Modelling carbon and water exchange from a grazed pasture in the Waikato region, New Zealand

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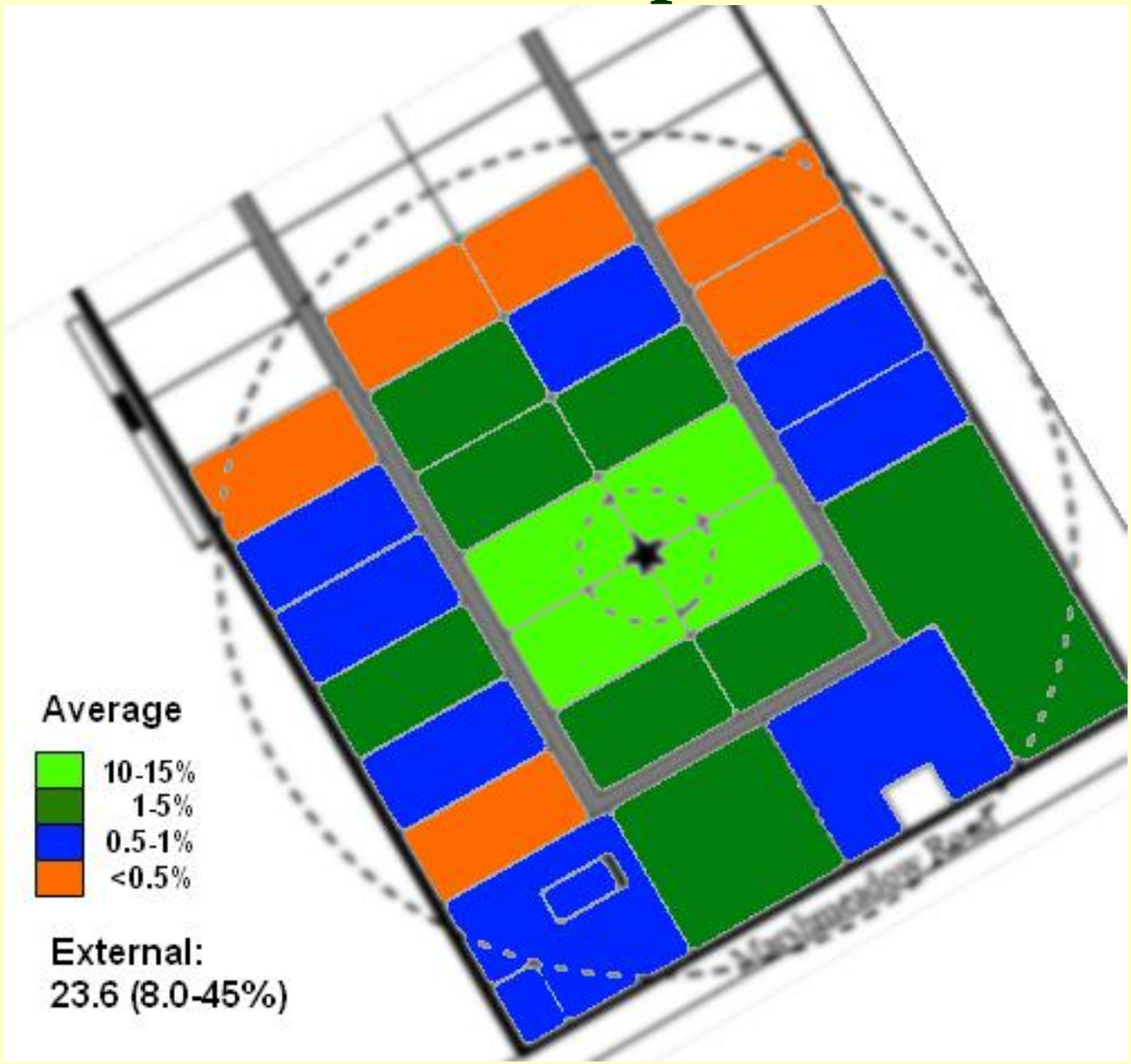
Key points

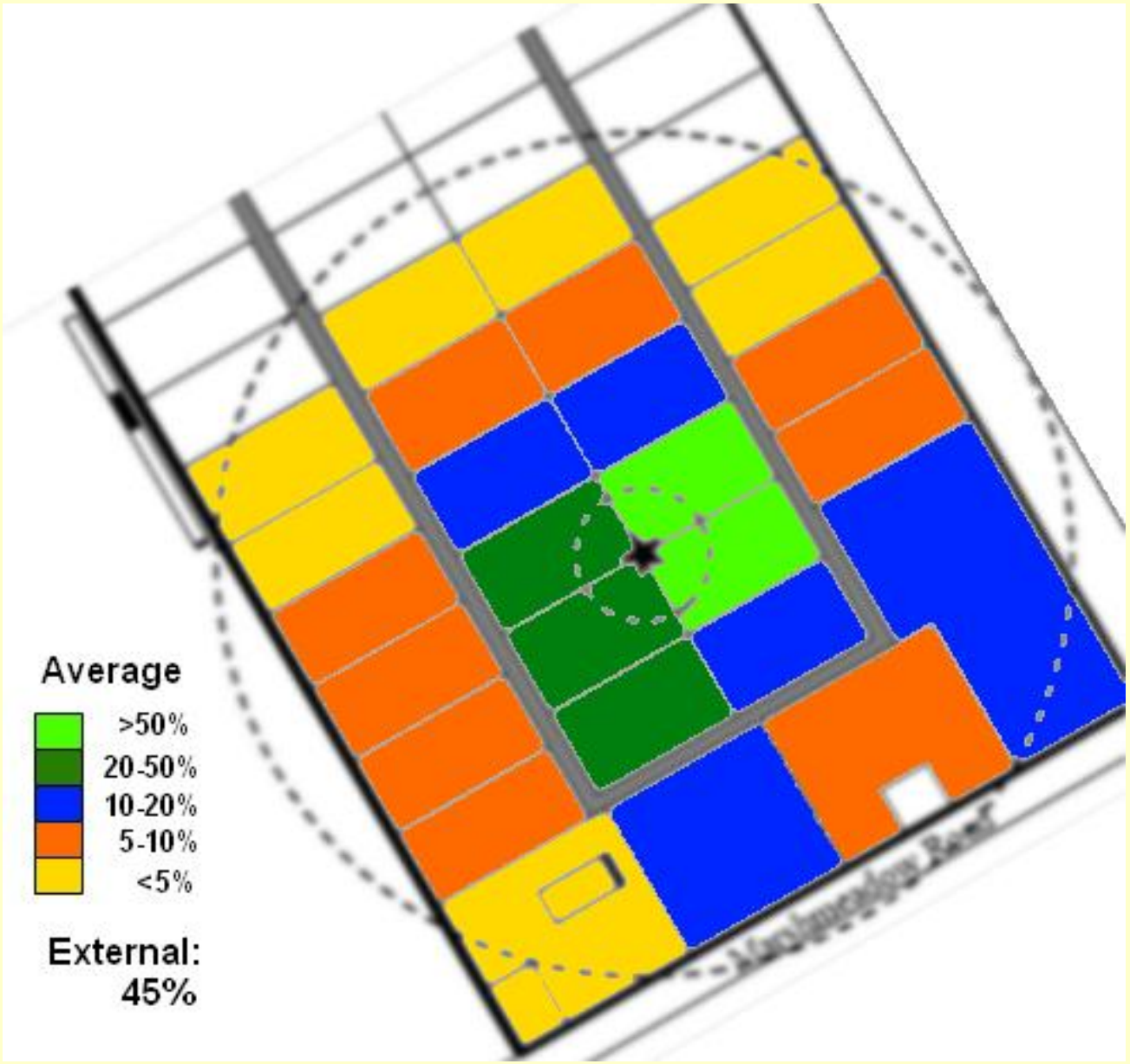
- Intensively grazed dairy farm
- Eddy covariance data
- Comparison with detailed mechanistic model CenW
- Dealing with the grazing issue

