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Growth of forest floor vegetation observed from snow depth measurements in Sodankylä, Finland

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MEASUREMENT SITE

The research station of Finnish Meteorological Institute in Sodankylä in northern Finland has measurement site with extent snow and soil measurements. The main snow measurement site (Intensive Observation Area, IOA) is in sparse pine forest and clearing in it. Vegatation of the forest floor mainly consists of moss (*Pleurozium schreberi*), lichen (*Cladonia rangiferina and Cladonia mitis*), heather (*Calluna vulgaris*), lingonberry (*Vaccinium vitis-idaea*) and crowberry (*Empetrum nigrum*). The area is fenced so that reindeers have no access to it.

AUTOMATIC SENSORS

Continuous automatic snow depth measurements are made since 2006 with two SR50 sensors (Campbell Scientific) installed in automatic weather stations to forest and clearing (orange). Below the automatic sensors is an artificial turf above wooden frame, thus forest floor vegetation has no affect to the observations.

FIXED STAKES

Snow depth is measured manually from clearing and forest with fixed stakes (red). The stakes are installed so that zero point is in level of ground surface. Five fixed stakes was installed in 2009 to the clearing and two stakes was added in 2010. Measurements are made from the forest with ten fixed stakes since 2010.

Measurements are made usually on weekly basis during the snow cover, except in winter 2014-2015 when observations were performed every two weeks. Observation is made visually by estimating average snow depth around the stake from approximately 1 m distance. The stakes have 1 cm and 10 cm scales.

RESULTS

Annually growing bias is observed in comparison of manual and automatic measurements, so that value of the manual measurements is larger than the automatic, on average. This trend is more visible in forest than in clearing. Bias between average of fixed stakes and automatic measurement from 9 UTC is calculated for clearing and forest separately.

Bias is estimated to grow linearly, and difference between beginning and end of the regression lines are 7.1 cm for forest and 3.6 cm for clearing. We suggest that the bias is caused by growth of forest floor vegetation around the fixed stakes. That means average growth rate of 1.0 cm per year for forest and 0.4 cm per year for clearing. Vegetation is slightly different in forest than in clearing, which cause the difference in growth rates.

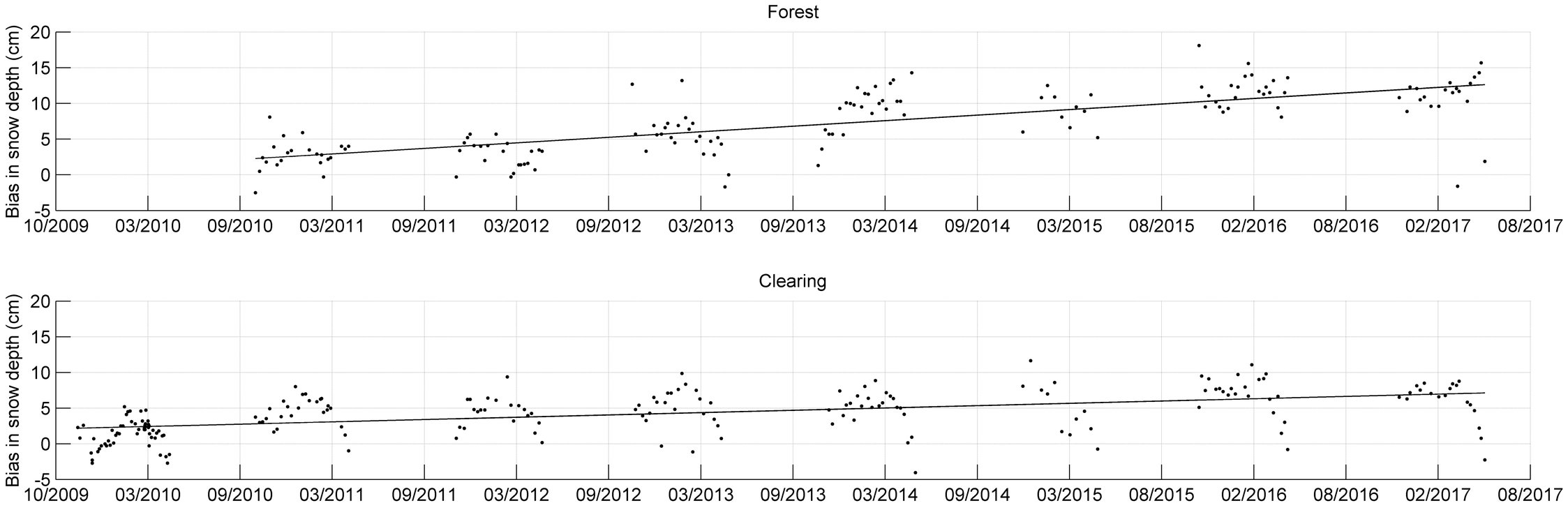
CONCLUSION

A new method to evaluate growth rate of forest floor vegetation is to compare snow depth measurements of manual fixed stake and automatic reference instrument. The method does not measure growth rate of a single plant, but gives an average growth rate for the area.

The bias between the measurements is annually growing, and it is possible to fit line to the values. **In Sodankylä average growth rate of forest floor vegetation is approximately 1.0 cm per year for forest and 0.4 cm per year for clearing, and on average 0.7 cm per year,** based on analysis of snow depth data.

Accordingly, growth of forest floor vegetation is related to measurement error of snow depth observations from fixed stakes.

Bias in snow depth between fixed stakes and automatic measurements



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