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What do vegetation indices tell us about the dynamics of the Amazon evergreen forests?

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Satellite information has been used to detect changes in the vegetation annual cycle in the Amazon forest. Vegetation dynamics can then be assessed through the use of Vegetation Indices (VIs). These satellite-based VIs rely on corrected and enhanced imagery to detect temporal shifts in the ratio of absorbed near infrared to visible red radiation.

In this study, we examine correlations between different VIs to climate variables, such as temperature and precipitation, at four sites in the Amazon forest for the years 1998-1999 and 2007. In order to assess the response, we have used the following VI datasets: a) the Normalized Difference Vegetation Index (NDVI) product derived from SPOT-4 satellite data; b) the Enhanced Vegetation Index (EVI) product derived from SPOT-4 satellite data; and c) the Fraction of Vegetation Cover (FVC) product derived from Meteosat-9 satellite data. We use climatic datasets of temperature and precipitation to characterize the temporal responses of EVI, FVC and NDVI during green-up for for the sites considered.

Our results show that, for the EVI and FVC indices, there is a slight dependence of vegetation greenness on temperature. We observe an increase in vegetation greennes during the dry season when these indices are applied. This suggests that the response may be due to high temperatures. In contrast, the NDVI index shows a decrease in vegetation greenness in the dry season. This implies that there is no vegetation development during the dry season.

The slighter dependence of vegetation on temperature than on precipitation obtained with the EVI and FVC indices occurs during the period characterized by less precipitation, whereas the influence of temperature on NDVI seems to be less clear for the same period. The results suggest that the EVI and FVC indices are the indicators of vegetation greenness which directly reflect the meteorological condition in terms of temperature. On the other hand the NDVI index is the indicator of vegetation greenness which best reflects the meteorological conditions in terms of precipitation.

We believe that the correct scaling of the Vegetation Indices used (especially the temporal and spatial scales) is crucial for a better assessment of the vegetation dynamics in the Amazon. In order to fully address this question, additional ground vegetation phenology measurements are needed - but these are rare in the region. It is hoped that new research funding in Brazil may be used for more data collection in the Amazon forest.