The site lay-out

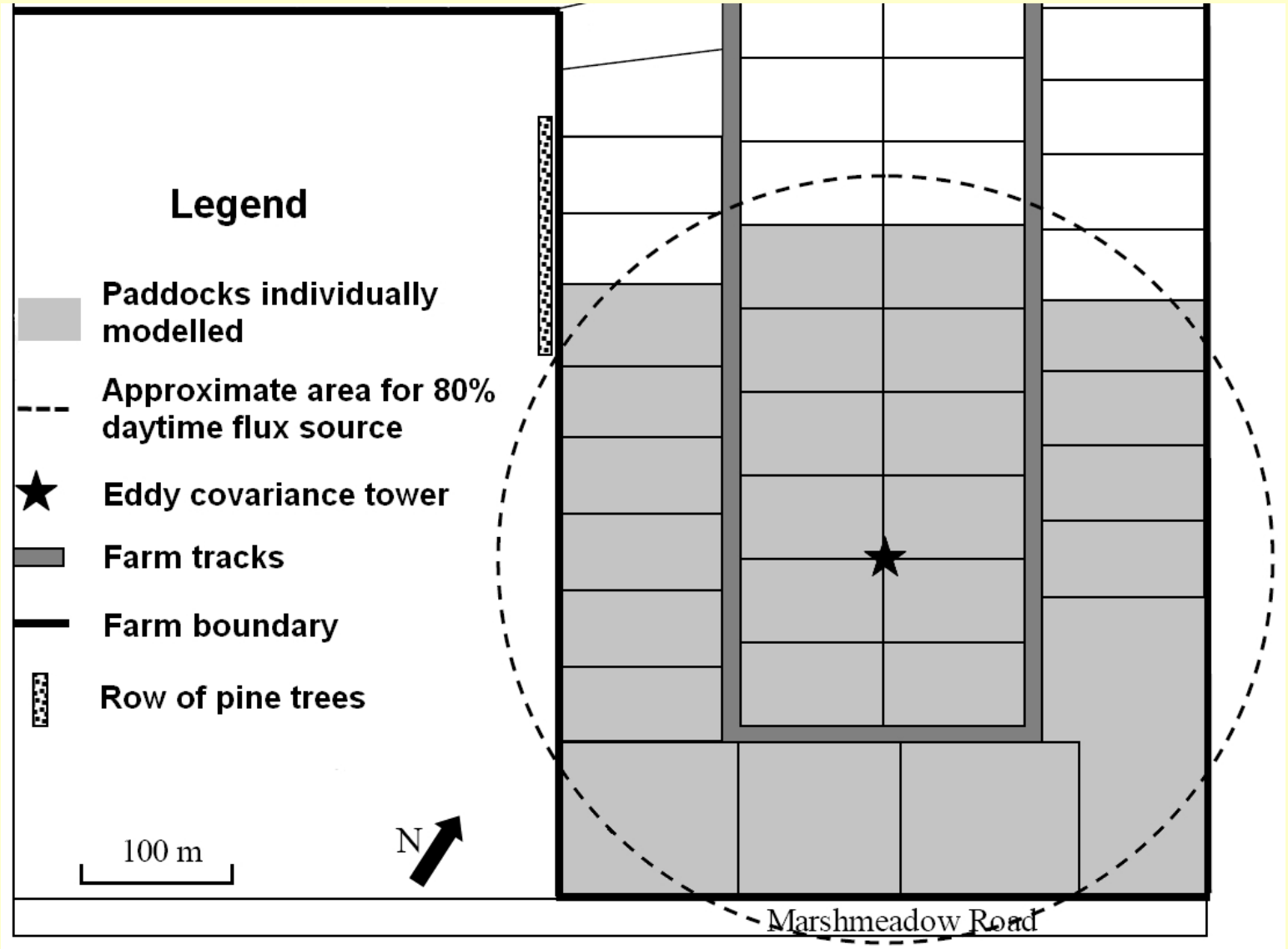
The foot-print



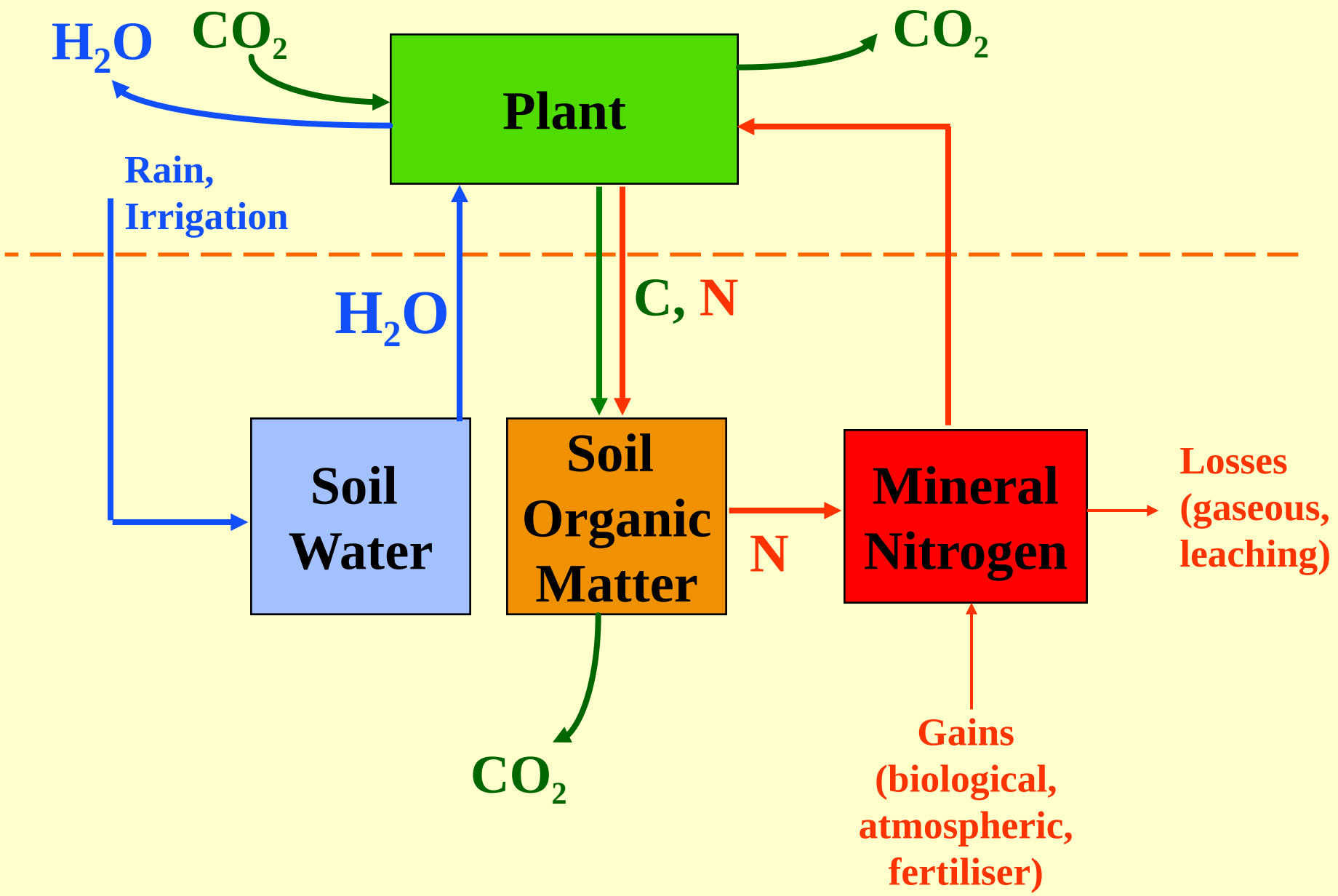
The foot-print



