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Supplement of

A 900-year New England temperature reconstruction from in situ seasonally produced branched glycerol dialkyl glycerol tetraethers (brGDGTs)

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MBT'_{5ME} Calibration to Local Temperature

As addressed previously, the Basin Pond MBT'_{5ME} record is presented without calibration to temperature. While the primary goal of this study was to understand the spatial and temporal variations in brGDGT production in Basin Pond in order to address potential seasonal bias in a novel 900 year temperature reconstruction, developing a brGDGT to temperature calibration for Basin Pond (or a regional calibration for the NE US) is an important aspect of research that merits focus in future projects and work. As a first step towards this, we investigated a preliminary lake-specific calibration for MBT'_{5ME} to air temperature using the SPM samples collected in this study, which shows promise. We compared MBT'_{5ME} values to average daily air temperatures recorded at the closest weather station over each collection interval (Table S1, Figure S1a). Measurements of water column temperature were not made. We note that during the January 2015 (late fall through spring) sample, only temperatures from ice-free dates were used in the average, as brGDGT production likely decreases drastically or ceases during times when the lake is ice covered. This is an assumption about brGDGT production that should be more thoroughly investigated in future work. Ice-in and ice-out dates (Table S1) were provided by the Maine Volunteer Lake Monitoring Program (MVLMP).

Through linear regression, we find a positive relationship between MBT'_{5ME} and average temperature for each time period, with a correlation coefficient of ~ 0.4 (Fig S1a). We applied this calibration downcore and compared to the two calibrations discussed in the manuscript (Fig S1b); the MBT'_{5ME} African lakes calibration (Russell et al., 2018) and a calibration from Chinese Lakes (Dang et al., 2018). The Basin Pond calibration has a similar slope to that of Russell et al. (2018), resulting in nearly identical reconstructed temperature trends, with temperature values offset by $\sim 1-2^{\circ}\text{C}$ (Figure S1b). While the Russell et al. (2018) calibration produces slightly lower than observed temperatures, the Dang et al. (2018) calibration produces far lower temperatures (10°C) than observed. The Dang et al. (2018) calibration also produces different temperature trends than those reconstructed by the MBT'_{5ME} calibrations (see section 5.2). Although the dataset is too short (4 data points) for a robust lake-specific calibration of MBT'_{5ME} against temperature, these initial results are promising, and provide support for future efforts to develop a calibration of MBT'_{5ME} to air and water temperature at Basin Pond. Currently, a new multi-year sampling campaign is underway in Basin Pond, with the goal of getting more data for a MBT'_{5ME} -temperature

correlation to produce a reliable calibration. This campaign includes water column temperature measurements.

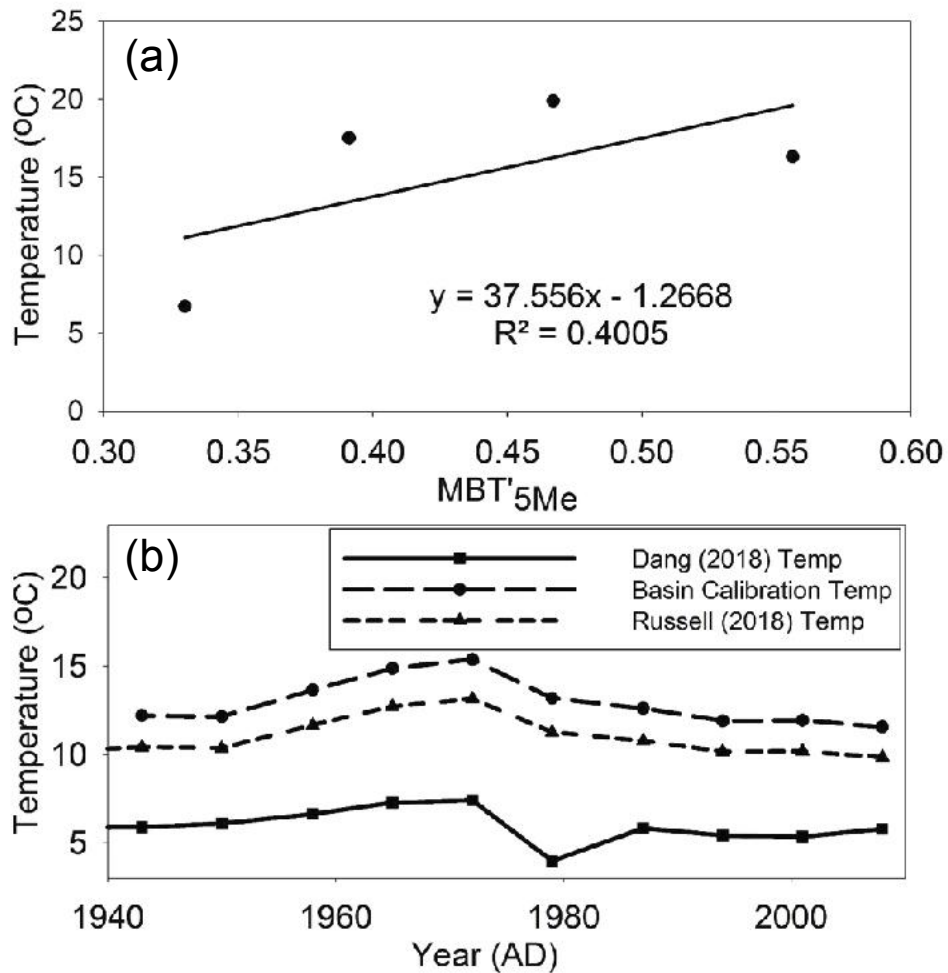


Figure S1. a) Comparison of MBT'_{5Me} values from all SPM samples (averaged for each date range) to average air temperatures during each time period. The equation for the plotted linear regression line, along with the correlation coefficient, are shown. b) Downcore reconstructed temperatures (in °C) from the Basin Pond calibration (long dashed line), the Russell et al. 2018 African lakes calibration (short dashed line), and from the Dang et al. 2018 Chinese lakes calibration (solid line).

Start Date	End Date	Avg Temp (°C)
05/27/2014	07/01/2014	16.31
07/02/2014	08/15/2014	19.90
08/16/2014	09/13/2014	17.52
09/14/2014	06/05/2015	6.71
<i>excluding ice-cover dates (12/2/14-4/26/15)</i>		
09/14/2014	06/05/2015	0.56

Table S1. Meteorological data used for calculating MBT_{5Me} to temperature calibration at Basin Pond, ME from June 2014 through June 2015

ID	Site Name	Type of Proxy	Lat	Lon	Avg. yr/sample	Citation
BP	Basin Pond	Pollen (Summer Temperature)	44.47	-70.05	24	Gajewski (1988)
BP	Basin Pond	Charcoal (Fire)	44.47	-70.05	7	Miller et al. (2017)
LI	Little Pond	Hydrogen Isotopes (Hydroclimate)	42.68	-72.19	25	Gao et al. (2017)
GH	Great Heath Bog	Testate Amoeba (Water Table Level)	44.7	-67.81	11	Clifford & Booth (2013)
SB	Saco Bog	Testate Amoeba (Water Table Level)	43.55	-70.46	5	Clifford & Booth (2013)
GH	Great Heath Bog	SVR (Hydroclimate)	44.7	-67.81	14	Nichols & Huang (2012)

Table S2. Additional information regarding sites discussed in the main text for comparison with the Basin Pond record.