Antarctic snow inaccurate temperature archive

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The data from several automatic weather stations which the Institute for Marine and Atmospheric Research Utrecht (IMAU) has maintained in Antarctica for many years were particularly valuable for the research.

According to Dutch researcher Michiel Helsen, annual and seasonal temperature fluctuations are not accurately recorded in the composition of the snow of Antarctica. His research into the isotopic composition of the Antarctic snow has exposed the complexity of climate reconstructions.

Polar ice caps contain valuable information about the earth's climate. Helsen investigated the extent to which meteorological data are stored in the composition of snow in order to improve the interpretation of deep ice cores from the Antarctic ice cap. He demonstrated that annual temperature variations in Antarctica could not be accurately

reconstructed from ice core investigations. The conditions during snowfall are not representative enough for the average weather over an entire year.

His research also revealed that although temperature differences over the entire continent of Antarctica have a major influence on the composition of the snow, there are strong spatial variations in this. Accordingly a simple conversion of the fluctuations in the snow composition to changes in the local temperature is unreliable.

'Heavy' or 'light' snow?

During climate reconstructions researchers mainly examine variations in the weight of the water molecules in the ice, the so-called isotope values. Differences in the isotopic composition of precipitation occur as a result of condensation cycles during atmospheric transport: heavier water molecules are precipitated earlier than lighter ones. Atmospheric temperature plays a major role in this process. Helsen simulated this process using recent meteorological data. With this the researcher demonstrated that although temperature differences across Antarctica could largely explain the observed variations in the isotope values, the spatial correlation between temperature and isotope value varies strongly from place to place.

The prevailing conditions during snowfall determine the climate signal that is stored in the snow pack. However a heavy snow storm is a relatively rare occurrence in the interior of Antarctica because the kilometres-thick ice functions as a barrier for depressions carrying snow. Therefore the conditions during snowfall are not representative for the annual average weather conditions. Only averages over several years will provide reliable climate data from ice cores.

Helsen emphasises the complexity of isotope variations in the

hydrological cycle, even in a relatively stable area such as Antarctica. He therefore advises fellow climatologists to be careful when quantifying climate signals over a period of several years on the basis of ice-core data.

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