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Atmosphere-ocean gas exchange based on radiocarbon data

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In recent decades, the intensity of global atmospheric convection has accelerated faster than climate warming; it is possible to judge this process from indirect data. Increasing ocean salinity contrasts provide evidence that evaporation has intensified [1]; sea surface wind velocities and wave heights have increased [2]. The CO_2 gas exchange between the atmosphere and ocean must also simultaneously increase. Monthly measurements of atmospheric CO_2 concentration have been published since 1958 [3], but directly measuring its fluxes from the atmosphere to the ocean and back is hardly possible. We show they can be reconstructed from 14C isotope concentration data. In the past century, two processes influenced the atmospheric 14C concentration in opposite directions: burning fossil fuels and testing nuclear weapons in the atmosphere. We compare the gas exchange theory with measurements of radiocarbon content in the atmosphere [4—6], which allows assessing the gas exchange quantitatively for the ocean to atmosphere and atmosphere to ocean fluxes separately for period 1960—2010 [7].

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