ABSTRACT:  Stem respiration from forest ecosystem is an important component of total ecosystem respiration and the forest carbon cycle. Our knowledge in understanding the variation in stem respiration and its governing drivers is limited, partially because empirical measurement of stem respiration is scarce. It has been reported that soil respiration is partially controlled by photosynthesis, but how stem respiration and soil respiration are controlled differently by photosynthesis over the diel scale is unknown.

The objectives of this research are to reveal the diel and seasonal pattern of stem respiration and soil respiration, the connection between stem and soil respiration, and how photosynthesis controls respiration through transport of photosynthate via phloem. The results will significantly improve our ability to model respiration and incorporate the process into earth system modeling.

We developed a novel system to automatically measure stem respiration at a half-hour frequency and to explore the diel pattern and its correlation with soil respiration and root respiration. We hypothesize that the peak value of stem respiration during a day reaches earlier than root respiration, resulting from the transit transport of newly assimilated photosynthate.

Our preliminary results indicate that the magnitude of stem respiration based on stem area was at the same order as soil respiration based on ground area. The diel pattern of stem respiration was primarily driven by temperature variation. But the peak stem respiration during the course of a day was controlled by tree photosynthesis. The peak value of stem respiration during a day reached earlier than root respiration. The CO2 source of stem respiration was primarily from locally produced stem metabolism, not from xylem water transported from roots.