Geophysical Research Abstracts
Vol. 13, EGU2011-5061, 2011
EGU General Assembly 2011

On the descent of dense water on a complex canyon system in the southern Adriatic basin

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Using the results of a numerical model for the description of bottom-arrested currents and statistical analyses, we elucidate different characteristics of the dynamics of a southward propagating vein of North Adriatic Dense Water (NAdDW) observed to evolve within a complex canyon system of the southern Adriatic basin. The vein, monitored from March 2004 to March 2005 by three distinct mooring lines, exhibits a complex, highly time-dependent dynamics characterized by large velocity and density fluctuations. In particular, lag correlation analyses performed on the observed velocity and temperature data show that a temporal lag ranging between 7 and 10 h governs the NAdDW signal propagation along the different canyons, its magnitude inversely depending on vein downslope velocities and density anomalies. The performed model simulations reveal that, weakly depending on its initial layer thickness, exact position, and density contrast with the upper ocean, a coherent flow of dense water located upstream of the canyon system on the Italian shelf will always bifurcate at the entrance of that system; while its shallower part will disintegrate into several branches, its deeper part will continue to flow more coherently, injecting part of the bottom water downward. Regions dominated by supercritical flow regimes are simulated, which contributes to explain part of the observed flow variability. Simulated lag times between signals propagating in the canyons are consistent with observations. They are found to depend crucially on initial, upstream vein location, layer thickness, and density contrast with the upper ocean. We finally use this information, retrieved by our numerical simulations on the basis of the available observations, to infer, in a kind of inverse problem solving, possible shape, location, and density contrast possessed by the observed vein of NAdDW on the Italian continental shelf, prior to its sinking toward the Bari canyon system.