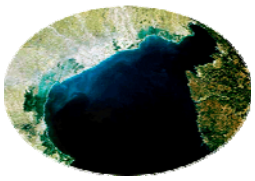

The climate in the Venetian and North Adriatic region: variability, trends and change

workshop

Venice, 27-29 October 2008

TOPIC T3. Land motions and relative sea level

Regional isostatic adjustment

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Short abstract:

Glacio-isostatic adjustment (GIA) is a mechanism operating on a global scale, which is responsible for a slow modification of the shape of the Earth in response to the melting of the late Pleistocene ice sheets. Since both topographic and geoid variations are involved, GIA is the cause of variations of sea level which significantly depart from eustasy (i. e., uniformity), being the result of the response to a complex spatially variable and time-dependent mass redistribution that stems from ice and a water components. GIA-induced sea level variations at a given place and time depend on the previous history of surface ice loads (ice and melt water) and sea level on the whole surface of the Earth. For this reason, it is virtually impossible to understand how GIA is operating on a regional scale without solving the global readjustment problem, which is governed by the so--called Sea level Equation, a linear integral equation that simultaneously accounts for the viscoelastic response of the mantle, for the evolving surface loads and for the gravitational interaction between the ice sheets, the oceans and the solid Earth. Using recently developed numerical codes that are freely distributed to the scientific community, I will show how GIA is currently modifying sea level at various spatial scales: globally, across the Mediterranean, along the coasts of Italy, and in the northern Adriatic. GIA is expected to produce a long-wavelength pattern of sea level variations in the Mediterranean, mostly determined by the response of the solid earth and of the geoid to loading effects of melt water since the end of deglaciation a few thousand years before present. Modeling GIA effects in this region is necessary for a correct interpretation of tide gauge and GPS time-series, and thereby to constrain both the present-day climate-related sea level rise and regional or local geological, tectonic and human-driven ground deformation. By an exploration of the parameter space of mantle rheology and ice sheet chronology, I will outline upper and lower bounds on the current rate of sea level variation associated with GIA in the Mediterranean and in particular in the northern Adriatic. This may contribute to a full assessment of coastal vulnerability by sea level rise on a regional and local scale.