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Interactive comment on "Daily burned area and carbon emissions from boreal fires in Alaska" *by* S. Veraverbeke et al.

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Review of Veraverbeke et al.

Here, the authors developed statistical models to better understand variability in C consumption in stand and soil components on a spatial scale of 500m from 2001-2012. To do this, they relate data from previous field based studies to spatially extensive land cover data from a variety of sources (ASTER, Landsat, MODIS, MOD44B, FCCS, AKFED) and scales (30m-500m), which are then convoluted to a 500m resolution. The authors use the statistical models developed herein to examine the ability of key environmental variables identified in prior research to estimate consumption across boreal Alaska. Of the environmental variables considered, elevation and dNBR were statistically significant in predicting belowground C consumption. The tools developed

are heuristically valuable in understanding C consumption patterns at very large spatial scales, and in doing retrospective analyses of C emissions for periods of time where remotely sensed data exist.

The authors cede that there are several major caveats in considering their conclusions about controls over patterns of C consumption. Primarily, contrasting findings presented in this study and other studies are likely driven by factors related to the scale dependency of controls on carbon consumption. The authors admit that at 500m resolution, the strong controls of slope and aspect on soil moisture and depth of burn are not likely to be realized [e.g., pg. 17600]. At such a large grain size, elevation was the only physiographic variable able to capture fuel moisture controls on burning. For this reason, soil moisture was modeled as a function of elevation and time of burning. So, in effect the authors use elevation as a proxy variable for other (potentially more relevant) drivers of depth of burn. In addition, other studies have varied on consensus of using dNBR as an indicator of depth of burn, but at the scales investigated herein, dNBR could be indicative of belowground consumption. The authors cede that this relationship may be correlative, owing to co-existing trends between depth of burn and occurrence of tree cover. For example, Increases in black spruce standing biomass are also strongly correlated to the total amount of C lost during wildfires in interior Alaska ($R2 = 0.80$, $P < 0.001$, $n = 12$; data from Kasischke and others 2000). The authors admit that fire weather indexes are not intended to be interpreted at 0.5km resolution. The authors also cite potential problems with land cover classification at such a coarse scale, and suggest that improved land cover characterization, including quantitative uncertainty estimates, are necessary to reduce region-wide uncertainty. This of course is important in interpreting the FCCS data, and the Consume outputs, but I think the authors are working with the best data available.

I feel that as long as the caveats stated in the previous paragraph are made clear, this work is significant and should be of interest to the readership of BGD. Perhaps in clarifying the interpretation, a sentence addressing what variables are likely to have muted

importance at 500m resolution could be included up front, or in the abstract? Generally, I found the writing to be concise and well researched. The figures are clear and the information is easy to interpret. Admittedly, the remote sensing methods presented here are not in my area of expertise and I defer to other reviewers for input on that, but I think overall the interpretation (caveats and all) is well presented. I otherwise offer general comments throughout, and hope they are useful in revision.

17594, 5: I think the inputs for the Consume model would be good to include, even if just in the supplemental. Is there precedent for using the black spruce fuel model as a proxy for tundra and non vegetated pixels? Could this be corrected or evaluated, based on some of the emerging plot-based consumption data for tundra wildfires?

17595, 20: "...which often burn less severe[ly] and frequent[ly]..."

17596, 25: "...however, there was considerable spatial variability..."

17601, 5-15: Another consideration here is that the Canadian FWI do not account for permafrost or critical drops in water table position, in lowland environments. A good reference addressing this: Waddington et al. 2012. Examining the utility of the Canadian Forest Fire Weather Index System in boreal peatlands. Can. J. For. Res.

17622, fig. 3: This is a really minor point, but shouldn't the independent data (observed) be on the x axis?

Interactive comment on Biogeosciences Discuss., 11, 17579, 2014.