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Interactive comment on "Mechanisms of methane transport through *Populus trichocarpa*" *by* Ellynne Kutschera et al.

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I agree that many of these papers are excellent resources. Some have served as impetus for our research (Whiting and Chanton, 1996, and Chanton and Whting, 1996) though they were not directly cited in our manuscript.

The transport types that Whiting and Chanton studied were through-flow convection and diffusive transport, as is appropriate for aquatic macrophytes. A difference of humidity across a leaf boundary or thermal transpiration may induce through-flow convection. Armstrong and Armstrong (1991) found convective through-flow to be induced in the living leaf sheaths and stomata of Phragmites. This mechanism works via the connection between gas-filled spaces in the rhizomes and culms (stalks) of the plants, where gas flows in through younger culms and exits from older leaves and culms. Although we have not ruled out a similar mechanism in trees, the anatomy of Populus is different from that of these aquatic plants and may not support this kind of through-flow. In plants with convective through-flow, little isotopic fractionation was found (Chanton and Whiting, 1996). This also suggests our results are not indicators of this mechanism. Beckett et al. (1998) found that non-through-flow convection was likely to be of minimal importance in any submerged root system.

The second type of mechanism studied for aquatic plants and certainly in rice is diffusion. As pointed out in our manuscript, many researchers have cited diffusion as the transport mechanism associated with aerenchyma, although we did not come to this conclusion. Chanton and Whiting (1996) reported isotopic fractionation values between 4 and 16 permil for plants without convective through-flow. Our values are of similar range. However, Popp et al. (1999) and Chanton (2005) discuss the build-up of enriched methane as a factor that would decrease the overall isotopic fractionation, although this would be at steady state. Since our canopy methane concentration was increasing linearly with time, we cannot assume steady state in our system. Additionally, the work cited here involved measurements from plants in soils, where the influence of soil mechanisms needed to be taken into account. Our measurements should reflect tree transport alone. The temperature relationship with isotopic fractionation that we found did not match the temperature dependence of diffusion. Also, that isotopic fractionation decreased with increased flux and increased temperature suggests that more than one mechanism is at work, so that while diffusive transport may be present, we did not conclude that it is the dominant mechanism.

Our results are in agreement with studies demonstrating that stomata do not control methane emission. Again, however, tree physiology is different from that of aquatic plants. We believe methane is not leaving through the tree leaves in significant amounts and the aerenchyma pathway is dominant.

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