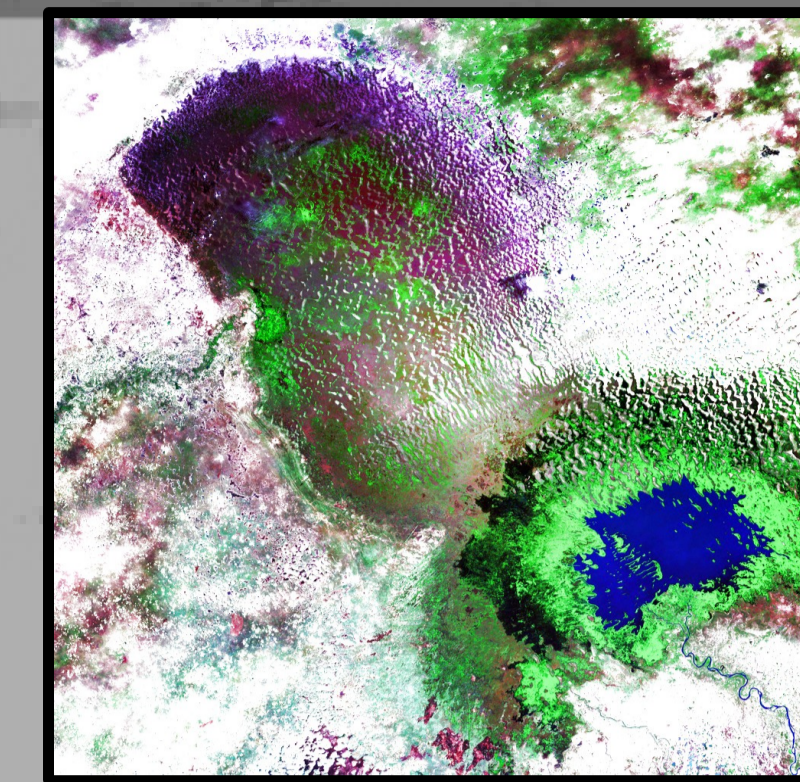


Estimation of water covered surfaces by inversion of High resolution waveforms

Tournadre J. IFREMER, FRANCE, Laboratoire d'Océanographie Spatiale, Plouzané France

