Supplement for: Burning-derived vanillic acid in an Arctic ice core from Tunu, Northeastern Greenland

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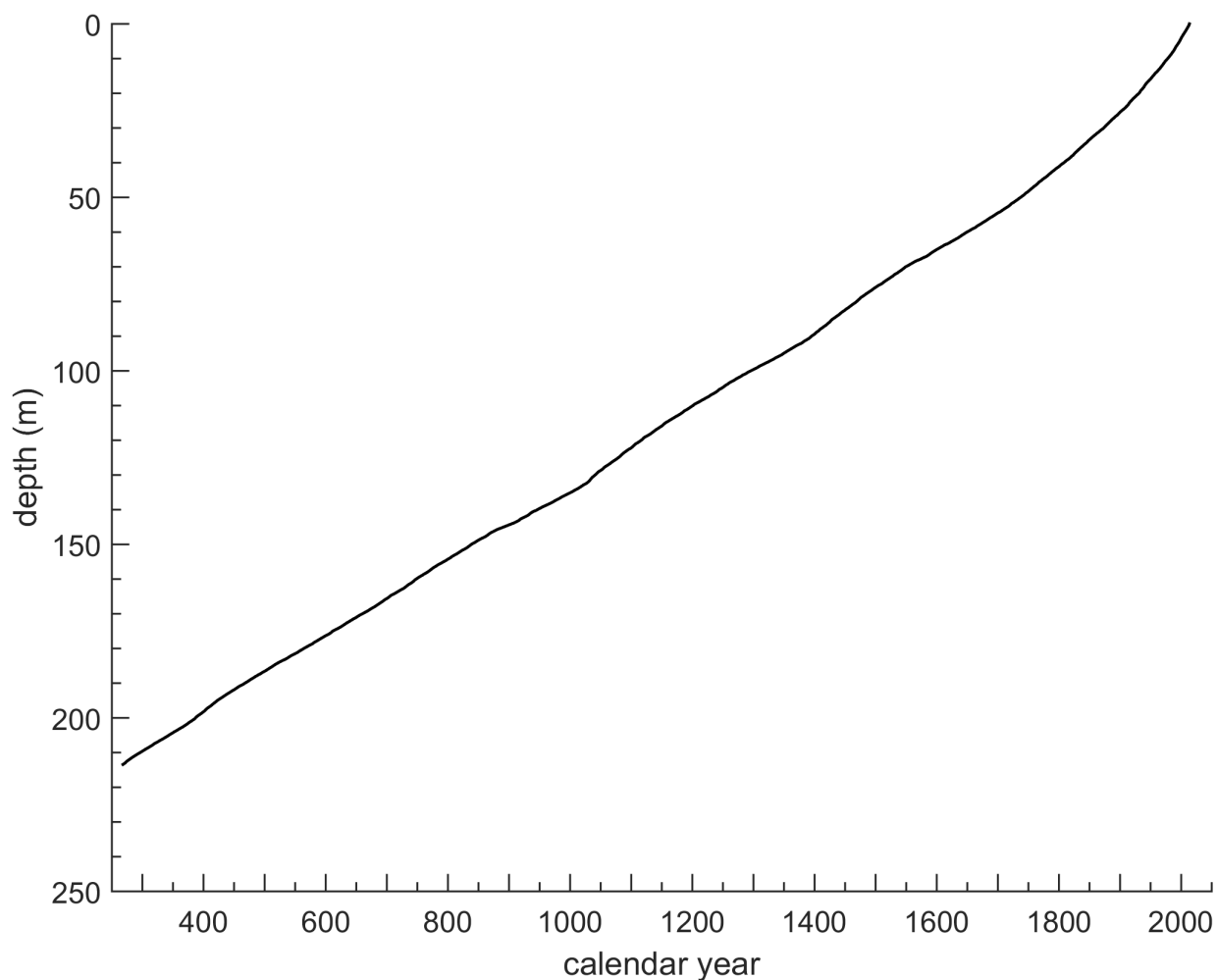
Figure S1. Tunu ice core depth-age scale.
