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Integrated assessment of socio-economic risks of dangerous hydrological phenomena in Russian coastal zones of the Baltic, the Azov and the Black Seas

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In 2012, an integrated damage from floods in Russia was about 1 billion euros, floods have caused the death of over 200 people. It is one of the most pressing scientific topics, but most of the works devoted to natural risks assessment. The main purpose of this work is to estimate the influence of dangerous hydrological phenomena (e.g. floods, underflooding and surges) on society, using vulnerability and damage assessment techniques. The objectives are to examine domestic and foreign methodologies, to integrate them and to test on specific Russian territory. Foreign training was organized at UNU-EHS (Bonn, Germany). Three different methods were used for each stage of research.

The first part of the research was devoted to estimation of potential damage for population and economy of the Baltic Sea coastal zones. The authors used a model, which takes into account direct damage (loss of life, destruction of buildings, etc.) as well as indirect effects of the first, second, etc. orders (loss of profits, loss of the budget, etc.). A database, based on satellite images, maps, yearbooks of Russian Statistical Service and reports of entities, has been prepared. The database is a matrix, in which the rows are coastal zones, and the columns are given indicators: number of people in port areas (people), cost of fixed assets (million rubles), investment (million rubles.), revenue / profit (million rubles.), etc. The authors identified zones with different depth of flooding, using satellite images, and calculated the direct and indirect costs, using the methodology of EMERCOM. Maximum direct potential damage for the Baltic coast is about 15,7 billion euros, but indirect damage is more than 25,5 billion euros.

The second part of research was devoted to vulnerability assessment of coastal municipalities of Krasnodar Region. A database, as a matrix of 252 parameters from 2007 to 2009 for 14 coastal municipalities, was developed. The parameters were divided into several blocks according to UNU-EHS methodology: ‘exposure’ and ‘vulnerability’, consisting of ‘susceptibility’, ‘coping capacity’ and ‘adaptive capacity’. Relevant indicators for each block were selected and verified by statistical methods. The authors estimated the share of people potentially exposed to flooding with the help of geographic information system. The authors, using the technique of World Risk Index (2011), calculated sub-indices for each block, and made the maps. Areas with the highest socio-economic risks were identified on the Azov and the Black sea coast: Slavyansky, Krymsky, Krasnoarmeysky, Temryuksky and Primorsko-Akhtarsky municipal districts.

On the third stage, the main purpose was to integrate and use both approaches in evaluation of socio-economic risks on micro-geographical level for different categories of the population and different industries (agriculture, utilities, etc.), using ‘field’ data. Field study was conducted in Slavyansky municipal district of Krasnodar region and included opinion polls, special interviews with businessmen and authorities, collection of municipal statistics and data from companies, etc. Vulnerability maps, speed evacuation maps, maps of possible locations of warning systems and maps of high insurance risks were developed. Proposals for improvement of legislation for coastal zones were prepared.

The conducted research has shown the importance of both social (‘vulnerability’), and economic (‘damage’) components of risk assessment. Using the previously discussed methods individually does not bring desired results because of deficiencies of Russian statistics. It is essential for accurate risk assessment to use an ‘ensemble’ of methods (statistical, field observations, etc.) on micro geographic level. The work has a practical importance for improving safety of local communities.