Geophysical Research Abstracts
Vol. 12, EGU2010-12542, 2010
EGU General Assembly 2010
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Dense water cascading, bottom currents and sediment wave formation at the exit of the Bari canyon (Southern Adriatic Sea, Italy)

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The dense water forming in the North Adriatic (NAdDW) spreading southward along the Italian continental shelf, sinks in the Southern Adriatic basin through particular cascading events. Such events are seasonal, occurring specially in April, with variable intensity. These phenomena control the water mass mixing, the deep ocean ventilation, the behaviour of deep ecosystems, the formation of complex erosive and depositional bedforms and the abyssal export and burial of nutrients and carbon.

Because of the NadDW formation is linked to climate factors (frequency, duration and size of Bura winds), the temporal variations of the NadDW dispersion into the Southern Adriatic allow to make inferences of the impact of recent climate changes on the ecosystems of the deep Mediterranean Sea.

Previous research projects (EuroStrataform, HERMES) acquired a large data set of bathymetric, side-scan sonar (TOBI) and Chirp sonar profiles, which were used to build detailed morpho-bathymetric maps of the Southern Adriatic margin. There, the seabed is extremely complex, characterized by a large variety of bedforms (sediment waves, erosive scours, longitudinal furrows and giant comet marks). A branch of the cascading NAdDW is confined and accelerated through the Bari canyon where it produces a strong current capable of reaching down-slope velocities greater than 60 cm s^{-1} near the bottom at $\sim$600 m of water depth, eroding the canyon thalweg and entraining large amounts of fine-grained sediment. At the exit of the canyon, in water depth greater than 800 m, the current becomes less confined, spreads laterally and generates an 80-km^2-wide field of mud waves; these bedforms migrate up current and show amplitudes up to 50 m and wavelengths of about 1 km.

Cruise IMPACT-09 of RV Urania was carried out in the Southern Adriatic Sea from 17-30 March 2009 with main scope of studying the impact of NadDW cascading events on the deep ecosystems of the Southern Adriatic. Experiments planned in the cruise IMPACT-09 followed multiple directions: 1) stations along a bathymetric transect and sites studied in previous projects (HERMES, VECTOR, BIOFUN) were re-occupied in order to identify changes of biodiversity and ecosystem functioning; 2) a moored array instrumented with an automatic sediment trap, two current meters, a turbidity sensor and a conductivity and temperature recorder was deployed on the sediment wave field in order to monitor the seasonal variations of food supply and hydrodynamics. Furthermore, a short deployment of the mooring was carried out between 15-24 March, 2009 in order to optimize the position of the instrumented array.

Here, we will show the first 6-month results of the mooring experiment, which is planned to last longer than two years. Aims are to verify is the consistence of present-day currents (speed and direction) with respect to the bedforms located at the exit of the canyon. Alternatively, these structures must be considered relict, evidencing past high-energy periods. Unfortunately (at least for this research), winter 2009 was mild and particularly wet. The Po river discharge remained relatively high through all the winter and peaked in late April-early May. Hence, the quantity and the characteristics of the produced NadDW made not likely the occurrence of dense water cascading in the Southern Adriatic. In fact, near-bottom currents at the mooring site were low, never exceeding 20 cm s^{-1}. Currents were generally quasi-parallel to the bedform orientation ($\sim$135°N). Nevertheless, during peak periods, the current direction slightly shifted northward, becoming more oblique with respect to the sediment wave crests, the water turbidity showed small amplitude peaks, and the water temperatures recorded the lowest values of the time-series.