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TITLE: Multi-year black carbon emissions from cropland burning in the Russian Federation

PRESENTATION TYPE: Assigned by Committee (Oral or Poster) [Invited]

CURRENT SECTION/FOCUS GROUP: Global Environmental Change (GC)

CURRENT SESSION: GC16. Regional Climate Impacts 7. Environmental, Socio-economic and Climatic Changes in Northern Eurasia and their Feedbacks to the Global Earth System: The Role of Remote Sensing and Integrative Studies

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ABSTRACT BODY: Cropland fires are an important source of black carbon (BC) emissions. Previous research has suggested that springtime cropland burning in Eastern Europe, and more specifically Russia, is a main source of BC in the Arctic atmosphere, acting as a short-lived climate forcer strongly influencing snow-ice albedo and radiation transmission in the atmosphere above the Arctic. BC emissions from cropland burning were estimated for the Russian Federation for years 2003 through 2009 using three satellite fire products, the 1 km MODIS Active Fire Product, 0.5° MODIS Fire Radiative Power monthly climate modeling grid product, and the 500 m MODIS Burned Area Product. Official statistics were also used to estimate BC emissions based on a modified approach developed and published by the All-Russian Institute of Organic Peat and Fertilizers to estimate farm- and regional-level residue loading based on straw surplus left after grain harvesting, while accounting for agricultural management and agrometeorological inputs. The satellite-based emission calculations utilized several different land cover classification schemas for defining croplands in Russia for both the 1 km MODIS Land Cover Product and the 300m MERIS GlobCover v2.2 data sets. In general, the peaks of BC emissions from cropland burning occurred during the spring (April – May), summer (July – August), and the fall (October). 2008 had the highest annual BC emissions. The range of average annual BC emissions from cropland burning calculated from the different satellite products was 2.49 Gg to 22.2 Gg, with the official statistics approach annual average equal to 7.34 Gg. The majority of BC emissions from the Fire Radiative Power and Burned Area satellite analyses originated in European Russia, followed by smaller contributions from West Siberia, Far East Russia, and East Siberia macro-regions, respectively. This presentation will further explore the uncertainties in the calculations of BC emissions from satellite and official statistics approaches, including input variables such as emission factors, fuel loads, and combustion efficiency. For example, a comparison of GIS field masks of three oblasts in European Russia with different levels of agricultural intensification revealed that between 22 to 42% of cropland fires detected by the MODIS 1 km Active Fire Product were incorrectly classified using the 1 km MODIS Land Cover data set's land cover classes of croplands and croplands/natural vegetation mosaic. Finally, we will show results from a comparison of our BC emission estimates with estimated emissions from agricultural burning from the Global Fire Emissions Database (GFED) version 3.

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