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Particle transport down to the Bari canyon (Southern Adriatic): processes involved in transferring particulate matter to the deep basin

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The Southern Adriatic is known to be an area of dense shelf water cascading and open ocean convection. The impact of cascading events in transferring fresh organic matter to the deep benthic community and in producing the wide range of bedforms found on the continental slope or at its base, has been highlighted in recent years. Particle fluxes and hydrodynamics were monitored in both branches of the Bari canyon and on the adjacent open slope from March 2004 to March 2005. Late March of both years were characterized by colder bottom waters, a notable intensification of bottom currents and increased particle fluxes, which indicated intense episodes of dense shelf water cascading.

In March 2009, we deployed a new instrumented mooring at 860 m water depth in a field of sediment waves situated down current to the Bari canyon. In March 2010, a second mooring was installed in the northern channel of the canyon, in the same position of mooring B deployed in 2004. The moorings are still acquiring data and are serviced twice a year.

Winters 2009, 2010 and 2011 were mild and particularly wet. The Po river discharge remained relatively high throughout the whole winter. Hence, we expected a not-particularly dense shelf water formation and a shallow shelf water overflowing off the Adriatic shelf. Very low near-bottom currents, never exceeding 20 cm s^{-1}, were recorded at both mooring sites. In addition, the water turbidity showed small amplitude peaks and the water temperature has showed only minor decreases. Trap fluxes showed much lower values with regards to the 2004-2005 experiment. Nevertheless, they varied both seasonally and interannually. Higher fluxes were again measured during the spring season with greater values in 2010 and 2011 than in 2009. In the canyon, fluxes were higher than those measured on the sediment wave field.

In winter 2012, the North Adriatic experienced a severe cold wave with NE Bora winds and reduced fresh water input from the Po river. The impact of these extreme weather conditions was the formation of extremely dense shelf water. Mass fluxes increased very much (up to 11 g m^{-2} d^{-1}), specially in the offshore station. Mass peaks during 2012 were up to 5 times higher than peaks of previous years. In the canyon station, currents exceeded 70 cm s^{-1} and temperature dropped to 12.2˚C at the near bottom. Surprisingly, the total mass peak occurred between 16 Feb-1 March, 3-4 weeks ahead of arrival of the North Adriatic Dense Water, suggesting the delivery of dense shelf water from another source area, maybe the Middle Adriatic Sea. While is apparent that deep cascading of dense shelf water is the main process driving the particle transfer thought the Bari canyon during spring 2012, other processes, such as open ocean convection, storm-driven shelf-to-canyon particle transport, or shallow dense water cascading, will be examined as forcing of the particle dynamics during 2009, 2010 and 2011 springs.