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What determines the spatial variability of soil respiration and its temperature dependence (Q10) at catchment scale (Rur Catchment, Germany)?

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Climate change is suspected to alter temperature, soil moisture, and nutrient inputs to the soil. These factors are supposed to strongly influence soil respiration. The degree by which respiration will respond to these changes is crucial for assessing future CO_2 feedbacks to the atmosphere.

We assume that the temperature sensitivity of soil respiration (Q10) differs spatially depending on land use, soil unit, and texture owing to their diverse properties of soil organic matter quantity and quality. We further hypothesize that the Q10 value is additionally regulated by soil moisture and nutrient status.

On the basis of soil and land use maps we divided the Rur catchment (Western Germany, 2350 km^2) into so called environmental soil classes (ESC) that combine each a unique combination of the factors land use, soil unit, and texture. We took nine samples from each of the 12 most common ESC's and incubated them at five temperatures (5-25°C), at four soil moisture levels (30-75% water holding capacity), and with an unfertilized and a fertilized treatment.

So far, our results indicate that both soil respiration and the Q10 value are spatially highly variable with Q10 values ranging from 1 to 4. The Q10 value is altered by the level of soil moisture and decreases when soils are as moist as 75% water holding capacity. Fertilization has no effect on the Q10 value. Currently, we are processing the whole data-set to derive the effect of ESC's on the Q10 value. Recent data suggest that forest soils are more sensitive to warming than cropland soils.