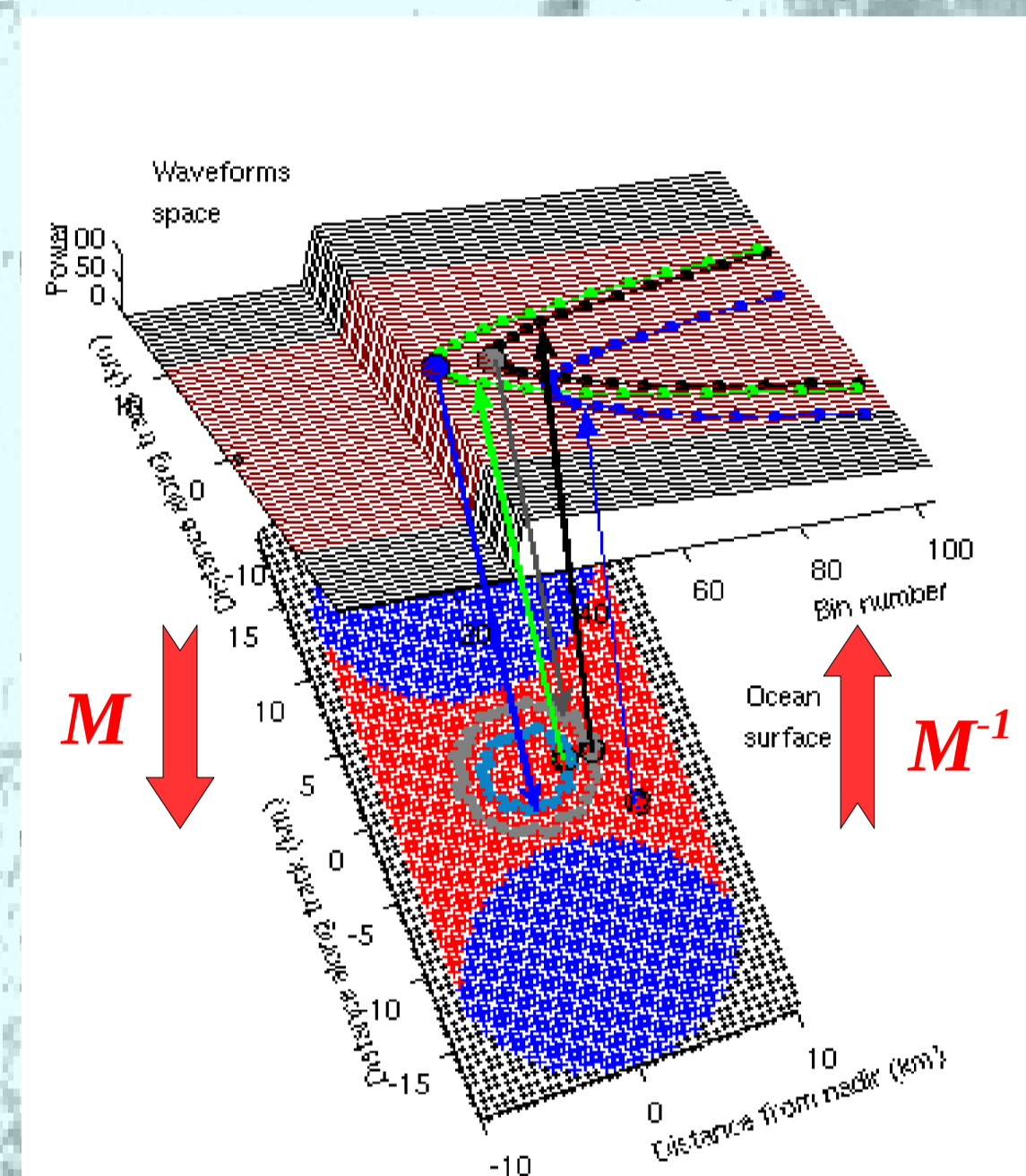
We present a new method of analysis of altimeter data for inland water. It is based on the inversion of altimeter waveforms in terms of surface backscatter at high resolution (~300m). The 2 Jason-2 orbits that overfly Lake Chad are analyzed for cycles 1 to 77. Pass 109 mainly samples the northern portion of the lake as well as the inundated marshes whilst pass 248 overflies the core of the lake. This region is characterized by the presence of numerous islands and vegetated area that can make the estimate of the lake elevation difficult. The high resolution waveforms provide a detailed view of the surface (at Ku and C bands) complementary to the one provided by passive sensor and can be of help to better interpret the altimeter waveforms in terms of elevation as well as the extension of the open water and the marshes.



