Understanding of plant physiological response using turbulent flux observation and transpiration model

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Atmospheric water vapor (H_2O) and carbon dioxide (CO_2) exchanges from transpiration and photosynthesis, calling stomatal flux, response to climate change present one of the more challenging and less studied aspects of the exchange in canopy scale by using observed data. Normally, H_2O and CO_2 fluxes over agricultural area are dominated by plant activity. Leaf gas exchange occurs when stomatal aperture open. Here, H_2O in leaf released to the air, while CO_2 is absorbed simultaneously via transpiration and photosynthesis. In this study, the opposite direction of stomatal gas transfers in H_2O and CO_2 concentration during daytime were estimated over a rain-fed paddy field using eddy covariance (EC) technique, flux partitioning approach (FVS-L) proposed by Scanlon and Sahu (2008), and fractional uncertainty principle (ε) proposed by Kim and Komori et al. (2012). Furthermore, the parameters of the transpiration model (Hino, 2005) were inversely estimated based on the stomatal flux partitioned by FVS-L with the lower and upper limits from the fractional uncertainty. As a result, it was found that the plants which belong to the lower limit had low stomatal opening ability (SOA). Even if their SOA was high, their water-absorbing ability of root tended to be low. In addition, those which have high SOA tended to belong the upper limit. However, not all plants which belong to the upper limit have high SOA. Therefore, it was suggested that there was individual difference of SOA even in the upper limit.