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How can the First ISLSCP Field Experiment contribute to present-day efforts to evaluate water stress in JULESv5.0?

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S1 Re-running the `repro-cox-1998` simulations with different $V_{cmax}(T)$

In this section, we explicitly demonstrate the effect of replacing $V_{cmax}(T)$ in the `repro-cox-1998` simulation with (a) $V_{cmax}(T)$ from the `global-C4-grass` simulation (b) $V_{cmax}(T)$ from the `tune-leaf` simulation and (c) replacing just T_{upp} in the `repro-cox-1998` simulation by T_{upp} from the `global-C4-grass` simulation. These V_{cmax} temperature distributions are plotted in Figure S1.

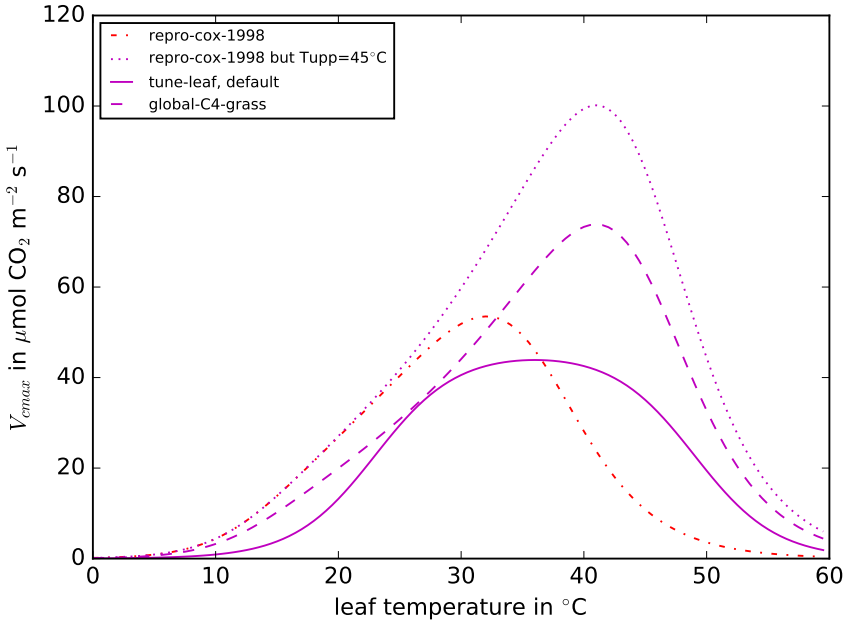

Figure S1. Model V_{cmax} against leaf temperature. Dot-dashed red line: `repro-cox-1998` parameters. Dashed magenta line: `global-C4-grass` parameters. Solid magenta line: `tune-leaf` parameters. Dotted magenta line: T_{upp} from `tune-leaf`, other parameters from `repro-cox-1998`. Model lines have been created using the Leaf Simulator package.

