Geophysical Research Abstracts
Vol. 20, EGU2018-11594, 2018
EGU General Assembly 2018

Assessment of Ecosystem Productivity and Efficiency using Long-Term Flux Measurement over Haenam Farmland Site in Korea (HFK)

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The climate-smart agriculture (CSA) initiative pursues triple objectives: 1) to achieve high productivity and incomes, (2) to adapt with resilience to climate change, and (3) to reduce greenhouse gases (GHG) emission. Scientific evidence on the fulfillment of CSA is needed for measuring the accomplishment of this global vision. A set of quantitative indicators from the time series data of carbon, water, and energy fluxes over a typical farmland dominated by rice paddies were evaluated to assess the first objective of CSA (i.e., productivity and efficiency). During the rice growing seasons from 2003 to 2015 in Haenam farmland in Korea (HFK), four different varieties of rice (i.e., Dongjin No.1, Nampyung, Onnuri, and Saenuri) were cultivated. Overall, the productivity assessed in term of gross primary productivity (*GPP*) ranged from 800 to 944 g C m^{-2}. Water use efficiency (*WUE*) ranged from 1.91 to 2.80 g C kg H_2O^{-1}, carbon uptake efficiency (*CUE*) ranged from 1.06 to 1.34, and light use efficiency (*LUE*) ranged from 0.99 to 1.55 g C MJ^{-1}. Among the four rice varieties, Dongjin No. 1 showed the highest productivity and efficiencies which was comparable to those of other rice-paddies in Asia except *CUE* and *WUE*. Dongjin No.1 was less efficient in carbon uptake but more efficient in water use. The demand of water has been dramatically increasing in Korea and better *WUE* would become an important trait with respect to the projected water shortage. Further evaluation on the other two objectives of CSA (GHG mitigation and system resilience) is needed for a complete assessment of the achievement of CSA, for which some preliminary results are also presented and discussed.

Acknowledgement:

This work was funded by the Korea Meteorological Administration Research and Development Program under Grant KMIPA 2015-2023.