

# Interannual variability of Soil moisture and Vegetation Biomass In Amazonian Cerrado

**M. Simard and S. Saatchi**

**MS 300-319**

**Jet Propulsion Laboratory**

**California Institute of Technology**

**Pasadena, CA 91109**

**Tel: (818) 354-6972**

**Fax: (818) 393-5184**

**E-mail: marc.simard@jpl.nasa.gov**

The Cerrado is the second most important biome in South America, which covers nearly 1.8M km<sup>2</sup> in Brazil and is a significant factor in the regional carbon cycle. According to most recent estimates, the total area and the rate of the clearing (mainly due to fire) in Cerrado region is higher than the central Amazonian rainforest. On a larger scale, Cerrado is also a dynamic system because of its seasonal changes in moisture and vegetation biomass and its sensitivity to climate variability and change. In this paper, we use a time series of coarse spatial resolution remote sensing data to examine the interannual variability of vegetation biomass and soil moisture over the Amazonian Cerrado. Space-borne scatterometer (ERS and Quikscat), and AVHRR NDVI (GAC) data over past 10 years (1992-2001) are used in a synergistic approach to separate the moisture and vegetation signal in the time series analysis. Scatterometer data is from an active microwave sensor with relatively coarse spatial resolution (25 km to 50 km) and high temporal resolution (daily). In its enhanced resolution mode, with 5 km resolution and 5-10 day composites, the data is compatible with the AVHRR NDVI global composites of 8 km resolution and 10-15 day composites. These two data sets are used to build a continuous time series data set for the past decade. By combining these data sets with existing precipitation data, and utilizing the sensitivity of each data set to biomass and moisture we decoupled the two effects. It is shown that, the scatterometer data is a useful instrument to monitor the rain events and moisture variability in Cerrado region. As the temporal dynamics of vegetation biomass in this region is strongly linked with seasonal water availability, the results of this analysis can provide the necessary long-term observation of carbon and water cycle within the Amazonian and LBA context.

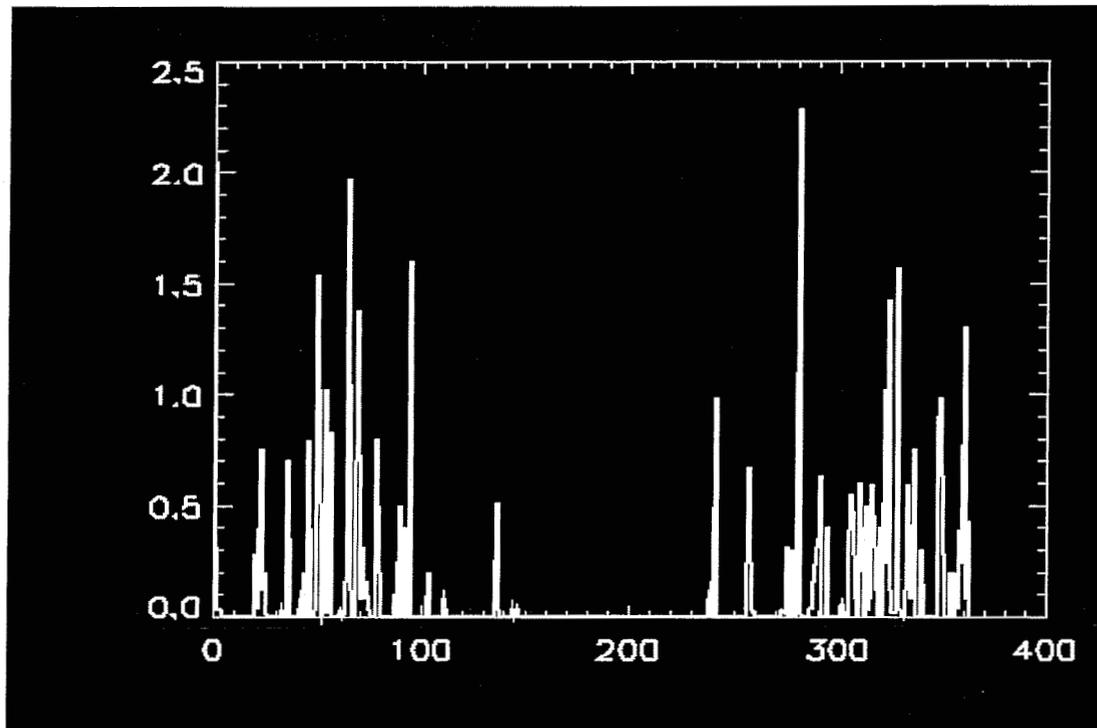


Figure 1. Precipitation profile obtained from station 833780 South of Brasilia ( $-15.86^{\circ}$ ,  $-47.93^{\circ}$ ) over year 2001. The Precipitation was acquired daily (Julian date) and measured in inches.

