AN APPRAISAL OF MORPHOLOGY CHANGE IN LAKE TUNI

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1. INTRODUCTION

Lakes are precious resources that provide benefits to their nearby habitants, their capacity to store water, sooner or later may be reduced by sedimentation. There are a variety of investigate strategies for understanding and evaluating this phenomena, regarding morphology change in a lake for instance, in Lake Ontario (Pinet & McClennen 1998), in Lake Biwa (Tsuchiya et al. 1984), in Lake Kasumigaura (Uda et al. 1998), in Lake Hawea (Kirk et al. 2000), in Lake Inawashiro (Fujita & Tanaka 2002) giving new insights into understanding basic process of sand movement and erosion in lakes.

In the present study has been analyzed the morphology change around of Tuni River mouth and a nameless river mouth.

2. STUDY AREA AND DATA COLLECTION

The study area, Lake Tuni (located in La Paz, Bolivia) provides important water resources to two major cities of Bolivia (La Paz and El Alto). Furthermore global climate change will accelerate glacier retreat and it may result in accelerate sediment deposit reducing the capacity of the lake.

In Lake Tuni were found two sand terrace placed in front of two rivers, one of them is called Tuni River and the other one a nameless river. Tuni River originates in Tuni Glacier, it flows for 5.46 Km before draining into Lake Tuni, and it has a contributing catchment area of 9.98 Km2. On the other hand a nameless river flows for 0.94 Km before draining into Lake Tuni, and it has a contributing catchment area of 0.65 Km2. Figure 1 is an outline of Lake Tuni, and shows the target area around the mouth of Tuni River and a nameless river.

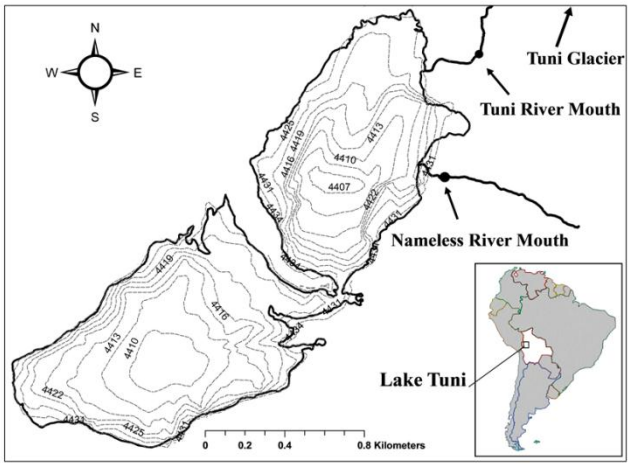

Figure 1. Location of Tuni River mouth and a nameless river mouth in Lake Tuni

For the analysis of morphology change, data of wind direction and velocity (from June 2011 to May 2012), bathymetric measurements performed in 2000 and water level data (from 2000 to 2012) of the lake were provided by EPSAS (Social public enterprise of water and sanitation in La Paz). Despite the lack of topographical data, Geo-Eye satellite images were used for the periods: November 2005, August 2009, May 2011 and September 2012.

3. METHODOLOGY ANALYSIS

Fujita & Tanaka (2002), showed through analysis of topographical maps and aerial photographs (different periods)around the mouth of Nagase River a multiple sandspit development (morphology changes), establishing that the waves attack the shore with a large incident angle because of west-northwest winds that prevail during winter, concluding the wind impact as the main erosive factor. Following this methodology analysis it was performed the appraisal in Lake Tuni.

4. RESULTS

Taking into account in the analysis that in Bolivia the raining season extends from January to March, while dry season extends from June to August. Water elevation in Lake Tuni through a year is depicted in Figure 2, where is clearly appreciated the water level variations due to the season.

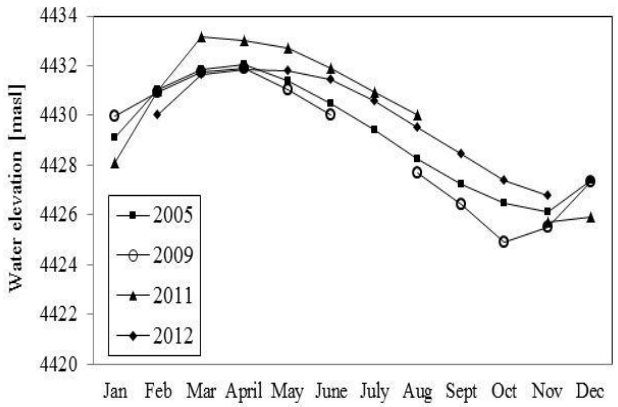

Figure 2. Temporal variation of water elevation on Lake Tuni from (2005,2009, 2011 and 2012)

It was made a comparison between morphology changes around Tuni River mouth and a nameless river mouth through overlapping satellite images respectively for each case as it can be seen in Figures 3-4.

