

**Seminar on Physics and Chemistry
of the Atmosphere
26.10.2018, WiSe 2018 - 2019, IUP Bremen**

Ice, Ocean, and Glacier Change in a Warming Arctic

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Abstract

Profound changes in the polar climate system are matched by advances in technology to document this change. I here present in situ and remotely sensed observations that relate oceanic heat and freshwater flux to retreating glaciers of northern Greenland. The dominant scale of such ocean flux is the internal Rossby radius of deformation that emerges when horizontal pressure gradients due to density variations almost balance Coriolis accelerations due to the earth's rotation. Friction enters the dynamics, too, but is usually constrained within boundary layers below the ice and above the bottom.

Both Petermann and 79N Glaciers in north-west and north-east Greenland contain floating ice shelves that are grounded near 600 m below the sea surface about 50-80 km landward from their terminus. Heat from the Atlantic Ocean melts both glaciers near these grounding lines at rates that are accelerating over the last 20 years. This subsurface heat reaches the glaciers via pathways that bear little resemblance to surface circulation or property distributions. Instead, we often find bottom intensified flows near sloping topography that advect warm Atlantic waters from the deep ocean across broad and shallow continental shelves to coastal glaciers via networks of canyons and straits whose width exceeds the internal Rossby radius of deformation.

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