The site lay-out



Basic Outline of CenW



Grazing events and respiration rates

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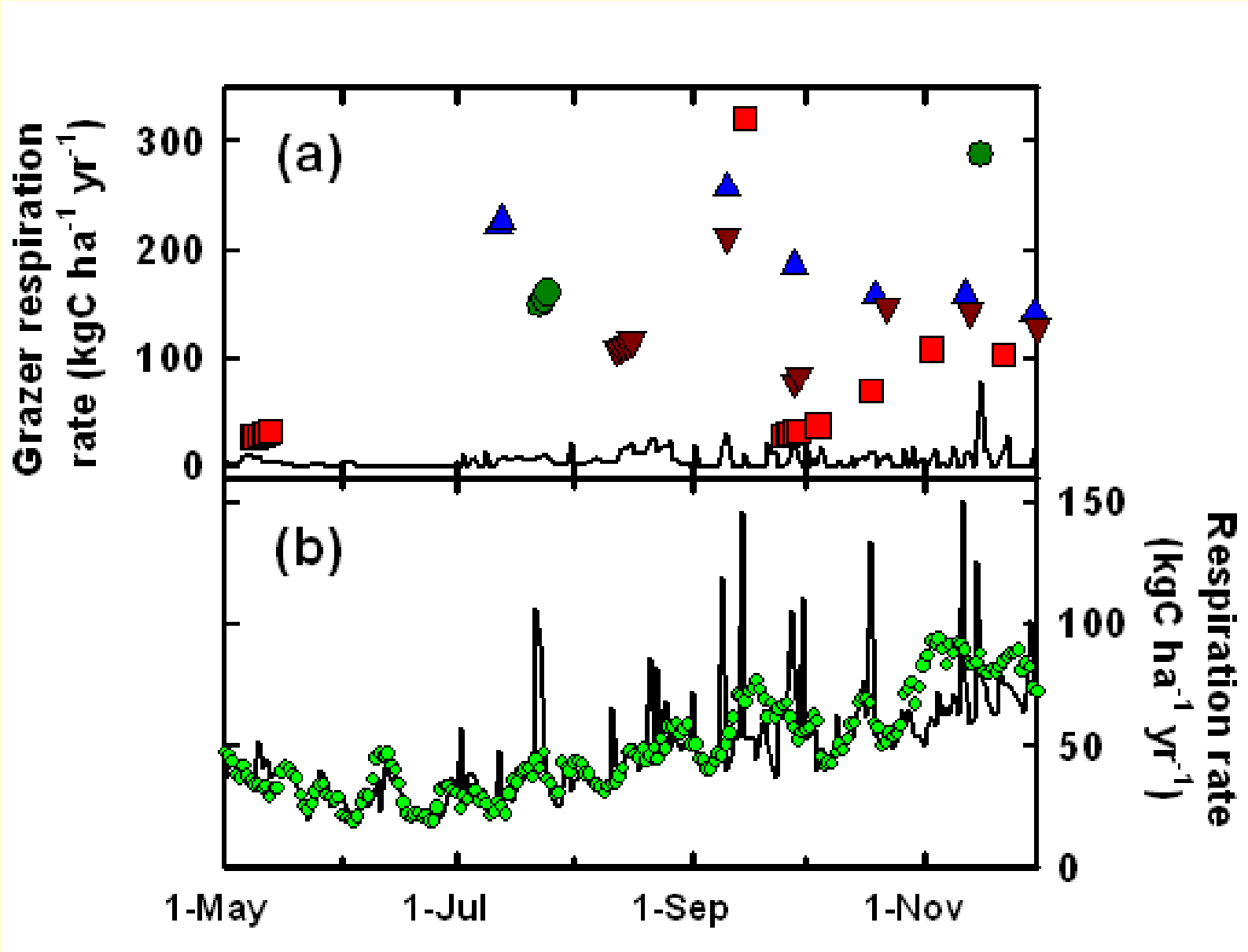
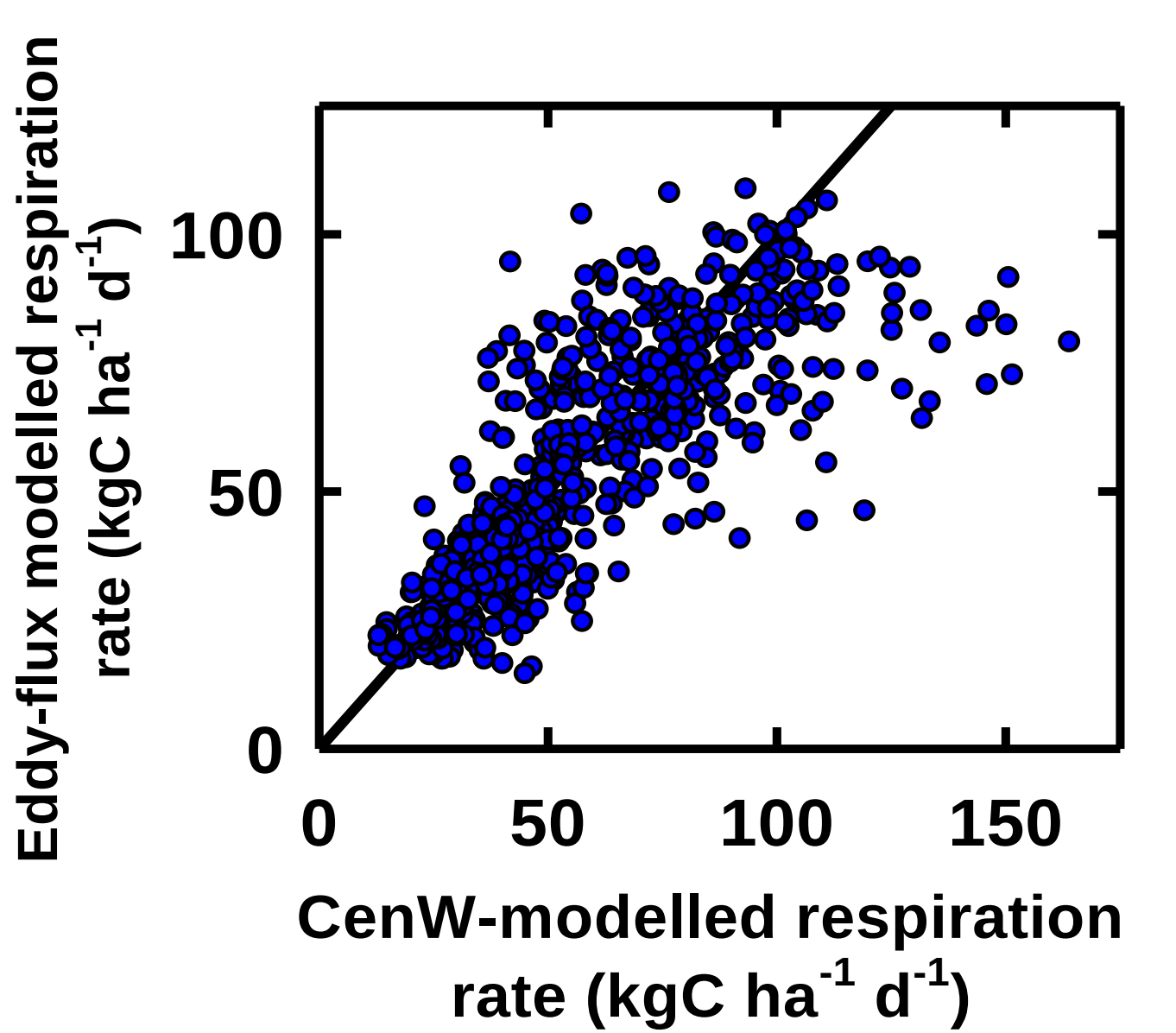
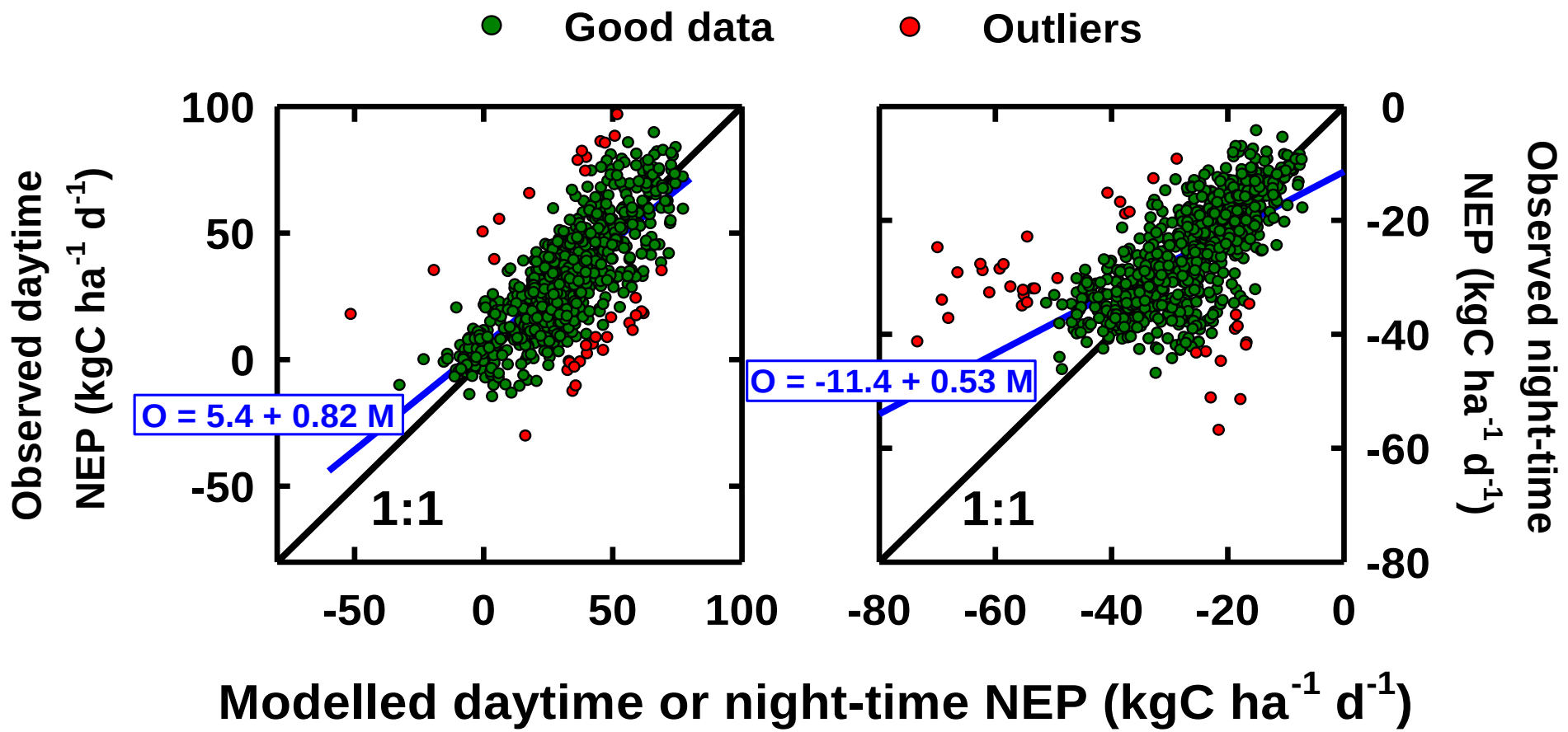


