SEASONAL AND INTERANNUAL PATTERNS OF 1000M DEPTH TRACE METALS FLUXES AT THE DYFAMED TIME-SERIES STATION (LIGURIAN SEA)

Christophe Migon [1]*, Lars-Eric Heimbürger [1], Remi Losno [2] and Juan-Carlos Miquel [3]
[1] (1) UPMC Université Paris 06, UMR 7093, LOV, Observatoire océanographique, F-06234, Villefranche-sur-mer, (France) (2) CNRS, UMR 7093, LOV, Observatoire océanographique, F-06234, Villefranche-sur-mer, (France) (3) IFREMER, Centre Nantes, BP 21109, F- - migon@obs-vlfr.fr
[2] LISA, Université Paris 7-Paris 12, CNRS, 61 Avenue du Général de Gaulle, F-94010 Créteil cedex (France)
[3] IAEA, Marine Environmental Laboratories, 4 Quai Antoine 1er, MC 98000 Monaco (Monaco)

Abstract
Sediment traps were moored at 1000m-depth at the DYFAMED time-series station (Ligurian Sea). 1990s and 2003-07 trace metal and mass flux data suggest that the transfer of atmospheric material is quantitatively driven by the magnitude and variability of biological production. Decadal trends are tentatively outlined, suggesting that the temporal variability of deep fluxes is modulated by the variability of external parameters that control winter convection and subsequent biological activity.
Keywords: Particle Flux, Trace Elements, Time Series, Ligurian Sea

In NW Mediterranean marine environments mainly constrained by atmospheric forcing, the accumulation of sinking particles presumably mirrors the evolution of anthropogenic emissions. Automated time-series sediment traps (Technicap PPS 5, equipped with a programmable 24-cup collector, sampling rate 15 days) were moored at the DYFAMED time-series station (Ligurian Sea, 43°25'N, 7° 52'E, 2350 m depth), in the frame of the French project COMET (COnstructing MEditerranean Time-series, LEFE programme). Owing to its circulation (permanent cyclonic gyre), the DYFAMED site is sheltered from lateral inputs, apart from exceptional conditions [1]. Trace metal (TM: Al, Fe, Mn, Ni, Cu, Cd, Pb, V, Zn) and mass fluxes were measured from March 2003 to March 2005. Archive data from deployments in the 1990s were used to estimate a possible decadal evolution. The seasonal pattern of mass and TM fluxes are compared in Fig. 1 for the case of Al and Pb. An outstanding feature is the strong covariance observed between mass flux and TM flux, whatever the nature of the TM (e.g., anthropogenic or crustal). This suggests that, apart from convection episodes associated with dense water formation, the transfer of atmospheric material is almost totally driven by the magnitude and variability of biological production. This statement is in agreement with previous studies that pointed out the prominent role of biological activity in the removal of TMs [2, 3]. The comparison of 1995 and 1997-98 data with 2003-07 data suggests decadal evolutions linked to changes in land-based emission sources. However, these findings are slightly different of the decadal evolutions observed in the atmospheric aerosol in the same region [4]. This presumably results from the interannual variability of external factors (temperature, wind stress, etc.) that determine the intensity of winter convection and, therefore, that of biological production, i.e. the driving force of atmospheric matter downward transfer.

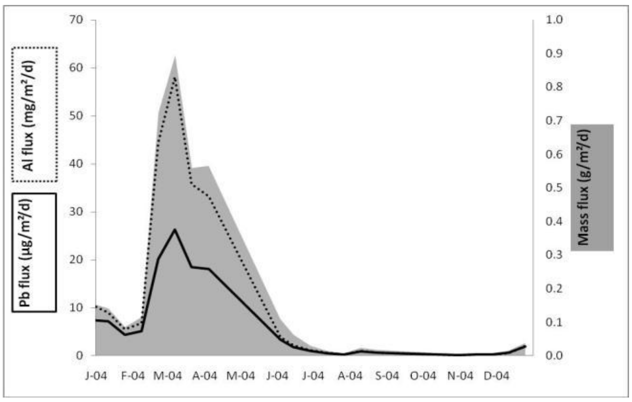

Fig. 1. Seasonal variability of mass, Al and Pb fluxes; 2004 as an example

References
1 - Lévy M., Mémery L. and André J.M., 1998. Simulation of primary production and export fluxes in the Northwestern Mediterranean Sea. *J. Mar. Res*. 56, 197-238.
2 - Buat-Ménard P., Davies J., Remoudaki E., Miquel J.C., Bergametti G., Lambert C.E., Ezat U., Quétel C., La Rosa J. and Fowler S.W., 1989. Non-steady-state biological removal of atmospheric particles from Mediterranean surface waters. *Nature* 340, 131-134.
3 - Migon, C., Sandroni, V., Marty, J.C., Gasser, B. and Miquel, J.C., 2002. Transfer of atmospheric matter through the euphotic layer in the northwestern Mediterranean: seasonal pattern and driving forces. *Deep-Sea Res. II* 49, 11, 2125-2142.
4 - Heimbürger L.E., Migon C., Dufour A., Chiffoleau J.F. and Cossa D. Evolution of trace metal concentrations in the Northwestern Mediterranean atmospheric aerosol between 1986 and 2008. Submitted to Sci. Total Environ.