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Assessing CO_2 fluxes between the alpine steppe and the atmosphere at lake Nam Co on the Tibetan plateau using Eddy Covariance

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Large areas of the Tibetan Plateau (about 800,000 km^2; Miehe et al., 2011) are covered with alpine steppe. During the long, dry and very cold winters, the degradation of organic carbon is largely inhibited. Carbon sequestration mainly takes place in the short vegetation period during the summer monsoon, thus accumulating roughly 2.5 % of terrestrial organic carbon stocks in the grassland soils over time (Wang et al., 2002). The air above these huge carbon stocks heats up about twice as fast as the global average. Together with increased precipitation, there is increased primary production of above- and below-ground biomass, which stores additional carbon in the soil. On the other hand, soil respiration is also stimulated, which in turn leads to higher CO_2 emissions. In the long term, this carbon sink can thus become a carbon source, which in turn contributes to global warming. This study investigated which processes drive the ecosystem-atmosphere CO_2 exchange, and whether a long-term trend can be identified. For this purpose, a multi-year data set of the CO_2 fluxes between alpine steppe and the atmosphere at the second largest central Tibetan lake Nam Co (4730 m a.s.l.) was analyzed. The data was acquired using the Eddy Covariance method and the results were compared with meteorological data from a nearby planetary boundary layer observation tower. The carbon dynamics follow the pronounced seasonal distribution of precipitation, with effective sequestration during the summer monsoon. The onset and strength of monsoonal precipitation differs largely between years, leading to uncertainties in the identification of a long-term trend. Further investigation on possible cause-and-effect relationships are necessary to adequately address the role of alpine steppe in the global carbon cycle.

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