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Factors controlling the temporal variation of soil respiration in a typical cropland over the North China Plain

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Abstract:
Soil respiration is an important carbon flux between terrestrial ecosystems and atmosphere, therefore, quantifying soil respiration is necessary for understanding global carbon balance. In this study, field experiments were conducted to explore possible factors controlling the temporal variation of soil respiration in a cropland over the North China Plain from 2009 to 2011. Total soil respiration was partitioned into heterotrophic respiration and autotrophic respiration through root-exclusion method. Total soil respiration had three peaks across one year, appearing at the boot stage of wheat season, the start of maize season and the start of wheat season. Soil temperature and soil water content were the main controlling factors of heterotrophic respiration. Heterotrophic respiration increased exponentially with soil temperature within the upper 10 cm on the seasonal scale. Soil water content had no effect on heterotrophic respiration when it was less than the field capacity, while suppressed heterotrophic respiration when it was larger than the field capacity. Autotrophic respiration correlated linearly with gross primary productivity (GPP). However, time lag existed between the variations of GPP and autotrophic respiration, and was about 1 hour in the wheat season and about 3.75 hours in the maize season. Autotrophic respiration was almost irrelevant with soil temperature and soil water content. Annually, heterotrophic respiration was the dominant component of total soil respiration. Average ratio of autotrophic to total soil respiration was 38.4% in the wheat season and 27.3% in the maize season.