



## **Morphometry and spatial distribution of lakes in the Lena Delta, NE Siberia (Remote Sensing and GIS analyses)**

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The Lena Delta in the Laptev Sea is the largest delta in the Arctic (about 29.000 km<sup>2</sup>) and an important land-ocean interface in northern Siberia. It is situated in the zone of continuous permafrost, but is also characterized by widespread thermokarst. Geomorphologically, three main terraces can be distinguished. The first main terrace, including the lower and upper floodplains and the first terrace above the floodplain represents the modern active delta. The second terrace (Late Pleistocene to Early Holocene) is of fluvial genesis, but poorly influenced by fluvial processes nowadays. Relics of a Late Pleistocene accumulation plain form the third terrace.

The Lena Delta is characterized by numerous lakes, which are important geomorphological and ecological features. Obviously, the lakes are of different genesis, e. g. thermokarst or abandoned channel lakes. Parts of the delta are dominated by oriented lakes, i. e. elongated lakes with a common, preferred long-axis orientation. Until now, only very general descriptions of the Lena Delta lakes had been available. Thus, one of the main intention of our work was to develop a detailed lake inventory and to conduct morphometric and statistical analyses on the resulting spatial dataset.

Our lake dataset consisting of more than 2600 lakes with an area of >200.000 m<sup>2</sup> was extracted from a Landsat-7 ETM+ image mosaic. Further spatial analysis was performed in vector format in a Geoinformation System (GIS). Several morphometric variables and indices including the main axis orientation of the lakes were determined. All parameters were statistically analyzed regarding their association with the geomorphological main units of the Delta. The results show significant differences in the occurrence of lake characteristics between the delta terraces. For each terrace, a

mean lake type could be distinguished, reflecting the special lithological and cryolithological conditions and geomorphological processes dominating there. Small lakes of irregular shape with strong deviations from mean orientation prevail on the first terrace. Those characteristics are typical for lakes in active floodplains like oxbow lakes and meander scrolls. On the second terrace the mean lake type is represented by large, elongated lakes with a common NNE orientation of their major axes. Lakes on the third terrace show typical features for thermokarst lakes in ice-rich permafrost, i. e. regular shorelines and little variation from circularity.

One main focus of our investigation was laid on lake orientation of the lakes on the second terrace. The phenomenon of oriented lakes, described for arctic coastal plains in Alaska, Canada and Siberia, has not been fully explained yet despite intense research during the past decades. Different theories on the cause of orientation have been proposed in the literature. The validity of these theories is discussed for the Lena Delta in the light of our results from morphometric analysis of the Lena Delta lakes and additional cryolithological data. One of our main conclusions is that wind driven circulation models favoured by many authors for north American oriented lakes cannot be applied to the oriented lakes of the Lena Delta.