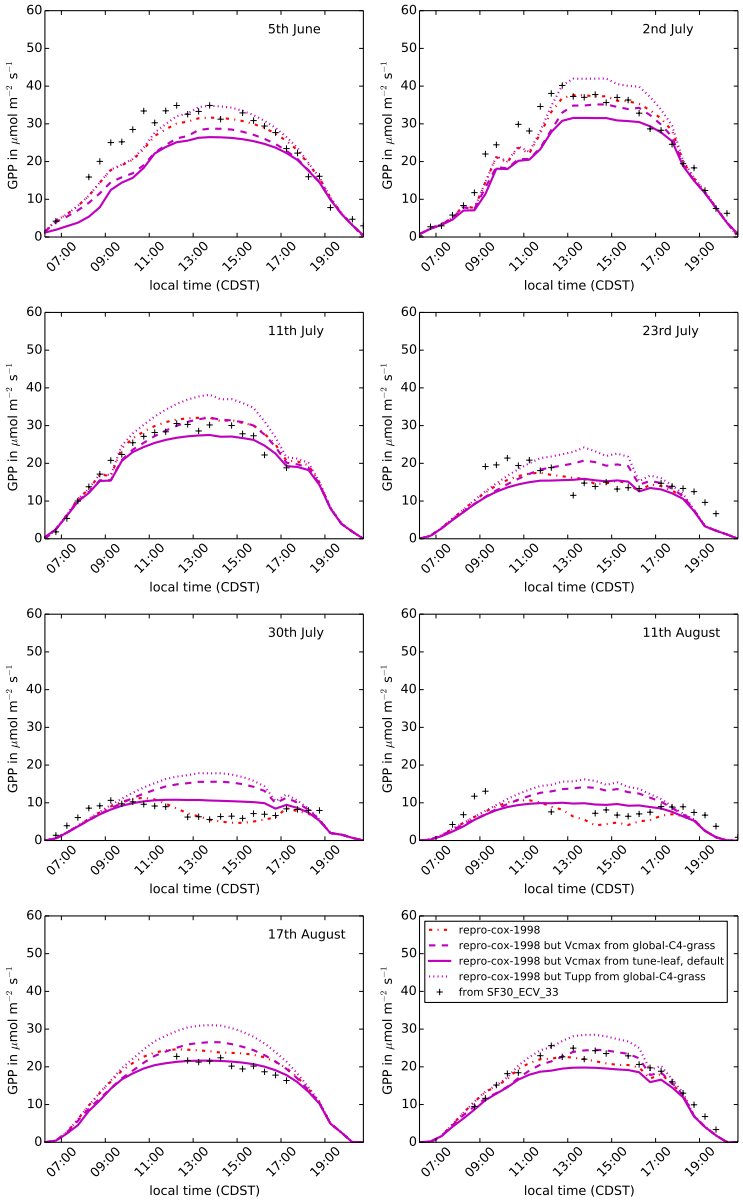

Figure S2. The diurnal cycle of GPP at site 4439 in the FIFE area for 8 days in 1987: 5th June (early growth), 2nd July and 11th July (peak growth), 23rd July, 30th July and 11th August (dry period) and 17th August and 20th August (early senescence). Dot-dashed red line: `repro-cox-1998` parameters. Dashed magenta line: `repro-cox-1998` parameters except $V_{cmax}(T)$ from `global-C4-grass` configuration. Solid magenta line: `repro-cox-1998` parameters except $V_{cmax}(T)$ from `tune-leaf` configuration. Dotted magenta line: `repro-cox-1998` parameters except T_{upp} from `tune-leaf` configuration. See Figure S1 for a plot of the $V_{cmax}(T)$ used in each of these similations.

