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## The impact of diurnal variability in sea surface temperature on the central Atlantic air-sea CO<sub>2</sub> flux

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**Abstract.** The effect of diurnal variations in sea surface temperature (SST) on the air-sea flux of CO<sub>2</sub> over the central Atlantic ocean and Mediterranean Sea (60 S–60 N, 60 W–45 E) is evaluated for 2005–2006. We use high spatial resolution hourly satellite ocean skin temperature data to determine the diurnal warming ( $\Delta$ SST). The CO<sub>2</sub> flux is then computed using three different temperature fields – a foundation temperature ( $T_f$ , measured at a depth where there is no diurnal variation),  $T_f$  plus the hourly  $\Delta$ SST and  $T_f$  plus the monthly average of the  $\Delta$ SSTs. This is done in conjunction with a physically-based parameterisation for the gas transfer velocity (NOAA-COARE). The differences between the fluxes evaluated for these three different temperature fields quantify the effects of both diurnal warming and diurnal covariations. We find that including diurnal warming increases the CO<sub>2</sub> flux out of this region of the Atlantic for 2005–2006 from 9.6 Tg C a<sup>-1</sup> to 30.4 Tg C a<sup>-1</sup> (hourly  $\Delta$ SST) and 31.2 Tg C a<sup>-1</sup> (monthly average of  $\Delta$ SST measurements). Diurnal warming in this region, therefore, has a large impact on the annual net CO<sub>2</sub> flux but diurnal covariations are negligible. However, in this region of the Atlantic the uptake and outgassing of CO<sub>2</sub> is approximately balanced over the annual cycle, so although we find diurnal warming has a very large effect here, the Atlantic as a whole is a very strong carbon sink (e.g. –920 Tg C a<sup>-1</sup> Takahashi et al., 2002) making this a small contribution to the Atlantic carbon budget.

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