CO_2 fluxes and vulnerability to acidification of coastal waters in the Gulf of Trieste (N Adriatic)

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The role of the coastal oceans in the global carbon budget is still poorly known, partly because of the lack of data from coastal regions. The general question is whether the coastal areas are a net CO_2 sink or a net CO_2 source to the atmosphere.

The study was conducted in the Gulf of Trieste, which is a small and shallow marine basin in the northern part of the Adriatic Sea. The gulf exhibits complex hydrodynamics due to freshwater input, tidal dynamics, and atmospheric forcing. The influence of organic matter remineralization and CO_2 exchange at the atmosphere-water interface on the CO_2 dynamics in the gulf have not yet been fully discussed until now.

The study investigated the influence of biological processes and local climate conditions on the atmosphere-water CO_2 exchange and on the carbonate system equilibrium in the gulf, in order to elucidate what drives the CO_2 exchange and to estimate the vulnerability to acidification processes. A variety of different technical and analytical methods were used, including carbon stable isotope composition of atmospheric CO_2 POC and DIC.

Our data indicate that the Gulf of Trieste is a net sink of CO_2 with the air-sea CO_2 flux estimated to be -1.47 ± 1.41 mol C m^{-2} yr^{-1}. The average temperature vs. biological production ratio of 1.74 showed that the temperature effect controls the CO_2 dynamics (and not biological activity) in the gulf. Results also indicated that gulf's buffer capacity is relatively high, meaning that it is not significantly exposed to acidification processes.

Understanding the processes that control the transport and fate of greenhouse gasses such as CO_2 is an important aspect of protecting the ocean environment. The presented research takes also part of SIRS project where new Stable Isotope Reference Standards for atmospheric CO_2 measurements will be developed that will greatly contribute into the estimation of processes that influence the carbon dynamics in the marine environment.