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C and ^{234}Th Downward Fluxes Through the Twilight Zone; a Multi-depth Sediment Trap Study in the NW Mediterranean Sea (DYNAPROC-2)

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Particulate carbon production in the ocean surface and subsequent transport to depth represents one of the critical processes governing the global carbon cycle. During their downward motion, sinking particles are modified through a number of processes including zooplankton grazing and repackaging, decomposition, and physical aggregation and disaggregation. Such interactions result in significant depth-dependant changes affecting the particle flux both quantitatively and qualitatively. During DYNAPROC 2, a Proof-France project aiming to better characterize the NW Mediterranean pelagic ecosystem during the summer-fall transition in relation to the physical structure of the water column, downward particle fluxes were studied at 5 depths in the twilight zone using moored sediment traps. Fluxes were measured during one month in September-October 2004 between 100 and 1000 m with a time resolution of 3 days. Carbon (TC, POC), nitrogen, pigments and ^{234}Th fluxes were assessed. Radionuclide and elemental fluxes were generally low and decreased with time and depth, except at 400 m where an input of fresh organic material likely related to the influence of zooplankton dial migrators was observed. Carbon fluxes (POC) ranged from 1 to 14 mg m^{-2} d^{-1} at 100 m and <1 to 4 mg m^{-2} d^{-1} at 1000m. High C/N ratios suggest an important degradation of the settling material except at the base of the euphotic layer (100m) and at 400m. Trap based ^{234}Th fluxes were rather variable, ranging from 8 to 108 dpm m^{-2} d^{-1} at 100 m and 16 to 126 dpm m^{-2} d^{-1} at 1000m; these differences can be mainly ascribed to variations in the ^{234}Th specific activity values of the trapped material, which tended to increase with depth. POC and ^{234}Th fluxes were also derived from a 0-1000m ^{234}Th water column profile (12 depths with 3 replicates), carried out 6 days after the end of the sediment trap sampling. Disequilibrium-based flux estimates at the base of the photic layer (100m) matched within uncertainty those which were directly measured in the sediment traps at the same depth. The high resolution of this study enabled biologically- and physically-mediated changes in particle fluxes to be clearly identified.