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Abyssal and deep circulation in the Eastern Mediterranean Sea (Ionian Sea)

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In the mid-1990s, experimental evidences on the Eastern Mediterranean Transient (EMT) were presented and it was shown that the Mediterranean abyssal circulation is not in a steady state but can be subjected to episodic sudden changes (Roether et al., 1996).

In the last 10 years the Ionian Sea, the central and deepest part of the Mediterranean Sea, was subjected to relevant scientific interests from a theoretical and experimental point of view. Among these, there is the discovery of the BiOS (Bimodal Oscillating System), one new mechanism that drives a periodic (almost decadal) redistribution of surface and subsurface waters in the Eastern Mediterranean, with considerable feedbacks in the variability of the deep-water formation both in the southern Adriatic and in the Levantine and Aegean sub-basins (Gačić et al., 2010).

In the Ionian Sea, numerous recent observational campaigns have been conducted to investigate the behaviour of deep and abyssal waters, at depths between 2000-4000m that are comparable to the mean global ocean depth (Rubino and Hainbucher, 2007; Bensi et al., 2013). There, advection, diffusion and vertical stability of the water masses can assume an important role on the internal quasi-periodical variability, creating the preconditions for catastrophic events such as the EMT or reversals of the Ionian circulation (Pisacane et al., 2006). Since there are no significant deep heat sources in the world ocean, waters that fill the deep ocean can only return to the sea surface as a result of downward mixing of heat from the sea surface to the bottom and vice versa and this occurs through eddy diffusion.

Along our presentation, mainly through the analysis of the deepest CTD casts taken from 2009 to 2011 in the eastern basins and in particular in the Ionian Sea, we will show a significant change in the deep thermohaline structure (including its biogeochemical and hydrological characteristics), giving an indication on the time scale of the renewal of deep water. Finally, we will give indications on the internal exchange mechanisms, in particular investigating the diffusion processes throughout the entire water column, and the variability of the stratification between 2000 and 4000m depth created by the quasi-periodical ventilation of the deep layers by different source waters (Adriatic and Aegean, respectively). The latter phenomenon mimics the well know Atlantic seesaw mechanism but at smaller Mediterranean scale (Stocker, 2000).

References:

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