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Dynamics of CO₂ exchange in irrigated and non-irrigated croplands in Haean Catchment, South Korea

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Aims

- To obtain reliable information about the net ecosystem exchange of CO₂ between the surface and the air in irrigated and non-irrigated croplands in South Korea.
- To better understand the dynamics of agro-ecosystem CO₂ exchange during the whole 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

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

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



Results

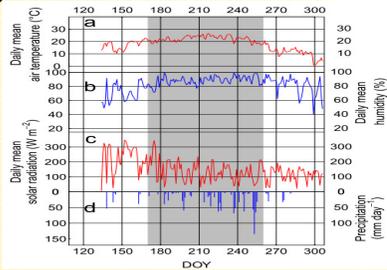


Fig. 1. Weather conditions

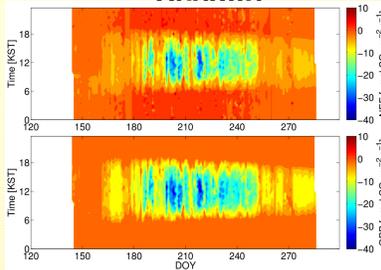


Fig. 2. NEE and GPP in the rice field

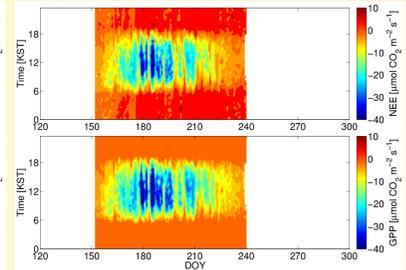


Fig. 3. NEE and GPP in the potato field

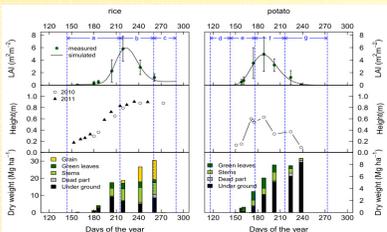


Fig. 4. Biomass development

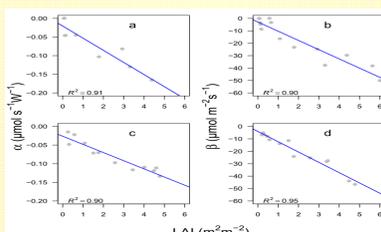


Fig. 5. LAI dependency of light response function

	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

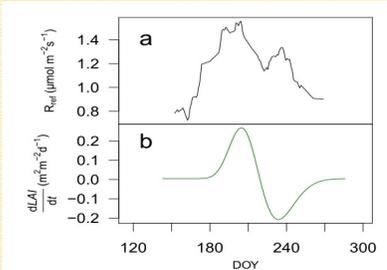


Fig. 6. Time series of R_{ref} and the changing rate of LAI in the rice field

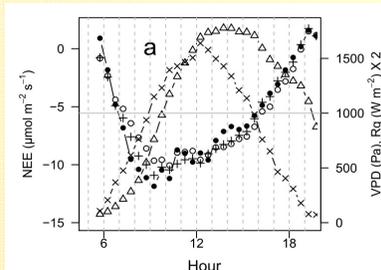


Fig. 7. Vapour pressure deficit influence on NEE

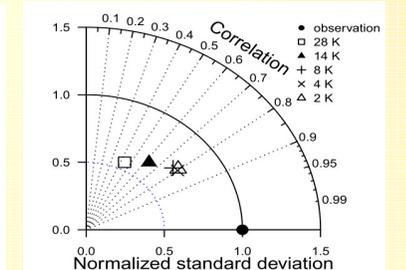


Fig. 8. Slight temperature dependency of GPP

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 the solar radiation. The photosynthetic efficiency of rice with diffuse radiatio is larger than with direct radiation. The photosynthetic efficiency of potatoes showed no difference between sunny and cloudy days.
- The seasonal change in the ecosystem respiration at the reference temperature in the rice field follows the change rate of LAI.
- 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.
- Zhao, P. et al., 2011. ISSN 1614-8916, Arbeitsergebnisse 45.

Acknowledgment

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References

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