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Assessment of forest disturbance induced carbon emissions in Central Siberia using earth observation, in-situ data and modelling

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The overall objective of the research presented here was to improve the spatially explicit assessment of carbon emissions induced by forest disturbances by incorporating Earth Observation techniques in combination with in-situ data and contemporary greenhouse gas models. The study has been carried out within the Central Siberia region, which regularly experiences disturbances by fire and logging. Carbon emissions from forest fires have been estimated for five consecutive years (2003-2007) on a grid size of 20 x 20 kilometres.

The methodology applied involved several steps of data assimilation, complex data analysis and model adaptation. First, a database of basic forests parameters, including tree species composition, forest age and biomass has been created. This forest database was developed through harmonization of existing Earth Observation data derived products (e.g. land cover maps) combined with additional remote sensing data analysis and available in-situ information. The second step was to develop a database on pre-disturbance forest fuel load which allows distinguishing different forest canopy layers, the main fire types in this region and the resulting potential biomass burnt. As part of this research project a new burnt area product including burnt severity has been derived from daily Terra MODIS data at 250m spatial resolution for the period 2003-2007. The same source data facilitated also the development of a database on forest area lost due to logging. The next step was to adapt an existing model and develop a user interface allowing the combination of these datasets in order to calculate Carbon emissions resulting from forest disturbances. The carbon emissions obtained for the study region are on average, over the period 2003-2007, 23.5% higher (Standard Deviation 15.6) than those from the official Russian statistics. Finally, a GIS-analysis has been conducted to estimate the fire ignition source based on databases of lightnings and fire cause records along with topographic base maps.

The developed tools and datasets will be made available to public organisations, NGO's and the international scientific community using the existing spatial data infrastructures of the Siberian Earth System Science Cluster as well as the TerraNorte System.