Development and validation of a 7 year, 500m daily burnt area product for the boreal forested zone.

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Abstract

Within their fourteen million km^2, the boreal forests of Russia, Canada, Alaska and Northern Europe contain approximately 30% of terrestrial global carbon. Some of the largest temperature changes under current climate change scenarios are expected to occur in these regions, especially Siberia, with increases in summer temperatures of up to 5–6 °C. Monitored data has already indicated significant warming in the boreal zone, resulting in a decrease in soil moisture in the summer caused by increased evaporation, and an extension of the growing season. These changes are predicted to shorten the fire return interval in the boreal forest. This increase in fire occurrence is expected to lower net primary productivity and carbon storage over the long term due to increased losses of carbon and nitrogen through combustion and volatilisation.

Critical to estimating both direct and longer-term fire-related perturbations to boreal C storage is knowledge of fire extent, intensity and/or type, which has strong controls on forest fire damage, the fraction of available fuel combusted, and patterns of post-fire re-growth. This work is part of a larger project, the aim of which is the improved understanding of spatio-temporal patterns and dynamics of boreal fire intensity and extent, the driving factors behind these variations, and the consequence for carbon fluxes for the whole boreal area.

In this paper we are reporting the results of a daily burnt area algorithm and its validation. The study area is the whole of the forested boreal zone (FAO Global Ecological Zones) for the years 2001 – 2007. The daily burned area algorithm relies on the synergy of several Terra/Aqua-Moderate Resolution Imaging Spectroradiometer (MODIS) products. The main dataset is the Nadir BRDF Adjusted Reflectance (NBAR, MCD43A4) from which we extract the NDSWIR ((NIR SWIR)/(NIR+SWIR)), which is sensitive to canopy moisture content. The burn scars are identified by thresholding a NDSWIR difference image ($year_{y-1} - year_y$), the threshold being calculated from the pixel values of this difference image which are coincident with clusters of thermal anomalies (MOD14A1). The burnt areas are then dated using daily thermal anomalies.

The validation was carried out using Landsat (E)TM scenes. Ten sample areas were randomly selected, totalling approximately 1% of the total study area. For each sample area a

temporal stack of (E)TM images were used. These covered each year that the burnt areas were mapped plus the year 2000 to give a starting baseline. However as not all the required 80 images were not available only 71 were used.

For each Landsat image any new burns from the year of the imagery were manually digitised, using the MODIS thermal anomalies as an aid if necessary. The results of this were then re-sampled to the 500m resolution of MODIS. For both the daily burnt area product and the digitised images, the burnt areas were eroded by one pixel to negate any geo-location issues, and a cross comparison carried out.

The daily burnt area has been completed for the 38 MODIS granules covering the whole of the boreal forested area, for each of the years 2001 – 2007. The final validation results will be reported at the conference in July.

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