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Seasonal and interannual dynamics of DIN and DIP in the NW Alboran Sea

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The aim of this work is to study the seasonal dynamics and the interannual variability of dissolved inorganic nitrogen DIN (NO_3^- + NO_2^-) and dissolved inorganic phosphorus DIP (PO_4^{3-}) in the continental margin of the northwestern Alboran Sea and their relationships with the hydrological features. The sampling was carried out during 12 cruises conducted in winter, spring, summer and autumn of 2002, 2003 and 2004. In the surface layers (top 20 m), nutrient concentrations and their molar ratios (N:P) showed a high seasonal an interannual variability influenced by the different hydrological conditions found during each season and year. Between 50 and 100 m depth the lower nutrient concentrations were observed during the winter cruises, while the higher concentrations were detected during the summer or autumn cruises. Neither nutrient concentrations nor the molar N:P ratio showed significant trends during the studied period. On overall, the results showed that the N:P ratio in the surface layers was lower than the Redfield ratio (16:1) during all the surveys, indicating a deficiency of DIN relative to DIP. In addition, the plots of DIN versus DIP indicate that phosphate remained at detectable levels when inorganic nitrogen became exhausted. All these findings suggest that primary productivity in the photic layer of the NW Alboran Sea may be limited by nitrate during great part of the year. N-limitation of primary production in the upper layers was confirmed by nutrient addition experiments carried out during spring 2003. The results of the present study also show that N-limitation can be temporally overcome by upwelling events, as occurred during spring 2002, when high nitrate concentrations (>3 μM) were observed in the upper layers. In contrast to that observed in the upper layers, the N:P ratio becomes close to 20:1 in the deeper layers (200-300 m), indicating a deficiency of DIP relative to DIN.