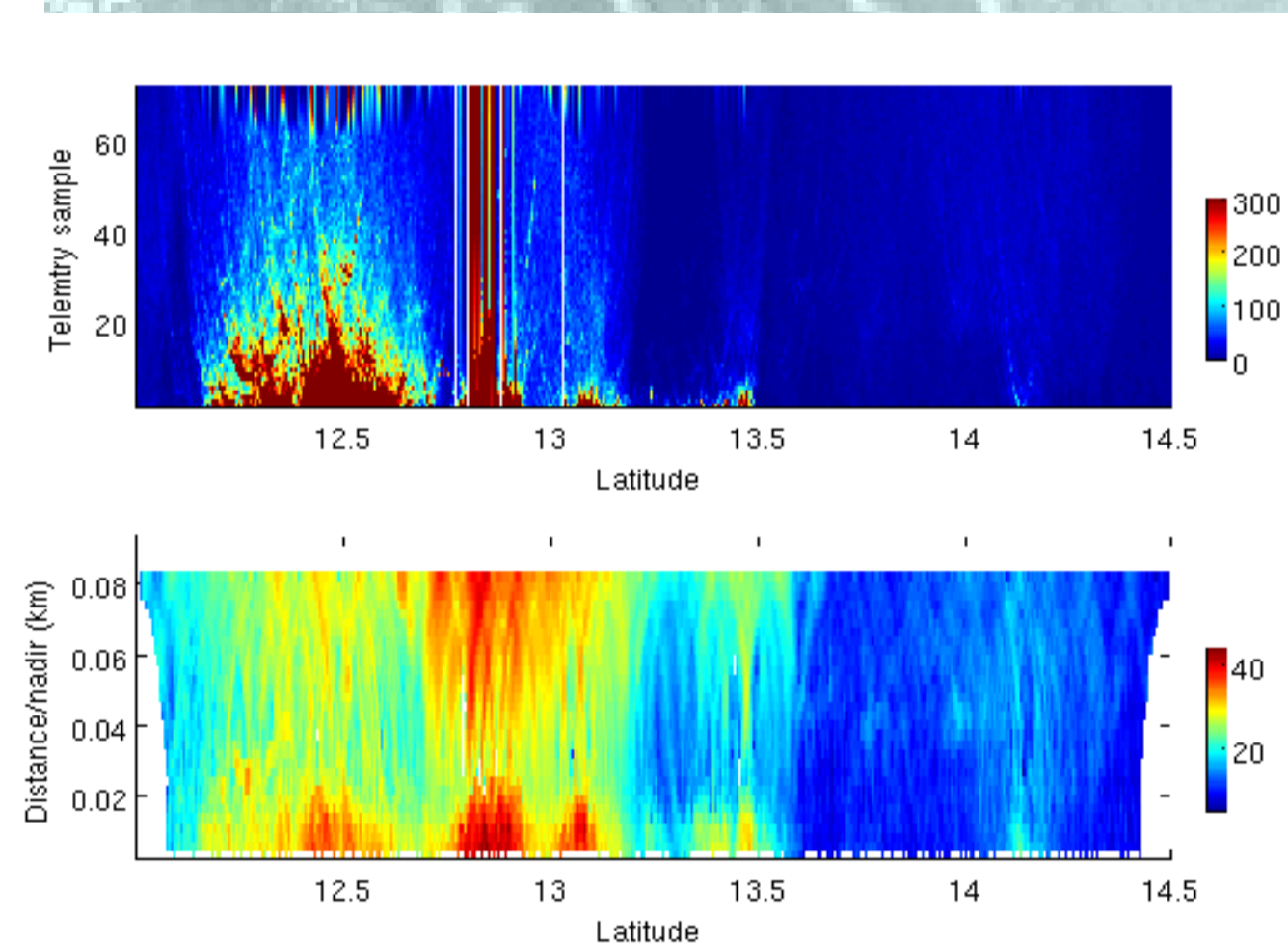
Inversion Method of the high rate altimeter waveforms

(See also the OSTST presentation)

Basic principle: Altimeter is also an imager of the surface backscatter with circular and annular pixel

