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Dynamics of CO_2 Exchange of Irrigated and Non-irrigated Crops in Haean Catchment, South Korea

Peng Zhao, Johannes Lüers

Contact: peng.zhao@uni-bayreuth.de, johannes.lueers@uni-bayreuth.de

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Aims

- To obtain reliable information about the net ecosystem exchange of CO_2 between the land surface and the atmosphere in irrigated and non-irrigated croplands in South Korea.
- To better understand the dynamics of agro-ecosystem CO_2 exchange over the entire growing period.

Methods

Research sites
- irrigated rice field 2010 & 2011
- non-irrigated potato field 2010

Observation techniques
- eddy-covariance
- weather stations
- biomass

Data base
- State-of-the-art quality control
- conventional and new gap-filling schemes

Equations

$$R_{eco} = R_{ref} e^{E_0\left(\frac{1}{T_{ref}-T_0} - \frac{1}{T-T_0}\right)}$$

$$\mathrm{NEE} = \frac{\alpha R_g \beta}{\alpha R_g + \beta} + R_{eco}$$

Results

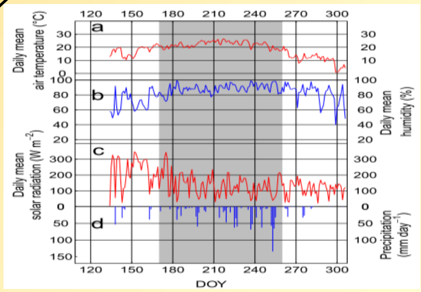

Fig. 1. Weather conditions

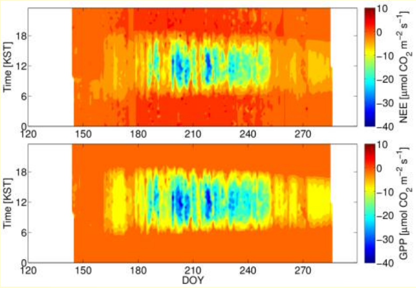

Fig. 2. NEE and GPP in the rice field

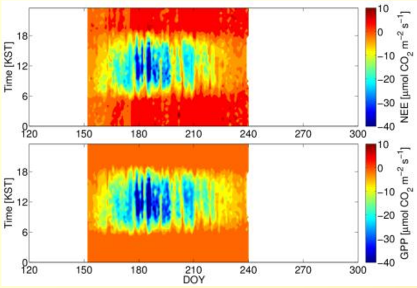

Fig. 3. NEE and GPP in the potato field

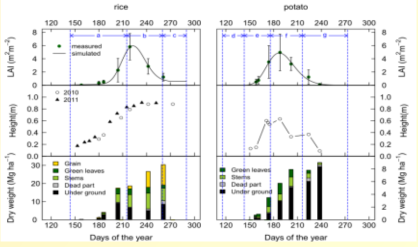

Fig. 4. Biomass development

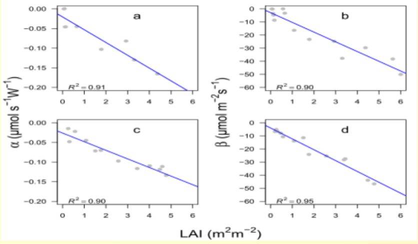

Fig. 5. LAI dependency of light response function

	clear		cloudy	
	α/LAI	β/LAI	α/LAI	β/LAI
rice	-0.024	-8.8	-0.029	-11.2
potato	-0.040	-15.2	-0.040	-15.5

Tab. 1. Light quality influence on light response function

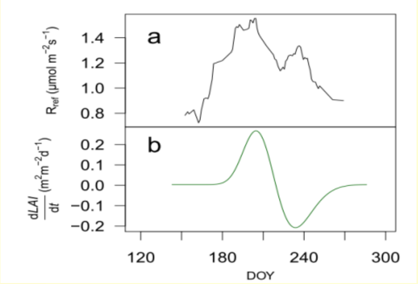

Fig. 6. Time series of R_{ref} and the changing rate of LAI increase in rice

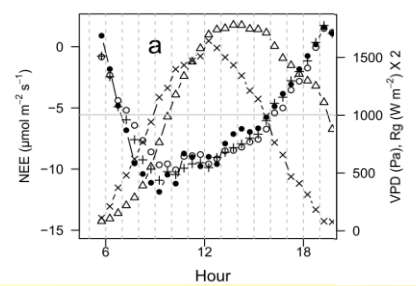

Fig. 7. Vapour pressure deficit influence on NEE

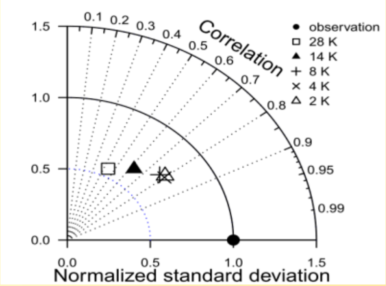

Fig. 8. Slight temperature dependency of GPP

Conclusions

- The primary cause of seasonal change in GPP is the change in Leaf Area Index (LAI) for both crops.
- The diurnal change in GPP is driven by solar radiation.The photosynthetic efficiency of rice with diffuse radiation is larger than with direct radiation. The photosynthetic efficiency of potatoes showed no difference between sunny and cloudy days.
- The seasonal change in ecosystem respiration at the reference temperature in the rice field follows the change in LAI increase
- Vapor pressure deficit (VPD) plays a significant role in the dry, pre-monsoon growing stage of non-irrigated crops and a minor role under Asian monsoon weather conditions.

Further information

- Zhao, P. and Lüers, J., 2012. Biogeosciences Discuss., 9(3), 2883–2919.
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