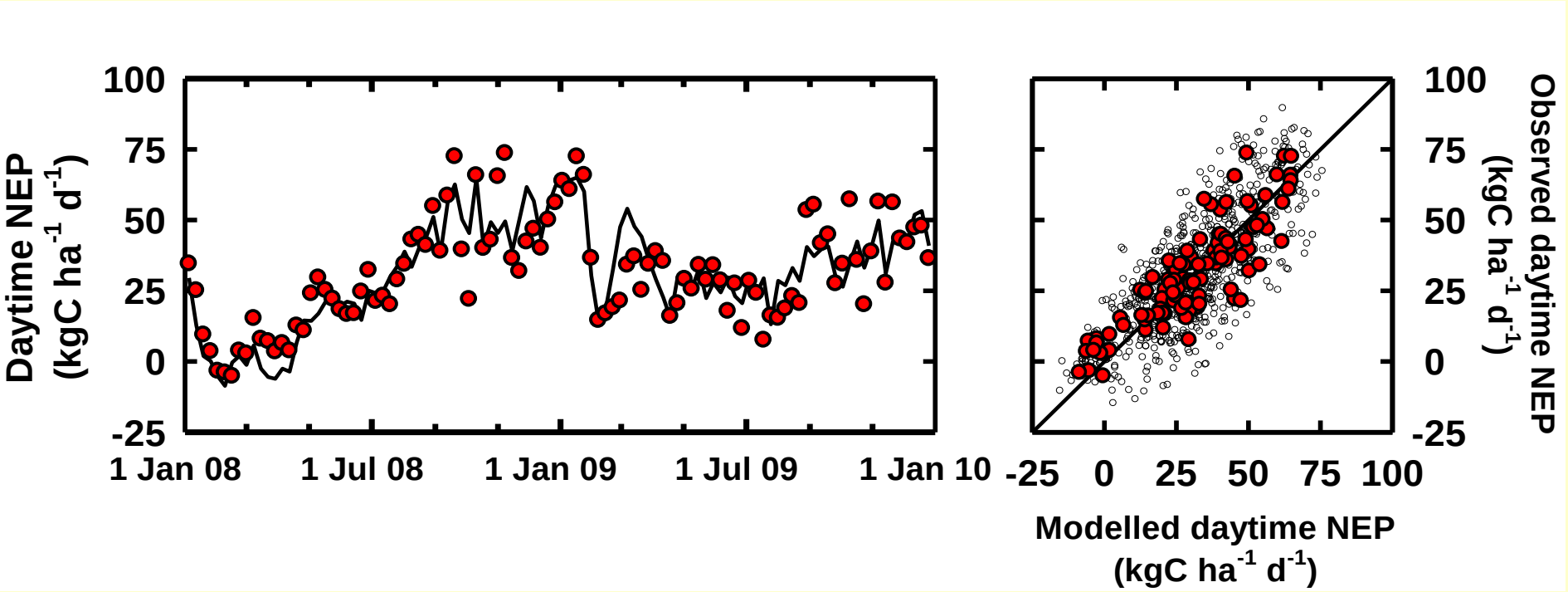
Grazing events and respiration rates



Daytime and night-time NEP

