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Evaluating the differenced Normalized Burn Ratio for assessing fire severity using Sentinel-2 imagery in Northeast Siberian larch forests

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Fire severity is a key fire regime characteristic with high ecological and carbon cycle relevance. Broadly defined, fire severity is a measure of the immediate impacts of a fire on the landscape, including the destruction and combustion of live vegetation and dead organic matter. Prior studies on boreal forest fires have mainly focused on mapping severity in North America's boreal forests. However, the dominant tree species and their impacts on fire regimes are strikingly different between boreal North America and Siberia. Here we used Sentinel-2 satellite imagery to test the potential for using the most common spectral index for assessing fire severity, the differenced Normalized Burn Ratio (dNBR), over two fire scars and 41 field plots in Northeast Siberia. These field plots, sampled in the summer of 2019, corresponded to three different forest types: dense larch-dominated (*Larix cajanderii*) forest, open larch-dominated forest and open forest with a mixture of larch and pine (*Pinus sylvestris*). For this evaluation, the dNBR was compared to field measurements of the Geo Composite Burn Index (GeoCBI) and burn depth. The dNBR performed better when the field data were grouped by forest type (e.g. GeoCBI- dNBR $R^2 = 0.38$ ($p < 0.01$) for all plots and 0.49 ($p < 0.001$) for open larch forest). The GeoCBI provides a holistic field assessment of fire severity, yet it is dominated by the effect of fire on vegetation. Nevertheless, the GeoCBI correlated reasonably well with the depth of burning in the organic soil ($R^2 = 0.11$, $p < 0.05$ for all plots). This relationship also varied among forest types, and was the highest for the dense larch forests (burn depth- GeoCBI $R^2 = 0.27$, $p < 0.05$). The dNBR showed some potential as a predictor for burn depth, especially in the dense larch forests (burn depth- dNBR $R^2 = 0.31$, $p < 0.05$). This is line with previous studies in boreal North America. More research is needed to refine spaceborne fire severity assessments in the larch forests of Northeast Siberia, including assessments of additional fire scars and integration of dNBR with other geospatial proxies of fire severity.