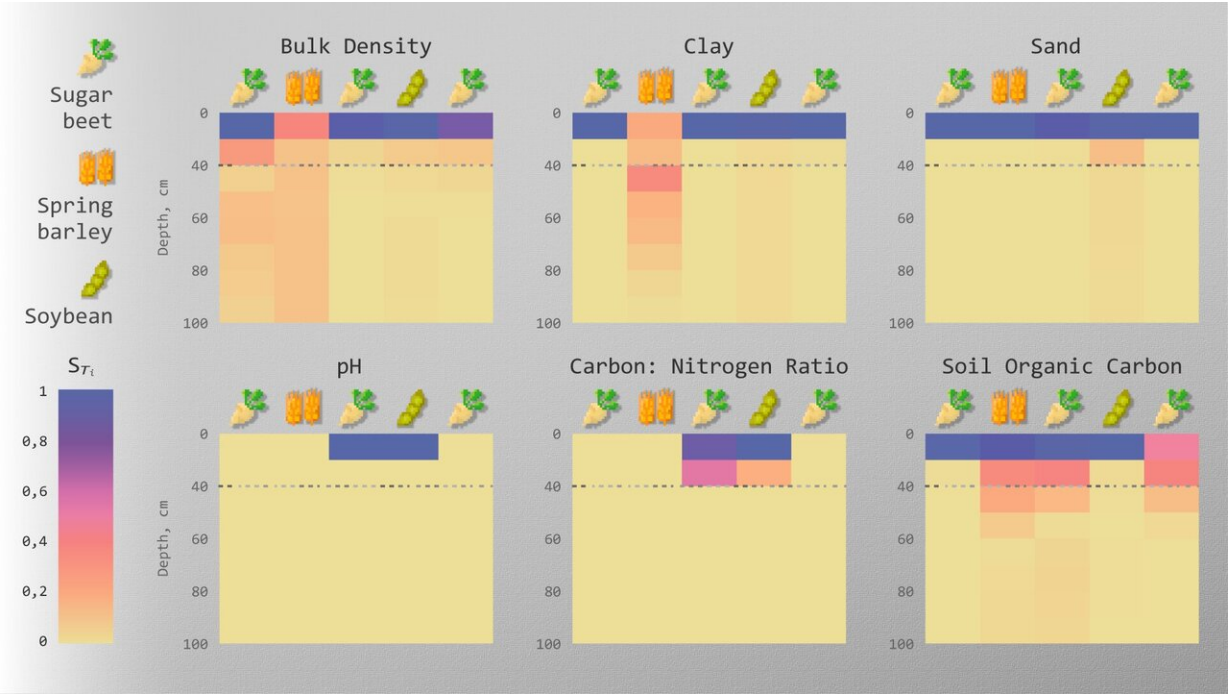


# Supercomputer helps scientists reveal most influential parameters for crop

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A heatmap of the impact of key soil parameters on yield. Credit: Pavel Odinev / Skoltech

Agriculture is becoming AI-native. Skoltech researchers have used the Zhores supercomputer to perform a very precise sensitivity analysis to reveal crucial parameters for different crop yields in the chernozem region. Their paper was published in *Computational Science*, the proceedings of the International Conference on Computational Science

2020.

Farmers all over the world use digital crop models to predict [crop yields](#); these models describe soil processes, climate and crop properties, and require environmental and agricultural management input data to calibrate them and improve the forecasts. In some countries, however, agrochemical data is not freely available for users of these models, and this calibration can become expensive and time-consuming.

A Skoltech team led by Professor Ivan Oseledets and Assistant Professor Maria Pukalchik used a popular open-source process-based [model](#) called MONICA to determine a way to reveal only the most important parameters for crop yield based on historical data and process modeling. Moreover, they sped up computational efficiency from one simulation per day to a half-million model simulations per hour using Zhores, the flagship Skoltech supercomputer.

This stunning number of simulations is necessary to perform high-quality sensitivity analysis to determine how the changes in certain input factors (such as soil parameters or fertilizer) influence the output crop yield prediction.

The research team used field data from an experiment in the Russian chernozem region with seasonal crop rotation of sugar beets (*Beta vulgaris*), spring barley (*Hordeum vulgare*), and soybeans (*Glycine max*) observed from 2011 to 2017. They picked six main soil parameters for sensitivity analysis and performed Sobol sensitivity analysis (named after Ilya Sobol, a Russian mathematician who proposed it in 2001).

"Soil is a very complicated issue in this country. Unfortunately, the data about [soil](#) properties and crop yield are not published. We have found an opportunity to overcome this barrier and set up the Zhores supercomputer to solve this issue. Now we can simulate all possible

variants and reveal the most crucial parameters without time-consuming and costly work. We hope that our achievements will help farmers digitalize their crop growth," said Maria Pukalchik.

**More information:** Mikhail Gasanov et al. Sensitivity Analysis of Soil Parameters in Crop Model Supported with High-Throughput Computing, *Computational Science – ICCS 2020* (2020). [DOI: 10.1007/978-3-030-50436-6\\_54](https://doi.org/10.1007/978-3-030-50436-6_54)

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