Sensivity of the West Antarctic Ice Sheet to 2° Celsius of Warming. The SWAIS2C project.

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The West Antarctic Ice Sheet (WAIS) is currently experiencing accelerated mass loss and contains enough ice to raise global sea levels by up to five meters if it were to melt completely. The objective of the international and interdisciplinary SWAIS2C project (Sensivity of the West Antarctic Ice Sheet to 2 Degrees Celsius of Warming) is to understand past and present factors influencing WAIS dynamics and to reconstruct WAIS response to warmer temperatures, including those exceeding the +2°C target outlined in the Paris Climate Agreement. The project will drill two deep boreholes beneath the Ross Ice Shelf to obtain sediment sequences from a site close to the grounding line of the Kamb Ice Stream site (KIS-3) and the Crary Ice Rise (CIR). The geological data will be used to improve model-based projections of future sea level contributions from Antarctica and to answer the overarching question under what climatic conditions the WAIS collapsed in the past.

Here we present an overview of the SWAIS2C project, its aims and current progress. In the first season 2023/24, hot water drilling was successfully completed at KIS-3 to penetrate the ~580 m thick Ross Ice Shelf. Oceanographic measurements were taken in the ~55 m ocean cavity beneath the ice shelf, together with videos of the seafloor and ice shelf, and installation of permanent moorings. Gravity and hammer coring yielded 7.6 m of sediment, which have been subsampled for microbiology and geochemistry, and described using field-based x-ray images. The sediments recovered include the longest sediment core from the Siple Cost, measuring 1.92 m.

The sedimentological and drilling experience gained will be of great value for the 2024/25 season, when a team of drillers and scientists will return to KIS-3 for deep drilling with the Antarctic
Intermediate Depth Drill (AIDD). A combination of hydraulic piston coring and rotary coring will be used to retrieve a sediment core of up to 200 m below sea floor. Drilling operations will be complemented by geophysical downhole logging with wireline tools from the Leibniz Institute for Applied Geophysics (LIAG) and a logging while tripping system provided by the German Research Centre for Geosciences (GFZ). The inclusion of different methods will allow downhole logging of several parameters over the entire sediment sequence and minimizes the influence of unstable borehole walls on the measurements.