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Biogeosciences Discussions

Interactive comment on "Thermal acclimation of leaf photosynthetic traits in an evergreen woodland, consistent with the co-ordination hypothesis" *by* Henrique Fürstenau Togashi et al.

Anonymous Referee #1

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General comments

This paper looks at the seasonal acclimation of photosynthetic parameters and whether this acclimation is consistent with the coordination hypothesis. To this end, the authors make photosynthetic measurements in two distinct seasons for several species in an Australian evergreen woodland and then compare the measured temperature response with the theoretical expectation. The findings are particularly important because photosynthetic parameters are often considered invariant in time in earth system models and also because seasonal photosynthetic measurements the same location are rare.

I find that while the results from the photosynthetic measurements are interesting and

well analysed and discussed, the theoretical analysis and the link between measurements and theory needs more discussion, in particular in relation to the many linear assumptions made, all of which are hidden in the appendix.

Specific comments

Data analysis and regressions

The conclusions relating to acclimation and coordination are based on the slopes of regression lines of photosynthetic variables to temperature but there is insufficient detail in the paper relating to the results of the statistical analysis. Figures 3-5 are presented without any goodness of fit metrics or p-values for the individual lines. In addition, the authors assume a linear relationship between the log10 values of each variable and temperature, an assumption which is detailed in appendix A but not sufficiently discussed in the main text.

Coordination hypothesis

The coordination hypothesis states that the Rubisco and electron transport limited rates are co-limiting under average conditions, which is generally taken to mean that there is a change in the J_{max25} to V_{cmax25} ratio and implicitly a change in nitrogen allocation inside the leaf. The authors make a linear approximation to solve for this co-limitation (eq. A3). This approximation removes the parameter J_{max25} from the calculation and its slope with temperature is calculated assuming proportionality to the slope of V_{cmax25} and a ratio of the biochemical temperature response. While these approximations can be justified, I believe that a further discussion is needed as the resulting equations are difficult to match with the coordination hypothesis as this is generally understood. I would also suggest including all the equations in the main body of the text since they are necessary to the central message of the paper

The authors report the slope of the log10 of each measured parameter with temperature and compare this to the theoretical equivalent slope (Table 1) to reach the conclu-

sion that the coordination hypothesis is valid. The more usual approach would be to calculate the theoretically predicted values of the photosynthetic parameters and plot these together with the measured values. The authors' approach is scientifically valid but given the multiple approximations and log values I find it hard to follow.

Also, the fitted slopes for all parameters are calculated as log10(parameter) vs. temperature, while the theoretical slopes are ln(parameter) vs. temperature. I would suggest that the authors check their calculations and verify that these slopes are equivalent.

Leaf nitrogen variation

Changes in V_{cmax} values alone do not verify the coordination hypothesis - these can be caused either by acclimation or by changes in total leaf nitrogen. According to Fig. 8 there are large differences in the leaf N for some species, which can be caused by a number of factors apart from temperature acclimation, especially leaf ageing. I would be interested to see how the ratio of V_{cmax} (and/or J_{max}) to leaf N changes seasonally, which would give a better indication of photosynthetic coordination.

Leaf respiration

While acclimation of respiration is a well documented and important process it is unclear how this links to the coordination hypothesis. Here the authors hypothesised that dark respiration scales linearly with Vcmax and will therefore follow the coordination hypothesis as well, but this is not necessarily the case in either models or reality and a better justification of why the variation in dark respiration should be linked with photosynthetic co-limitation is needed.

Technical comments

The authors should decide whether we are talking about 'coordination' or 'co-ordination'.

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