

Seasonal and Inter-Annual MODIS Data Analyses over a Dry to Wet Amazon Tropical Forest Gradient



Alfredo Huete (1)*, Kamel Didan (1), Yosio Shimabokuro (2), Andree Jacobson (1), Piyachat Ratana (1)



(1) Dept. Soil, Water and Environmental Science, University of Arizona, Tucson, AZ USA (ahuete@ag.arizona.edu)
 (2) INPE - Instituto Nacional de Pesquisas Espaciais, Sao Jose dos Campos BRAZIL

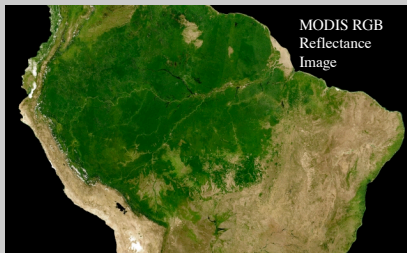
1. Introduction and objectives

Knowledge of the spatial and temporal (seasonal and interannual) variations of biologic activity in the Amazon Region is needed to better understand climate variability and forcings and their impacts on the biogeochemical and hydrologic functioning of Amazônia.

- In this study we utilized high temporal frequency measurements from the Moderate Resolution Imaging Spectroradiometer (MODIS) to analyze the seasonal dynamics of the tropical rainforest along an east to west transect along the Amazon River. We used 4 years of MODIS Enhanced Vegetation Index (EVI) data at 250m and 0.05° climate modeling grid (CMG) resolutions over specific natural and converted sites, as well as along transects, and finally the entire Basin.

- Our objective was to utilize MODIS data to measure the seasonal dynamics of the seasonally-dry and perhumid tropical rainforests and their conversions.

2. Study Area



- Our study sites included forest and converted areas associated with LBA studies and documented with IKONOS imagery



3. Results

- A 4 year time series of 250-m EVI values was extracted over each of these sites at 3x3 and 7x7 window sizes.

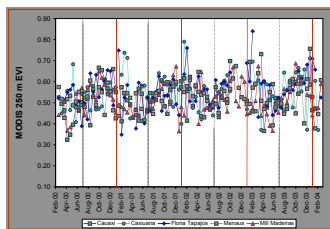
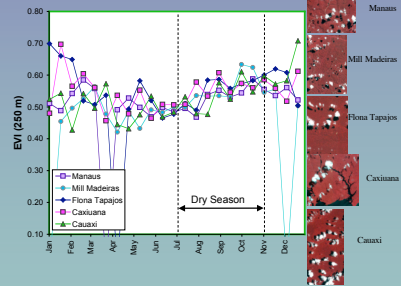


Figure. Example of 4 year, 250m time series of MODIS EVI for 5 forest sites along the Amazon Basin (data averaged to 7x7 pixels).

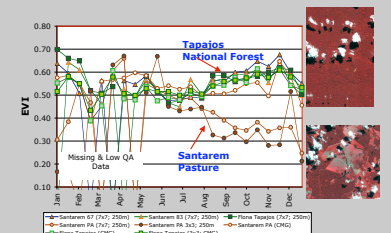
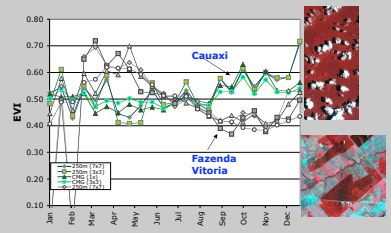
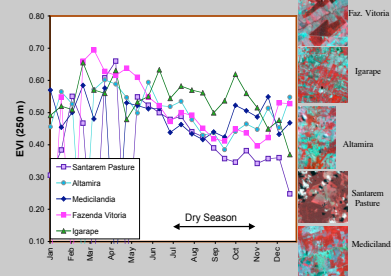
We averaged the 4 year time series into a single annual 'year' for detection of seasonality trends:



- Among the forested sites selected, a seasonal trend of increasing "greenness" was observed from July through November (the dry season). This may be attributed to the flush of new leaf growth following the onset of the dry season.

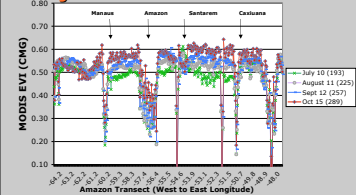
4. Comparison of natural with converted areas

In the 3 figures below, we compared the seasonal response profiles of the 'land conversion' sites with each other (top) and with their closest forested equivalent (middle, bottom). We used 250m and CMG data.

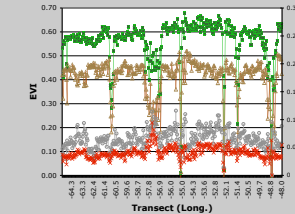


The land conversion sites had distinct seasonal profiles that followed the wet and dry seasons, i.e., in the dry season, the converted lands had lower biologic activity.

5. West - East Transect Analyses

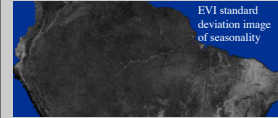
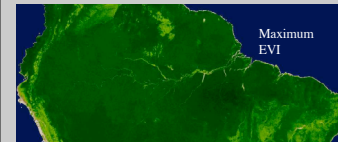


The MODIS EVI transect (CMG pixels) depicts lower biologic activity or "greenness" conditions in western Amazônia and the most seasonal variations near Santarem.



Transect statistics show maximum EVI values near Santarem as well as the highest contrasts (and variance).

6. CMG Image Analyses



4-year averaged image depictions of biologic activity and seasonality across the Amazon basin. Most variations and highest values are seen in the mid-eastern part of the Amazon.

Conclusions

- MODIS provides VI data of sufficient sensitivity for Amazon spatio-temporal studies in biologic activity which should improve integrative studies of Amazon water and carbon cycles in response to climate variability and anthropogenic forcings.
- The EVI does not saturate in high biomass areas allowing for land conversion and seasonality studies.

This work was supported by LBA Air-Eco grant, NCC-5603 and MODIS contract NASS-31364