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Past local summer temperature revealed by the total air content record from the Antarctic EPICA Dome C ice core

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Seasonal temperature reconstructions from ice cores are missing over glacial-interglacial timescales, preventing a good understanding of the driving factors of Antarctic past climate changes. Here we present a new total air content (TAC) record from the Antarctic EPICA Dome C (EDC) ice core covering the last 800 thousand of years (ka).

We show that the TAC record is highly correlated with the mean insolation over the local astronomical half-year summer. Benefiting from new climate transient simulations from the Earth system model of intermediate complexity LOVECLIM covering the past 440 ka, we evidence that the EDC TAC record is correlated with the simulated local summer temperature changes. Hence, our new results suggest that the EDC TAC record could potentially be used as a proxy for local summer temperature changes. We present also preliminary results exploring this link between TAC and past summer local surface temperature at other ice core sites in Antarctica and in Greenland.

Finally, our simulations show that local summer insolation is the primary driver of Antarctic summer surface temperature variations while changes in atmospheric greenhouse gas concentrations and northern hemisphere ice sheet configurations play a more important role on Antarctic annual surface temperature changes.