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Correcting Net Ocean-Atmosphere CO₂ Fluxes for Near-surface Temperature Deviations.

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We have recently shown the neglect of small temperature differences in the ocean mixed layer has led to substantial underestimates in the ocean sink for atmospheric CO₂ as calculated from surface pCO₂ observations, which we find should be increased by ~0.8 Pg Cyr⁻¹ when globally integrated. Surface observations of ocean pCO₂ such as those in the SOCAT (Surface Ocean CO₂ Atlas, www.socat.info) are reported at a temperature typically measured at several metres depth, but co-location of satellite estimates of the subskin surface temperature (at a few centimetres depth) differ from this, and are on average lower. In addition the top millimetre or so of the ocean is cooler than the underlying subskin because the ocean is a source of radiative and latent heat to the atmosphere. These two temperature deviations have subtly different effects on the air-sea flux of CO₂ as calculated by the gas exchange equation, but both result in an increase in the flux into the ocean and the combined effect is large. We are making available several datasets enabling calculation of these effects, including the regular provision of SOCAT data corrected to the subskin temperature, a climatology of the skin temperature deviation, and corrected ocean-atmosphere CO₂ flux estimates for the period since 1985.