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## Wheat yields in Kazakhstan can successfully be forecasted using a statistical crop model

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The COVID-19 pandemic, recent extreme weather events around the globe and the invasion of Russian forces in Ukraine have led to a disrupted global food market. As the 12<sup>th</sup> largest global wheat exporter, Kazakhstan is fundamental for regional and global food security. Timely and reliable predictions of Kazakh wheat production could therefore improve food security planning and management in Central Asia and beyond.

In this session, we want to present a statistical weather-driven yield forecast model that is run with publicly available weather and yield data and requires low computational power, making it easily replicable. Decision makers in Kazakhstan have expressed high interest in using the forecast model as a replenishment to currently applied work-intensive forecasting methods. We stringently evaluated our model in a double out-of-sample validation and used it to forecast total national wheat production in a fully blind run for 2022.

Our results show that the model can successfully hindcast wheat yields at the oblast (regional) level up to two months before the harvest. The hindcast of wheat yields for 1993 to 2021 produces a median  $R^2$  of 0.69 for the full model run and  $R^2$  values of 0.60 and 0.37 for two levels of out-of-sample validations, respectively. Based on these yield estimates we provide a robust hindcast of the total wheat production for Kazakhstan with an  $R^2$  value of 0.86 (0.81 and 0.73 for two levels of out-of-sample validations). We forecast total wheat production in Kazakhstan for 2022 to be 12.4 million tonnes and thus 5 % above the production of the last year.