



Rainfall and MODIS LAI relationships in the north semi-arid zone of Chile

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Ecosystems in arid climates react very sensitively to small changes in precipitation available water. Regional impacts of global changes are often investigated for these areas threatened by desertification

The study zone, part of the Norte Chico of Chile between 27°S and 33°S latitude, is located at the south of the hyper-arid Atacama Desert and called region of Coquimbo or IV Region: Elqui, Limari and Choapa valleys. It is characterized by cultivated and irrigated areas along the valley floor and sparse vegetation in the arid surrounding called "Secano". The "Secano" is a pastoral zone dominated by a shrub perennial layer with an annual herbaceous layer (during the rainy season between May and September). Mainly, rainfall associated to the El Niño Southern Oscillation (ENSO) and goat pasture limit the vegetation growth. Consequently, severe economic problems appear when occur several consecutive years of low rainfalls which reduce the net primary production.

If this region does not present a high density of vegetation, widespread a considerable superficie. The estimation of variables which quantitatively identify the effects of climate variability upon vegetation over large areas is greatly facilitated by remote sensing techniques.

Moderate Resolution Imaging Spectroradiometers (MODIS) based leaf area index is validated for six representative biomes, used to examine detailed information regarding total annual production for various regions and available free of charge to users.

We studied the spatial and temporal variability of MODIS LAI in relation with pre-

precipitation at the regional scale from 6 years data set in the north semi-arid zone of Chile.

Products of vegetation green leaf area index from Terra MODIS at 1-km resolution and eight-day frequency (MOD 15) over a 6 years period (2000-2006) were used. While rain gauges distributed along the south-north and west to east (elevation) gradients supplied precipitation data set.

Our results demonstrate significant LAI increases related with the south-north rainfall gradient and El Niño events. Major drought and rainy events are well captured by the MODIS LAI product. Moreover, seasonal variability of MODIS LAI shows us a potential sensitivity to the phenology and herbaceous growth during the rainy season (emergence up to senescence). Simultaneously to the latitude gradient, the elevation-related LAI changes are well described.

The sensitive MODIS LAI product characterizes an efficient potential monitoring tool. A great number of land management applications for the arid zones can be improved accounting for the role of LAI in controlling plant adaptation to environmental changes and limited resource supply. In this pastoral context, this analysis does not help to the highly relevant understanding of local impacts of grazing. Nevertheless, livestock management can benefit thanks to the formulation of a short term alert system of vegetation resources. Knowledge gained from this analysis has to be completed by enclosure experiments of livestock considering that both, abiotic and biotic forage constrain the vegetation pattern.