Remote Sensing Study of the Volga Delta

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Before influx to the Caspian Sea, Volga divides to hundreds of branches of different scales, forming a great amount of islands and permanent or temporary lakes. It is the Volga Delta with area about 15,000 km2. Considerable part of the Delta can be covered temporarily by river water during spring-flood or for a long time by the Caspian Sea water during high Sea level stages.Main part of the Volga runoff losses (in average about 10 km³/year) takes place in the Delta. These losses depend on the proportion of land and water areas, depending in its turn on the Caspian Sea level and on the Volga river flow phase. Irrigation causes considerable anthropogenic runoff losses in the Delta.Remote sensing study of the Volga Delta was carried out to define the following: The Sea border of the Delta and its dynamics depending on the Sea level; Water surface area dynamics in the Delta depending on the Volga hydrological phase and the spring flood volume; The inter-year and long-term landuse dynamics in the Delta.13 digital satellite images of the Delta from 1970s - 1990s were used for realization of the study: 3 Landsat-MSS (USA, 4 spectral bands), 4 Landsat-TM (USA, 7 bands) and 6 Resource-01 (Russia, 2-4 bands), chosen on a principle of covering both various Volga flow phases and all am-plitude of the Sea level, which rose during this period by 2.5 m.Classification of the images was carried out by means of the ILWIS software, using both original spectral bands and calculated artificial bands, such as NDVI, etc. From 4 to 5 bands with the least correlation were used for classification of each image.Analysis of classification results has shown that water surface in the Delta during low-flow period occupies 5-7% of the area, sharply growing (to 50%) during the spring high water.Area of half-submerged reeds, located along the Sea coast, reduced from 34% in 1970s to 20-24% in 1980s, and by 1995 significant part of them could be flooded by the Volga high water at a maximum level of the Sea. Agricultural fields during active vegetation occupy 20-25% of the Delta area; however dur-ing high spring water they can be partially flooded. Forests and bushes occupy not more than 5-6% of the area. Other territory of the Delta, occupied mainly by grasslands, changes its area in a wide range depending on a degree of flooding by the high water.Dependency of the Delta water surface area on the Volga water level at Astrakhan was de-termined, and water surface area long-term dynamics was calculated. These data, as well as the data on landuse dynamics were used to determine long-term series of runoff losses in the Volga Delta.