



## 5th European Conference on Permafrost, Book of Abstract

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## Flood zones delineation in Arctic river delta, Case study on Krasnoe settlement, Pechora river, Russian Federation

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### Abstract

The research is focused on natural floods investigation based on hydrological analysis and flood zones delineation for arctic settlement in Pechora river delta (Russian Federation). Statistical approach to hydraulic calculations and field-based data allowed authors to produce reasonable applied flood zones delineation result.

**Keywords:** flood zones, water levels, Pechora, Arctic region of Russia

### Introduction

The problem of periodic flooding is quite urgent in a number of localities on the territory of Russia. In arctic regions access to people suffering by floods may be hardly limited due to undeveloped infrastructure and extreme natural conditions during spring flood period. Nowadays in Russia the state program on flood zone delineation for populated areas is carried out.

Krasnoe settlement is situated behind the Arctic Circle on the Pechora river delta (in Nenets province of Russian Federation). The settlement population count is 1470 people. This part of the Pechora river catchment refers to the Kaninsk-Timan geocryological region, to the discontinuous permafrost sub-zone and is located in relief depression. River valley and river bed are surrounded by through-type hydrogenic-radiative talic, saturated with pieces of frozen rocks. The village of Krasnoe is surrounded by water bodies on three sides connected to the Pechora River.

### Methods

To determine the boundaries of flood zones, it is necessary to create a digital elevation model (DEM) and to calculate the maximum water levels with different probability.

DEM based on the georeferenced and digitized detailed-scale map of Krasnoe settlement using structure contours and height marks. The DEM was verified and

updated using geodetic methods during field work session in 2017.

To calculate water levels along delta branches it requires initial water levels data at the top of the delta (Oksino hydrological gauging station). Water level distribution was calculated in two stages:

- Compilation of water surface longitudinal profiles in the defined orthometric height system from the data of several gauges.
- Respectively water level graphs are plotted using extremum values (minimum or maximum). So it should be used for longitudinal water level interpolation between gauging stations for extremum conditions.

The maximum water levels calculation for Krasnoe was carried out using water level measurement series for the Pechora River delta gauges (Oksino, Naryan-Mar, Oskolkovo). Empirical and analytical probability distribution curves were constructed with the use of the software complex "Hydrocalc" based on the gamma distribution of Kritsky-Menkel (Methodological..., 2005). The method of moments used to determine the parameters of the curves. Based on these curves, the values of maximum low probability water levels (with 1, 3, 5, 10, 20, 25 and 50% probability) were calculated. These values were correlated to the absolute elevations of the Baltic elevation system. Based on calculated maximum water levels, water surface profiles were created taking into account the distance between Krasnoe settlement and gauges in Pechora delta.

Flood zones caused by low probability water levels are delineated using special self-made software package called "Flood zones" developed by authors in Zubov State Institute of Oceanography. "Flood zones" package based on ESRI ArcGIS, QGIS, Hydrocalc, Python and C++ scripts and models meets the requirements of Russian hydrological regulatory acts (Terskii et.al, 2017).

### Results

According to cadaster map of Russian Federation (RF) flooding affects 555 registered units of Krasnoe including 340 land plots, 80 buildings and 135 economic installations. Also flood zone covers 16 km of roads and dozens of electricity and pipe lines. According to General plan of settlement development until 2027 floodzone caused by 50% probability water level covers 80 different constructions in Krasnoe and 1% probability – 433.

Flood zones delineated for Krasnoe in 2017 are used for ground water short dynamics modeling and also to modify human activity legislation in Nenets administrative region.

### Acknowledgments

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### References

Methodological recommendations for determining the calculated hydrological characteristics in the presence of hydrometric observations. 2005. St. Petersburg, State Hydrological Institute, 103 p.

Krasnoe Settlement official webpage, [www.pksovet.ru](http://www.pksovet.ru)

Terskii, P.N., Fatkhi, M.O., Tsyplov, A.S., Zemlyanov, I.V., Gorelits, O.V., Pavlovskiy, A.E., 2017. Flood zones delineation for Moscow city rivers. *Georisk*, #3, p.20-29.