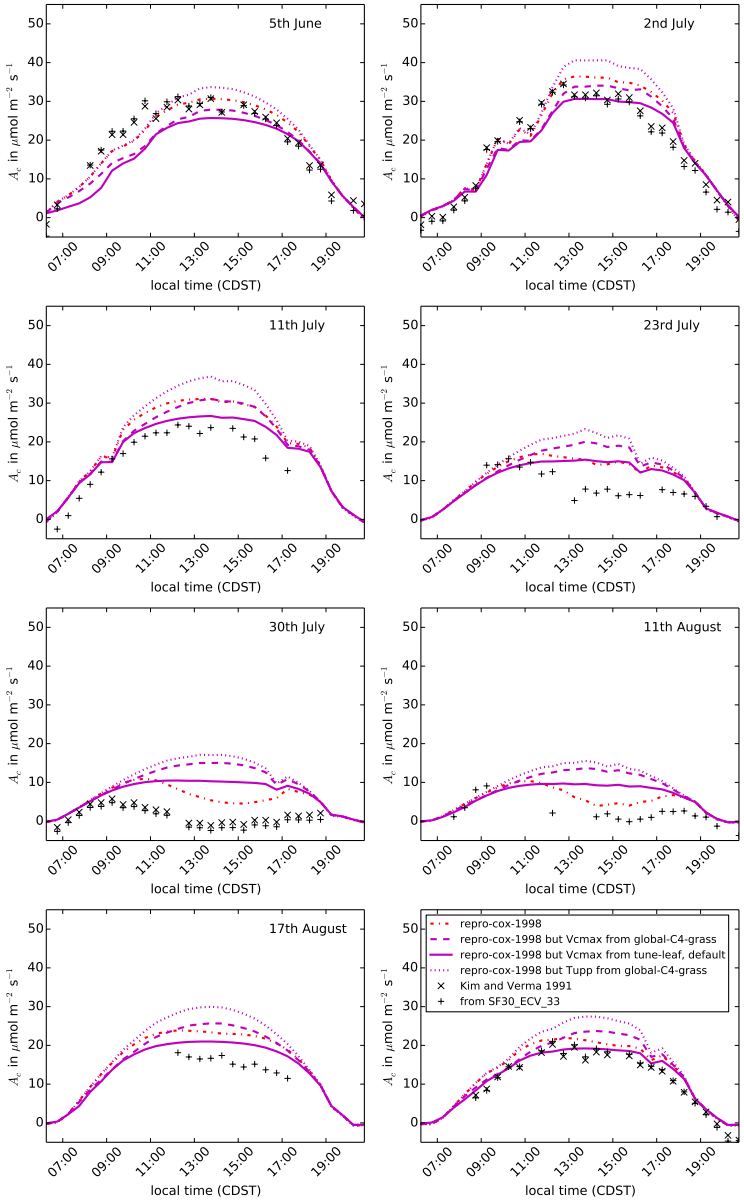

Figure S3. The diurnal cycle of net canopy assimilation A_c at site 4439 in the FIFE area for 8 days in 1987: 5th June (early growth), 2nd July and 11th July (peak growth), 23rd July, 30th July and 11th August (dry period) and 17th August and 20th August (early senescence). Dot-dashed red line: `repro-cox-1998` parameters. Dashed magenta line: `repro-cox-1998` parameters except $V_{cmax}(T)$ from `global-C4-grass` configuration. Solid magenta line: `repro-cox-1998` parameters except $V_{cmax}(T)$ from `tune-leaf` configuration. Dotted magenta line: `repro-cox-1998` parameters except T_{upp} from `tune-leaf` configuration. See Figure S1 for a plot of the $V_{cmax}(T)$ used in each of these similations.

