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Winter cereal detection based on seasonality metrics derived from Landsat time series

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Spatially explicit and accurate information on the spatiotemporal distribution of croplands and crop types can assist in more effective policy making, sustainable land management practices and more accurate land use statistics evaluation. Agriculture is an important sector of national economy of Ukraine as it is one of the biggest crop producers in the world [1] and winter wheat is one of the major food crops. With the aim to create mask of winter cereals and to study the spatial distribution of this crops, we used intra-annual temporal signatures of remotely sensed observations and a prior knowledge of crop calendars and cropping systems. For winter cereals, it is known that the sowing of non-irrigated croplands begins in September and harvesting during July and August of the following year [2].

Landsat images and the generated time-series metrics that capture within season phenological variation were prepossessed and analyzed using the Google Earth Engine cloud computing platform. Prior to this, to eliminate the noise in the data, the clouds and shadows were masked out. The stage of the development of crops throughout the entire growing season was modeled using the harmonic regression. Afterward, winter cereals were disseminated with the use of consecutive decision rules based on aforementioned temporal features and with the use of CART (classification and regression tree) algorithm.

The first step was the separation of different crop groups e.g. winter and summer crops, which was straightforward with the use of within season temporal dynamics. The separation of different winter crops was challenging due to the spectral similarities of crops. We have tested several classification schemes and time series features in order to successfully disseminate these classes. The 16-day temporal

frequency and 30 m pixel size of the Landsat imagery make them suitable to characterize the agricultural land use. The spectral properties are also an important advantage over other sensors as acquired images in visible, near infrared (NIR) and shortwave infrared (SWIR) portions of the electromagnetic spectrum make them appropriate for studies of vegetation properties. The proposed algorithm is robust and useful tool for the classification of crop types based on remotely sensed time series along with agro ecological knowledge.

References

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