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High-resolution retrospective analysis of storm surges in the North Caspian Sea based on numerical simulations

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Russian coast of the Caspian Sea can be divided into three areas with different magnitude of surge inundations: 1) the modern delta and delta of Volga river with small amplitudes (surge height 0.15-0.4 m); 2) the territory of Dagestan from the Agrakhan Peninsula to the Samur delta, which is subject to surge up to 1.5 m, but with a narrow flooding zone of 0.5 to 1.5 km; 3) coast from Volga delta to Kizlyar Bay which is subject to catastrophic surges with height of 2.5-3.5 m and a inundation width of up to 20-50 km. Due to absence of inundation observational data in the North Caspian Sea it is necessary to use modeling. We used model of coastal circulation and storm surge ADCIRC (Luettich, Westerink, 2008) with unstructured computational grid established within the SMS (Aquaveo Surface-water Modeling Solution), which are useful for the low-lying coastal areas such as the Northern Caspian. Wind fields were taken from the reanalysis of NCEP/NCAR (1,9°x1,9°, 4-daily), the hindcast period was 1949-2010, the changes of the annual mean level of the Caspian Sea were also taken into account. The calculations were performed on supercomputers of Lomonosov Moscow State University (MSU). We analyzed 28 storm surge situations. In order to compare observations with numerical simulations we selected storm surge at the Russian coast of the North Caspian Sea in November 10-13, 1952. According to the simulation surge height at the shoreline reached 2.5 m and 1.5 m at a distance of 30-40 km from the coast. The total area of flooding was about 6000 square km. The modeling results were lower than observational data. This phenomenon can be explained by smoothed wind fields and inappropriate relief model of the coastal region. The work was done in Natural Risk Assessment Laboratory, MSU under contract G.34.31.0007.