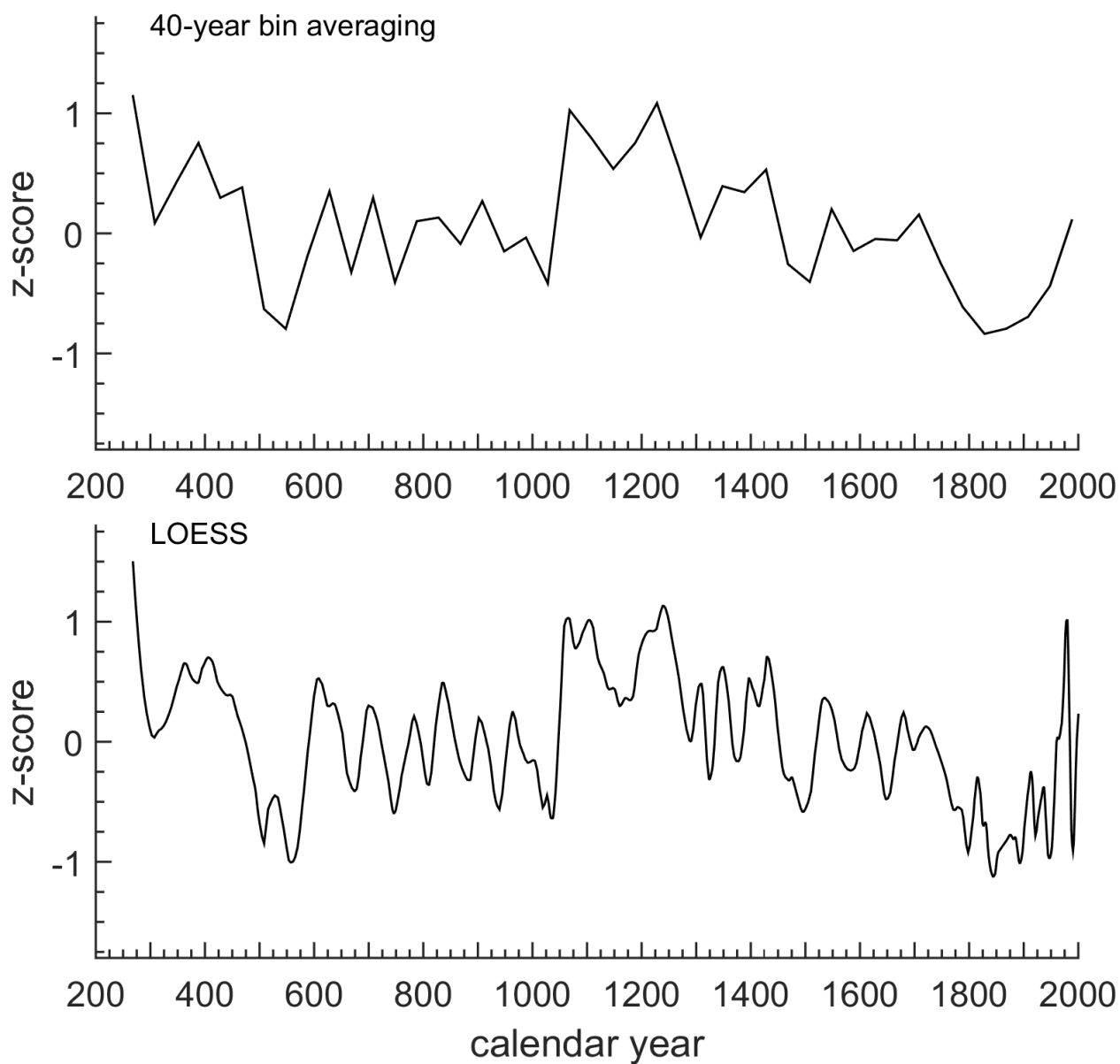
Figure S2. Tunu vanillic acid (top) using 40-year bin averaging (top) and LOESS smoothing (span = 0.04) (bottom) of the log transform. Data were normalized using the mini-max transformation and the z-score.
