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Reproducing Long-Term Vegetation Variability in Paraguay Using Remotely Sensed Data

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The advances in remote sensing techniques made it possible to count with more reliable observations for the proper representation of the current land surface. However, accurate past long-term data stills remains an issue and methods addressing this problem are required. Such is the case of the Advanced Very High Resolution Radiometer (AVHRR) NDVI dataset, which spans a period of 25 years (1981-2006), in which sampling error might have been introduced. This research aims to adjust AVHRR NDVI dataset in Paraguay to improve its accuracy when representing the surface conditions during periods in which higher resolution data are not available.

NDVI products used in this study consists of the GIMMS dataset, derived from the AVHRR with a spatial resolution of 8 km, and the Spot-Vegetation dataset, which has a spatial resolution of 1 km and is available from 1999 to present. In order to identify pixels, which could possibly contain forest information, 1km NDVI data was presorted based on vegetation phenology characteristics. Once these pixels were identified, the data was up-scaled to 8km and forest ratio was calculated. Pixels that were likely to contain forest ratio equal to 1 were further analyzed by using histograms and NDVI characteristics curves in order to identify better forest classification thresholds. Next, 1km NDVI data was reclassified with the new parameters and forest distribution and new forest ratio maps for 2000-2006 were generated. NDVI monthly averages at 8km from both datasets were then correlated for different forest ratios, using the least squares regression method, to identify possible bias and relationships between them, and finally AVHRR dataset was adjusted for 1981-1999.

The forest distribution map produced for the year 2000 has an overall accuracy of 0.957 when compared with the Paraguay Forest Change Product derived from Landsat imagery by the Global Land Cover Facility. NDVI correlations between the datasets tend to be higher as pixel heterogeneity decreases. A similar bias tendency can also be observed, in which the slopes of the regression line equations, for different ranges of forest ratios, decrease as the pixel heterogeneity does. Figure 1 shows the comparison between original AVHRR and fitted with Spot Vegetation data (black dots and red marks, respectively), for the year 2003. From this figure we can observe that, even though the correlation values are almost the same for both cases, the bias correction was improved since the regression line of Spot-Fitted NDVI is closer to the 1:1 line than that of Spot-AVHRR.

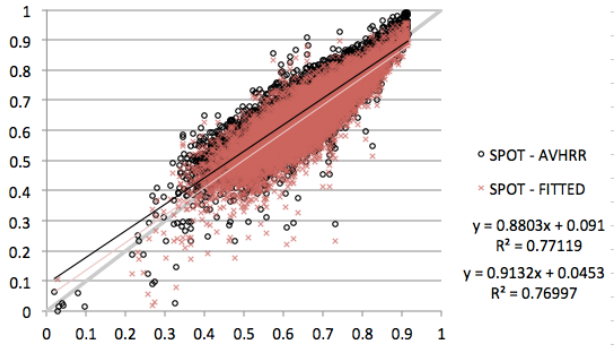

Figure 1. Correlations between Spot Vegetation and AVHRR, and Spot Vegetation and fitted NDVI data.