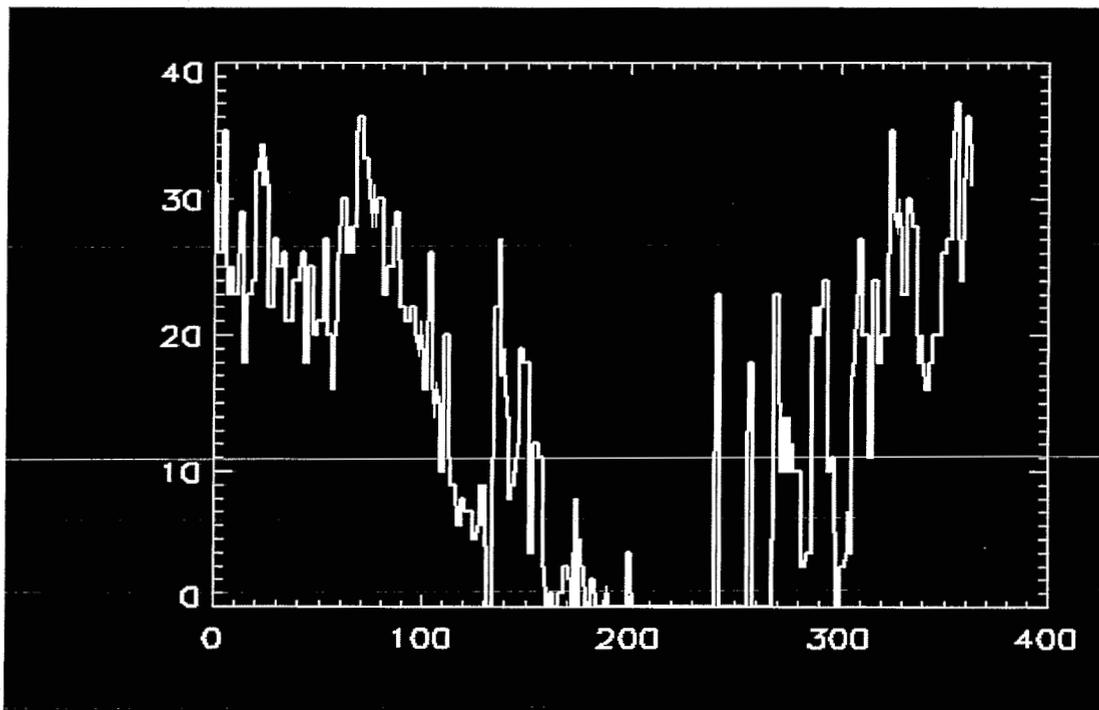
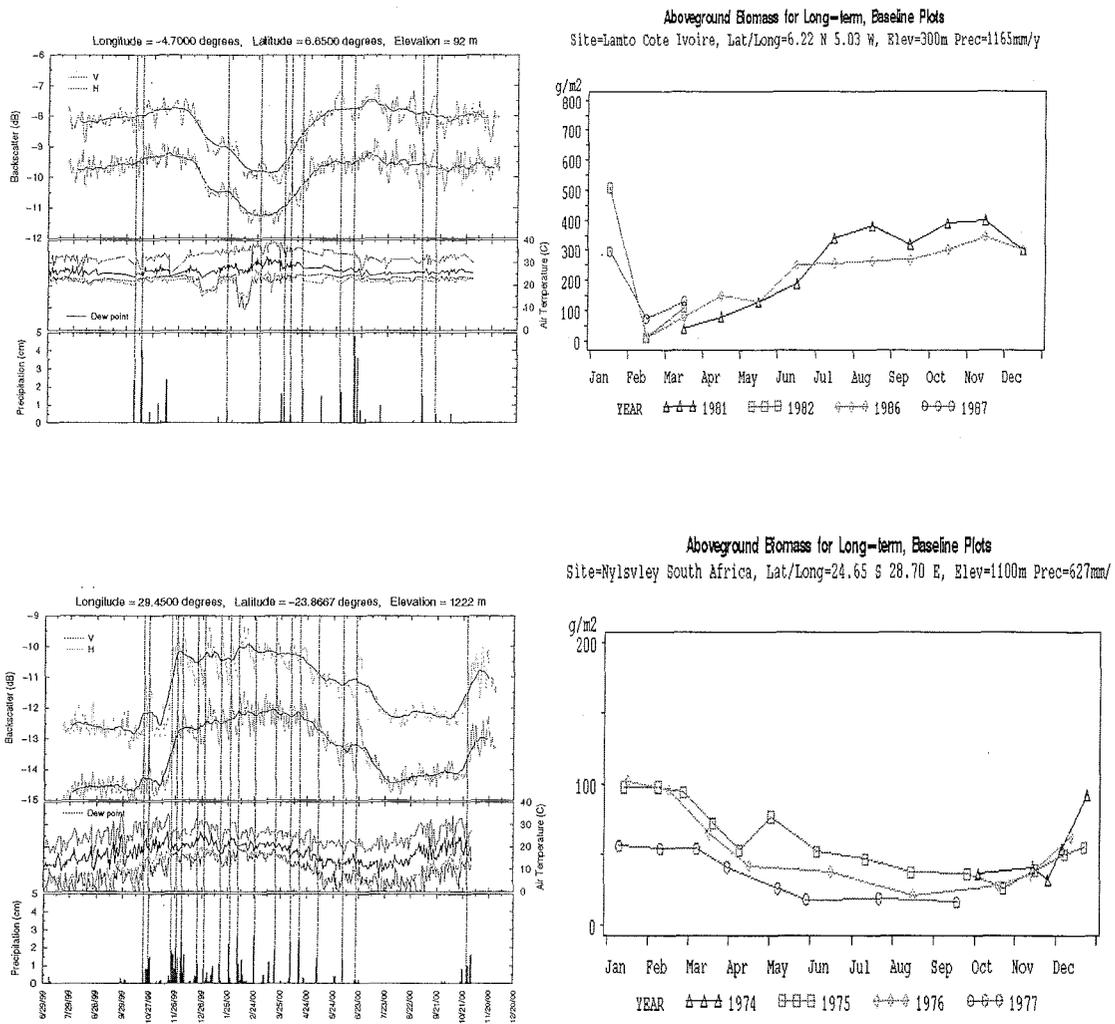
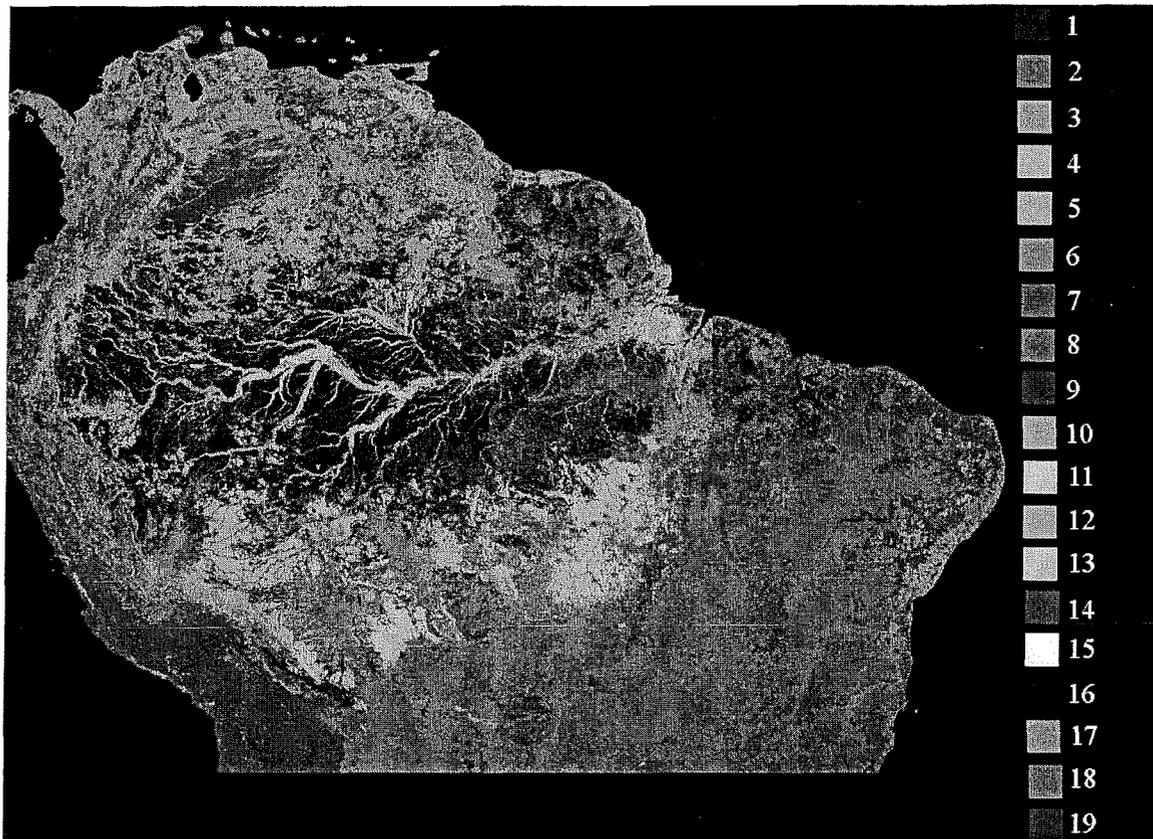


