

## Reply to Comment by T.J. Osborn and K.R. Briffa on "Mid-latitude (30°–60°N) climatic warming inferred by combining borehole temperatures with surface air temperatures"

Robert N. Harris and David S. Chapman

Department of Geology and Geophysics, University of Utah, Salt Lake City, USA

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[1] We thank *Osborn and Briffa* [2002] for their comment regarding our use of the climatic reconstruction of *Overpeck et al.* [1997]. We [*Harris and Chapman*, 2001] had taken a proxy, Arctic wide summer-weighted annual temperature reconstruction [*Overpeck et al.*, 1997], given in dimensionless sigma units (i.e., normalized deviation from the 1901–1960 proxy mean in units of standard deviation of the new series for the period 1901–1960) and represented the reconstruction in our Figure 3 and Table 1 in terms of dimensional temperature units °C.

[2] While Figure 3 of *Overpeck et al.* [1997] is given in dimensionless units, the text refers twice to dimensional temperature change in the Arctic. In both instances ("the 19th to 20th-century warming...averaged about 1.5°C across the Arctic" [*Overpeck et al.*, p. 1252]; "Half of the post-1840 warming (about 0.75°C) took place from 1840 to 1920" [*Overpeck et al.*, p. 1253]) the magnitude of the changes, cited in dimensional temperature °C, match the change in dimensionless units. Because the Earth is a low-pass filter and borehole temperature reconstructions are sensitive to long-term variations we felt that the long-term variations in the arctic temperature were adequately represented. The calibration of the *Overpeck et al.* [1997] proxy temperature reconstruction given by *Briffa et al.* [2001] suggests that this is not the case. The calibrated reconstruction does not indicate greater warming than other northern hemispheric reconstructions and thus the latitudinal amplification of surface warming in the Northern Hemisphere now appears illusory.

[3] The comparison of calibrated climatic reconstructions shown in Figure 1 [*Osborn and Briffa*, 2002] illustrates results from two kinds of analysis, each yielding a different climate-change parameter. The proxy reconstructions [*Briffa et al.*, 2001] are calibrated into temperature space by comparison with observed April–September surface air temperature (SAT) averaged over all land areas north of 20°N, and for the period 1881–1960. Temperature anomalies are plotted relative to the 1961–90 mean. The POM-SAT model of *Harris and Chapman* [1997, 2001] combines borehole temperatures for long-term baseline temperature

information with co-located SAT information for high-resolution 20th century temperature change. The hybrid reconstruction is referenced to the 1961–1990 mean annual, rather than spring-summer, temperature. We emphasize that the magnitude of temperature change determined with this method is the same as that determined from the borehole temperatures alone, and thus does not represent a calibration in the sense used with proxy methods.

[4] These temperature reconstructions, whether proxy or SGT (see also *Huang et al.* [2000]) show that the 20th century exhibits unusual warming relative to the previous three or four centuries. The other major observation that remains, if the Arctic reconstruction is not an outlier of northern hemisphere reconstructions, is that surface ground temperatures (SGT) histories inferred from borehole temperatures clearly suggest greater warming since the 18th and 17th centuries than do proxy reconstructions. This discrepancy (see *Harris and Chapman* [2001] for some possible explanations) needs to be resolved before the potential of combining borehole temperatures with high-resolution proxy indicators of climate change can be fully realized.

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R. N. Harris, Dept. of Geology and Geophysics, University of Utah, 135 S 1460 E, Rm 719, Salt Lake City, UT 84112-0111, USA. (mharris@mines.utah.edu)