West Antarctic Ice Sheet Divide Ice Core

Climate, Ice Sheet History, Cryobiology

Why do we study ice cores?

Ice cores help predict how climate will change in the future. Snow that falls on the ice sheet is buried by subsequent snow and forms the layers of ice that make up the ice sheet. The ice layers contain dissolved chemicals, insoluble dust particles, and atmospheric gases that were present when the snow fell. By drilling down into the ice sheet and recovering ice from ancient times, it is possible to determine the climate conditions when the snow fell. The ice layers contain a record of how the climate changed. This allows us to determine how and why climate changed in the past. By understanding how and why climate changed in the past, we are able to improve predictions of how climate change will happen in the future. Ice cores also help us understand how the size of the ice sheet has changed in the past in response to different climate conditions, which helps us predict how the ice sheet will respond to future climate changes.

Site Selection

The location for the West Antarctic Ice Sheet (WAIS) Divide ice core was selected to maximize the time resolution of the climate record during the last 100,000 years. We anticipate that we will recover a record of climate and ice sheet characteristics that extends 100,000 years into the past with annual resolution to 40,000 years. Because the drill site is located on an ice divide (similar to a watershed divide) the core is called the WAIS Divide Core (WDC). The ice is approximately 3,465 m thick at this location.

Main Objectives

1. Examine the relationship between the changes in the atmospheric concentration of greenhouse gases and climate, to improve our understanding of how human induced changes in greenhouse gases have and will alter climate.

2. Examine the relationship between Arctic and Antarctic climate, to determine the role of the polar regions in future climate changes.

3. Examine the possibility that the size of West Antarctic Ice Sheet may decrease, to determine if a rapid rise in sea level might occur.

4. Examine the biology of ancient deep ice, to better understand how life adapts to extreme environments.

Schedule

2005/2006: Established field camp and started construction of drill shelter
2006/2007: Completed construction of drill shelter and drilled pilot hole
2007/2008: Install the DISC drill and start deep drilling
2008/2009: Second year of deep drilling
2009/2010: Third year of deep drilling
2010/2011: Last year of deep drilling, reach the bottom of the ice sheet. Basal sampling and borehole logging.
2011/2012: Collection of more ice from depths of special interest

Some Examples of Ice Core Data

The ice contains gases that are analyzed to determine the atmospheric concentration of greenhouse gases in the past. Isotopes of the hydrogen and oxygen in the ice are used to determine what the temperatures were at the drill site and the ocean where the water evaporated and entered the atmosphere. Calcium, aluminum, manganese, and the concentration, size, and mineralogy of insoluble dust particles are used to estimate the wind speed and direction when the snow fell.

Organizational Participants

The National Science Foundation (NSF) Office of Polar Programs funds the project with most of the science funding coming from the Glaciology Program managed by Julie Palais. Some additional science funding is provided by the Antarctic Organisms and Ecosystems Program. Logistical support is provided by NSF’s Division of Antarctic Infrastructure and Logistics. Contact: Dr. Julie Palais (jpalais@nsf.gov)

Raytheon Polar Services Company is responsible for the field logistics including construction of the field camp and drill shelter, and general camp operations. Contact: Matthew Kippenhan (matthew.kippenhan@usap.gov)

ICF and Drilling Services (University of Madison, Wisconsin) designed, built and operates the deep ice drilling that will recover the ice core. Contact: Dr. Alex Shuurmakov (alex.shuurmakov@uwisc.wisc.edu)

The National Ice Core Laboratory (USGS) is responsible for the depth core handling system, assisting investigators in sampling the ice core, and permanently archiving the ice core in Denver. Contact: Dr. R. Randall Schumann (rschumann@usgs.gov)

The Science Coordination Office (Desert Research Institute and the University of New Hampshire) coordinates the science aspects of the project. Contact: Dr. Ken Taylor (kendrick@dri.edu)

Currently Funded Projects

Project

- Application of Optical Stratigraphy to the West Antarctic Ice Sheet Divide Ice Core (Collaborative Research)
- Collection of more ice from depths of special interest
- 4,000 m in diameter to depths of 4,000 meters. The DISC Drill utilizes many technologies proven on Russian and European drills, as well as several new innovations.

- The Deep Ice Core Coring (DISC) drill is an electromechanical drill designed to cut and retrieve ice cores 122 mm in diameter to depths of 4,000 meters. The DISC Drill utilizes many technologies proven on Russian and European drills, as well as several new innovations.

- The drill site for the WAIS Divide Ice core is located at the WAIS Divide. Locations of other deep ice cores are also indicated (Spie Dôme and Byrdy). Surface elevations are shown in meters. The blue areas on the ice sheet are ice streams, regions of an ice sheet that move significantly faster than the surrounding ice.

- Light shining through the wall of a snowpit at WAIS Divide highlights the layering in the upper two meters of the ice sheet.

Additional Information

For more information, email Kendrick Taylor (kendrick@dri.edu) at the Desert Research Institute, or visit our website at www.waisdivide.unh.edu.