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High-resolution monthly pCO_2 climatology for the global continental shelf seas derived from a two-step artificial neural network interpolation

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While they only account for less than 8% of the global oceanic surface area, continental shelf seas are significant contributors to the global oceanic CO_2 sink, with the most recent estimates ranging from 0.18 to 0.45 Pg C yr-1. This is particularly true in high latitude regions, which contribute to more than half of that total. However, large regions of the world remain poorly monitored and thus make data derived estimates highly uncertain. Furthermore, the seasonal dynamics of these fluxes is still largely unknown in many areas of the world. In the open ocean, however, novel statistical methods relying on artificial neural networks allow overcoming these issues by creating continuous maps in time for CO_2 partial pressures with a monthly resolution. A two-step artificial neural network which was already successfully applied to the open ocean has been modified to better account for the coastal ocean by increasing its spatial resolution to 0.25 degrees and including physical forcings such as sea ice cover in its calculations. The resulting pCO_2 generated for more than 2 million grid cells allows better quantifying the CO_2 exchange at air-water interface by providing continuous high resolution maps for the CO_2 flux which will help better integrate continental shelf seas into larger estimates. Also, for the first time, the seasonality of the CO_2 exchange between continental shelves and the atmosphere can be resolved globally thanks to the monthly resolution of our pCO_2 estimates.