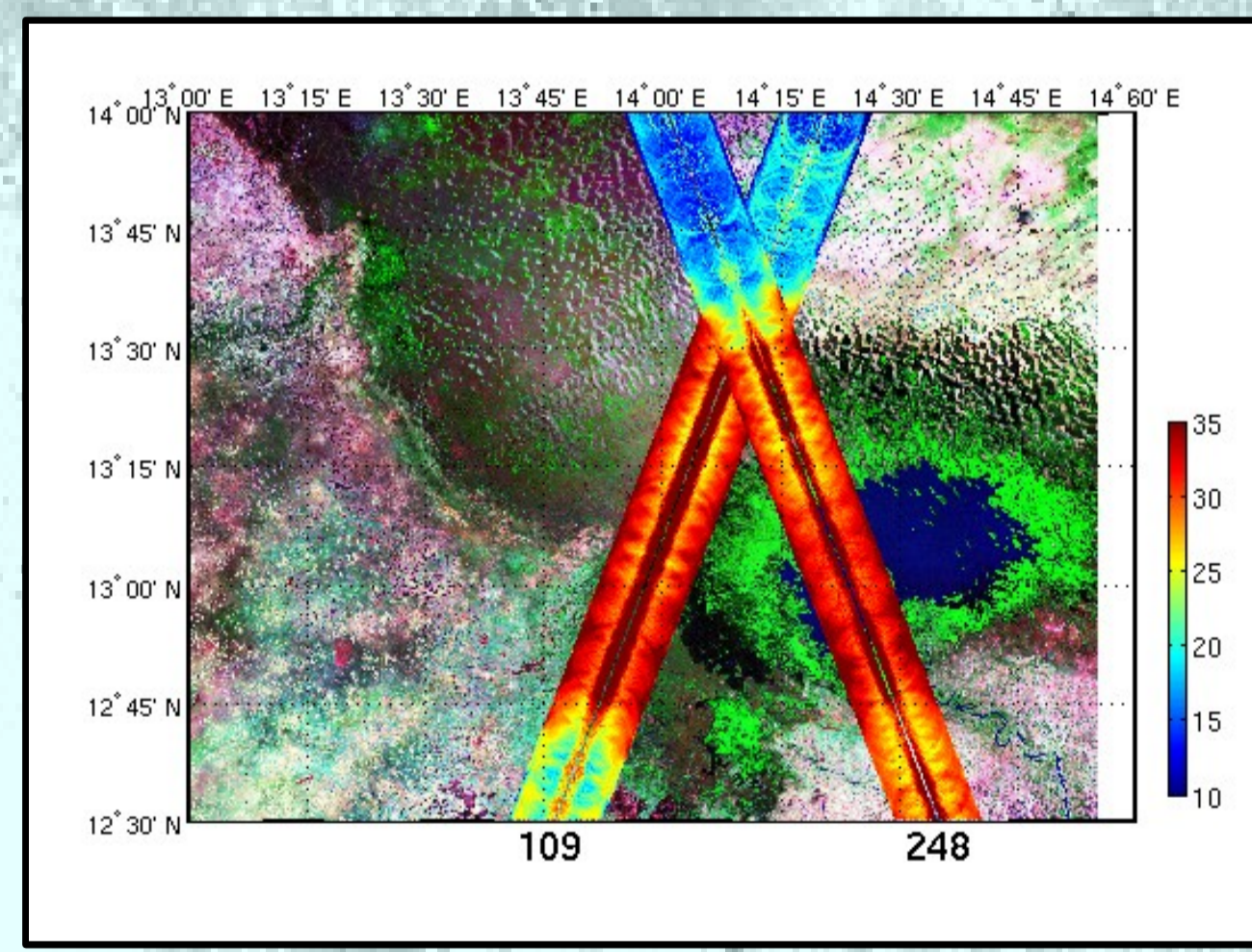


Imaging matrix M depends only on orbit and sensors characteristics. Inversion for a group of waveforms (in red on the figure) corresponding to the blue points of the surface. Only the red points which contribute only to the red waveforms are considered. Inversion using pseudo inverse of M for a group of waveforms

