

## Beaufort Gyre Exploration Project: Beaufort Gyre (BG) circulation

The Beaufort Gyre is an important circulation cell of the Arctic Ocean dynamics. Figure 1 illustrates idealized patterns of the two dominant wind-driven ocean circulation regimes: anticyclonic and cyclonic. Climatological studies (e.g., *Proshutinsky and Johnson, 1997*) provide a foundation for understanding the significance of these ocean surface conditions. These studies indicate that the Arctic Ocean surface layer currents are consistent with the Arctic atmosphere surface layer motion, alternating between cyclonic and anticyclonic circulation regimes. Each regime persists from 4 to 8 years, resulting in a period of 8–16 years. The cyclonic pattern dominated during 1989-1996. Since 1997 the dominant regime has fluctuated, with an anticyclonic pattern being more prevalent (Fig. 1). Figures 1-9 show annual simulated wind-driven surface ice and ocean motion for 2000 through 2008. The Arctic Ocean Oscillation index (bottom panel in Figure 1) illustrates alternation of circulation regimes at a period of 8-16 years. During anticyclonic circulation regimes the BG region accumulates fresh water and during cyclonic regimes the BG region releases fresh water and this water could be available for transportation to the North Atlantic via Straits of Canadian Archipelago and Fram Strait.

The circulation of Pacific water (located at depths between 50 and 200 m) in the Arctic Ocean may be coherent with the surface currents, but its pathways are not known from direct observations.

The Atlantic water circulates in the Arctic Ocean at approximately 200–800m deep. This water penetrates to the Arctic via Fram Strait and St. Anna Trough (Barents Sea). Under extensive surface cooling, it sinks to intermediate depths and forms the warm Atlantic Layer, with water temperatures greater than 0°C. This layer is covered by low-density surface waters and is thus prevented from undergoing heat exchange with the atmosphere. The most widely accepted circulation scheme of Atlantic water (*Rudels et al., 1994*) postulates that it circulates counterclockwise, forming several loops in the Arctic basins (Fig. 4, red arrows). The variability of the Atlantic water circulation pattern is not known from observations, but model results show that its circulation has a pulsating character expressed in the propagation of warm and cold events, changing from seasonal to decadal time scales.

### References

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