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Predictors selection results validation for wheat yield forecasting in Ukraine

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Ukraine is one of the biggest crop producers in the world. Timely and accurate operational crop yield forecasts for Ukraine at regional level become a key element in providing support to policy makers in food security.

Earth observation data from space and derived products play an important role in crop yield forecasting and thus in food security ensuring, and are used most frequently for assimilating variables into the models or providing variables as a predictor in empirical models. In our previous study [1], we assessed relative efficiency and feasibility of using an NDVI-based empirical model for winter wheat yield forecasting at oblast level in Ukraine.

Though the NDVI-based model provides minimum data requirements, it has some limitations since NDVI is indirectly related just to biomass but not meteorological conditions. Therefore, it is necessary to assess satellite-derived parameters that incorporate meteorology while maintaining the requirement of minimum data inputs.

It is necessary to estimate the level of timely consistency of predictors selection for different sources of data and to assess the robustness of feature selection process by usage of different methods from machine learning.

In our study two new parameters are considered: (i) vegetation health index (VHI) at 4 km spatial resolution derived from a series of NOAA satellites; (ii) Fraction of Absorbed Photosynthetically Active Radiation (FAPAR) derived from SPOT-VEGETATION at 1 km spatial resolution. VHI data are provided as weekly composites and FAPAR data are provided as decadal composites. The particular advantage of using VHI is that it incorporates

moisture and thermal conditions of vegetation canopy, while FAPAR is directly related to the primary productivity of photosynthesis

It is required to find a day of the year for which a parameter is taken and used in the empirical model. For this purpose, a Random Forest feature selection procedure is applied. It is found that VHI and FAPAR values taken in April–May provided the minimum error value when comparing to the official statistics, thus enabling forecasts 2-3 months prior to harvest, and this corresponds to results derived from LOOCV procedure. The best timing for making reliable yield forecasts is nearly the same as it was for the NDVI-based approach (±16 days).

Therefore, we can conclude that different methods of feature selection produces consistent results and the dates in April-May are the most adequate for winter wheat yield prediction.

References

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