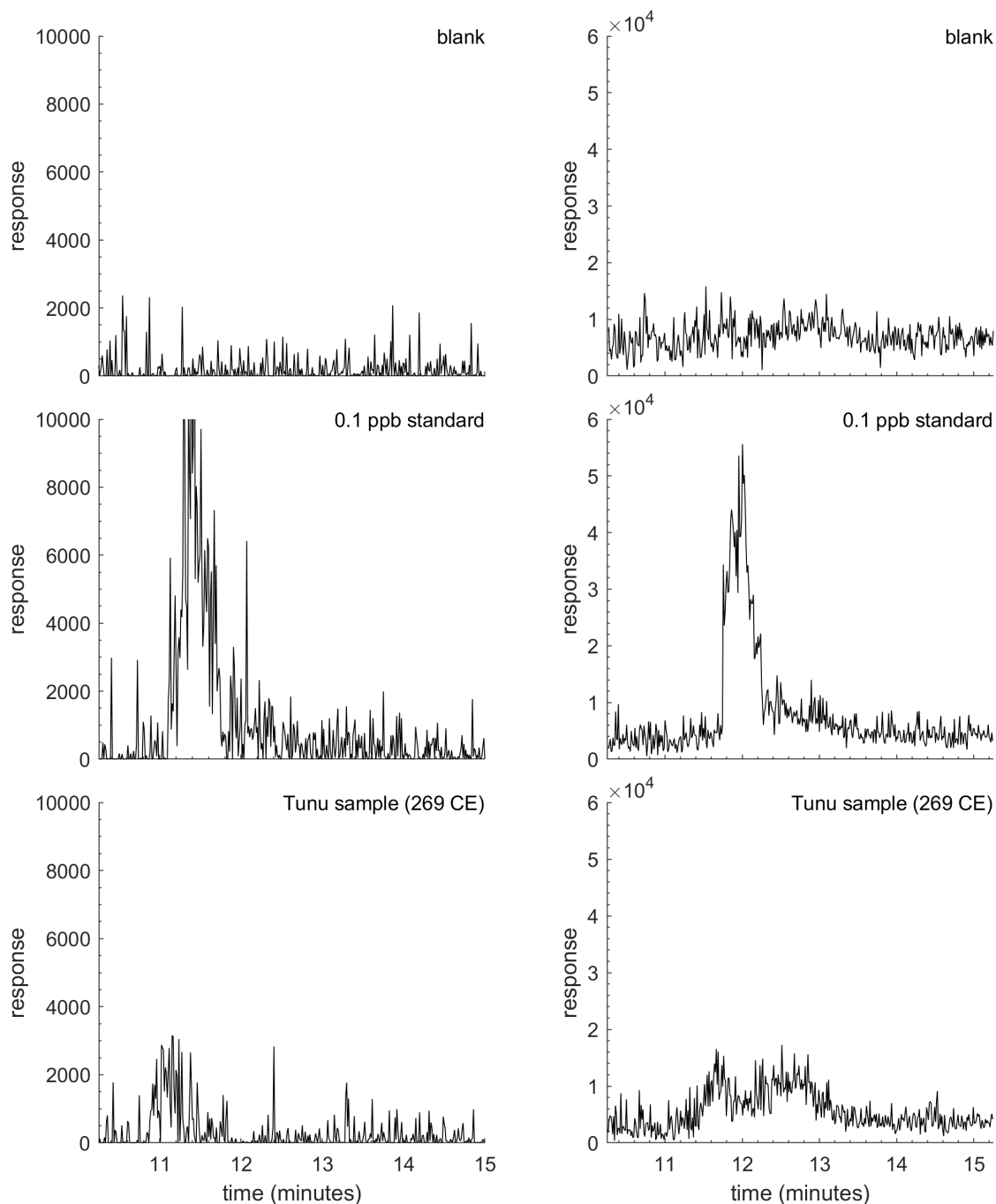
Figure S3. Vanillic (mass transition 167→108; left column) and p-hydroxybenzoic acid (mass transition 137→93; right column) analysis using anion-exchange chromatography and electrospray tandem mass spectrometry. From top: MillQ water blank, 0.1 ppb standard, Tunu ice core sample dated as 269 CE. Note that an additional peak appears after p-hydroxybenzoic acid at the 137→93 mass transition indicating the presence of an unknown interferent.