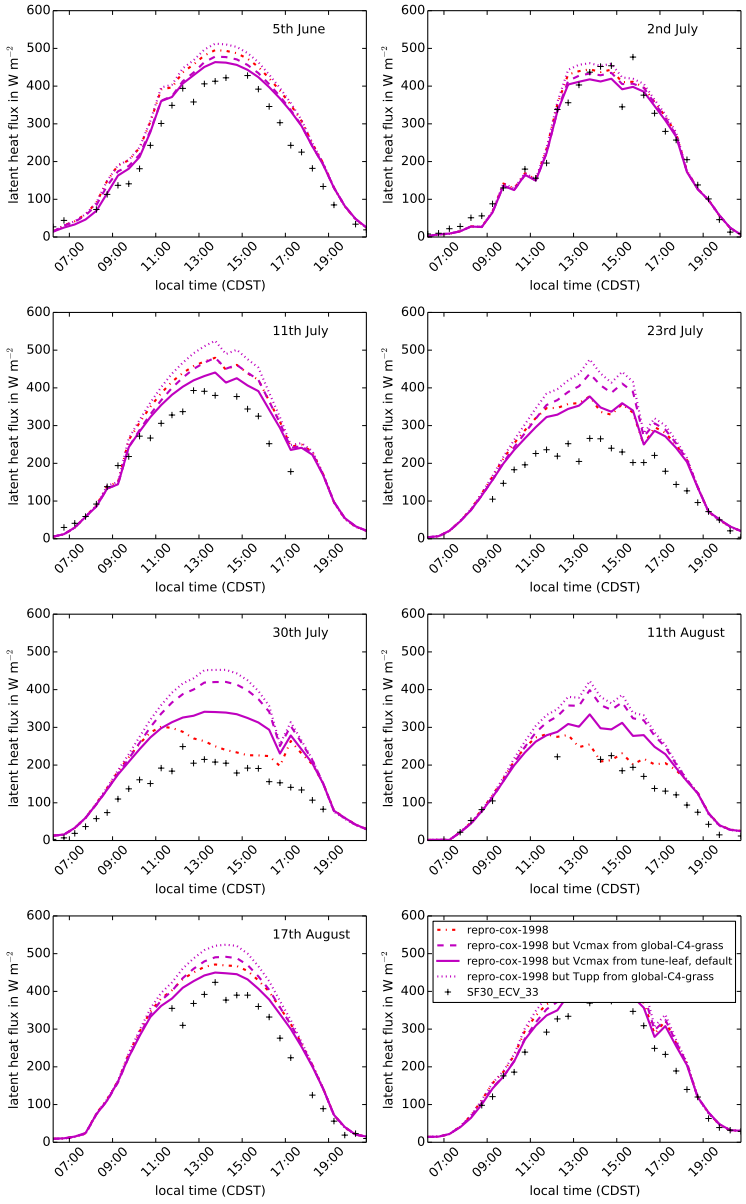

Figure S4. The diurnal cycle of latent heat flux at site 4439 in the FIFE area for 8 days in 1987: 5th June (early growth), 2nd July and 11th July (peak growth), 23rd July, 30th July and 11th August (dry period) and 17th August and 20th August (early senescence). Dot-dashed red line: `repro-cox-1998` parameters. Dashed magenta line: `repro-cox-1998` parameters except $V_{cmax}(T)$ from `global-C4-grass` configuration. Solid magenta line: `repro-cox-1998` parameters except $V_{cmax}(T)$ from `tune-leaf` configuration. Dotted magenta line: `repro-cox-1998` parameters except T_{upp} from `tune-leaf` configuration. See Figure S1 for a plot of the $V_{cmax}(T)$ used in each of these similations.

S2 Plots of air temperature, leaf temperature and vapour pressure deficit diurnal cycles

