Table 2
Physical attributes of till facies, Mullins Valley.

Facies	Porosity[a] (std deviation)	Grain size analysis (mean, %)			Lithology (>16 mm) dolerite:sandstone:siltstone[b]	Impact chips	Munsell color
		Gravel	Sand	Mud			
Weathered	29.0% (2.9%)	25.2	72.9	1.9	96:04:00	Absent	10YR 5/4–5YR 5/7
Fresh	29.5% (2.1%)	45.3	49.7	5.0	93:06:01	Present	2.5Y 7/2
Sand-Wedge	31.0% (2.4%)	3.1	92.9	4.0	99:01:00	Absent	10YR 5/4

[a] Reported values reflect the smallest measured variation among facies.
[b] Green and maroon siltstone, most probably derived from rockfall from the Arena Sandstone.

vast majority of which are relict wedges), 15% weathered facies, and 20% fresh facies (see also Fig. 6 for additional details).

4.5. Microclimate variation

Tables 1a, 1b, 1c summarizes our observations and meteorological data collected between December 2004 and December 2009 (Fig. 7). An important point is that summertime environmental conditions vary appreciably along the length of Mullins Glacier. For example, the maximum summertime air temperature (December, January, and February) recorded at 10 cm above the till in upper Mullins Valley (site 2, 1524 m elevation) reached 1.6 °C, while at the glacier terminus (site 5, 1272 m elevation) the maximum temperature reached 5 °C. All recorded atmospheric temperature maxima were short lived, lasting only a few hours; and none of our five monitored sites showed positive-degree days for any portion of the study interval (2004–2009). At all measured locations, the buried surface of Mullins glacier was dry and <<0 °C.

Measured values for relative humidity (RH) revealed a general trend toward higher values with increasing elevation, with a mean of ~48% at Mullins terminus (site 5, 1272 m elevation) and 60% at 1550 m elevation in upper Mullins Valley (site 1). The higher values in upper Mullins Valley likely reflect the persistence of low clouds in that region (as observed in the field).

Apart from abrupt spikes in soil moisture that arise from minor snowmelt at the margin of solar-heated rocks, all facies within Mullins till contain <5% gravimetric water content (GWC). The infrequent snowmelt along solar-heated rocks generates a moist (but not

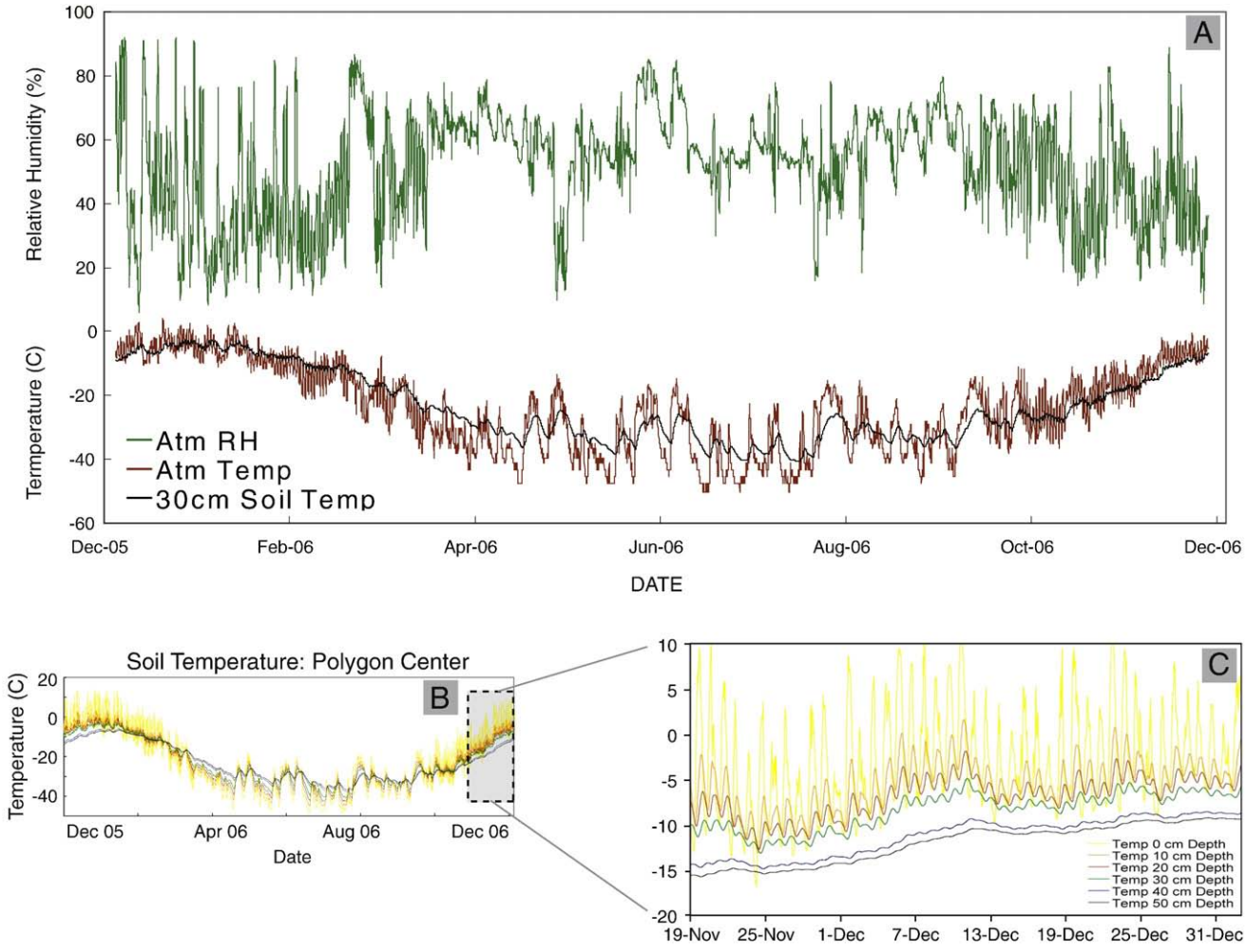

Fig. 7. A 12-month data set of (A) atmospheric data and (B) soil temperature recorded at Mullins terminus meteorological station (site 5; see Fig. 2C). (C) Blow-up of soil temperature profile data. Note progressive dampening of the thermal wave with depth; daily variations are essentially absent at depths of ≥50 cm. Ground surface temperatures exceed 0 °C by several degrees because of solar warming of low-albedo rocks, but temperatures at depths >10 cm consistently remain below 0 °C.