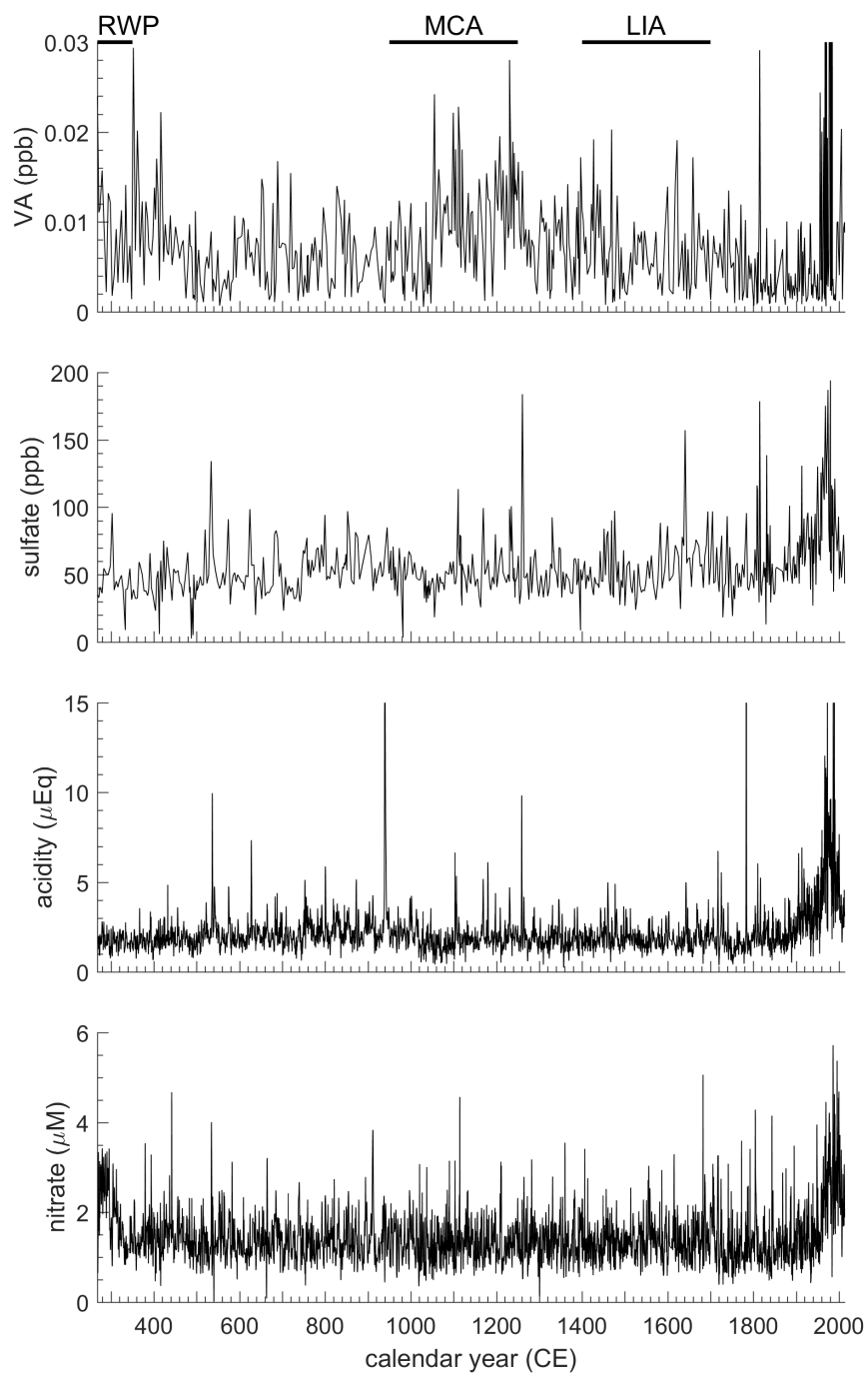
Figure S4. Relationship between Tunu vanillic acid, para-hydroxybenzoic acid, sulfate, acidity, and nitrate. Vanillic acid and sulfate were measured using the method described in the manuscript. Acidity and nitrate were measured at the Desert Research Institute (McConnell, 2016). The black horizontal lines are the Roman warm period (RWP), the Medieval Climate Anomaly (MCA) and the Little Ice Age (LIA) (Mann et al., 2009; Wang et al., 2012).
