Glacier-ocean interactions

The melting of tidewater outlet glaciers from the Greenland Ice Sheet contributes significantly to global sea level rise. Accelerated mass loss is related to melt processes in front of calving glaciers, yet the role of ocean heat transports is poorly understood.

Satellite observations show a significant increase in mass loss from the polar ice caps. The greatest contribution to the accelerated mass loss derives from the Greenland Ice Sheet.

Ocean heat transport and subsurface melting are critical processes for understanding glacier stability and increased mass loss from the polar ice caps. The subsurface melt rates are high at tidewater outlet glaciers in Greenland. Variability in melt rates is associated with temperature change in surrounding water masses.

Ice melt occurs both directly at the glacier front and in adjacent waters where calved ice is melted by atmospheric heating and ocean heat fluxes. In particular, buoyant plumes, driven by subglacial meltwater discharge, transport significant amounts of heat to the surface through the entrainment of relatively warm ambient bottom water. However, few direct observations of ice-ocean interaction have been made in front of calving glaciers. Model studies have shown that ice melt may enhance the overall calving rate, and studies using buoyant plume models have further elucidated the important role of ocean temperature and subglacial discharge rate for ice melt.

We examine the coupling between the glacier retreat and atmospheric and ocean conditions and how that will affect biological and chemical conditions in the fjord systems and coastal areas. This approach will

- Provide detailed information of the atmosphere-glacier-ocean interactions
- Document how heat affects melting of marine terminating glaciers
- Document the effect on iceberg production
- Document how subglacial discharge affect local circulation and upwelling
- Document how glacier melt will affect nutrient availability and biological production
- Document how glacier melt will affect CO_2 fluxes between the atmosphere and ocean
- Enable us to integrate this information to global processes and models

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