RELACIONES ENTRE EL NDVI Y LOS FLUJOS TURBULENTOS DE CALOR EN UN PASTIZAL MEDITERRÁNEO

RELATIONSHIPS BETWEEN NDVI AND TURBULENT HEAT FLUXES IN A MEDITERRANEAN GRASSLAND

Victor Cicuéndez(1), Juan Carbone(1), Pablo Ortiz-Corral(1), Rosa Inclán(2), Carlos Román-Cascón(3), Mariano Sastre(1), Carlos Yagüe(1)

(1) Departamento de Física de la Tierra y Astrofísica, Universidad Complutense de Madrid, Plaza de Ciencias 1, Madrid, Spain. victcicu@ucm.es, jcarbone@ucm.es, pabloo01@ucm.es, msastrem@ucm.es, carlos@ucm.es.

(2) Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas (CIEMAT), Avda. Complutense 40, Madrid, Spain. rm.inclan@ciemat.es.

(3) Departamento de Física Aplicada, Facultad de Ciencias del Mar y Ambientales, Universidad de Cádiz, Av. República Saharahui s/n, Cádiz, Spain. carlos.roman@uca.es

SUMMARY

Vegetation plays a key role on the interaction between the land surface and the atmospheric processes, and its functioning could be monitored through spectral indices such as the Normalized Difference Vegetation Index (NDVI) obtained through remote sensing data. The aim of this work is to investigate the relationships between NDVI and the turbulent heat fluxes near the surface in a grassland ecosystem of Central Spain throughout a three-year period (January 2018- August 2020). Results showed that NDVI is strong correlated with sensible and latent fluxes especially during the end of growing period. Thus, including NDVI in could improve atmospheric models.

Vegetation exerts a strong influence on the interaction between the land surface and the atmospheric processes, modifying the relative contribution of sensible and latent heat to the total energy of atmospheric motions (Forzieri et al., 2020). The role of ecosystems in energy partitioning processes must be considered in Land Surface Models to improve the understanding of the land–atmosphere coupling. In this sense, parameters related to vegetation structure such as the Leaf Area Index (LAI) have been used as an indicator of the influence of vegetation on surface energy fluxes (Hoek van Dijke et al., 2020). More recently, Cicuéndez et al. (2023) used the Gross Primary production (GPP) of three contrasted forests to assess their influence on the energy partitioning processes.

Nowadays, remote sensing is an excellent tool to monitor vegetation functioning at different spatial and temporal scales. Spectral indices obtained from remote sensing data, such as the Normalized Difference Vegetation Index (NDVI) (Tucker, 1979), are strongly related to photosynthesis and vegetation functioning. Thus, the role of vegetation in the energy partitioning processes could be assessed using these spectral indices. Recently, Lan et al. (2020) revealed the importance of considering vegetation dynamics through remote sensing observations to quantify the effect of greening on energy partitioning in China. The overall aim of this work is to investigate the relationships between NDVI and the turbulent heat fluxes near the surface in a grassland ecosystem of Central Spain throughout a three-year period (January 2018- August 2020). The NDVI is obtained from Sentinel-2 of the European Space Agency (ESA) with a high spatial (10 meters) and temporal resolution (5 days). Turbulent heat fluxes were obtained from an Eddy Covariance flux tower which belongs to the GuMNet network (https://www.ucm.es/gumnet).

Figure 1 showed the dynamics of the GPP and Soil Water Content (SWC) during the study period. The growing period was delayed on time in 2018 in comparison to 2019 and 2020 and it could be extended during June due to the soil moisture conditions. This fact was determinant for the stronger relationship between NDVI and turbulent heat fluxes during June and July. During 2019 and 2020, the relationship between NDVI and turbulent fluxes began earlier (mid-May).

Results in Figure 2 showed that NDVI was strongly correlated with latent (a) and sensible (b) heat especially for two months (15th of May to 15th of July). These two months coincided when the grassland showed its maximum changes, presenting their maxima of biomass and then drying quickly during the following months due to the lack of soil water availability.

In conclusion, this work showed that NDVI was strongly related to turbulent heat fluxes during the maximum and the end of the growing period of grasslands. It is well-known that it is essential to include the vegetation dynamics to improve the atmospheric and land surface models. This study is a first step to use spectral indices as a proxy to improve these models.

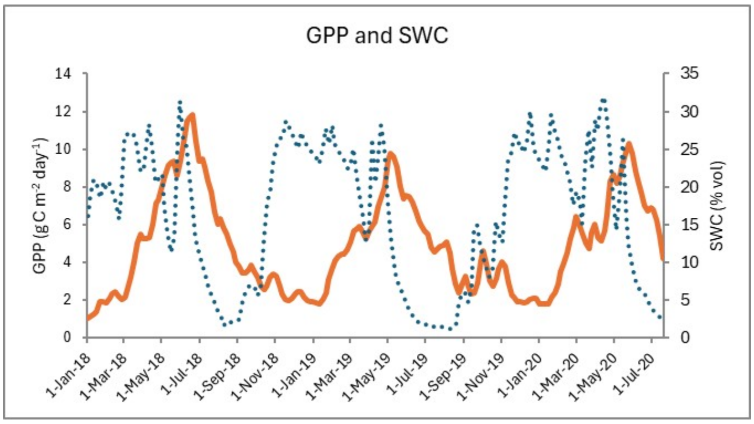

Figure 1 - Temporal evolution of Gross Primary Productivity (GPP) and Soil Water Content (SWC) during the study period: January 2018 to August 2020.

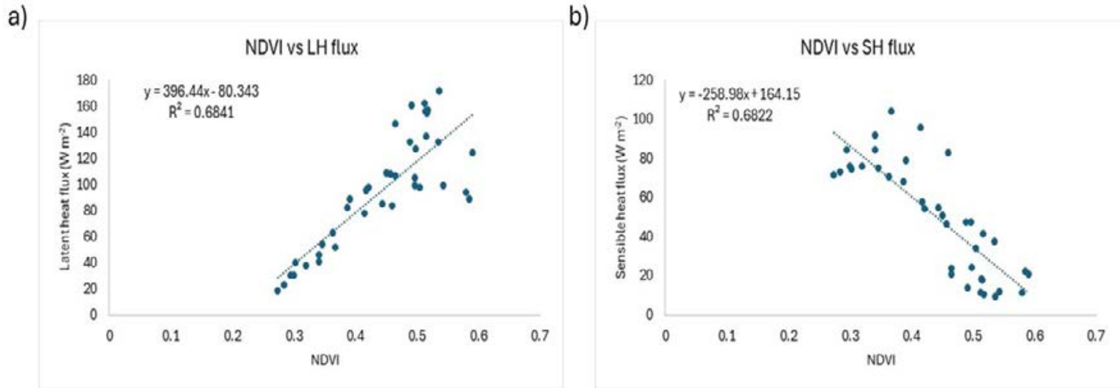

Figure 2 - Linear relationship between NDVI and Latent heat (a) and Sensible Heat (b) fluxes.

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