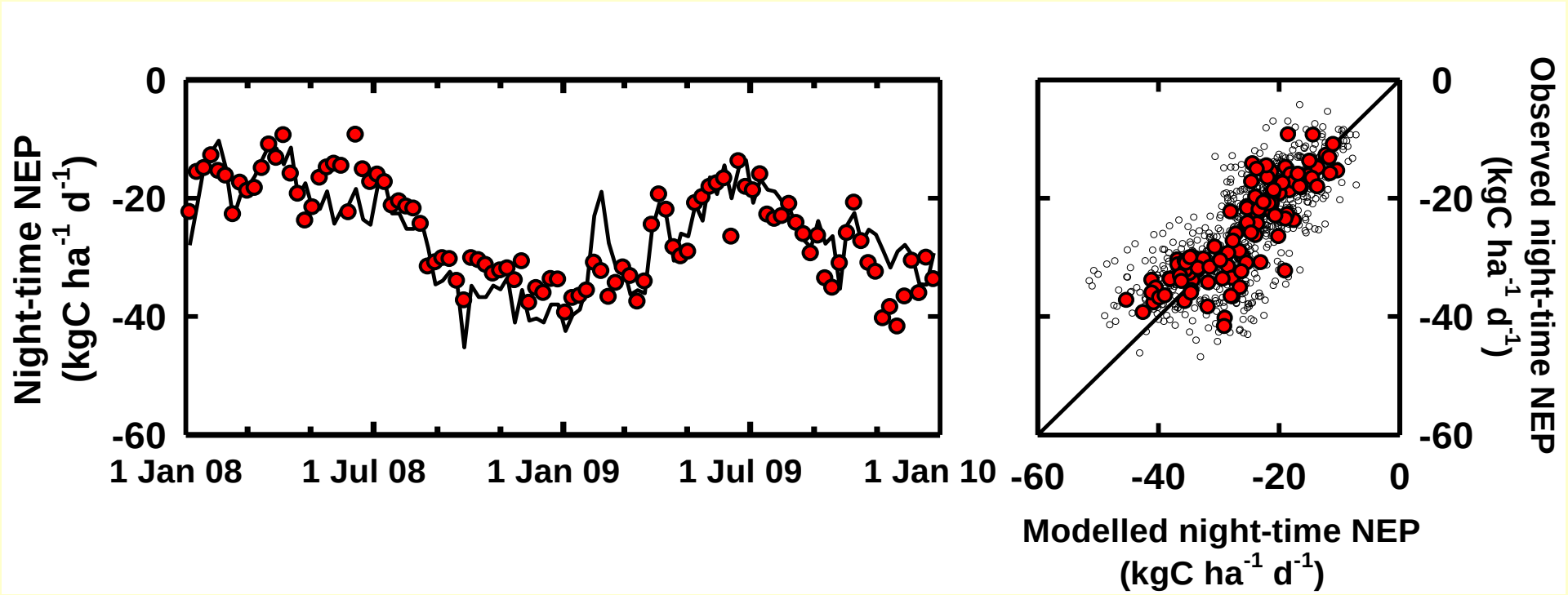


Daytime NEP



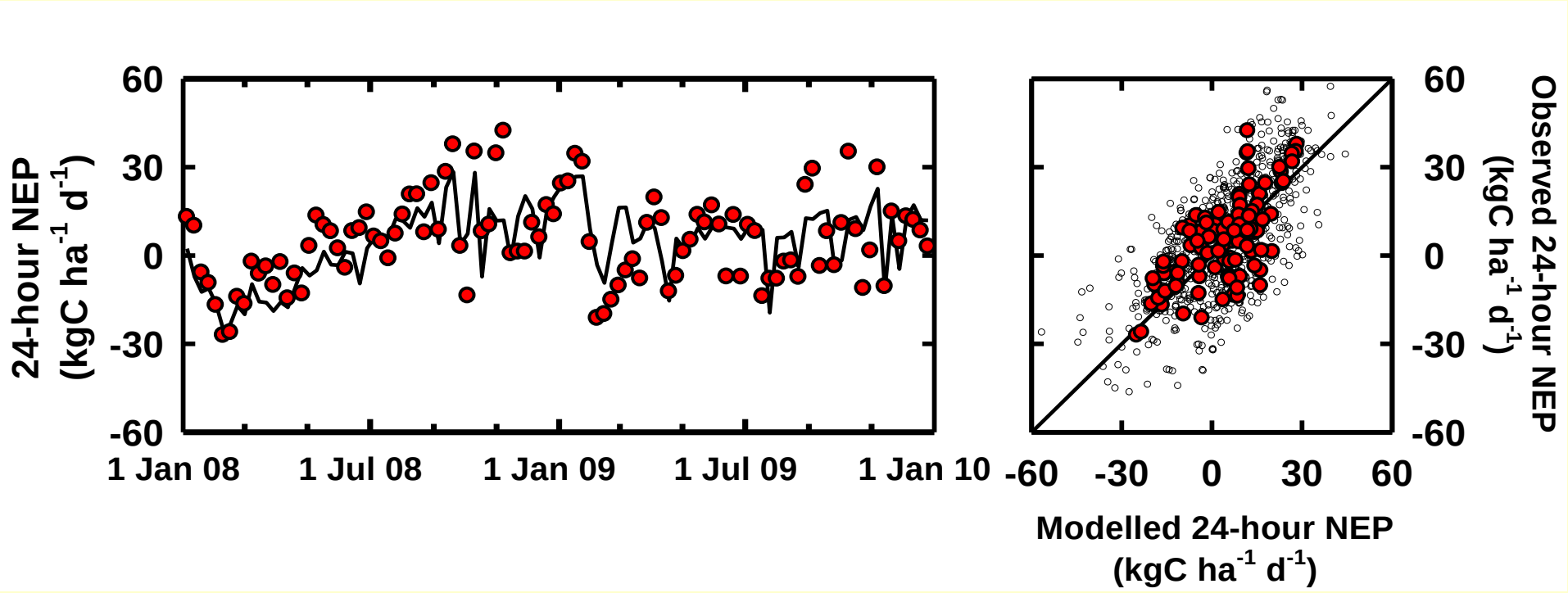
Model efficiencies:
Daily: 0.61 Weekly: 0.72

