Remote Sensing for sampling station selection in the study of water circulation from river system to and Amazon floodplain lakes: a methodological proposal

Cláudio Barbosa, Evlyn Novo , Maycira Costa



Instituto Nacional de Pesquisas Espaciais Sao Jose dos Campos, SP, Brasil

ABSTRACT

Although remote sensing is a suitable tool for monitoring vast remote areas such as the Amazon floodplain, the accurate extraction of information must rely on ground validation sampling, through burdensome and expensive field campaigns.

This paper proposes a methodology for planning and optimizing the acquisition of water quality parameters during field campaigns aiming the study of water circulation between Amazon River and Amazon floodplains lakes and wetlands. The objective of the approach is to settle an optimized geographic position data set spatially representative of water quality parameters revealing water circulation patterns.

The first step in the study was to build a georeferenced image database consisting of seven dates of Landsat-TM/ETM+ images selected according to Amazon River water level. Each image date was then submitted to the following processing: 1) atmospheric correction 2) region growing segmentation, 3) unsupervised segmented-based classification.

Each resulting class for each date was then characterized by the statistical attributes estimated from bands TM1, TM2, TM3 and TM4 of Landsat Thematic Mapper, which are the bands sensitive to water optical properties. Changes in the spatial dynamic of each class from images acquired at different water level were then mapped and the number of sampling stations and the geographic position of each station were defined analyzing the results of the previous step.

METHODOLOGY DATA and RESULTS 2000-08-11 1999-07-16 2001-09-23 1999-10-28 2001-12-12 1999-06-22 LANDSAT historical data set 1999-07-16 ETM+ 2000-08-11 2001-09-23 TM 1999-10-28 ETM+ 1999-07-16 Path: 228 1999-10-28 2001-12-12 Row: 61 Open water mask ETM+ Bands 1..5 Landsat TM band 5 was segmented and classified into two classes: open water and non-open water. It allowed creating a mask to isolate the open water area from the remaining environment reducing the computation time in the following steps. Atmosphere correction (6S)** Band Band 3 Band 4 Band 2 Band 1 **second simulation of satellite **Open water surface** signal in the solar spectrum extraction The open water mask was applied to Landsat TM bands 1 to 4 to generate a spectral open water data set. (Geocoding) This procedure allowed enhancing Multi-Temporal Geocoded Image Database watercolor features related to different water optically active components. **Open water surface Open water mask** extraction (Band 5) 1999-07-14 Image Segmentation and unsupervised Classification Segmentation and Classification of each The open water spectral data set date image for each date was submitted to segmentation and unsupervised classification. This procedure allowed identifying optically distinct water masses. Statistical characterization 2000-08-11 of each Class Date 5 Date 6 Date 1 Date 2 Date 3 Date 4 Class (µ,s²) 2001-09-23 Class 2 **Clustering Analysis of Multi-temporal Classes** 1999-10-28 Optimized geographic position for sampling stations Results The number, shape and spectral Study site signature for each class at each date were submitted to statistical analyses in order to assess the 2001-12-12 main water components affecting changes in water color and to track the water masses across time.