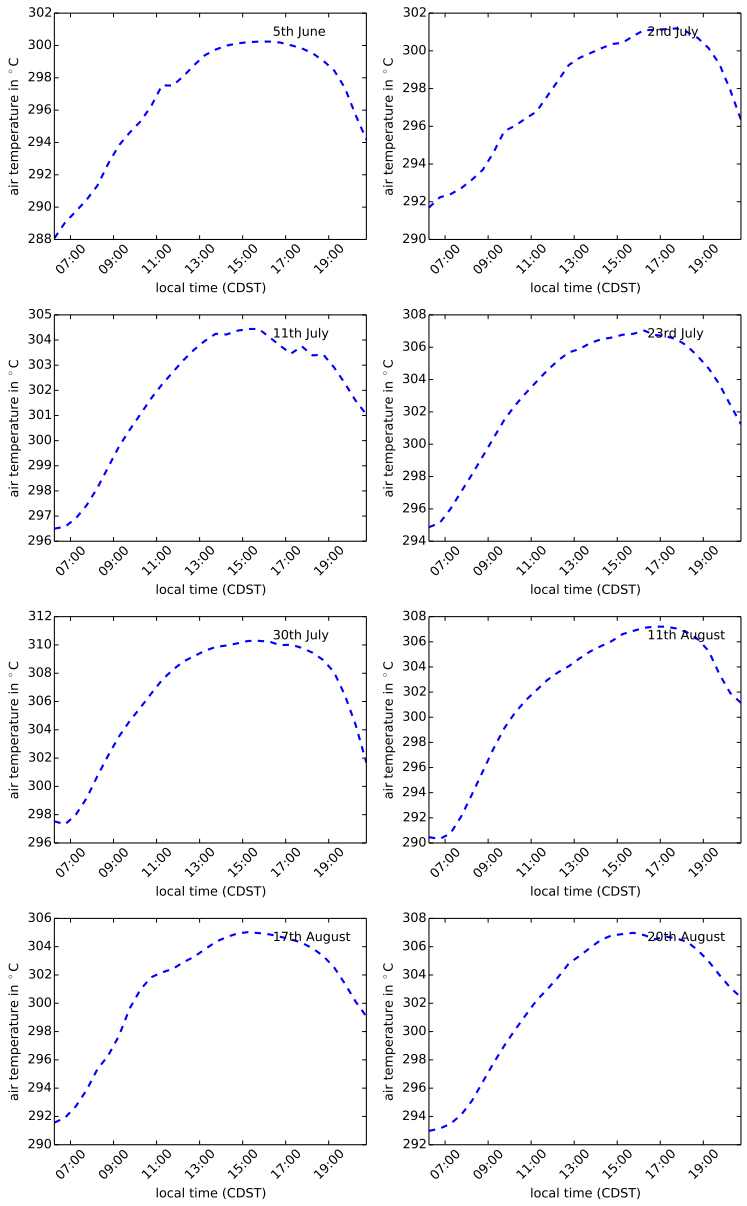

Figure S5. The diurnal cycle of air temperature used to drive JULES runs for site 4439 in the FIFE area for 8 days in 1987: 5th June (early growth), 2nd July and 11th July (peak growth), 23rd July, 30th July and 11th August (dry period) and 17th August and 20th August (early senescence).

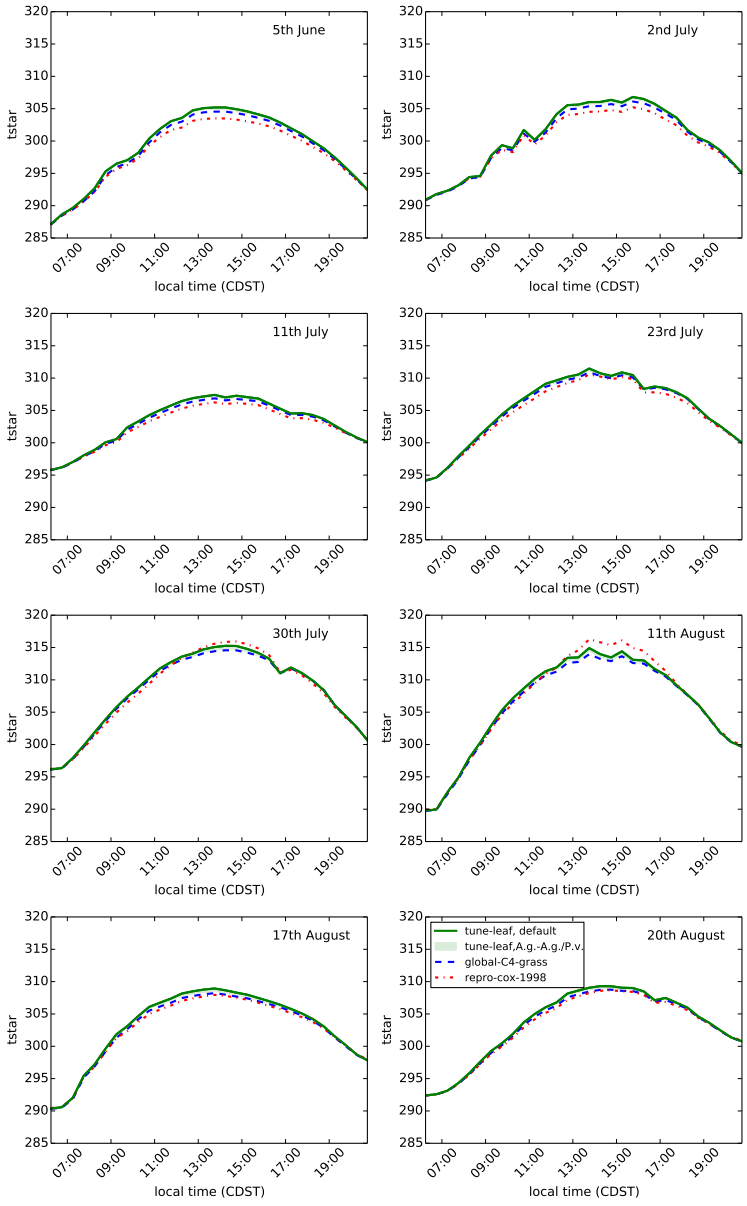

Figure S6. The diurnal cycle of modelled leaf temperature for site 4439 in the FIFE area for 8 days in 1987: 5th June (early growth), 2nd July and 11th July (peak growth), 23rd July, 30th July and 11th August (dry period) and 17th August and 20th August (early senescence). Green band show uncertainty from fitting plant parameters to *A. gerardii* compared to fitting to both *A. gerardii* and *P. virgatum*.