Night-time NEP



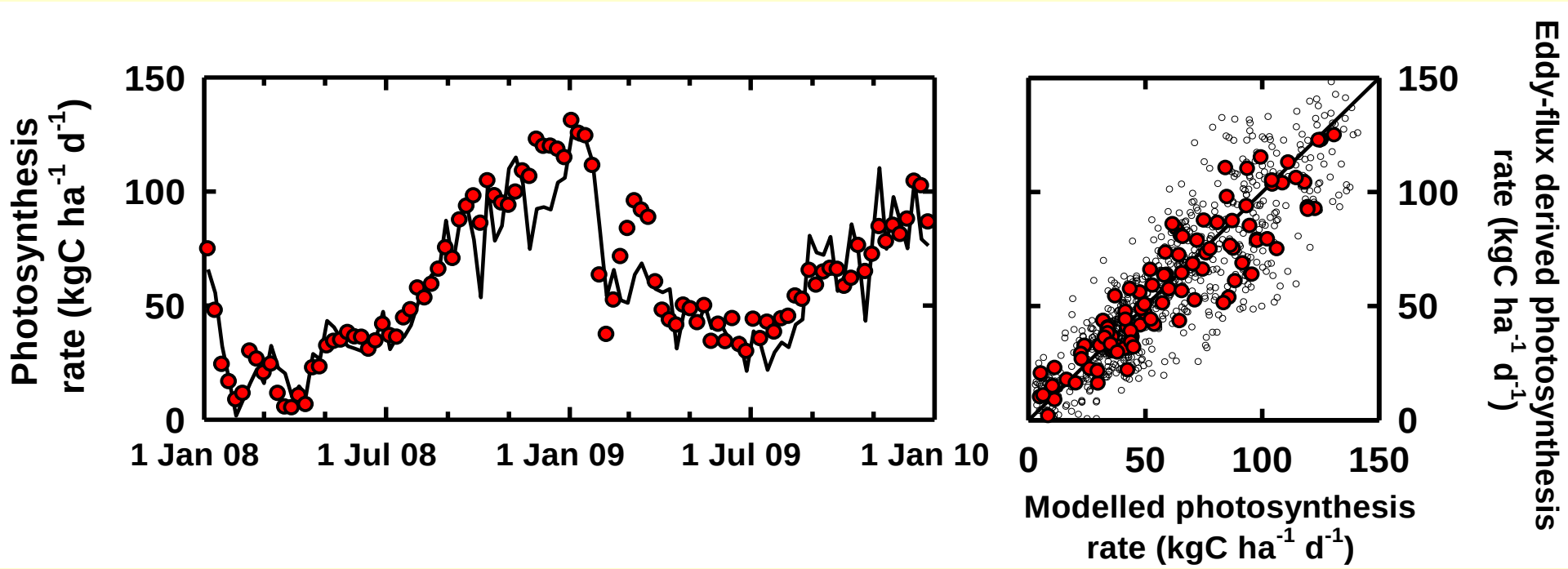
Model efficiencies:
Daily: 0.48 Weekly: 0.69

24-hour NEP



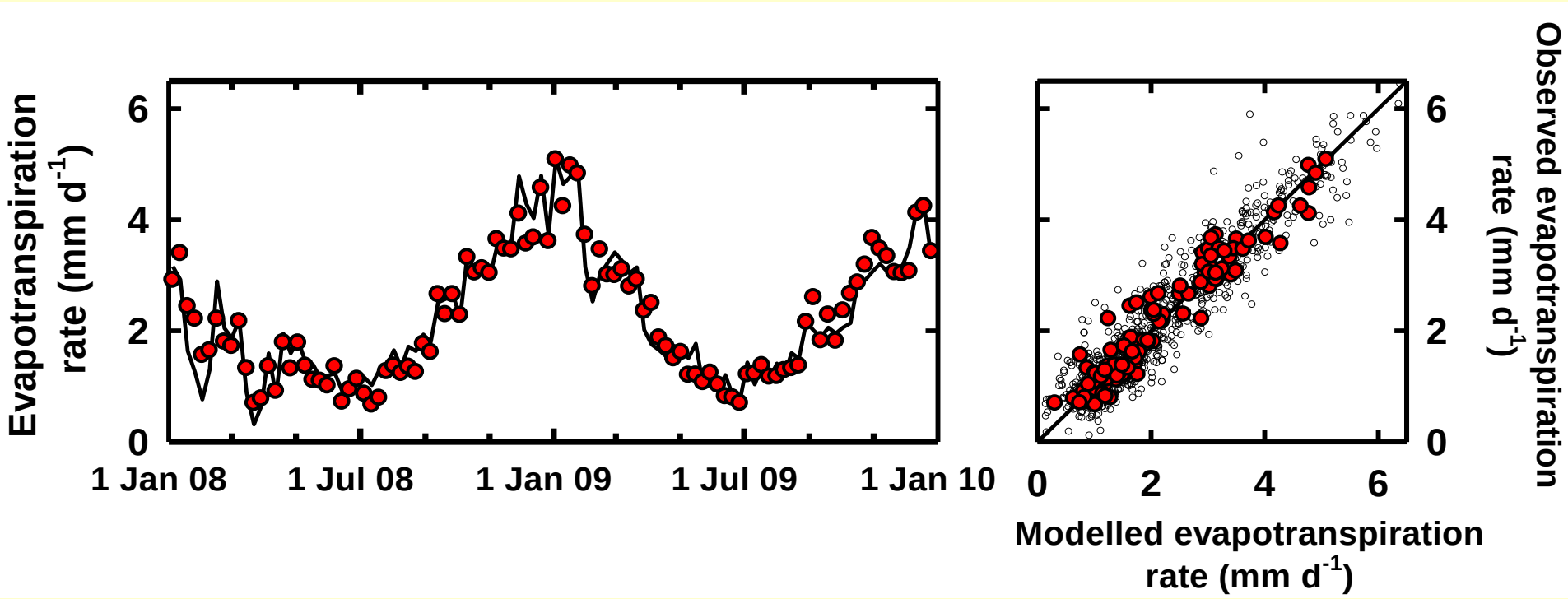
Model efficiencies:
Daily: 0.43 Weekly: 0.44

