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Global Modeling of Oceanic Carbon Monoxide Emissions

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Carbon monoxide (CO) is an important compound for tropospheric chemistry. It is the dominant sink for hydroxyl radicals and is involved in ozone chemistry. Hence, atmospheric CO concentrations indirectly affect the lifetime of greenhouse gases like methane and have impacts on air quality. The ocean has long been recognized as a source of atmospheric CO. Even if in minority at the global scale, it plays a key role far from continental anthropized zones. Its marine production is linked to both photooxidation of organic matter and phytoplanktonic activity and can thus have a large interannual variability. Several campaigns have been carried out to characterize these emissions and were used to assess the global oceanic source but due to their scarcity and to large heterogeneities in phytoplankton and organic matter distributions, the extrapolation is rather imprecise. Our study aims to quantify the CO oceanic emissions at the global scale and to characterize their interannual variability and trends considering multidecadal global changes. The marine biogeochemical model PISCES, coupled to the ocean general circulation model NEMO, explicitly represents CO source and sink terms in the ocean. These terms include photoproduction, which is related to the action of UV on colored dissolved organic matter, phytoplankton production, bacterial consumption and fluxes at the ocean-atmosphere interface. Simulated oceanic CO concentrations have been compared to literature reported surface data as well as vertical profiles collected around the world during the last 30 years. First results show a global emission of a few TgC per year, with large spatial and seasonal variabilities in both oceanic concentrations and emissions.