Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

The mechanism of sugar export from long conifer needles II: Modelling the sugar flow SEAN MARKER, TOMAS BOHR, RODRIGUE BRAVARD, Technical University of Denmark, Lyngby, Denmark, JOHANNES LIESCHE, XIAOYU HAN, Northwest A&F University, Yangling, China, ALEXANDER SCHULZ, CHEN GAO, University of Copenhagen, Frederiksberg, Denmark, CHRISTOPHER VINCENT, University of Florida, Lake Alfred, FL, USA, MACIEJ ZWIENIECKI, University of California, Davis, CA, USA — It was recently pointed out by Rademaker et al. (*Phys Rev. E.* **95**, 042402, 2017) that the sugar transport in the phloem vascular tissue of conifer needles, represented by a sugar filled semipermeable tube, is characterized by an effective length scale (6-10 cm). For needles longer than this, the sugar transport will be stagnant near the tip. It has been observed that, starting from the tip and moving towards the base, the sieve elements appear in separated groups every few cm, with each new group appearing on the outer flank of the phloem vascular tissue and continuing all the way to the base. We hypothesize that only the outmost group is loaded with sugar and include this observation into a simple model. As the distance between two consecutive groups is of the same order as the effective length scale, this avoids stagnation in the tip region. However, it has also been observed that needles can have selective starch management, i.e., that starch accumulates primarily near the tip during the day, whereas the sugar transport is largest in the tip region during the night. This indicates that stagnation zones cannot be completely avoided during the day in long needles due to lateral sugar exchange between parallel groups of sieve elements.

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Date submitted: 03 Aug 2020 Electronic form version 1.4