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The use of grassland reflectance data for quantitative remote estimation of NEE and GPP in a mountain meadow

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At ecosystem and regional levels, there is a considerable interest in relating ecosystems fluxes measured by the eddy covariance method and remotely sensed data. The major advantage of combining fluxes and remote sensing is the possibility to extend the site-specific data (temporally rich but spatially poor) of the eddy covariance method across a broad spatial scale.

In this study, we use reflectance data for quantitative remote estimation of grassland NEE, GPP and LAI. Eddy covariance measurements were performed during the summer of 2005 at an intensive meadow study site (Monte Bondone, Italian Alps) where ecosystem energy, water, and carbon fluxes are continuously monitored within the framework of the European network CarboEuroflux. Ground radiometric measurements were acquired 14 times during the vegetative period (before the meadow cutting) using an ASD Hand-Held spectroradiometer (wavelength range 325-1075 nm). A cosine diffuser foreoptic was used and measurements were carried out between 9:30 to 11 am, depending on the sky conditions. At the same time, Leaf Area Index was indirectly measured by means of a Sunscan Canopy Analyzer ceptometer. Reflectance values in the green, red and Near-Infrared were obtained in relation to simulated ETM+, MODIS and Hyperion bandwidths.

LAI, NEE and GPP showed a significant correlation with GreenNDVI calculated from ETM+, MODIS and Hyperion bandwidths. The correlation was not significant when considering standard NDVI index (calculated with the red band). As shown by many authors, the use of the green band instead of the red one improves the predictabil-

ity of vegetation abundance-related biophysical parameters such as biomass and LAI. According to the dataset of this study, this seems to be true also for grassland eco-physiological parameters such as cumulated NEE and GPP.

For all the different sensors bandwidths, logarithmic correlations showed higher and significantly different R^2 values when compared to the linear. Regressions calculated from Hyperion and MODIS-simulated bands produced similar R^2 values, while regressions calculated from Landsat ETM+ simulated bands yielded, in all cases, lower R^2 values. We found that NEE was the most predictable parameter (R^2= 0.87 both for MODIS and Hyperion GreenNDVI).

According to these datasets, cumulated NEE and GPP seem to be predictable from proximal-sensed data.

As GreenNDVI produced better results than NDVI (which is commonly used in Carboeurope protocol), the use of a green narrow band sensor appears to be recommendable for remote sensing measurements taken in the eddy covariance sites.

More work is needed in order to investigate the relationships between NEE-GPP and vegetation indexes calculated from remote sensing platforms, using the bands available on MODIS and Hyperion sensors.