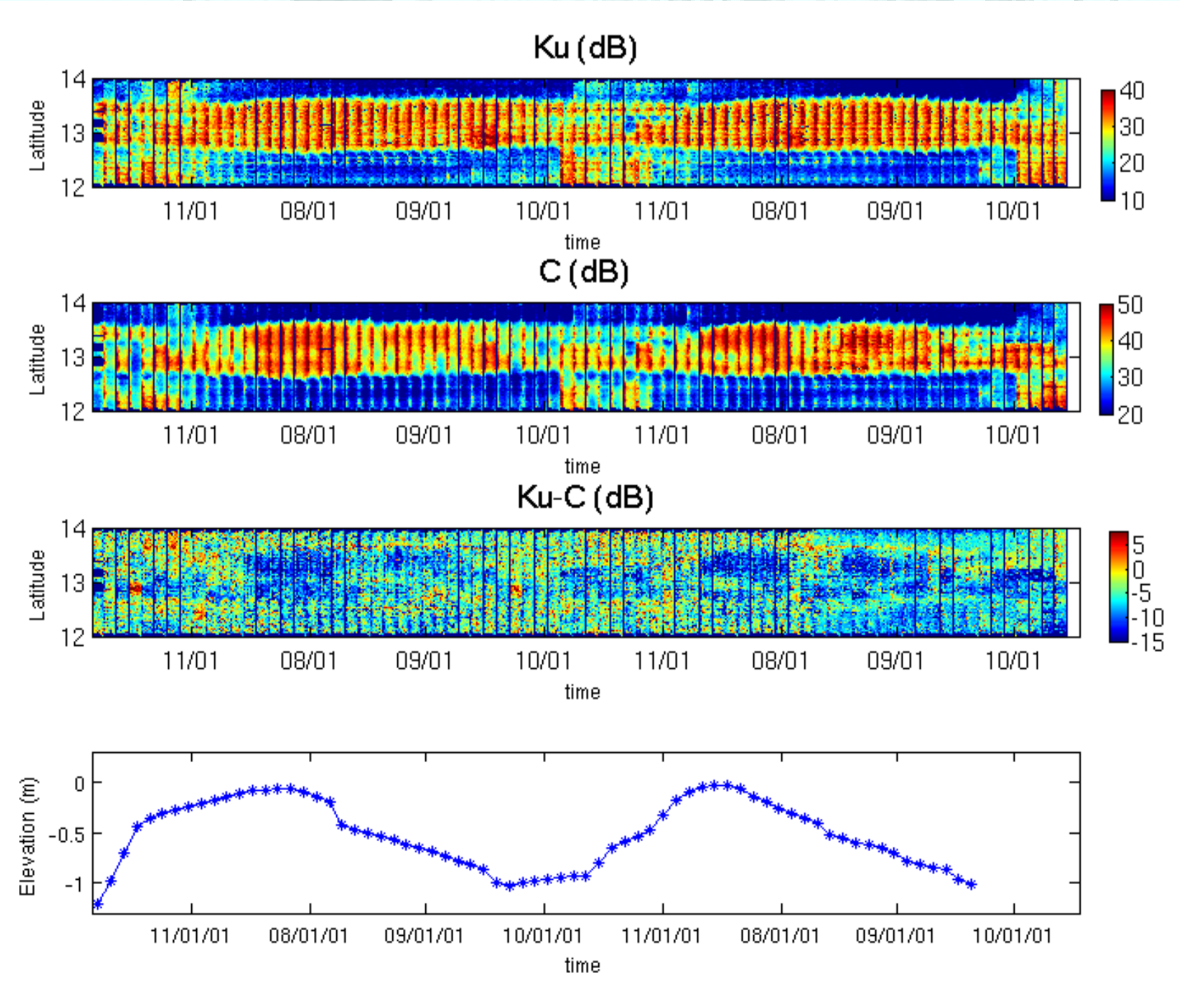


Exemple of inversion of Jason2 altimeter waevfroms over Lake Chad. Pass 248 cycle 70

