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Interactive comment on "Retrieval of the photochemical reflectance index for assessing xanthophyll cycle activity: a comparison of near-surface optical sensors" *by* A. Harris et al.

A. Porcar-Castell (Referee)

joan.porcar@helsinki.fi

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A multitude of optical sensors and spectrometer systems are being rapidly deployed across flux sites. These sensors are expected to facilitate the interpretation of remotely sensed data and therefore the upscaling of processes such as photosynthesis. To reach this goal it is critical: i) that sensors remain stable on the long-term, or otherwise regularly calibrated and well characterized; and ii) that data obtained with different sensors and configurations can be intercompared.

The photochemical reflectance Index (PRI) is an index that uses narrow spectral bands, normally centered at 531 and 570nm, to track the epoxidation status of the xanthophyll-

cycle pigments. The PRI should therefore be susceptible to slight changes in instrument properties such as band location or spectral resolution. In this study, Harris et al. compare the performance of two different systems to estimate diurnal variations in the PRI of different plant canopies: a widely used lower-cost multichannel sensor vs a more expensive spectrometer system, arranged in three different configurations.Their results show that both instruments were able to successfully track the adjustments in the PRI through the day, which in turn correlated with the diurnal changes in epoxidation status of the xanthophyll-cycle. Their study demonstrates that while data obtained from different instruments and setups was linearly correlated, differences in spectral response and sensor configuration had a significant effect on absolute PRI levels. Interestingly, the authors present a method that can be applied to correct data obtained with instruments with different spectral functions which was able to correct for most of the discrepancy.

The experiments were carefully planned, the article is clearly written and informative, and overall the paper is a significant, timely and useful contribution that will serve the community involved in optical measurements at flux sites. The article fits very well within the EUROSPEC Issue as it represents a perfect example of the sort of activities that EUROSPEC was set to do.

Perhaps the only "weakness" was that the study did not go into the seasonal domain so the reader is left with some relevant questions: A) how these instruments would perform under seasonal (=large) fluctuations in temperature? B) how different configuration and setups (e.g. SC or DC) would perform under more demanding environments, e.g. rain, snow, dust deposition, etc)? C) how would different sensors and spectral configurations succeed in tracking the slow seasonal changes in the de-epoxidation status of the xanthophyll-cycle pigments and its total pools? Obviously, answering these questions would have required a different experimental setup outside the scope of this paper. Perhaps a good topic for future work?

Specific comments: -Page 11922, 10. The authors write "...SKR 1800 sensors recorded a prominent decrease in the PRI during the early afternoon (Fig. 7)... Consequently the observed between-sensor differences are likely due (to) each sensor having a slightly different IFOV". The authors could discuss the possibility that the higher spectral resolution of the SKR 1800 relative to the UniSpec sytem (as seen from Fig. 1) was actually outperforming the latter. Indeed, the diurnal PRI pattern from the Unispec in Fig 7 is rather flat despite the clear changes in illumination, in fact I would have expected some more variation. On the other hand, average PPFD appears to be higher at 13:00 compared to 14:00 when the sky was occasionally covered by clouds, consistent with the lower PRI at 13:00 relative to 14:00 obtained with the SKR 1800. Could the SKR 1800 be better at tracking diurnal changes?

- In view of the impact that minor changes in sensor spectral configuration have on the resulting PRI levels, how would the authors suggest/recommend to deal with sensor heterogeneity and intercomparability of results? For example, if we have data from a network of 10 flux sites each equipped with a slightly different SKR 1800 sensor, how would the authors suggest to compare the PRIs based on their findings? Should one apply their deconvultion method? use some scaled measure of PRI? I believe this is an interesting point that the authors are well in place to discuss in the Concluding Remarks.

Minor Corrections: -The authors use the FWHM provided by the manufacturer to perform the spectral deconvultion and compare the result with the SKR 1800 PRI. Was the manufacturers FWHM provided for different wavelengths or for a single wavelenght? how much can FWHM be expected to vary across wavelengths (525-570 range)? Could that have an impact on the deconvultion process?

-Section 2.3.1. "Dark-to-light transition experiments were performed over *five* different plant canopies..." I believe it is *four*, the fifth being for the diurnal study? -Section 2.3.2. 10-15, "...were also sampled (2x3 cm) and immediately...". Please specify, 2x3 cm of what? total needle area? did you produce a mat of needles and then cut out a 2x3 square?

-Section 2.3.2. Please give at least some minor details on the temperature and relative humidity measurements

-Section 3.2.1. 15, "...after the SRF correction had been applied to both (add: UniSpec) instruments"

-Pag 11924. 25. Although one can draw conclusions on the seasonal scale, the article by Gamon and Berry deals with the spatial component of the PRI variability rather than the temporal. The authors may consider adding a reference to a seasonal study that supports their statement e.g. Stylinsky et al. 2002, Filella et al. 2009, or Porcar-Castell et al. 2012.

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