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Using broad band reflectance indices to estimate carbon dioxide fluxes from a temperate mountain grassland

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Remote/proximate sensing of radiation reflected from the earth's surface allows monitoring the 'status' of the planet earth with reasonable spatial and temporal coverage. Here we explore the use of vegetation indices (VIs) calculated from reflectance in broad spectral regions for inferring ecosystem carbon dioxide (CO2) fluxes. To this end we use one year of concurrent measurements of reflectance in the spectral bands of photosynthetically active radiation (PAR) and the near infrared (NIR), as well as the net ecosystem CO2 exchange (NEE) made above a temperate mountain grassland in Austria.

Our data show close relationships between several different metrics of NEE and broad band VIs derived from measured reflectances. In most cases these broad band VIs are better predictors of NEE than other widely used metrics such as the fraction of absorbed PAR or the amount of photosynthetically active plant matter.

It is concluded that broad band VIs provide a suitable means to remotely infer the NEE of grassland ecosystems, and possibly other ecosystems with time-varying vegetation cover. Given that measurements of reflectance in the PAR and NIR spectral regions require little additional investment at most sites where NEE is measured, flux networks are encouraged to include such measurements into their protocol.