

Temperature in West Antarctica over the last 50 and 200 years

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ITASE has collected more than 200 shallow ice cores, providing an unprecedented picture of Antarctic glaciochemistry over the last few hundred years. Yet the challenge to use these data to quantitatively reconstruct past climate in Antarctica over the last 200 years – the stated goal of the original ITASE science planning documents – still lies largely ahead of us. Ironically, the greatest challenge may no longer lie in the paucity of ice core data, but rather in the paucity of instrumental data against which to calibrate the ice cores. With this in mind, several attempts have recently been made to improve our understanding of recent climate -- and in particular temperature variability -- in Antarctica, based largely on instrumental data. Our approach (Steig et al., 2008) has been to use statistical climate field reconstruction to combine the spatial information from satellites with temporal data from weather stations. Among the findings is that, in the last 50 years, significant warming has occurred over most of West Antarctica, extending well beyond the Antarctic Peninsula, an area much larger than previously reported. This warming exceeds 0.1 °C/decade in the last 50 years, and is strongest in winter and spring. Although this is partly offset by fall cooling in East Antarctica, this effect is restricted to the 1980s and 1990s. The continent-wide average surface temperature trend is positive and significant at >0.05°C/decade since 1957. Comparison with simulations from coupled and atmosphere-only general circulation models suggests that these changes are closely associated with variations in sea ice.

Having established what we believe to be the most reliable reconstruction of Antarctic temperature change to date, we use the growing database of annually resolved and well-dated (Steig et al., 2005) ice core isotopes records from ITASE (and earlier programs) to extend this reconstruction over the last 200 years. While we cannot confidently reconstruct East Antarctic temperature during this time period, verification statistics show that the reconstruction is reliable for West Antarctica. Our results are consistent with our earlier results based on a simple composite of ice core records (Schneider et al., 2006). We find that there has been warming on average in West Antarctica throughout the 20th century; the trend is dominated by the influence of several relatively strong El Niño events in the late 20th century. Preliminary data from the WAIS Divide core suggests that this warming may be unprecedented in the last 200 years or more.

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