



Recent nutrient dynamics in the Mediterranean Sea

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The concentrations of nitrate (N) and phosphate (P), and the N:P ratio in the upper water column of the Mediterranean Sea (MED) were examined using observational data (~173,000 data points) collected since 1980s. The observed trends were found to distinctly evolve in the western and eastern MED. In the western MED the N and P concentrations have rapidly increased over time and was broadly consistent with the riverine input history from the populated areas surrounding the western MED. Contrarily, the N and P concentrations in the eastern MED markedly increased up until the mid-1995 and briefly remained high between 1995 and 2000. The N concentration rapidly decreased thereafter. In particular, the three-phase temporal transition of N and P in the eastern MED (increase-constant-decline) was more consistent with the emission history of pollutant nitrogen from the western European continent, in which regulation of emissions of pollutant nitrogen has been in place since 1970s. Our analysis implies that the recent N dynamics in the upper MED appeared to be sensitive to input dynamics of anthropogenic N, via atmospheric deposition and river. This conclusion is further strengthened by good agreement between the integrated rate of increase in the upper-water N inventory and the total anthropogenic N input during the past 30 years.