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Modelling of extreme hydrometeorological phenomena over the Kara Sea and Arctic coast

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Work is devoted to investigation extreme meteorological phenomena (anomalies of wind velocities, temperature, precipitation), causing a dangerous events in other environments embracing as well wind waves (open seawaters environment), as storm surges (seashore environment), as erosion processes (coastal inlands environment) over the region of the Kara Sea and the adjacent Arctic coast on different spatial scales, based on long-term high-resolution regional climate modelling. Studying of extremes' statistical properties, determining their genesis and mechanisms are the basis for construct a model of complex extreme hydrometeorological phenomena.

The main investigation tool is the regional climate model COSMO-CLM, applying for long-term (30-year) simulation over the cited region. The dynamical downscaling scheme with ∼13 km, and ∼2.8 km will be used to achieve the highest detailing of atmospheric processes. This information will allow to investigate the extremes of meteorological characteristics and to serve as input data for calculating the characteristics of wind waves and storm surges over the sea area and erosion processes on land (the Yamal Peninsula).

First experiments were conducted to test model configuration, driving global data, optimize domains and verify outputs for ocean waves and erosion models. Verification for erosion models done for snowmelt period (beginning of June 1992 and 1993), and model reproduced too late snowmelt and summer temperature growth. As well, strong dependence on starting time, spectral nudging technique and turbulence scheme was revealed according to temperature course. The most suitable configuration was chosen according to daily runs during the snowmelt period. Verification for ocean models done for two summer-autumn periods (August-September 2014, September-October 2012) shown good agreement in wind speed with correlation coefficients ∼0.6 – 0.7, mean errors +-0.5 – 1.5 m/s, standard errors ∼2 – 3 m/s. It realized in satisfactory agreement in wave spectra characteristics. Future perspectives of this study is to develop the statistical model describing extremes characteristics based on the long-term archive of complex hydrometeorological features.

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