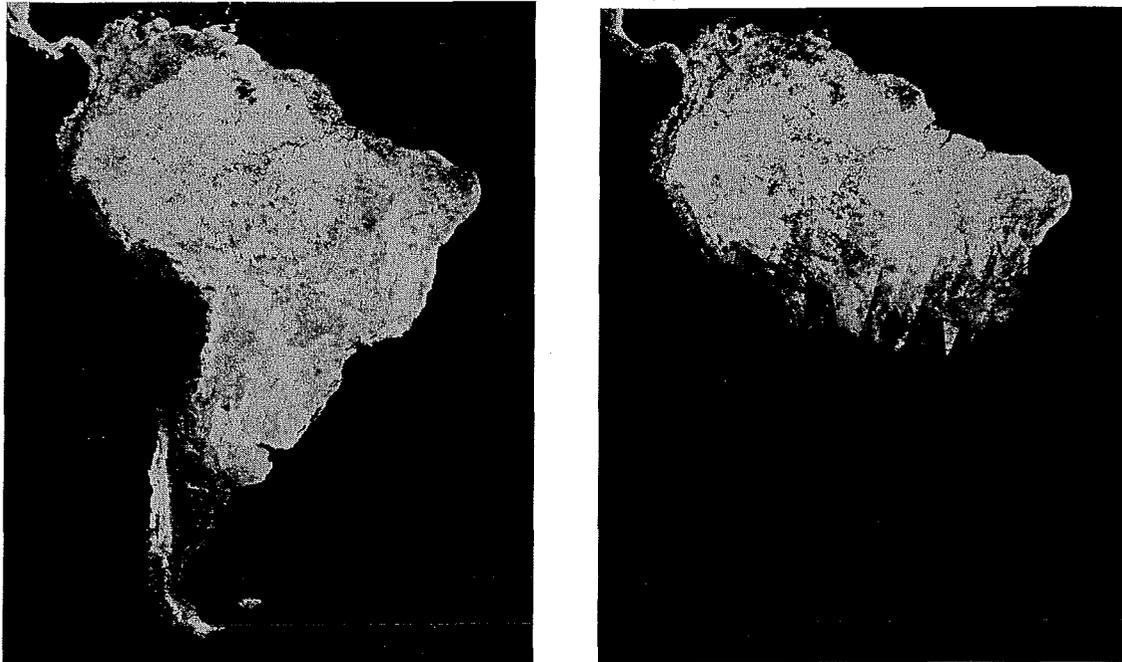
Figure 2. Relative Quikscat/Seawinds backscatter measurement around latitude  $-15.8^{\circ}$  and longitude  $-48.0^{\circ}$  over year 2001. Quikscat data is daily and clearly related to precipitation as seen by comparing with Figure 1.