Photosynthetic rates



Model efficiencies:
Daily: 0.73 Weekly: 0.81

Evapotranspiration rates

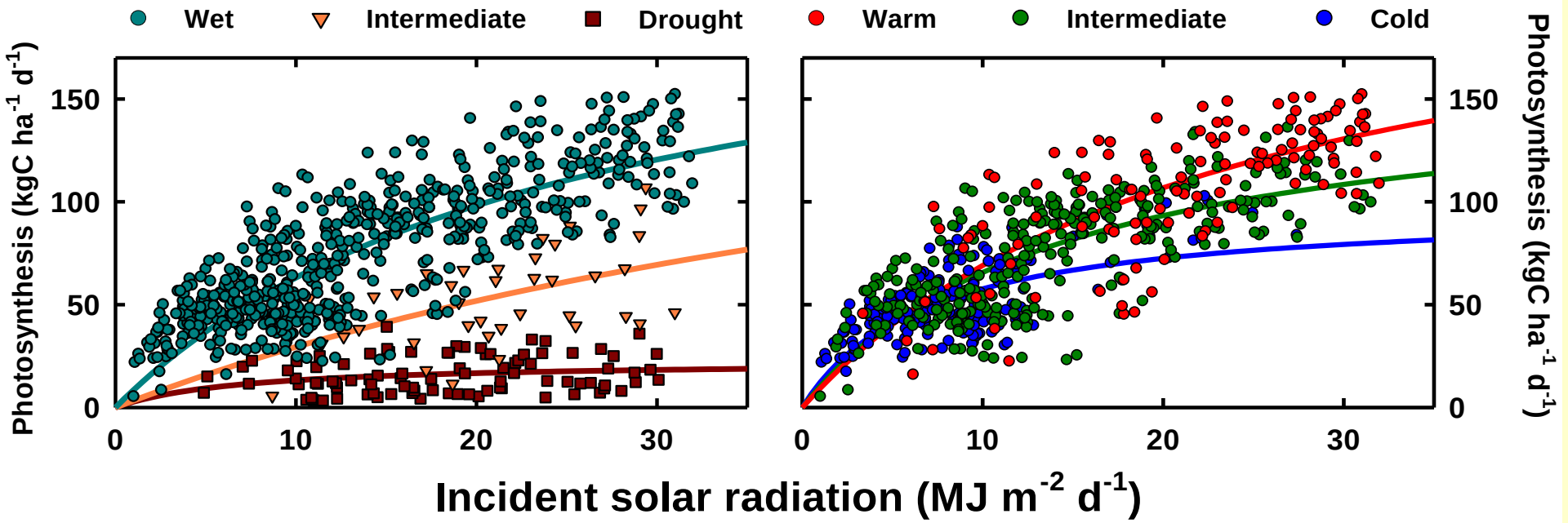


Model efficiencies:
Daily: 0.86 Weekly: 0.92

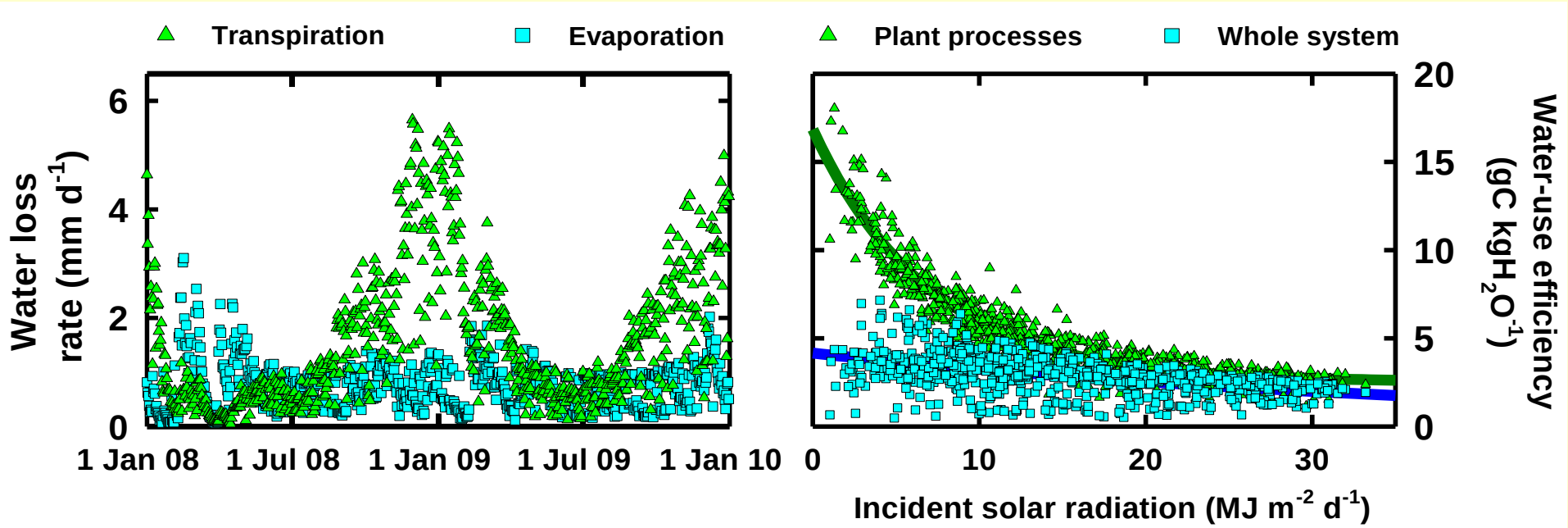
Summary information

	Observed	Modelled	Model efficiency	
	Average values over two years		Daily	Weekly
Daily NEP	5.3 kgC ha^{-1} d^{-1}	4.3 kgC ha^{-1} d^{-1}	0.43	0.44
Daytime NEP	30.9 kgC ha^{-1} d^{-1}	30.6 kgC ha^{-1} d^{-1}	0.61	0.72
Night-time NEP	-25.4 kgC ha^{-1} d^{-1}	-25.8 kgC ha^{-1} d^{-1}	0.48	0.69
Evapotranspiration rate	2.23 mm d^{-1}	2.25 mm d^{-1}	0.86	0.92
Photosynthesis rate	57.9 kgC ha^{-1} d^{-1}	60.2kgC ha^{-1} d^{-1}	0.73	0.81
Foliage biomass	2.08 tDW ha^{-1}	2.01 tDW ha^{-1}	0.189	
Soil water (5 cm)	47.8%	47.2%	0.869	
Soil water (10 cm)	47.2%	45.0%	0.712	
	Final model estimates (averaged over two years)			
Photosynthesis	60.2 kgC ha^{-1} d^{-1} (22.0 tC ha^{-1} yr^{-1})			
Autotrophic respiration	30.4 kgC ha^{-1} d^{-1} (11.1 tC ha^{-1} yr^{-1})			
Heterotrophic respn	21.0 kgC ha^{-1} d^{-1} (7.7 tC ha^{-1} yr^{-1})			
Grazer respiration	5.3 kgC ha^{-1} d^{-1} (1.9 tC ha^{-1} yr^{-1})			
Methane emission	0.39 kgC ha^{-1} d^{-1} (0.14 tC ha^{-1} yr^{-1})			

Controls on photosynthesis



Water relations



Conclusions

- **CenW simulations provide modelling results that are consistent with eddy-flux data**
- **Evapotranspiration and photosynthesis rates have particularly high model efficiency**
- **The capture of large C release during grazing is reasonable but remains problematic**
- **Simulations are credible and can be used for exploration of processes and scenario analysis**

Thank you!