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Uncertainty in modelling carbon turnover induced by temperature aggregation

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The response of soil carbon decomposition to climate change is of great importance because terrestrial soils act as the largest carbon sink worldwide. This large carbon pool interacts strongly with the atmosphere and vegetation, and even small relative changes in organic storage in the soil could constitute a significant feedback effect on greenhouse gases in the atmosphere. CO_2 modelling approaches seem to be a powerful tool to describe the influence of changes in soil temperature and soil water content on carbon decomposition. Irrespectively of the possibility to run most carbon turnover models on small time steps (hourly or daily) most applications were performed on monthly averaged data. This is especially the case in modeling approaches for long-term experiments and for the prognosis of the impact of climate change on soil organic carbon (SOC) stocks in the soil. On the other hand, if relative temporally dense CO_2 efflux data are available, short time intervals for the simulation input are required to match the highly variable fluxes. Out of this contradicting findings – hourly data input to match peak efflux and monthly data to simulate long-term trends – the question arises if the input temperature can be averaged over longer time periods (days to month) to accurately estimate total CO_2 efflux and corresponding carbon stock changes. This is especially the case due to the fact that the temperature scaling functions in all models are known to be non-linear. Therefore, the aim of this study is to show, that temperature averaging over various time scales for the simulation input will lead to a non negligible uncertainty in short and long-term CO_2 efflux and also in carbon stock estimation.