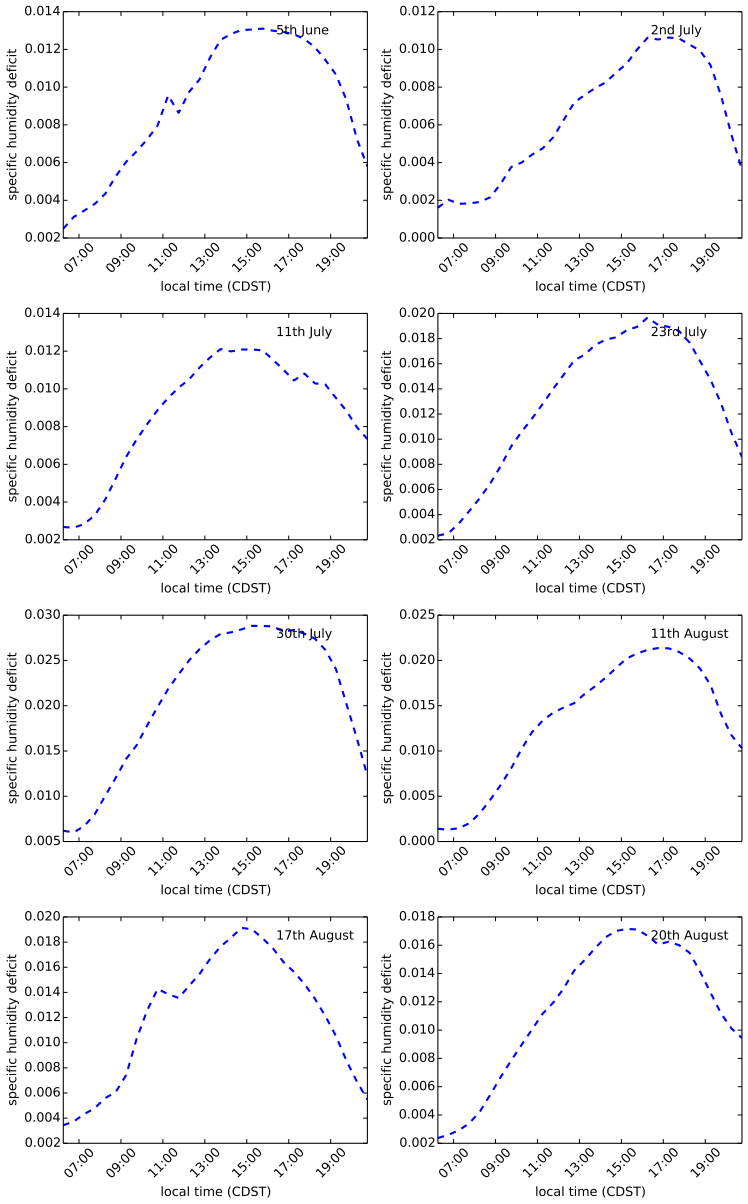

Figure S7. The diurnal cycle of specific humidity deficit, calculated from the driving data for the JULES runs at site 4439 in the FIFE area for 8 days in 1987: 5th June (early growth), 2nd July and 11th July (peak growth), 23rd July, 30th July and 11th August (dry period) and 17th August and 20th August (early senescence).