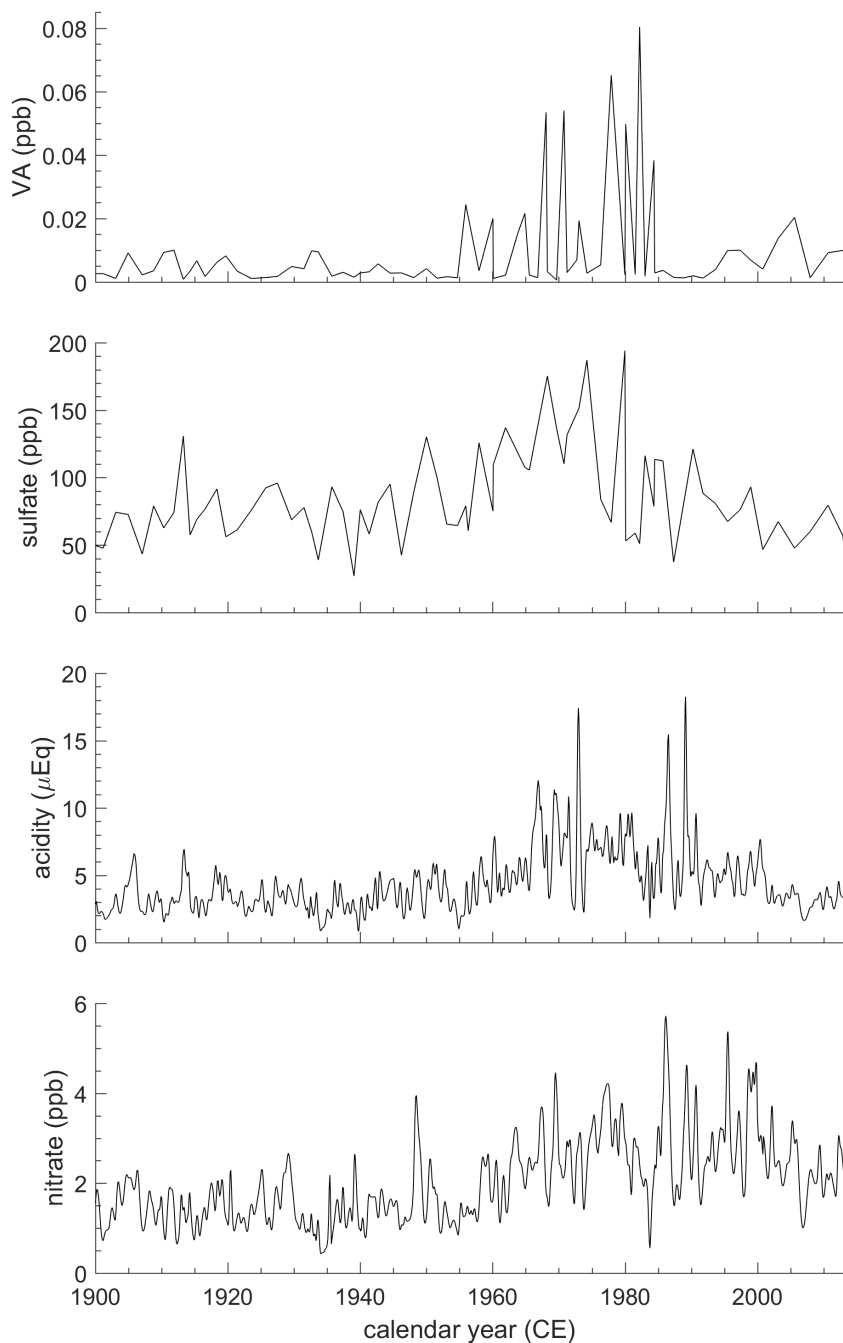
Figure S5. Relationship between Tunu vanillic acid, para-hydroxybenzoic acid, sulfate, acidity, and nitrate in the 20th century. Vanillic acid and sulfate were measured using the method described in the manuscript. Acidity and nitrate were measured at the Desert Research Institute (McConnell, 2016).
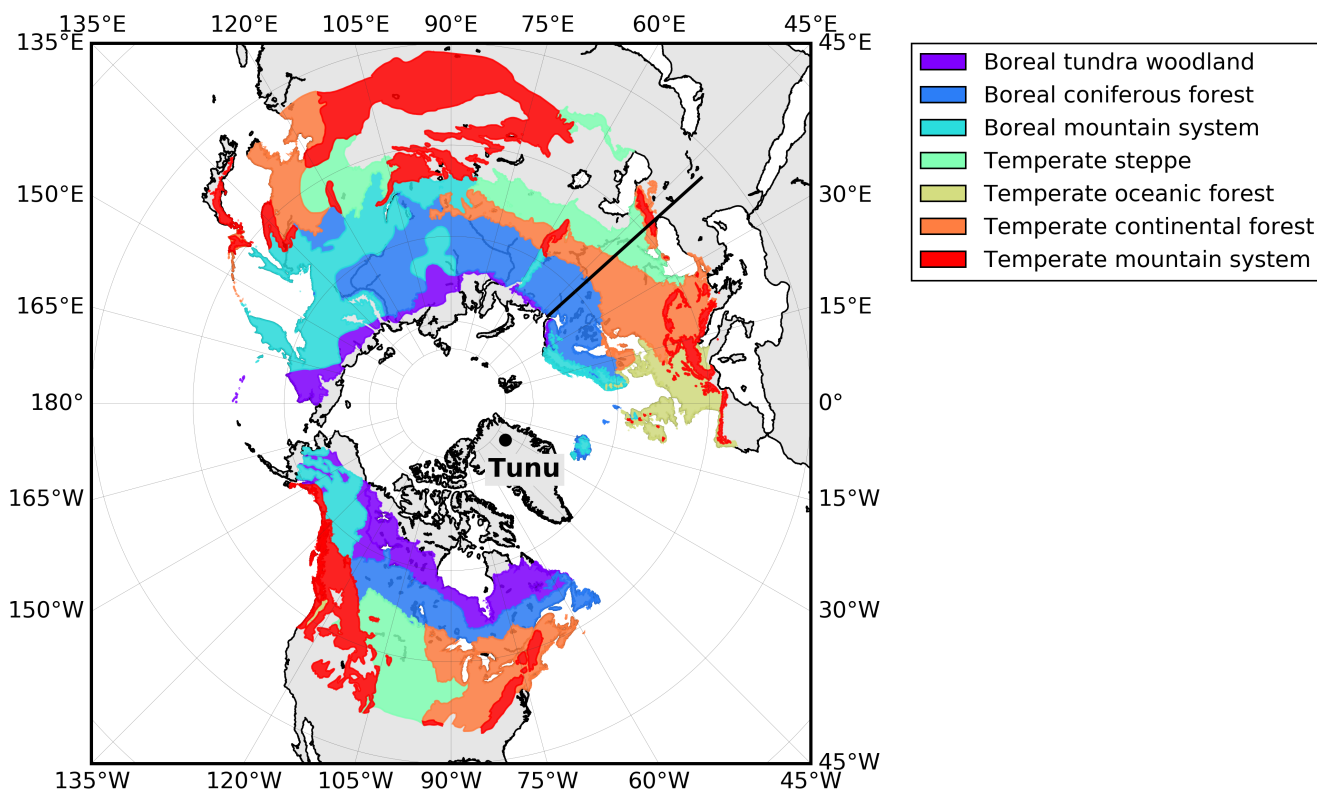
