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Application of harmonized landsat Sentinel-2 product for crop yield assessment

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Combination of data acquired by Landsat 8 and Sentinel-2 remote sensing satellites can provide high temporal resolution (3-5 days), which is critical for various applications requiring dense data time series. Previously, such (or better) high temporal resolution was available mainly for remote sensing sensors, which acquire daily data over Earth's surface, but at coarser spatial resolution (> 250 m). The latter, for example, includes space-borne remote sensing sensors, such as MODIS, VIIRS, AVHRR, SPOT-VEGETATION. Taking into account an increased frequency of observations at moderate spatial resolution (<30 m), the assumption is that methods and models developed for generating products for coarse spatial resolution sensors can be ported to moderate spatial resolution sensors (Landsat 8/OLI, Sentinel-2/MSI). However, the practice shows that such transition is not always straightforward due to larger data gaps because of clouds and uneven coverage, sensor characteristics and increased spatial resolution (at least at the order of 10, when going from 250 m to 30 m).

Irregular spatial coverage, when the area in question is covered by several "stripes" sensed at different times, and high revisit cycles lead to discrepancies in dates of cloud-free observations. A frequently used approach to normalize satellite data is through phenological fitting. Current general consensus is that no single model would fit all requirements and selection of the satellite data normalization method and/or model is predicated by the application and a prior knowledge on the land surface dynamics. Though a combination of Landsat 8 and Sentinel-2 offers high frequency of observations, discrepancies in available cloud-free data will still exist. With more and more applications transitioning to a higher spatial resolution, it is important to explore and analyze the effect of those discrepancies on the quality of the resulting products. In the case of crop yield assessment, one of the important questions is as follows: How do discrepancies in dates of satellite observations influence the performance of empirical crop yield models at regional scale? The present study aims to partially address this question by documenting results of the study on building empirical models for winter wheat yield assessment with Landsat 8 and Sentinel-2 data in Ukraine. Through simulation modelling and analysis of real datasets, we show that satellite data normalization is critical in building robust crop yield models. Not performing satellite data normalization may lead to poorer performance of the

empirical crop yield model, which would be attributed not to the lack of correlation with satellitederived variables, but rather to observation irregularities.