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Using AVHRR data to assess the impact of the NAO on Iberian vegetation dynamics and NPP estimates

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Over the last 25 years, the temperature of northern latitudes has risen by 0.8 žC, with a longer active growing season as a consequence of an early spring and delayed autumn and, consequently an increased on photosynthetic activity of vegetation, detectable by changes in NDVI (Zhow et al., 2001). These changes have been shown to be related with changes in near surface climatic variables such as land surface temperature for vegetated areas (Zhow et al., 2001). Since land use, land use change, and forestry activities, as well as vegetation response to enhanced levels of atmospheric CO2, are major influences on greenhouse gas emissions, quantifying and identifying sources behind carbon dynamics presents relevant issues in environmental sciences.

The impact of the dominant mode of climate variability in the northern hemisphere, the North Atlantic Oscillation - NAO, in vegetation greenness in both northern and southern European sectors has been described (Gouveia, 2004). During the positive phase a reduction of the cloud cover occurs in southern Europe, which corresponds to an increase in net long wave radiation, at the same time that there is an increase in cloud cover over central Europe (Trigo et al., 2002). Consequently, high (low) values of winter NAO induce low (high) vegetation activity in the following spring and summer season in Iberia (Gouveia, 2004). This impact is associated with the immediate impact of winter NAO in winter precipitation and relatively insensitivity to winter temperature. For the Iberian Peninsula the maximum of photosynthetic activity occurs in spring for the years of low winter NAO, due the availability of water in these years (high precipitation values in winter).

The present study analyses the relation between satellite-based measures of vegetation greenness, net carbon absorption rate by living plants and climate over Iberian Peninsula. For this purpose, we analysed dynamics of Normalised Difference Vegetation Index (NDVI), retrieved between 1981 and 1999 from Global Inventory Monitoring and Modelling System (GIMMS) group, and Net Primary Productivity (NPP) estimates, from the Carnegie Ames Stanford Approach (CASA) model (Potter et al., 1993). The results were compared with the influence of the North Atlantic Oscillation (NAO) index. Significant correlations patterns between NAO and NDVI were obtained, identifying a negative impact in spring and summer. Significant correlations patterns between NAO and NPP were also obtained. High (low) values of winter NAO induce low (high) net carbon absorption rate (NPP) in the following spring or summer season in Iberia, depending of the region and the land cover type. Such a spatial pattern is linked to precipitation distribution and net solar radiation in the Iberian Peninsula greatly influenced by this atmospheric pattern. The relationships between vegetation greenness, net carbon absorption rate and NAO are discussed in detail.

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