Why are methane emissions delayed in the response to the water level fluctuation and soil temperature?

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Methane is a product of anaerobic decomposition of organic matter, usually occurring in water-saturated soils. Its formation is an important component of carbon cycling, especially in wetland ecosystems. The processes of methane production and emission are thus closely related to actual environmental conditions. However, this relationship is not simply reflected in immediately changing of emitted methane amounts. It is often with some time lag that the rate of methane emission reflected changes of environmental conditions. We found a time lag on methane emissions between 0 to 8 days in different areas of our studied wetland, and also in different periods of the growing season. Possible explanation of this time lag could be that the final measured emission from sedges stand is a result of complex biogeochemical processes located in soil. The latter state promotes methane production by methanogenic Archaea bacteria follows (sometimes ended) previous aerobic and anoxic processes decomposed organic matter. Very high complexity and the last state of these processes resulted in different time lags to changing environmental conditions. Understanding methane emission is important for better interpretation of measured emissions in wetland ecosystems and also for a better understanding of the dynamics of carbon cycling in the whole wetland ecosystems.

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