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Discussions

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Interactive comment on "MODIS vegetation products as proxies of photosynthetic potential: a look across meteorological and biologic driven ecosystem productivity" *by* N. Restrepo-Coupe et al.

Anonymous Referee #1

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The authors investigate the potential of MODIS vegetation indices (VIs) to predict gross primary production in semi-arid ecosystems of Australia. This is an important topic since GPP of such ecosystem types are indeed difficult to capture by VIs and this deserves an in depth analysis. Overall, the paper contains several interesting aspects that are worth being published. But I agree with referee #2 that the manuscript requires substantial sharpening and streamlining.

The first objective was 'to gain understanding of ecosystem behavior' but it is not clear what is meant by that. In that regard I had expected more insights on the role of wa-

ter limitation (VPD and soil moisture) on GPP and to what extent VIs can capture that or not. Water limitation is in my view perhaps the most critical point on why VIs may not 'see' the productivity response properly. Using precipitation from a coarse scale product does not seem appropriate to capture water availability. I'm wondering why not observed soil moisture or simple ecohydrological metrics like cumulative water deficit (from measured precip and ET) has been used here. It has been argued that during water stressed conditions the yellowing of the herbaceous understory may act as a 'drought indicator' which might drive the VI in the 'right' direction (Sims et al 2014, GCB; Jung et al 2008, GCB). If so, the capacity of VIs to reflect GPP response would depend on the presence and density of herbaceous vegetation and the openness of the forest canopy. The color of the leaves is influencing the VIs and this could also indicate changes of LUE. The authors mention repeatedly that 'understanding' is more important than 'well-fitting models' but the authors present a systematic analysis on which regression models work best (which I like!). Investigating the coefficients of these regression models shows often unexpected signs, e.g. GPP decreasing with VI, or the presence of intercept terms, which conceptually makes little sense. Discussing and explaining these things may be a chance to make the point why 'understanding' is important. The second objective was to disentangle the seasonality of 'vegetation structure and function from climatic drivers of productivity'. The authors derive 4 metrics here (alpha, Pc, LUE, GEP_sat). I agree with referee #2 regarding the (non-optimal) nomenclature of 'photosynthetic potential' vs 'activity'. I also see a conceptual problem here because all 4 metrics are actually confounded by changes in light harvesting (reflected by VIs) such that vegetation structure and functioning cannot be disentangled from ecophysiological effects. In my opinion the authors should have used PAR*VI in the light response cure fitting to account for that. I'm also wondering about the usefulness of Pc – first it seems redundant given alpha and GEP_sat, and second it requires somewhat arbitrary thresholds and site specific knowledge to compute it. I'm wondering why the authors did not employ the 'classical' approach (GPP=APAR*LUE) here to disentangle 'biophysical' (APAR=VI*PAR) from 'ecophysiological' (LUE) components, which seems

more straightforward and would do the job (?). For example, given GPP=VI*RAD*LUE it derives that GPP scales with VI if a) the product of RAD and LUE is nearly constant (compared to the variability of VI), or b) product of RAD and LUE is in phase with VI. I guess I'm lacking a more clear presentation and justification of a clear framework and motivation of the analysis strategy.

Minor points: - Why were coarse scale products of radiation d precip being used? Why monthly if those are available daily? - Page 19234, line 6: R2=0.16 does not suggest a 'strong' relationship to me - Page 19240 line 23: I'm not sure but I thought a brighter soil (or snow) increases ndvi (?). In any case, this is an interesting section of discussion which might be expanded ('understanding' why things work or not).

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