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# CloudRoots: integration of advanced instrumental techniques and process modelling of sub-hourly and sub-kilometre land–atmosphere interactions

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## 1. Impact of new constants in the photosynthesis and stomatal A-gs model

Figure S1 shows the changes on the evolution of the sensible, latent heat fluxes and boundary-layer height due to the use of optimized constants in the A-gs model (see Table 3). Figure S1 (left) shows the improvement in the comparison of the latent heat flux modelled and observed using the new constants (CloudRoots) compare to the default. The impact on the shift of the surface partitioning is shown in Fig. S1 (right). The boundary-layer evolution is slightly faster in the model experiment that employs the CloudRoots optimized constants in closer agreement with the observations. It is important to mention that not all the constants have the same impact on the model runs. In our numerical experiments, the dominant constant is the light-use efficiency ($\alpha_0$).

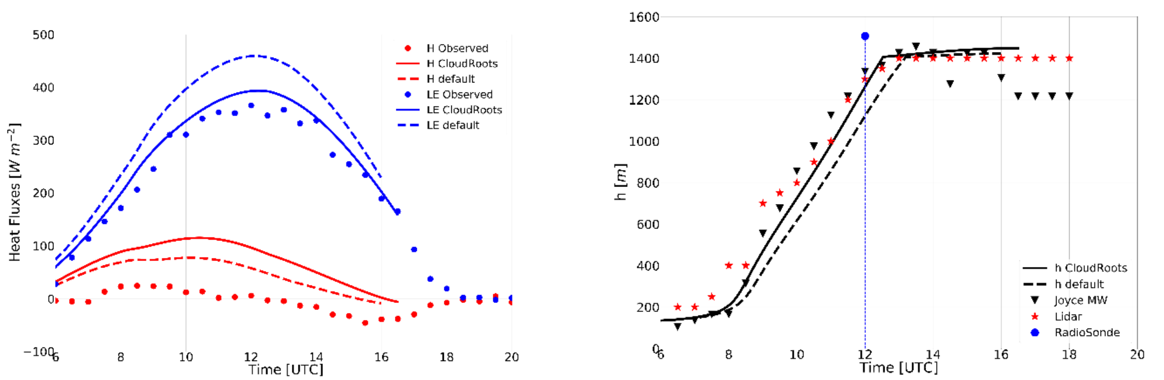


**Figure S1:** Comparison of the model results and observations of 7 May 2018 using the default and CloudRoots constants (Table 3): (left) surface fluxes and (right) boundary-layer depth.

## 2. Normalize Difference Vegetation Index during CloudRoots

NDVI was calculated using the formula NDVI = ( $(R_{<795-810>} - R_{<665-680>})/(R_{<795-810>} + R_{<665-680>})$), where $R_{<795-810>}$ is an averaged reflectance at the wavelengths between 795 and 810 nm (near-infrared range) and $R_{<665-680>}$ is an averaged reflectance at the wavelengths between 665 and 680 nm (red wavelength range).

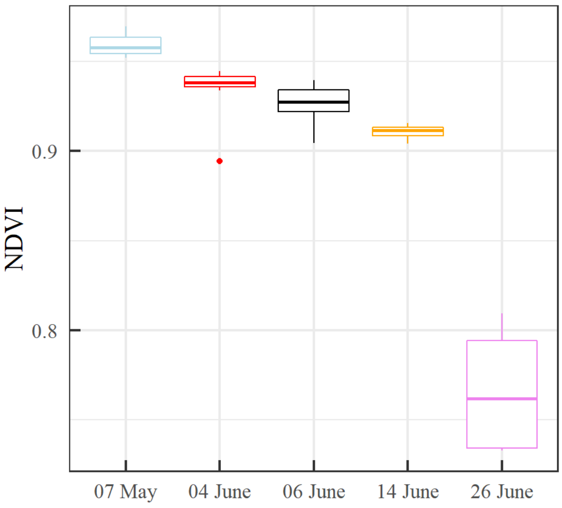


**Figure S2:** Seasonal changes of a NDVI in winter wheat field over the course of the CloudRoots campaign.

**Table S1**: Equivalent temperature-normalized maximum carboxylation, electron transport and triose phosphate utilization rates ($V_{cmax25}$ , $J_{max25}$ $TPU_{25}$, respectively) commonly used in the Farquhar-Berry-von Caemmerer (FBvC) model of leaf photosynthesis (Farquhar *et al.*, 1980). Fits between the FBvC and A-$g_s$ models were obtained using the plantecophys package (Duursma, 2015) based on A-$g_s$ model output with parameter values noted in Table 3, a constant temperature of 25°C and PAR of 1500 µmol $m^{-2}$ $s^{-1}$.

| Parameter setting (table 3) | $V_{cmax25}$ (µmol $m^{-2}$ $s^{-1}$) | $J_{max25}$ (µmol $m^{-2}$ $s^{-1}$) | TPU (µmol $m^{-2}$ $s^{-1}$) | RMSE |
|---|---|---|---|---|
| Default | 81.11 | 240.95 | - | 7.53 |
| IOP1 | 98.37 | 196.43 | 12.97 | 5.96 |
| IOP2 | 93.69 | 121.09 | 7.58 | 2.16 |
| IOP3 | 15.43 | 15.77 | 0.82 | 2.56 |

## References


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Farquhar GD, Caemmerer S von and Berry J. A.: A biochemical model of photosynthetic $CO_2$ assimilation in leaves of C3 species. Planta 149, 78–90, 1980.