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An Integrated Analysis of Soil Incubation Data: Deriving Soil Type Dependent Moisture-Respiration Relations

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One of the most important factors affecting soil carbon mineralization is soil moisture. The general relation between moisture and soil microbial activity is well known, with many publications on the topic throughout the last decades. Soil respiration is at a minimum at very low and very high moisture levels, limited either by mobility and osmotic potential effects or by a lack of oxygen. Moisture-respiration relations are integrated into all widely used soil carbon dynamics models. However, models such as Century and Roth-C apply only one moisture function to all soil types. The reason for this is that, despite the amount of related studies, little information is available on the variations of these moisture effects across soil types. Limited knowledge in this area, with related uncertainties in models, could lead to widely wrong predictions of soil carbon stock changes. With this study we aim at finding, on the one hand, general dependencies across soils describing variations of the moisture-respiration relation, and on the other hand, information as to what studies are necessary to advance our understanding in this area by identifying soil types or moisture conditions which are not well characterized. Soil incubations under controlled conditions are well suited for obtaining precise relationships between variables, avoiding the confounding effects commonly found in field studies. To explore relations between moisture effects on decomposition of organic matter and a number of soil characteristics, we compiled data on soil incubations from both published and unpublished sources where soil moisture was varied and measured. Values of respiration, moisture, temperature, texture, carbon and nitrogen content, and pH are available for most of the obtained data-sets. Since different units and incubation conditions characterize each of the data-sets, a prerequisite was to process and normalize the data from different sources for this study. In the next step, currently being carried out, we look for relations between soil characteristics and the moisture effects on respiration that can be applied to a range of (non-waterlogged) soils. We expect such findings to ultimately lead to improvements in the performance and predictive power of soil models.