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***Interactive comment on* “Future biogeochemical forcing in Eastern Siberia: cooling or warming?” by A. Arneth et al.**

Anonymous Referee #2

Received and published: 21 September 2014

This is an interesting paper with results from an understudied region. The paper makes an important point that the climate change feedbacks that are typically considered may not be the dominant ones and impacts such as BVOC emission changes need to be quantified. While this is a good first step in a qualitative assessment of the potential impacts in this region it is not really quantitative because not enough is known about these processes and the uncertainties are too high. This paper shows the potentially important role of BVOC but the authors need to be very clear on how little is known of the key processes and rates here. I recommend the paper be published after addressing the following points. General: In order to determine if changing BVOC can be important for climate, it is necessary to show that BVOC are emitted at rates that can impact particle concentrations. There is large range in emission factors (1.9 to 9.6

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ugCm-2h-1) and the resulting impact on particles is sensitive to the assumed emission magnitude. The authors should provide some assessment of the BVOC emission factors by comparing with ambient data. How do these leaf level emissions compare with observed monoterpene concentrations and the aerosol growth rate shown in Figure 2? What evidence is there that monoterpene emissions, especially emissions from stored pools, will be higher in a warmer environment. There is no question that emissions are higher if temperatures increase for a few hours but what do we know about monoterpenes emitted from trees growing in a warmer environment. There could be limits based on the pool size or perhaps plants adapt to a future climate. Discuss what is known about this and how the results depend on the assumptions made here.

Specific: Section 2.1 BVOC measurements: The first sentence says “ Leaf and canopy BVOC emissions fluxes. . . . were measured” but I don’t see the canopy BVOC flux measurements described anywhere. Monoterpene concentration data are shown in Figure 2 but I don’t see where there are described in section 2.1 Page 19154, line 3: delete ‘was” Page 19155, line 7-10: This does not seem to agree with what is reported by Kajos et al. Also, it does not agree with the monoterpene concentration data in Figure 2. If there are light dependent monoterpenes then the lower PAR values should have lower emissions but the figure shows the opposite. Page 19155, line 15: reword “allows to” Page 19155, line 17-19: reword this sentence. “applying the necessary BVOC emission capacities” is repeated Page 19155, line 20-21: reword this sentence. “Larch, in this model setup” is repeated Page 19156, line 10: reword this sentence. “to allow establishment” is repeated Page 19155, line 28: insert “the” in between “from” and “biosphere” Page 19157, line 1: Why 15%? Provide some justification for this number. Page 19157, line 17: It is not noise that is being reduced Page 19159, line 5: reword “the thus” Page 19159, line 22: Solar radiation can be, but is not always, a good surrogate for OH concentration. The authors should provide some results from their modeling to demonstrate Page 19160, line 27: recent studies have shown that many conifers emit some light dependent monoterpenes Page 19161: Was there any change in emissions simulated with change in species composition within a PFT? Were all

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conifers assigned the same emission factor? What was the impact on BVOC emissions due to the change in PFT distributions? Page 19162, line 13: is “are” supposed to be “area”? Page 19163: are these changes significant (for example, the CCN increase of 5-10 cm⁻³). Page 19163, line 17: what is “CCN (0.2%)”? I can’t tell what 0.2% represents.

Interactive comment on Atmos. Chem. Phys. Discuss., 14, 19149, 2014.

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