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Assessment of biomass burning molecular tracers in Greenland ice core

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Biomass burning is an important source of numerous greenhouse gases and aerosols, which significantly influence climate by changing the Earth's energy budget by scattering and absorbing the radiation or acting as cloud condensation nuclei. Thus, it is important to better understand a substantial impact of biomass burning on climate for improving predictions of future climate changes. For this purpose, it is necessary to precisely reconstruct long-term variability of biomass burning associated with climate change. Ice core is a special archive, which preserves variability of atmospheric aerosols in a past. Levoglucosan is produced by pyrolysis of cellulose and hemicellulose and thus is a general tracer of biomass burning. In contrast, dehydroabietic acid, a specific tracer of the pyrolysis of conifer resin and has been used as a tracer of burning of conifer tree.However, application of those biomass burning organic tracers to ice core has not been evaluated well. Thus, we provide continuous records of the biomass burning aerosol tracers in Greenland ice core collected from Southeastern Dome (SE-Dome ice core) over the past several decades to assess the applicability of those tracers to Greenland ice core. Air mass backward trajectory analysis indicates that Canada is likely the main source region of the biomass burning aerosols. Comparison of our ice core and biomass burning records in Canada revealed that organic tracers in SE-Dome ice core record some prominent events of biomass burning in source regions. However, other biomass burning events are not recognized in organic tracer records in SE-Dome ice core. Detailed analysis of backward trajectory suggests that air mass did not come from Canada during the events. We also observe that, the ice core biomass burning tracer records weakly correlates with decadal climate oscillation such as Arctic Oscillation, Atlantic Multidecadal Oscillation and source region temperature, suggesting that decadal scale changes in wind regime and temperature slightly influence the emission and transport of the biomass burning tracers to the study site. Our results highlight that whether biomass burning events are recorded in ice core depends on from which region air mass is arriving to the ice core site.