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Carbonate System and Acidification of the Adriatic Sea

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Although the marginal seas represent only 7% of the total ocean area, the CO₂ fluxes are intensive and important for the carbon budget, exposing to an intense process of anthropogenic ocean acidification (OA). A decline in pH, especially in the estuarine waters, results also from the eutrophication-induced acidification. The Adriatic Sea is currently a CO₂ sink with an annual flux of approximately -1.2 to -3 mol C m⁻² yr⁻¹ which is twice as low compared to the net sink rates in the NW Mediterranean (-4 to -5 mol C m⁻² yr⁻¹). Based on the comparison of two winter cruises carried out in the 25-year interval between 1983 and 2008, acidification rate of 0.003 pH_T units yr⁻¹ was estimated in the northern Adriatic which is similar to the Mediterranean open waters (with recent estimations of -0.0028 ± 0.0003 units pH_T yr⁻¹) and the surface coastal waters (-0.003 ± 0.001 and -0.0044 ± 0.00006 pH_T units yr⁻¹). The computed Revelle factor for the Adriatic Sea, with the value of about 10, indicates that the buffer capacity is rather high and that the waters should not be particularly exposed to acidification. Total alkalinity (TA) in the Adriatic (2.6-2.7 mM) is in the upper range of TA measured in the Mediterranean Sea because riverine inputs transport carbonates dissolved from the Alpine dolomites and karstic watersheds. The Adriatic Sea is the second sub-basin (319 Gmol yr⁻¹), following the Aegean Sea (which receives the TA contribution from the Black Sea), that contribute to the riverine TA discharges into the Mediterranean Sea. About 60% of the TA inflow into the Adriatic Sea is attributed to the Po river discharge with TA of ~3 mM and TA decreases with increasing salinity. Saturation state indicates that the waters of the Adriatic are supersaturated with respect to calcite (Ω_{Ca}) and aragonite (Ω_{Ar}) throughout the year. However, saturation states are considerably lower in the bottom water layers, due to the prevalence of benthic remineralization processes in the stratification period. The seasonal changes of the chemical and environmental conditions and relatively small size of the Adriatic Sea area the microbial community composition, function (growth, enzymatic activity) and carbon and nitrogen biogeochemical cycles. Significant effects on calcifying organisms and phytoplankton are expected while the effects of possible OA on microbially-driven processes are not known yet.