S3 Plot of internal CO_2 concentration against chamber CO_2 concentration

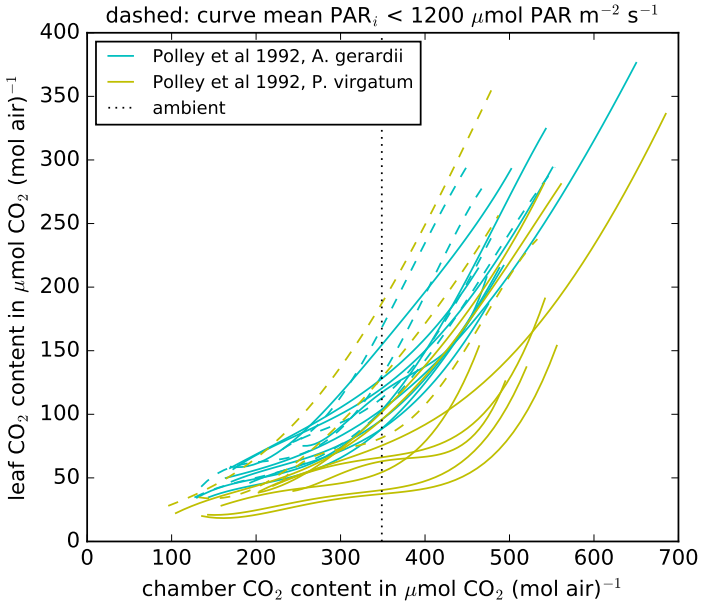

Figure S8. Leaf internal CO_2 against chamber CO_2 for A.g. (cyan) and P.v. (yellow) from FIFE_PHO_LEAF_46. Each line is from the same A_l-c_i curve, and was taken at approximately constant humidity.