**Figure 3:** Time-series backscatter, meteorology, and seasonal NPP dynamics for 2 areas of savannas. The Net Primary Productivity (NPP) data is from the website of the Oak Ridge National Laboratory (ORNL) Distributed Active Archive Center (ORNL DAAC) Database. For both regions, notice the correspondance of the inset of vegetation growth NPP, the precipitation and scatterometer backscatter.



**Figure 4:** Result of land cover classification over the Amazon basin including all periphery countries with tropical rainforests. The class types from 1 to 18 areas described in the text are given as: 1=dense evergreen forest, 2=open and mountain forest, 3= bamboo forest, 4=open liana forest, 5= transitional deciduous forest, 6=mixed forest (campinarana, mixed forest and woodlands), 7=dense woodland, 8=open woodland, 9=shrublands/park savanna, 10=grasslands, savanna, 11=dense inundated forest, 12=open inundated forest, 13=inundated savanna/herbaceous, 14=inundated canarana, 15=mangrove, 16=secondary forests, 17=nonforest, 18=subtropical grass and shrublands, 19: bare field (mixed class).



**Figure 5.** The monthly mean NDVI data products for the month of January and May 2001 respectively left to right. The difference between the two season is due to changes in vegetation greenness and coverage (LAI). The changes are more pronounced in the Cerrado large region around Brasilia.