Figure S6. Ecofloristic zone classifications of the Food and Agriculture Organization

(http://cdiac.ornl.gov/epubs/ndp/global_carbon/carbon_documentation.html; Ruesch and Gibbs, 2008).
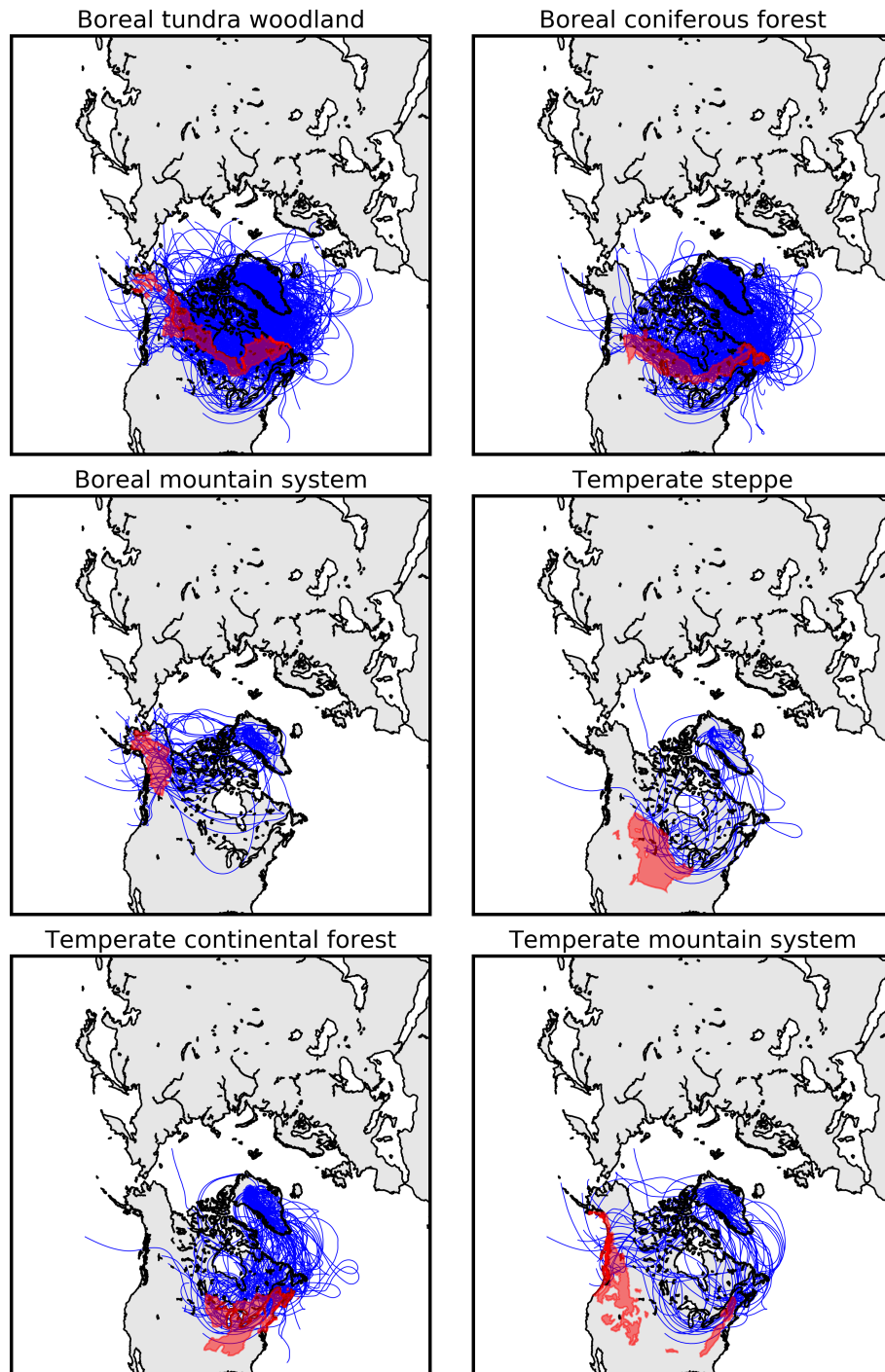
Figure S7. Back trajectories that transect North American ecoflorisitic zones. Blue lines are back trajectories crossing over the labeled ecoflorisitic zones from March-November 2006-2015. Ecofloristic zones are the red areas.
