GC31B-0468 Synergistic Use of Passive Microwave and Visible to Near Infrared Data Improves Fine Scale Dynamics in Major Grain Production Areas of Russia, Ukraine, and Kazakhstan

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Wednesday, December 17, 2014 08:00 AM - 12:20 PM
Moscone West
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Many studies have used vegetation indices (VIs) and land surface temperature data derived from visible and near infrared (VNIR) sensors to study land surface phenology (LSP) and land surface seasonality (LSS). Here, we describe the synergistic use of passive microwave and VNIR data to characterize LSP and LSS in croplands. We combined passive microwave air temperature from AMSR-E with two VIs—NDVI and EVI—from MODIS to study cropland dynamics from 2003-2010 in the major grain production areas of Northern Eurasia. Using MODIS IGBP 0.05º land cover type 1 percentage data, we selected a total of 49 AMSR-E pixels at 25km spatial resolution in Ukraine (UA=14), Southern Russia (RU=24) and Northern Kazakhstan (KZ=11). Convex quadratic (CxQ) models fitted by site to growing degree-day (GDD) as a function of accumulated growing degree-days (AGDD) yielded high coefficients of determination ($0.88 \leq r^2 \leq 0.98$). Deviations of GDD from the average CxQ model by site corresponded to peak VI for negative residuals and low VI at beginning and end of growing season. These patterns are understandable in terms of changes in the surface energy balance: higher latent heat flux during times of actively growing vegetation and higher sensible heat flux during periods of lower canopy evapotranspiration. Modeled thermal time to peak, i.e., AGDD at peak GDD, showed a strong inverse linear trend with respect to latitude with r^2 of 0.92 for RU and KZ and 0.81 for UA. Lower latitude sites (≤48° N) that grow winter grains show either a longer unimodal growing season or a bimodal growing season; whereas, higher latitude sites (>48° N) where spring grains are cultivated show shorter, unimodal growing seasons. All sites show distinct seasonality in both GDD and VIs. Over the 8 year study period, some exhibit shifts between unimodal and bimodal LSP patterns. Regional heatwaves that devastated grain production in 2007 in UA and 2010 in RU and KZ appear anomalous from average models of GDD and VIs.

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