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EVOLUTION OF THE LAKES NETWORK OF CURUAI FLOODPLAIN BY CLASSIFICATION OF RADAR ALTIMETRY ECHOES

*Pauline Enguehard*¹; *Frédéric Frappart*²; *Thibault Catry*¹; *Fabien Blarel*²; *Loïc Marie-Louise*¹;
*Pierre Audisio*¹ & *Marie-Paule Bonnet*¹

Keywords – Radar altimetry, Amazon, Floodplains.

INTRODUCTION

In the coming years, Amazonian floodplains will be increasingly threatened by agricultural expansion and climate change. Their disappearance has a direct impact on the environment. In this regard, remote sensing techniques offer a unique opportunity to monitor the hydrology of watersheds in areas difficult to access. Radar altimeters provides information on surface water heights and radar backscattering overcoming the meteorological conditions (Hess *et al.*, 2003). However, it is still difficult to make a clear separation between the open water of rivers and lakes and the vegetated water in the surrounding floodplains. We developed the methodology upon the large floodplain of Curuaí (4,000 km² in Óbidos, Pará, Brazil), for which the altimetry data has been used successfully (Bonnet *et al.* 2008), then, we aim to transfer it to the Juruá basin, a more complex area with a denser vegetation cover (224,000 km², starts in the Ucayali region of Peru and ends in the Solimões River). The objective of this study is to identify the characteristic differences between altimetry echoes parameters to classify them and distinguish the different hydrological regimes along the tracks to finally automatically generate radar altimetry-based on water levels.

METODOLOGY

Radar altimetry data were acquired by ENVISAT and SARAL on their nominal orbits from 05/2002 to 10/2010 by the advanced radar altimeter RA-2 for ENVISAT and from 02/2013 to 07/2016 by the radar altimeter AltiKa for SARAL. Backscattering and range are available at <http://ctoh.legos.obs-mip.fr>. Time-series of the following altimetry-derived parameters were generated over different land types (e.g. rivers, floodplains and forests) using the Altimetry Time Series (AlTiS) software (Frappart *et al.*, 2021): radar altimetry backscattering, peakiness and altimetry heights. The median of the altimeter heights over the different zones was computed to build time-series of altimeter heights.

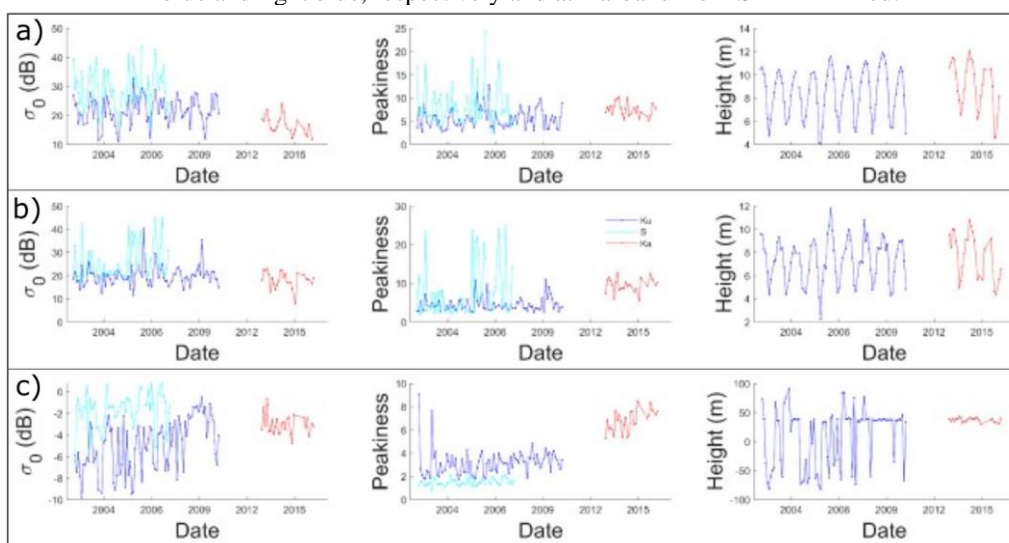
RESULTS

The time series of the different parameters are presented in Figure 1 for examples taken over Curuai varzea study site. Over the river and the floodplain (Figures 1a and 1b, respectively), large variations of the backscattering coefficients and peakiness occur along the hydrological cycle, well-synchronized with the temporal variations of the water level over the Amazon River and the Curuai floodplain. These temporal variations are related to changes in river width and floodplain extent (caused by the increase in water levels) in the altimeter footprint. Over the forest site, lower variations of backscattering, peakiness and height, not related to the changes caused by the hydrological cycle are observed (Figure 1c). These changes can be mostly attributed to orbital drifts and to changes in local roughness as the wavelength of the electromagnetic waves at S-, Ku-, and Ka-bands is lower than 0.1 m. These very different temporal behaviours, observed over open water and forest areas, are likely to be very useful to discriminate between radar altimetry echoes acquired over land and water applying statistical analysis, such as classification approaches, to these parameters.

1) ESPACE-DEV, IRD, Univ Montpellier, Univ Antilles, Univ Guyane, Univ Réunion, Montpellier, France

2) LEGOS, CNRS/CNES/IRD/UPS, 31400 Toulouse, France

Figure 1 – Time-series of backscattering, peakiness and height over a) the Amazon River in the north of Curuaí varzea, b) in the Lago Grande do Curuaí, and c) in a forest in the south the Curuaí varzea, at Ku- and S-bands from ENVISAT, in blue and light blue, respectively and at Ka-band from SARAL in red.



CONCLUSION

In conclusion, a preliminary analysis of parameters derived from the radar altimetry echoes exhibits different temporal patterns over inland water and vegetation in the varzea of Curuaí in the different frequency bands considered here. These characteristics will be used to identify water using a classification approach along the altimetry ground-tracks. Over the portions of radar altimetry ground-tracks identified as water (rivers or floodplains), time-series will be automatically generated considering the median of the height for each cycle. This technique will be applied over the Curuaí varzea and the Juruá floodplains to improve their hydrological monitoring.

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