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Biogeosciences
Discussions

Interactive comment on "Timing of fire relative to seed development controls availability of non-serotinous aerial seed banks" *by* S. T. Michaletz et al.

Anonymous Referee #3

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As you show that spruce cones retain viable seeds throughout fire, doesn't that by definition mean that spruce is serotinous, and the issue is that is has been thus far, been misclassified? What is the differences between a "true" serotinous strategy (what the other species listed by you in the same ecosystem are doing) and what you show that the spruce is doing?

The CFD simulations are at a much larger scale (0.5m2, P16714, L7) than a cone. They therefore, assuming the model is perfectly parameterized and that all the intensive list of parameters and assumptions about fuel, fire and tree structure are perfect, can at best, provide an estimate to the mean temperature and radiation forcing during a fire. There is a huge variability of these conditions during fire, in different locations in an active fire and between different fires, I do not think that the small number of cases that was simulated here could represent the actual range of common conditions. But even if we leave that alone and restrict ourselves to the range provided by these simulations, there is large variability of convective heat due to air-flow and turbulence patterns around the code and the branch-leaf cluster that surround the cone. None of it is resolved by the FDS model given the resolution used here. Even for cylindrical or spherical objects, lee-side eddies tap heat and provide strong and uneven eating at the downwind side of the object during a fire. The details are therefore lost, and while still providing important information, the value of these super-detailed simulations is somewhat diminished given the scale mismatch between the simulations and the scale of the actual processes that are critical for the heat distribution within the cone.

My most critical point is that there were no empirical observations and no attempt to evaluate the heat transfer model. It is rather straight forward to heat some cones and test whether the model predictions of maximal seed temperatures are in any way close to reality. The large number of parameters that control heat transfer where mostly based on other published data that I doubt was directly applicable to white spruce cones in wildfire condition. Also, the super simplistic assumed structure of the cone is rather far from real. The cones have cracks that lead to the seeds and sub-millimeter differences in the width of these cracks may lead to very large differences in the amount of heat that is advected inward. Given this rather large leap of faith between the parameter and setup of the heat transfer simulation and a realistic cone, some evaluation of whether the model is even in the ball park is critically needed. Given the CFD model resolution and assumption this can be conducted in a furnace, given constant temperature and uniform heat distribution, and while not very realistic it would be consistent with the rest of the data and would still produce an important insight into the applicability of the model. I would recommend testing cones from different stages of maturation, because I suspect that the cone properties change with time.

BGD

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Interactive Comment

Minor comments: P16706 L9 – the (Navier–Stokes) is not appropriate here, it I not the name of the model used but the governing equation in the general theory behind fluid dynamics. What was the actual cell size (you only provide an abstract equation) of the heat transfer model? What was the timestep of the CFD and heat transfer models? Are the thermal parameters in table 1 that are taken from previous publications specific to spruce cones, or are they general to wood/bark of that (other?) species?

Interactive comment on Biogeosciences Discuss., 9, 16705, 2012.