Analysis of the Ku and C band HR backscatter



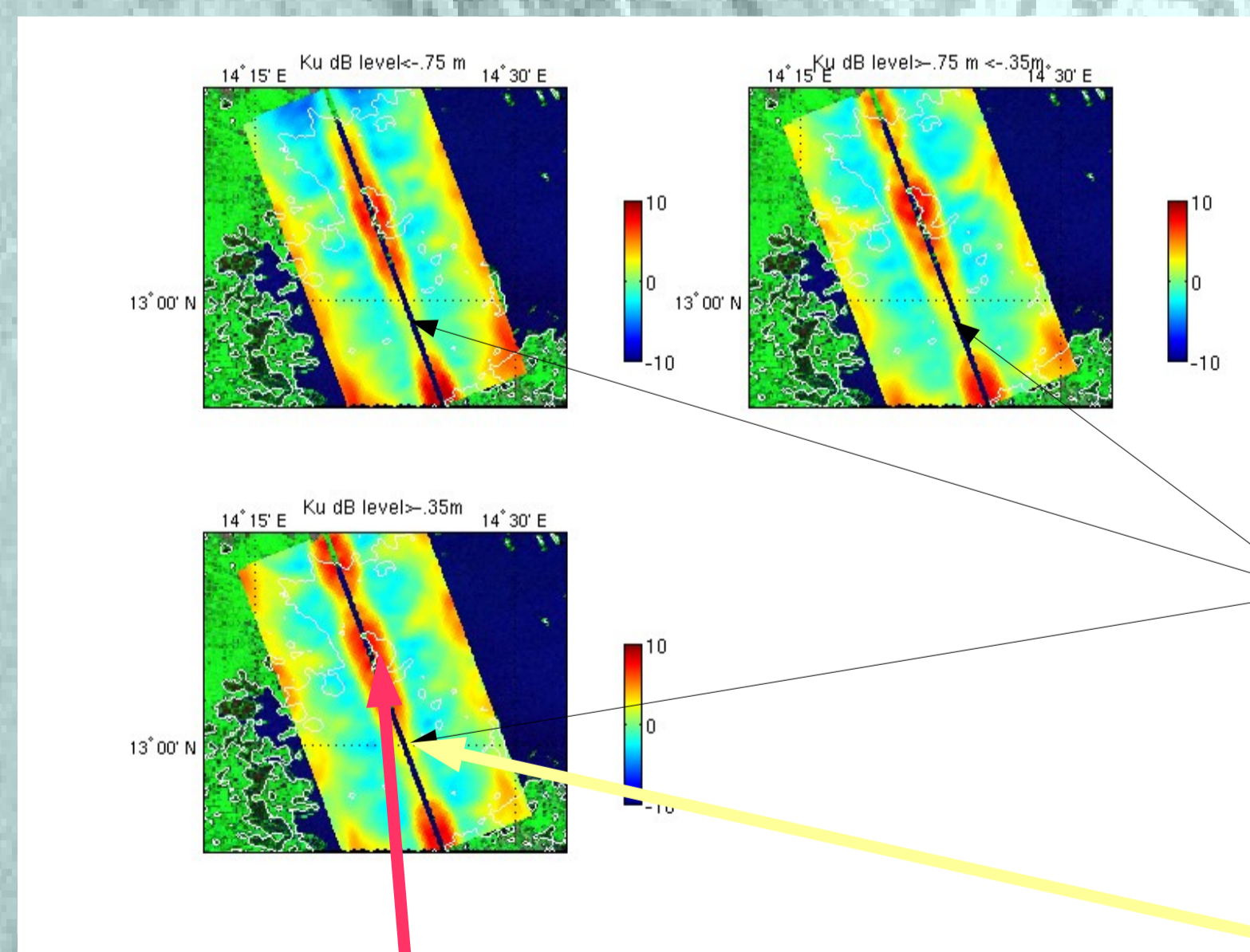
Mean Ku backscatter for the 2 passes and the 77 cycles showing the water covered surface (pass 248 and the swamp (inundated) area. Note the very agreement between the region of high backscatter and the extension of the wet area.



Temporal variation of backscatter for pass 109 showing the change of surface backscatter at Ku and C band over pass 109. Note the extension of water over the north basin during the wet season with an increase of backscatter at both band and the inversion of the difference between C and Ku.

