Geophysical Research Abstracts, Vol. 9, 02717, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-02717

A mass-balanced reconstruction of sediment supply to the Adriatic Basin from the Last Glacial Maximum to the present

M.B. Brommer (1), G.J. Weltje (1), A.J. Kettner (1) and F. Trincardi (2)

(1) Delft University of Technology, Department of Geotechnology, Delft, The Netherlands (m.b.brommer@tudelft.nl / Phone: +31 15 2786001)

(2) ISMAR (CNR), via Gobetti, 101, 40129, Bologna, Italy

The principle of mass conservation is a fundamental concept of physics. A sediment dispersal system is mass-balanced if all sediment produced in its source area is deposited in the basin without bypassing the site of deposition. In this case, the basin is said to be closed and the conservation principle states that the mass of sediments supplied to the basin is equal to the mass of sediments deposited in the basin. Yet, in sedimentary basin analysis, the conservation principle is seldom used, and quantitative datasets on long-term (10^1-10^5 years) sediment supply to basins are almost non-existent. Instead, time-average rates of sediment supply are usually inferred from the stratigraphic record, which is implicitly assumed to be complete. Predictions of sedimentary system evolution, i.e. forecasts of mass transfer from source to sink in response to climate, sea-level, and land-use changes, are not testable if we cannot quantify long-term (10^2-10^5 yrs) sediment supply independent of the sedimentary record. A true mass-balance study requires an independent check of sediment supply to basins.

In this study, we present the results of a true mass-balance exercise carried out in a closed basin, the Northern Adriatic Sea (Italy). We cover the time interval from the Last Glacial Maximum (LGM; 19 kyrs BP) to the present, which could be subdivided into five basinwide time slices. This is a particular interesting time span to study sedimentary system evolution, since climate changed significantly during the past 19 kyrs. Spectacular changes in sea level controlled the area of sediment deposition in the basin, at the downstream end of the dispersal system, whereas variable climate regimes controlled sediment generation and dispersal mechanisms upstream in the drainage basins.

The long-term sediment load model (BQART) built into the model HydroTrend, has been used to simulate sediment supply to the Adriatic Basin from the LGM to the present. These results were compared to estimated masses of well-dated seismic-stratigraphic units mapped in the Adriatic Basin. Quantification of the uncertainties associated with the sediment mass balance is an essential part of our method. Uncertainties of the BQART model were assessed by means of error propagation theory. We adopted a stochastic simulation approach to determine the uncertainty associated with the stratigraphic record. To satisfy the mass-conservation principle our null hypothesis states that the two independent median masses are equal. For every time slice, the null hypothesis was tested at a 5 % significance level.

Our results indicate that there is no reason to reject the null hypothesis for any of the five time intervals, which indicates that the conservation principle is satisfied. The fact that we are capable of producing a closed-budget on this spatio-temporal scale has important consequences. A mass-balanced control on sediment supply to basins means that we can actually test different scenarios of sedimentary system evolution in response to climate change. This is important to geological reconstructions of sedimentary system evolution, but also for instance to predictions of long-term dynamics of the coastal zone.