S4 Plots of components of modelled evapotranspiration

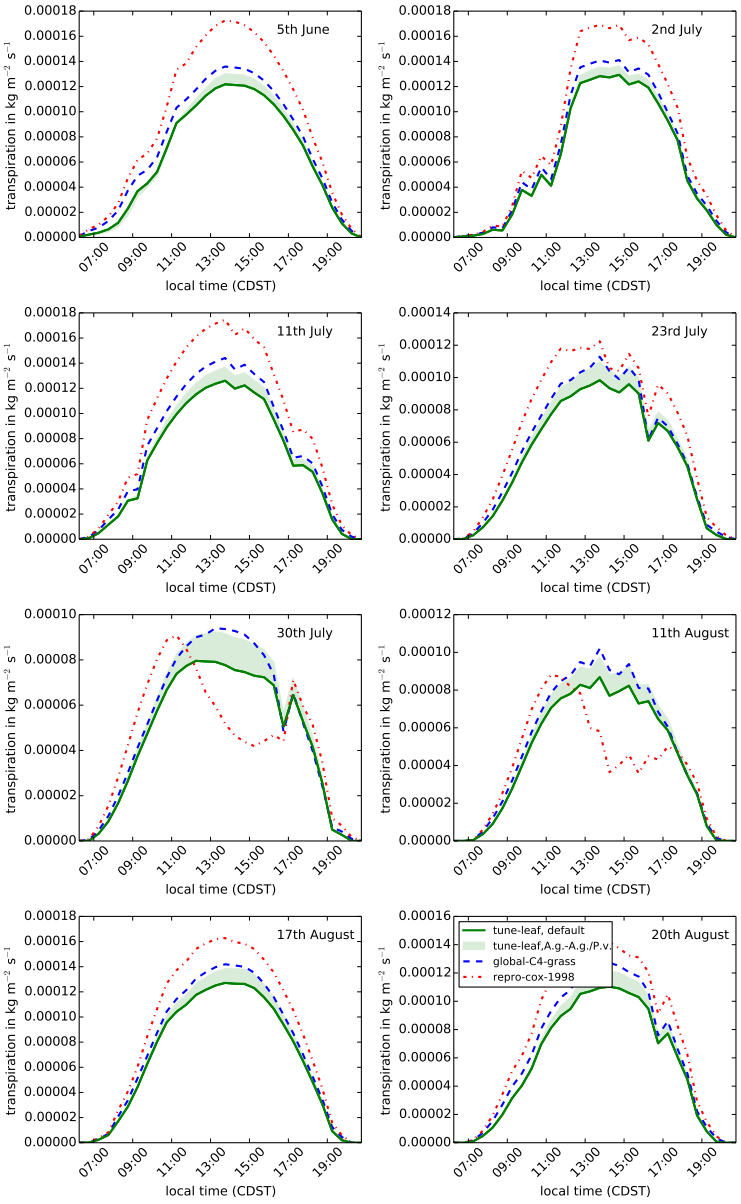

Figure S9. The diurnal cycle of plant transpiration at site 4439 in the FIFE area for 8 days in 1987: 5th June (early growth), 2nd July and 11th July (peak growth), 23rd July, 30th July and 11th August (dry period) and 17th August and 20th August (early senescence). Green band show uncertainty from fitting plant parameters to *A. gerardii* compared to fitting to both *A. gerardii* and *P. virgatum*.

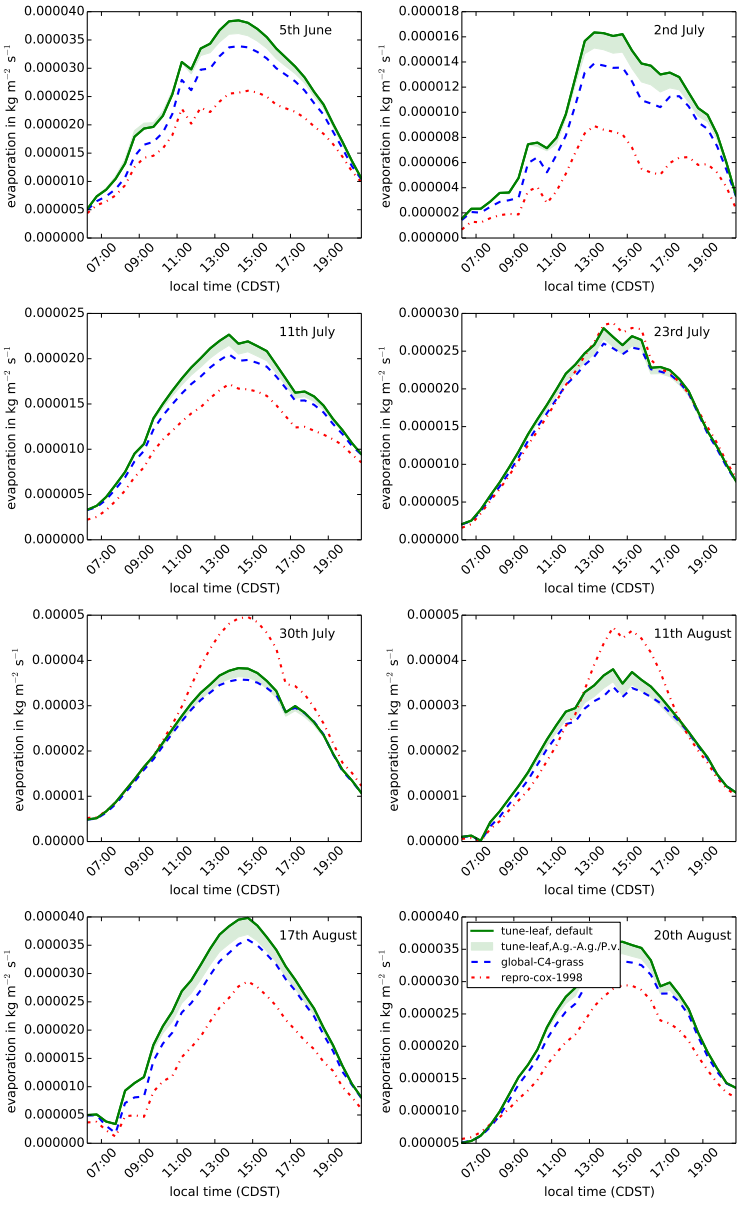

Figure S10. The diurnal cycle of evaporation from canopy and surface/soil moisture stores at site 4439 in the FIFE area for 8 days in 1987: 5th June (early growth), 2nd July and 11th July (peak growth), 23rd July, 30th July and 11th August (dry period) and 17th August and 20th August (early senescence). Green band show uncertainty from fitting plant parameters to *A. gerardii* compared to fitting to both *A. gerardii* and *P. virgatum*.