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Large and Small Scale Nitrogen and Phosporous Manipulation Experiment in a Tree-Grass Ecosystem: first year of results

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Recent studies have shown how human induced N/P imbalances affect essential ecosystem processes (e.g. photosynthesis, plant growth rate, respiration), and might be particularly important in water-limited ecosystems. In this contribution we will present the experimental design and the results of the first year of two nutrient manipulation experiments conducted at different spatial scale.
In the first experiment a cluster of 2 eddy covariance (EC) flux towers has been set up beside a long-term EC site (Las Majadas del Tietar, Spain). Sites are selected in a way to have similar nutrient conditions, canopy structure, and stoichiometry of the different vegetation and soil pools. Two of the three footprints will be manipulated with addition of N and NP fertilizer at the beginning of 2015. The comparison of the three EC flux towers installed during the first year of the experiment (without fertilization) will be shown. We characterized the differences of the responses of carbon and water fluxes measured by the EC systems to environmental drivers, and structural and biophysical properties of the canopy.
The second experiment was conducted over a Mediterranean grassland, where 16 plots of 10x10 meters that were manipulated by adding nutrient (N, P, and NP). The overall objective was to investigate the response of the gross primary productivity (GPP), assessed by using transparent transient-state canopy chambers, to different nutrient availability. The second objective was to evaluate the capability of hyperspectral data and Solar induced fluorescence to track short- and long-term GPP and light use efficiency variation under different N and P fertilization treatments. Spectral vegetation indices (VIs) were acquired manually using high resolution spectrometers (HR4000, OceanOptics, USA) along a phenological cycle. The VIs used included photochemical reflectance index (PRI), MERIS terrestrial-chlorophyll index (MTCI) and normalized difference vegetation index (NDVI). Solar-induced chlorophyll fluorescence calculated at the oxygen absorption band O_2-A (F760) using spectral fitting methods was also used.
The results showed significant differences ($p<0.05$) in midday GPP values between N and without N addition plots. While NDVI did not show any significant difference between treatments, VIs sensitive to pigment variations and physiology (PRI, MTCI) and F760 showed differences between different treatments. Different formulations of Light Use Efficiency (LUE) modelling approaches were applied and the results indicated that the use of LUE models based on VIs related to physiology and fluorescence are key to account for nutrient availability in LUE models and to better predict GPP.