EGU21-6676
https://doi.org/10.5194/egusphere-egu21-6676
EGU General Assembly 2021

COSMO-CLM Russian Arctic hindcast 1980 – 2016: experimental design and first evaluation results

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Detailed long-term hydrometeorological dataset for Russian Arctic seas was created using hydrodynamic modelling via regional nonhydrostatic atmospheric model COSMO-CLM for 1980 – 2016 period with ~12 km grid. Many test experiments with different model options for summertime and wintertime periods were evaluated to determine the best model configuration. Verification has showed that optimal model setup included usage of ERA-Interim reanalysis as forcing data, new model version 5.05 with a so-called ICON-based physics and spectral nudging technique. Final long-term experiments were simulated on the MSU Supercomputer Complex "Lomonosov-2" become more than 120 Tb data volume excluding many side files.

Primary evaluation of obtained dataset was done for surface wind and temperature variables. There are some mesoscale details in wind sped climatology reproduced by COSMO-CLM dataset including the Svalbard, Severnaya Zemlya islands, and the western coast of the Novaya Zemlya island. At the same time, high wind speed frequencies based on COSMO-CLM data increased compared to ERA-Interim, especially over Barents Sea, Arctic islands (Novaya Zemlya) and some seacoasts and mainland areas. Regional details are manifested in wind speed increase and marked well for large lakes and orography (Taymyr and Kola peninsulas, Eastern Siberia highlands).

Comparison of two periods (1980 – 1990 and 2010 – 2016) has shown that spatial distributions of high wind speed frequencies are very similar, but there are some detailed differences. Wind speed frequencies above 20.8 m/s has been decreased in the last decade over the Novaya Zemlya, southwest from Svalbard, middle Siberia inlands; however, it has been increased over Franz Josef Land and Severnaya Zemlya.

Large-scale temperature climatology patterns have shown a good accordance between ERA-Interim and COSMO-CLM datasets. Significant temperature patterns are detailed relief and lakes manifestations, e.g., over Scandinavian mountains, Eastern Siberian and Taymyr highlands, Novaya Zemlya ranges. The added value in the 1% temperature percentile patterns is more

pronounced, especially in the mountainous Eastern Siberia. Regional features are prominent over Onega and Ladoga lakes, and western Kara Sea. There is a remarkable warming over islands and Eastern Siberia valleys, and more clear temperature differentiation between ridges and valleys.

The nearest prospect of the COSMO-CLM Russian Arctic dataset application is its comparison with other appropriate datasets including reanalyses, satellite data, observations, etc. This will provide important and useful information about opportunities and restrictions of this dataset regarding different variables and specific regions, outline the limits of its applicability and get framework of possible tasks. The other important task is to share this dataset with scientific community.