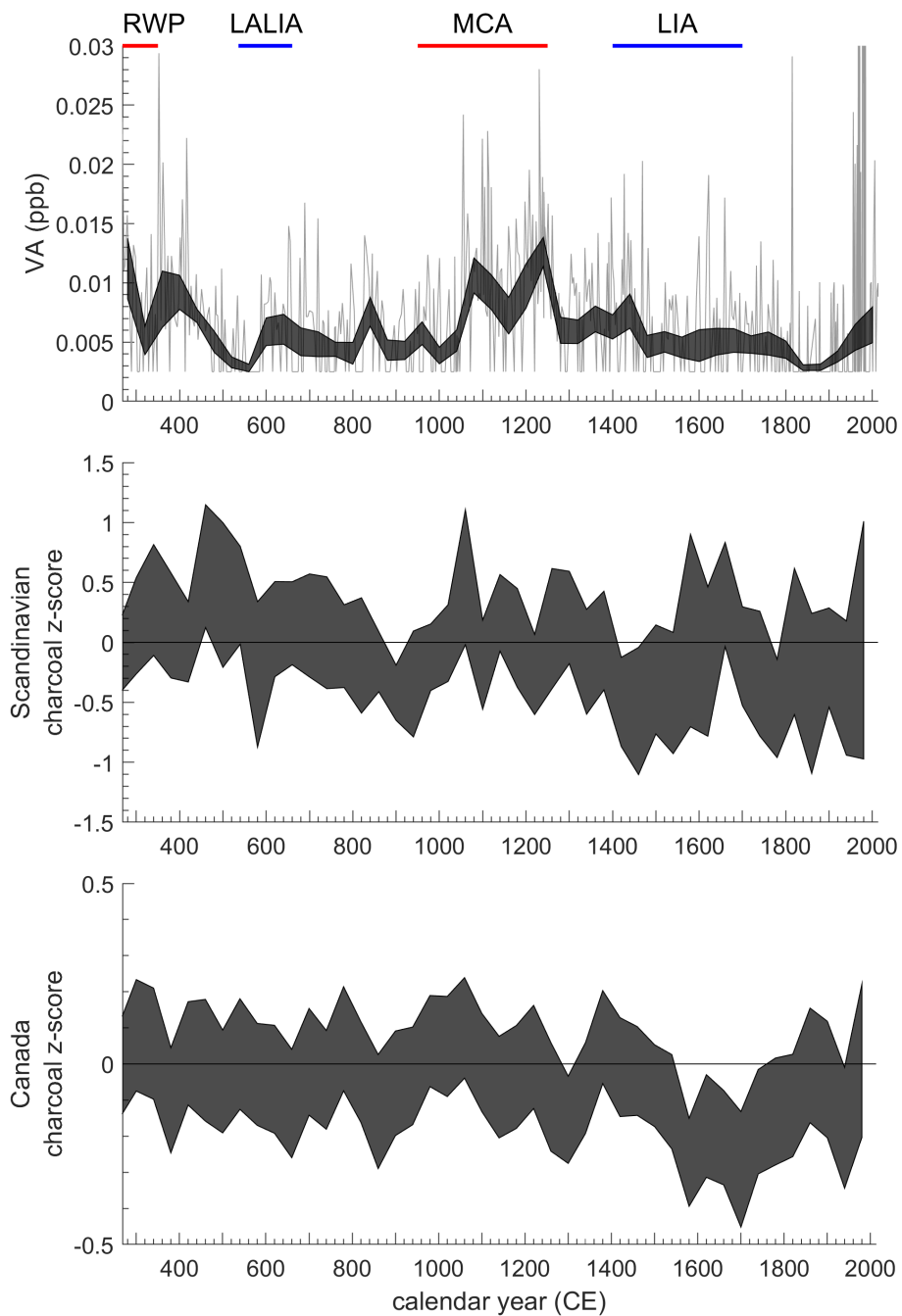
Figure S8. Comparison between Tunu vanillic acid (VA) and charcoal records. Tunu VA (Top): the gray filled lines are ± 1 standards errors of the 40-year bin averages of the data. Composites of 19 charcoal records from Scandinavia (middle, 50°-70°N, 0°-40°E) and 179 charcoal records from Canada (bottom, 40°-70°N, 10°-160°W). The gray filled lines are the 95% confidence intervals.
