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Biogeosciences Discussions

Interactive comment on "Emergent relationships on burned area in global satellite observations and fire-enabled vegetation models" *by* Matthias Forkel et al.

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1 Review bg-2018-427

1.1 Emergent relationships on burned area in global satellite observations and fire-enabled vegetation models

This paper applies a novel and apparently useful methodology, of comparing the performance machine learning (RandomForest) models to fire-enabled DGVMs paramaterised with equivalent driving variables. I feel this paper is a valuable contribution, given the importance of improving fire-enabled DGVMs in order to properly understand

future global-scale shifts in vegetation, climate and fire regime. The paper's methods for assessing variable dependence and importance on a spatial basis are novel and useful. The paper presents a number of useful findings, such as identifying that while DGVM perform comparably to machine learning methods in many area, they tend to poorly capture previous-season productivity drivers of fire - this productivity can be highly variable and a very important driver of fire in arid areas and tropical savannas. As is typical, quantifying the human drivers of ignition patterns through proxies such as population density, GDP etc. proved problematic. This study provides a useful resource for improving global fire and vegetation modelling.

1.2 Specific Comments

- The authors used direct rainfall quantities as a predictor variable in the model - both DGVMs and many fire behaviour models and simulation use a measure of soil moisture (as a proxy for fuel moisture) that takes into account rainfall input, and evaporation over time. Soil moisture content is also a variable available in global climate model output. Why did the authors not include soil moisture content as a predictor variable in the random forest modelling, in addition to precipitation, as it may provide a more physically relevant correlate of fire activity?
- What defines the white, presumably "missing data" cells in maps, eg. Figure 2? It is notable that no data appears availabe for south-eastern and south-western Australia, which are both fire-prone areas with comparable climates to eg. South Africa, western United States, mediterranean. I see tht there is a brief comment in the caption for figure 6 explaining there was "missing data" in the vegetation carbon dataset for Australia and New Zealand, but I feel this needs more explanation given the importance of fire in this area. What would need to be done to include this area - is there another potential data source that could be used as a replacement?

1.3 Technical corrections

- P 2 L 3: Allowed *us* to diagnose. . .
- P 3 L 16: potential drivers *of* fire. . .
- P 9 L 25: same range *as* the correlation. . .
- Supplementary figure S16 (a) - The labels for the different model lines are poorly justified and are clipped by the edge of the figure. I'm also not sure why these labels need to be repeated in panel (f). Figure 17 has similar issues - the choice of which panel(s) to include this legend in seems arbitrary.

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