the altimeter data in those cases in which the tracks are far from the tide gauges, as is the case for the satellite Topex/Poseidon and the tectonically interesting tide gauge stations of Sicily and Calabria. An adequate space-time interpolation of the satellite data produces maps of spatial variations of sea surface change that are used in the study of the differential sea level rates of tide gauges. We show that geologically consistent crustal uplift rates are found for the highly seismic area of eastern Sicily and Calabria.