Around Tuni River mouth (Figure 3), it can be seen differences on the morphologies between May 2011 and September 2012 with November 2005 and August 2009, but it can be explained that it is because the images were not taken in the same season, nor with the same water level. Therefore it can be assumed that in Tuni River there is not remarkable erosive process.

In Figure 4 it was analyzed around the nameless river

mouth. In this case the influence of water level does not play an important role because it is clearly represented in the graph that there is no remarkable morphology change. Also for this case can be assumed that the erosive process is not significant.

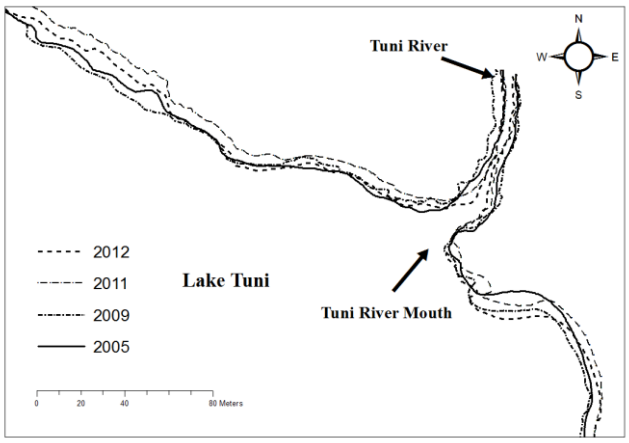

Figure 3. Morphology change process around Tuni River mouth

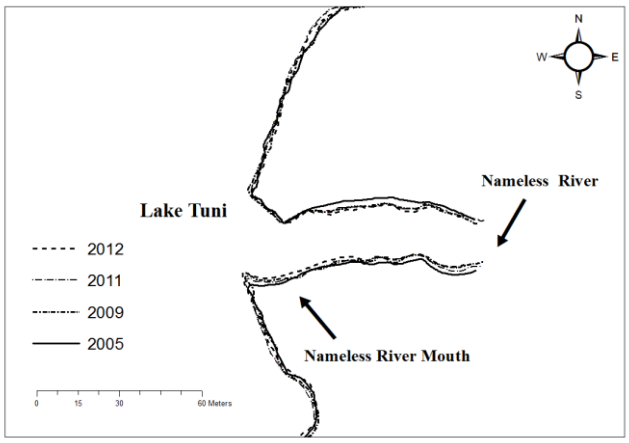

Figure 4. Morphology change process around a nameless river mouth

Examining the correspondence of wind direction, wind velocity and sand movement it was found that, due to wind direction prevails in north-north-east direction (Figure 5), the fetch length cannot have a remarkable erosive action around the mouth of both rivers.

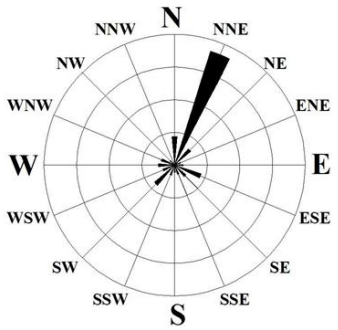

Figure 5. Measurement of wind direction

Furthermore 0.9 % of the data analyzed for north-north-east direction is bigger than 10 m/s and 2.3% of the velocity analyzed for the whole data is bigger than 10 m/s, it was conclude that the rate of velocity is low.

Despite the analysis made in Lake Tuni have not counted with older periods as it was made in Lake Inawashiro, this appraisal bring and important perspective of the grade of erosive phenomena which is acting around the mouth of both rivers.

5. CONCLUSIONS

Despite the lack of meteorological data and based on satellite overlap graphs it can be said that neither Tuni River mouth nor the nameless river mouth develop significant morphology changes.

Fujita & Tanaka (2002) found the wind impact as a remarkable erosive factor on morphology change process, but in Lake Tuni, it has a low impact, consequence of a low wind velocity; in addition, the relationship between wind direction and fetch length does not contribute to the erosive phenomena.

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