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Siberia Integrated Regional Study megaproject: challenges, approaches and first results

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Siberia Integrated Regional Study (SIRS, http://sirs.scert.ru/en/) is a Northern Eurasia Earth Science Partnership Initiative (NEESPI) megaproject coordinating national and international activity in the region in line with Earth System Science Program (ESSP) approach whose overall objectives are to understand impact of Global change on on-going regional climate and ecosystems dynamics; to study future potential changes in the both, and to estimate possible influence of those processes on the whole Earth System dynamics. Crucial challenges are formed by accelerated warming occurred in Siberia, scare observational network, complexity of on-going and potential land-surface processes sharpened by inherent hydrology pattern and permafrost presence and caused by this specific lack of reliable high-resolution meteorological and climatic modeling data.

The approaches used to meet these challenges include development of distributed information-computational infrastructure required to generate high resolution data sets in demand, to manage multidisciplinary environmental data and to support of multidisciplinary and “distributed” teams of specialists performing cooperative work with tools for exchange and sharing of data, models and knowledge. The Climate site of the Enviro-RISKS web portal (http://climate.risks.scert.ru/), providing an access to interactive web-system for regional climate assessment on the base of available meteorological data archives is a prototype of one of key infrastructure elements optimizing the usage of information-computational resources, services and applications is described in details as well as a concept of its transformation to a web based information-computational system provided with GIS functionality. Another element is the mesoscale meteorological model WRF currently used for downscaling results of Reanalyzes and climatic modeling for the targeted region.

Statistical analysis of available data sets reveals some remarkable features of on-going changes of regional climatic characteristics including those, which control vegetation dynamics. In particular,it is shown that fields of long-term temperature trends have inhomogeneous structure. One can separate regions with maximum warming rates, which are located mostly in East Siberia. Spatial distribution of seasonally mean temperature changes is specific for seasons. Winter and spring seasons made the main contribution to climate warming. However, autumn became more cool at the vast territories in the north of West and East Siberia. In general, changes are within range -0.5º to +0.5º every 10 years.

Currently, efforts of the community involved are concentrated on issues related to regional and global risks rising with regional environment changes. There are three main scientific problems, whose solution is very important for understanding potential change of the whole Earth System dynamics and has strong regional socio-economical impact:
Permafrost fate, especially its border shift, which seriously threats to infrastructure and might form significant carbon source;
Desert - steppe- forest-tundra ecosystems borders shifts to North, which might change region input into global carbon cycle as well as provoke serious socio-economical consequences for local population; and
Temperature/precipitation/hydrology regime change, which might increase risks of forest and peat fires thus increasing significantly carbon release from the region under study.