ATMOSPHERIC DEPOSITION OF DISSOLVED ORGANIC CARBON (DOC) AT THE ISLAND OF LAMPEDUSA: A PRELIMINARY STUDY

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Abstract
Atmospheric deposition of dissolved organic carbon (DOC) at the Lampedusa Island allowed for a first estimate of the DOC fluxes at this site. The excitation-emission matrixes (EEMs) allowed to gain information about the composition of atmospheric DOM.

Keywords: Atmospheric input, Organic matter, Mediterranean Sea

Marine dissolved organic carbon (DOC) represents the largest reservoir of organic carbon on Earth. Its pool is equivalent to the atmospheric CO_2, the net oxidation of only 1% of marine DOC would therefore generate a CO_2 flux similar as that produced annually by fossil fuel combustion [1]. The Mediterranean Sea (Med Sea) receives different types of compounds (inorganic and organic) from the atmosphere via wet or dry deposition. The organic fraction of atmospheric deposition can undergo biotic and abiotic transformations in the atmosphere and upon its arrival to the surface ocean, with an important impact on the marine carbon cycle. Although the organic fraction of aerosol plays a crucial role in the C, N, and P biogeochemical cycles, very limited information is available in the Med Sea. The main goals of this study are: (1) to obtain the first information on the atmospheric deposition of DOC at the island of Lampedusa and (2) to gain some qualitative information about the composition of atmospheric dissolved organic matter (DOM) through the analysis of the optical properties (absorption and fluorescence) of its chromophoric fraction (CDOM). A specifically designed total atmospheric deposition sampler for DOM was installed at the ENEA Station for Climate Observations at Lampedusa in March 2015. The sampling site is strategic because Lampedusa is far from continental regions and from relevant pollutant sources. It is suitable for the study of specific phenomena relevant for climate, such as the transport and effects of Saharan dust, as well as for oceanographic studies, since it is close to the Sicily Channel, a strategic point for the Med Sea circulation. Atmospheric deposition was collected between March 19th and December 2nd 2015. Measured DOC fluxes range between 0.07 and 1.81 mmol C m^{-2} day^{-1}, with a marked variability (Fig. 1).

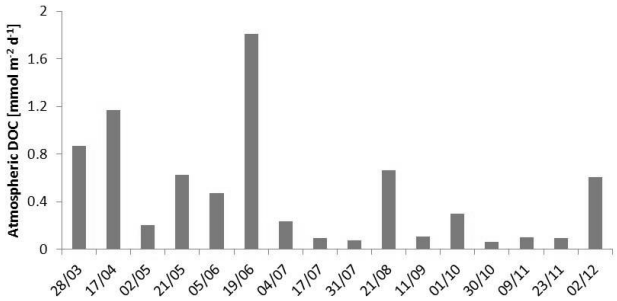

Fig. 1. DOC fluxes between March and December 2015

These data are in the range of DOC atmospheric fluxes measured at Cap Ferrat in 2006 (0.04-1.2 mmol C m^{-2} day^{-1}) [2] and of total OC (TOC) in rainwater at the island of Crete (0.14 mmol C m^{-2} day^{-1}) [3]. Assuming this range valid for the whole basin, a total input of 0.4-4.3·10^{12} g C year^{-1} can be estimated. This rough estimate suggests that DOC input from the atmosphere could be up to 18 times larger than the river input [4].
The excitation-emission matrixes (EEMs) of CDOM in total deposition generally show 3 peaks (2 examples are reported in Fig. 2). (1) Peak A (excitation wavelength, λ_{ex} = 250 nm and emission wavelength, λ_{em} = 400-500 nm), this peak has been observed in many studies on marine DOM, in particular in coastal regions and is attributed to terrestrial humic-like substances [5,6,7]. (2) Peak M (λ_{ex} = 310-320 nm and λ_{em} = 400-450 nm) shows lower levels of fluorescence intensity than peak A and it is observed in all the samples. In previous studies it was attributed to marine as well as terrestrial humic-like substances [5,6,7]. (3) Peak T (λ_{ex} = 280 nm and λ_{em} = 340 nm) is attributed to protein-like substances [5,6,7] and it is present in a sub-group of samples.
These preliminary results suggest that atmospheric input can be an important, and up to now overlooked, source of DOC and CDOM to the Med Sea.

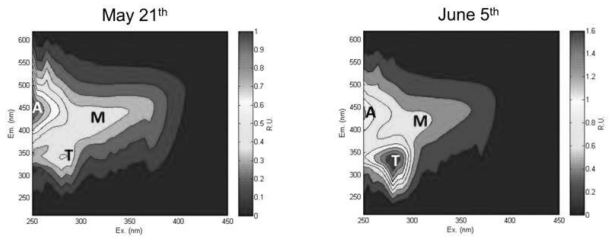

Fig. 2. The EEMs of CDOM. The letters refer to the 3 main peaks reported in the text.

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