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Dual scale trend analysis to evaluate climatic and anthropogenic effects on the vegetated land surface in agricultural Russia

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Russia's population is projected to shrink by a staggering 29% by 2050. Differential dynamics among rural populations are correlated with ethnicity and constitute a key driver in the spatial disintegration of rural Russia. Currently, Russia is slowly transitioning into a country with an internal "archipelago" of islands of productive agriculture around cities set within a matrix of much less productive and abandoned croplands. This heterogeneous spatial pattern is mainly driven by depopulation of the least favorable parts of the countryside, where "least favorable" is some function of lower fertility of land, higher remoteness from urban markets, or both.

Our aim is to improve current understanding of the interactions of climate change and the spatio-temporal impacts of agricultural reform in European Russia. We present a dual scale trend analysis to characterize change in agricultural European Russia. We selected a global NASA MODIS product (MCD43C4 and MCD43A4) at a 0.05° (∼5.6 km) and 500m spatial resolution and a 16-day temporal resolution from 2000 through 2008. We applied a refinement of the Seasonal Kendal trend method to Normalized Difference Vegetation Index (NDVI) image series at both scales. We only incorporated composites during the vegetative growing season which was delineated by start of season and end of season estimates based on analysis of Normalized Difference Infrared Index (NDII) data. Trend patterns revealed areas of increasing NDVI trend in Russia which was linked through the dual scale analysis with agricultural land cover change. The coarser scale analysis was relevant to atmospheric boundary layer processes, while the finer scale data revealed trends that were more relevant to human decision-making and regional economics. We evaluated the weather patterns and land surface phenologies for the areas with increasing NDVI over the past 9 years and compared the results with agricultural areas without change. This analysis improved our understanding of the spatio-temporal weather and phenological patterns related to agricultural changes.