Is there water under the Antarctic ice sheet?

More than 300 discovered subglacial lakes which are connected by subglacial rivers form a widespread hydrological network.

Ice streams

Basal water flux

RIMBAY

Model a single subglacial lake

Idealized model geometry

Lakes can be identified by unusual flat ice sheet surface areas on satellite images. Despite the cold surface with temperatures around -50°C, large areas of the bed of the ice sheet are at the pressure melting point and actively melting through the combined influence of the insulating cover of ice and the flow of geothermal heat into the base of the ice sheet.

How do we know that?

Despite the cold surface with temperatures around -50°C, large areas of the bed of the ice sheet are at the pressure melting point and actively melting through the combined influence of the insulating cover of ice and the flow of geothermal heat into the base of the ice sheet.

Where does the basal water come from?

Subglacial lakes are often situated at the onset of ice streams and act as water reservoirs for upstream catchment areas.

Why incorporate basal hydrology in ice sheet modeling?

Subglacial lakes are often situated at the onset of ice streams and act as water reservoirs for upstream catchment areas.

Ice model RIMBAY
- Shallow ice approximation (SIA) for grounded ice sheet
- Shallow shelf approximation (SSA) for 'floating' ice over the lake

Model results indicate all characteristics of real lakes
- flat ice sheet surface over subglacial lake
- inclined lake surface

Geothermal heat flux for Antarctica, Fox Maule 2005

RIMBAY: flat ice sheet surface over a subglacial lake

Antarctica: Gamburtsev Mountains with a very mountainous bedrock topology

Greenland: Jakobshavn Glacier with a deep trench

Ice streams and subglacial lakes
the crucial impact of basal hydrology on ice sheet modeling

How does the subglacial bedrock typically looks like?

Mountainous bedrock topography with a sine-shaped trench.

After 10,000 years of accumulation a stable ice sheet builds up.