**$CO_2$ Concentration, Flux and Net Ecosystem Carbon Exchange over a Corn Surface on the North China Plain**

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The eddy covariance technique allows for direct measurement of the exchange rate of $CO_2$ across the interface between the vegetation canopy and the atmosphere, and has been adopted as a standard method in the global carbon flux observation network (FLUXNET). Here we present the annual variation of $CO_2$ concentration and flux measured by the eddy covariance system over a typical corn surface on North China Plain. To determine the net $CO_2$ exchange across the interface between the corn field and the atmosphere, we employ three methods: direct fluctuation covariance, the WPL correction (Webb et al.; 1980), and the Liu correction (Liu, 2005). We find that the direct estimation by fluctuation covariance includes some unreal carbon sink information that requires correcting. The WPL method has been used to correct these sinks in recent years, but often overcorrects owing to some theoretical assumptions. The Liu method gives a compromise result between the direct estimation and WPL correction without theoretical assumptions of the WPL correction. Based on the Liu correction, we determined the net budget of $CO_2$ at measurement height on daily and seasonal scales. The results of our studies show that: (1) On an annual basis, large increases in $CO_2$ concentrations are produce by human's field activities such as tillage and burning of the corn waste in addition to corn plant growth that lowers $CO_2$ concentrations; (2) $CO_2$ concentration have a diurnal during the whole period of measurement, but a strong diurnal $CO_2$ flux over the growing corn was not visible until the corn canopy developed to some degree. The peak (vale) value of $CO_2$ concentration usually appeared with the sunrise (sunset), related to the altering direction of the $CO_2$ flux. The vale value of $CO_2$ flux in daytime is clearer than the peak value in nighttime; (3) the daily net budget of $CO_2$ flux was maximum at the bloom stage, followed by the spin-ripe and jointing stages; (4) The cumulative $CO_2$ flux budget suggests that corn serves as a carbon sink to from the young canopy to mature stage, and a carbon the remainder of the year. The net exchange of $CO_2$ flux at measurement height over the whole period is -176 g C m-2. We note that the different flux calculation methods mentioned above might bring as large as 160% bias to the net $CO_2$ exchange estimation in our experiment.

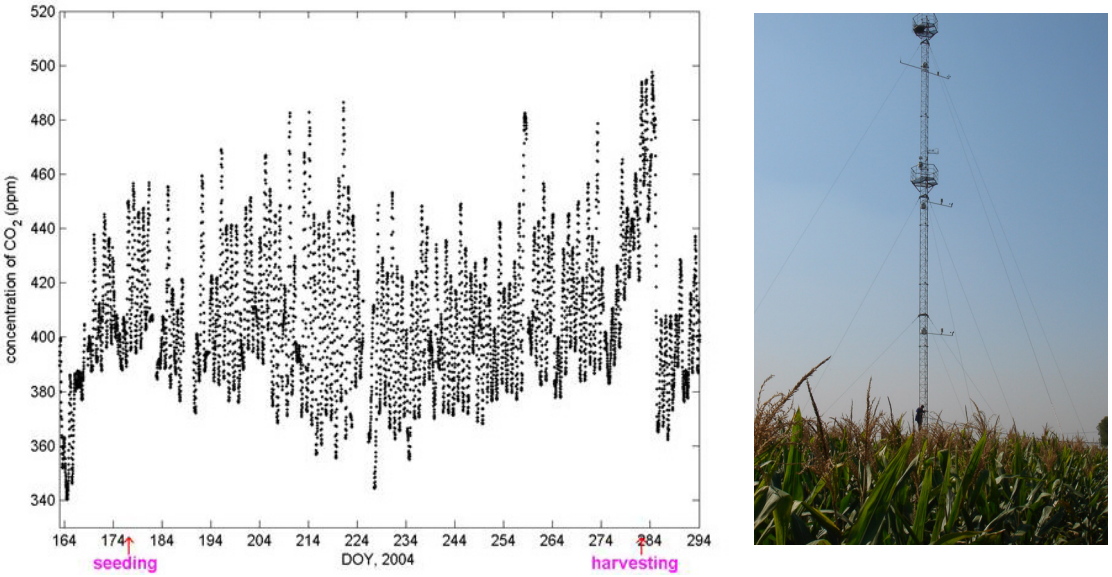


**Figure 1.** The variation of atmosphere $CO_2$ concentration during the corn growing season and the flux measurement tower used in the study