



Borehole climatology: In search of the long-term subsurface thermal signature of deforestation events

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The subsurface temperature signal of deforestation and related land-use changes is not well understood. However, subsurface temperature anomalies resulting from such changes will complicate the reconstruction of surface temperatures from borehole temperature logs. Moreover, land-use change will introduce temporal discontinuities in the relation between air and soil temperatures. Subsurface temperature profiles measured in areas affected by deforestation or forest fire up to 60 a before measurements show warming between 0.5 and 1 K in the upper 100 m. Subsurface temperature measurements immediately after deforestation are significantly cooler than those data acquired 30 a after re-growth. In addition, short term (5 a) continuous monitoring of air and soil temperatures at five sites in Atlantic Canada with different land-use and cover histories shows that annual mean soil temperatures are about 2 K higher in deforested areas than in areas covered by vegetation. However, there are no significant differences in annual mean surface air temperatures at any of these sites. Long-term data along a chronosequence shows that annual soil temperatures vary with time in rough agreement with the Nitoiu and Beltrami (2005) proposed model of long-term subsurface thermal anomalies due to land-use changes. Here we summarize the model and data, and discuss the relation these measurements may have to small-scale land-use and climate modeling.