

# **Seasonal and interannual relations between precipitation, soil moisture and vegetation dynamics in the North American monsoon region**

Luis A. Mendez-Barroso

The North American monsoon region in northwestern Mexico and the southwestern United States experiences a seasonal hydroclimatological shift that promotes vegetation greening throughout a number of different ecosystems. In this study, we analyze the vegetation response to seasonal precipitation pulses using remote sensing observations (16-day MODIS composites) for the period 2004 to 2006. Our study is focused on a large region in northern Sonora occupied by the Río Sonora river basin, where we have installed and maintained a long term network of precipitation and soil moisture observations. Results show that strong seasonal and interannual differences exist in several metrics derived from the Normalized Difference Vegetation Index (NDVI) observations in a range of ecosystems. For example, growing season integrated NDVI showed strong correlation with accumulated rainfall in the region, with 2006 exhibiting the most intense vegetation response due to the higher monsoon rainfall. Based on time stability analysis of the remotely sensed data, we identified spatial patterns characterizing each of the major ecosystems and their degree of coupling with precipitation pulses. We identify the subtropical scrubland as the most dynamic ecosystem with the highest greenness-precipitation ratio, indicating its efficient use of monsoon rainfall for biomass production. Finally, we relate vegetation dynamics across several ecosystems and elevation gradients to the regional precipitation and soil moisture observations. Our study points to the strong coupling between precipitation, soil moisture and vegetation dynamics in the North American monsoon region and suggests that improved climate forecasts would be useful in hydrologic and ecological applications.