REMOTE SENSING APPLIED TO THE MODELLING OF ANTHROPOGENIC IMPACTS ON WETLANDS AND AQUATIC SYSTEMS IN THE SOLIMÕES/AMAZON FLOODPLAIN

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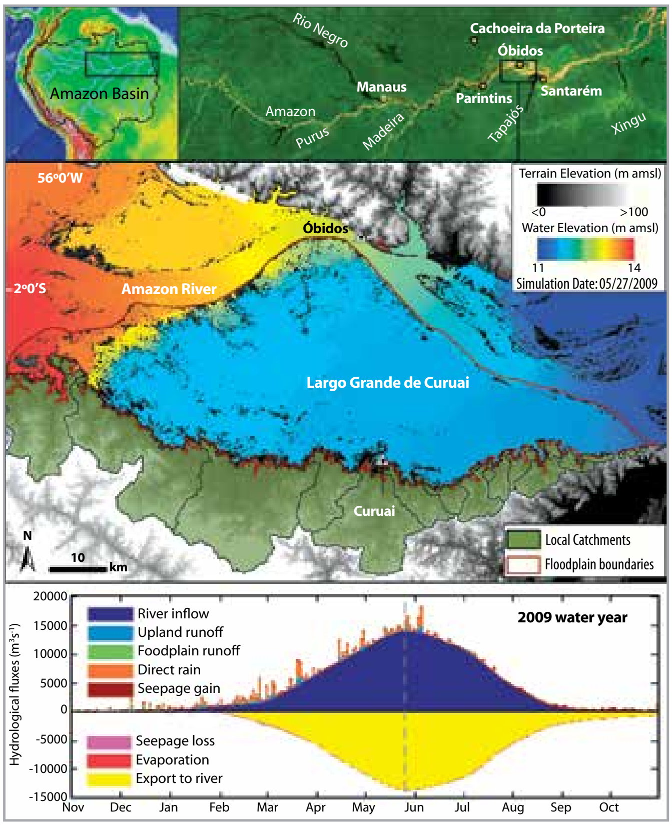

Figure 1. Location of the Amazon River mainstem floodplain within its basin (top right). Overview of the Amazon River in its lower reach (top left). Floodplain encompassing the Lago Grande de Curuai. LISFLOOD-FP simulation of water elevation during peak discharge of the extreme high flood year of 2009 (middle). Floodplain daily hydrological exchanges (bottom). Water balance components are stacked to allow interpretation of total fluxes. Courtesy Dr Conrado Rudorff

The Solimões-Amazon floodplain, locally known as "várzea", is a landscape characterized by natural extremes in water level along the hydrological year. This water level oscillation, in interaction with floodplain topography, shapes the floodplain biogeochemical cycles, imposes biota adaptations and economic and social activity of the human population. Floodplain lakes functioning and its response to anthropogenic impacts are poorly understood because there are only few lakes, which have been studied. Conservative estimates indicate the existence of over 10 thousand lakes larger than one hectare in the Solimões/Amazon varzea alone. From which, around one percent has been already studied. In the Mamirauá Sustainable Development Reserve (RDSM) for instance, in a single sector, there are more than 100 lakes with distinct origins, shapes and dimensions, which respond to extreme variability in water properties and in fish abundance. Further than this natural variability, those wetlands and associated aquatic systems are also subjected to direct and indirect anthropogenic impacts. Direct impacts are related to floodplain forest removal and cattle rising, which respond for more than 50 % of the deforestation of the lower Amazon River flooded forest. Indirect impacts are related to climate changes and the intensification of the hydrological cycle in the Amazon Basin, which are responsible for extreme events, such as the 2005 and 2009 floodplain draught and successive extreme floods in the last decade. Due to complex processes acting upon different space and time scales, the project faces the challenge of uncoupling the signs of human impact out of the natural variability at wider scales. In order to overcome those challenges, the project integrates remote sensing and *in situ* data collection to feed numerical modelling to provide key information on the inherent optical properties of floodplain aquatic systems; on the carbon, nutrient and sediment budgets; on changes in water velocity in response to deforestation; on varzea population wellbeing in response to direct and indirect anthropogenic impacts.

SUMMARY OF RESULTS TO DATE AND PERSPECTIVES

Optical characterization of Curuai Lake indicates that it represents a non-algal particle (NAP) dominated aquatic system during the falling limb of the hydrograph. The high NAP absorption dominates total absorption and single scattering albedo values indicating the dominance of scattering processes. However, the influence of the colored dissolved organic matter (CDOM) in the blue range and phytoplankton related to absorption peaks of Chl-a in 440 and 676 nm. Results also showed that additional efforts should be taken to improve the closure between *in situ* remote sensing reflectance (*In situ* Rrs) and numerically modelled remote sensing reflectance (mol Rrs) by improving the correction methods for the measurements of inherent optical properties. Underwater light environment is fundamental for the biological processes within the floodplain. In NAP dominated systems, light availability is reduced and may impair aquatic system primary productivity. Simulations of floodplain inundation using the LISFLOOD-FP model revealed that the dominant source of inflow to Curuai Lake alternates seasonally between direct rain and local runoff (November), Amazon R. (December through August), and seepage (September and October). The average annual inflow from the Amazon R. was 43.3 km^3 (ranging from 15.3 to 134.2 km^3), corresponding to 82% of inputs from all sources. Overbank flow represents 93 % of the total inflow to the floodplain from mid-rising water through mid-receding water (February to August) what indicates the importance of the flooded forest in controlling the velocity of the water flow into the floodplain and the flow capacity to transport sediments. The figure shows LISFLOOD-FP simulation of water elevation during peak discharge of 2009 and floodplain daily hydrological exchanges. Water balance components are stacked to allow interpretation of total fluxes.

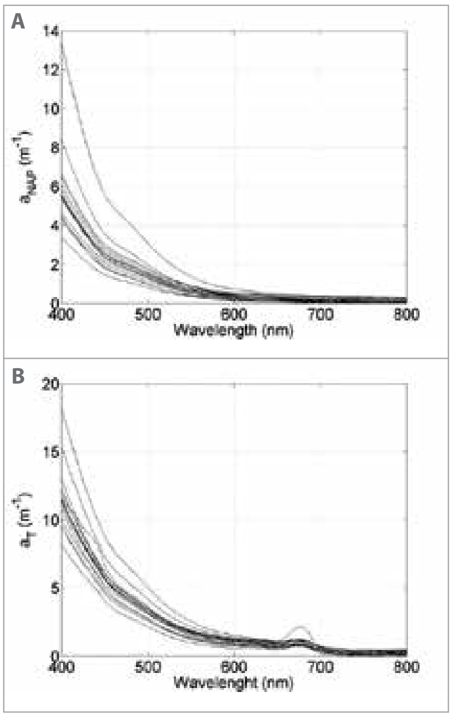

Figure 2. A: NAP Absorption Coefficient. B: Total Absorption Coefficient. Courtesy : Lino Augusto S. Carvalho

MAIN PUBLICATIONS

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