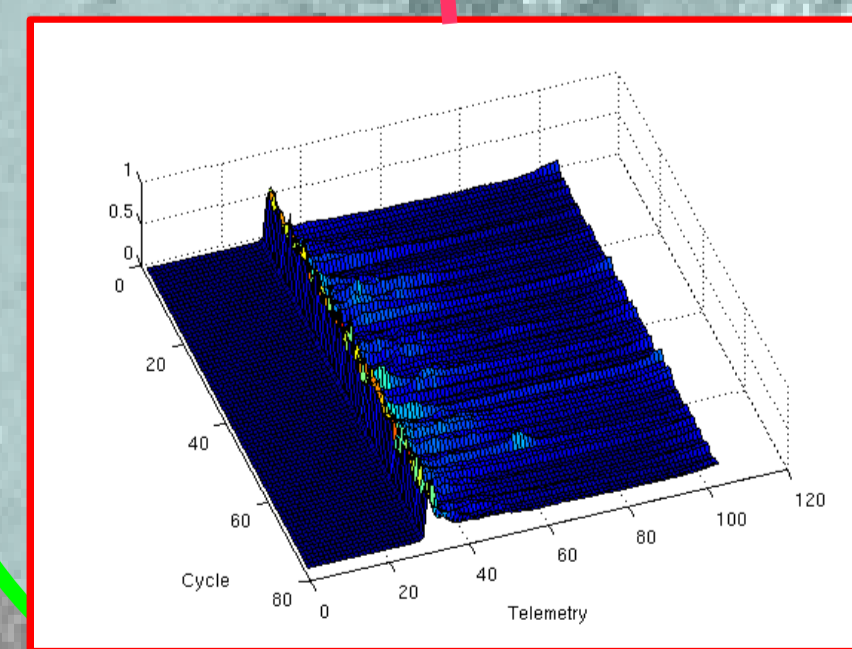
Elevation data from the analysis of Jason altimeter data from <http://www.pecad.fas.usda.gov/lakes/>

Selection of waveform for the best determination of elevation

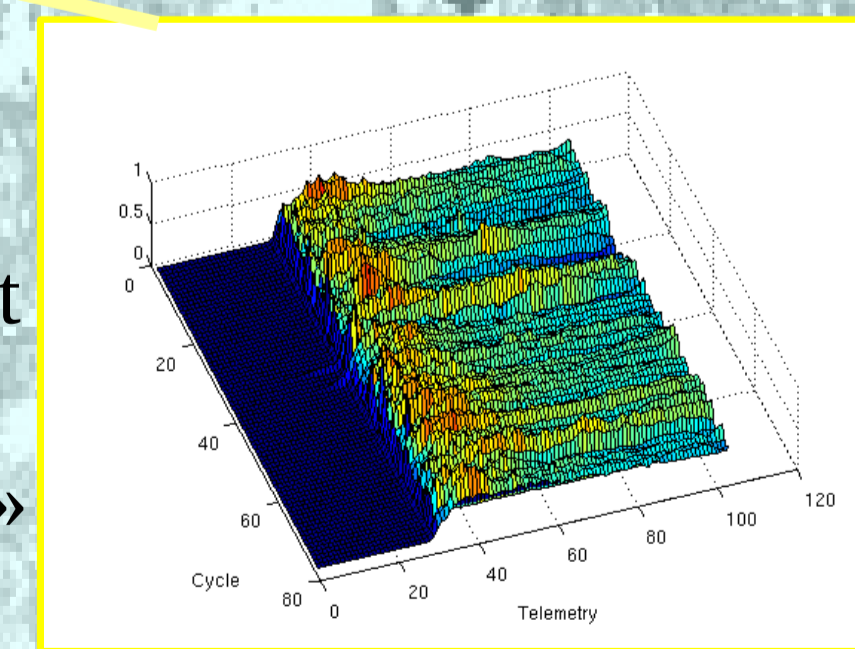


Detail over the southern basin showing the impact of small island (or vegetated portions of the lake)

The section between 12°57' and 13°00' is the least affected by island or land



Waveform at 12.97° and 13.1° for the 77 Jason 2 cycles showing the impact of the small island. From highly specular to 'ocean' like shape



CONCLUSION & PERSPECTIVE
This analysis of the high resolution surface backscatter at Ku and C band over lakes aims at demonstrating the potential of high resolution altimetry for continental hydrology