Optimising the MODIS-based PRI for arid areas

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Current remote sensing based models of gross primary productivity (GPP) often a variation of the light use efficiency theme first introduced by Monteith. Primary productivity is calculated as the product of absorbed photosynthetically active radiation (aPAR, calculated as fraction of absorbed PAR times incoming PAR) and a light use efficiency (LUE) term. In drought prone areas the dynamics of LUE are decoupled from seasonal variations in canopy structure and "greenness". In these cases LUE can not be sufficiently constrained with e.g. vapour pressure deficit and temperature. Some promising attempts have been made to estimate LUE directly from remote sensing data the photochemical reflectance index (PRI). These studies used the MODIS sensor to calculate PRI as it features the 531 nm band. As the 570 nm band is not available on MODIS, several alternative reference bands have been used. From previous work it remains unclear whether there is one universally applicable reference band or if we have to differentiate between plant functional types and according to the density of vegetation cover. In this study we test the suitability of different red and green reference bands for ecosystems with (temporal) water scarcity, namely evergreen broadleaf forests with different vegetation densities, woodland and savannah.
For evaluation, we use LUE estimates derived from CO_2 flux and radiation observations made at eddy covariance tower sites.