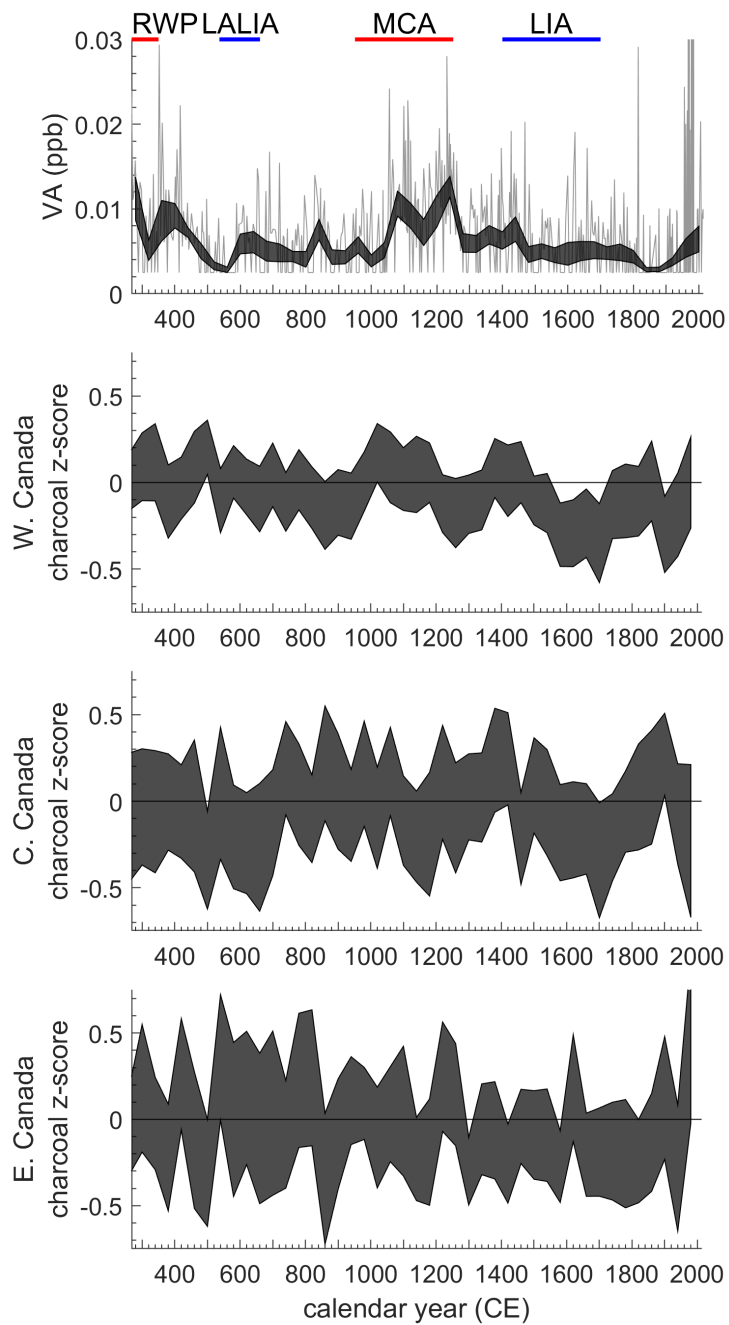
Figure S9. Comparison between Tunu vanillic acid (VA) and regional Canadian charcoal records. Tunu VA (Top): the gray filled lines are ±1 standards errors of the 40-year bin averages of the data. From top: 77 charcoal records from western Canada (40°-80°N, 110°-180°W), 34 charcoal records from central Canada (40°-80°N, 80°-110°W), and 60 charcoal records from eastern Canada (40°-80°N, 10°-10°W). The gray filled lines are the 95% confidence intervals.

References

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