The Beaufort Shelfbreak Jet: Structure, Variability, And Fate

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LONG-TERM GOALS

The long-term goal is to understand the dynamics of exchange between the shelf and open ocean. Regionally, we wish to determine the dominant processes leading to shelf-basin exchange in the western Arctic, and the impact of this on the ventilation of the Arctic halocline.

OBJECTIVES

The main objectives of this study are (1) To determine the mean transport and cross-stream structure of the Beaufort shelfbreak current; (2) To elucidate the temporal and spatial variability of the jet; and (3) To compare the water mass components of the current to the observed offshore eddies in the western Arctic, to help determine their source.

APPROACH

The approach is to use historical hydrographic and current meter data archived at the National Ocean Data Center, concentrating on the area between Barrow Canyon and 140°W (Figure 1a). It is here

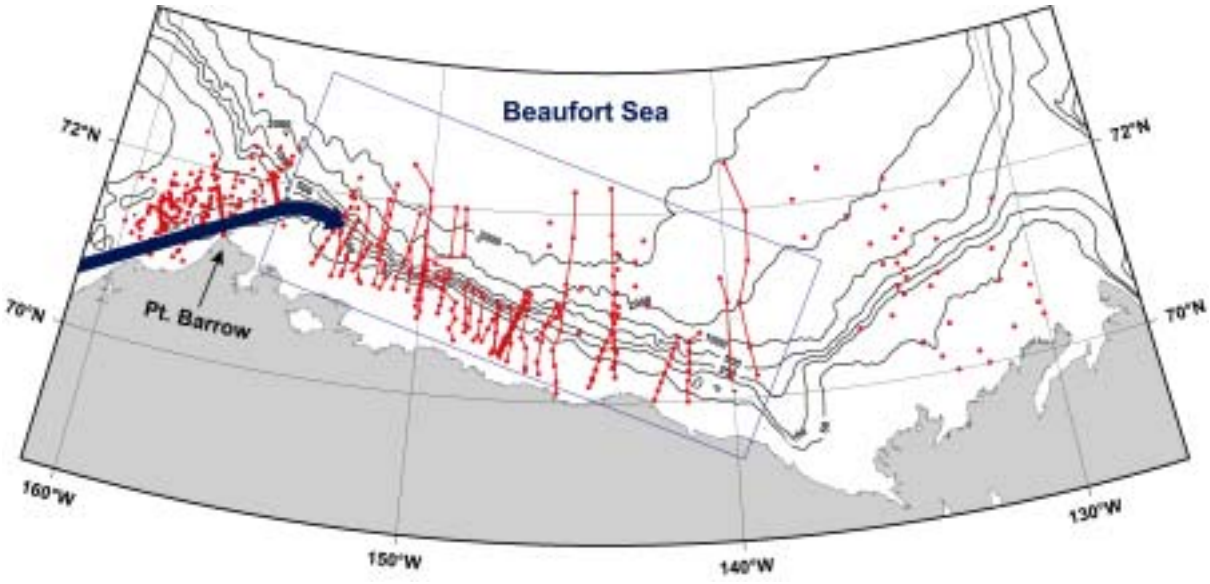

Figure 1a. Study area on the Beaufort shelf and slope. The arrow denotes the flow of Pacific water past Barrow Canyon. The hydrographic sections used in the study are those within the blue box.

that the Pacific water flowing northward from Bering Strait reaches the shelfbreak and turns eastward as a shelfbreak current. There have been 42 hydrographic sections done over the last 50 years (Figure 1a), and a handful of current meter mooring deployments. First, an overall mean section is to be computed, followed by an analysis of the variance about this mean, including a comparison to the observed interior eddy field.

WORK COMPLETED

All of the synoptic sections have been extracted from the historical database. Using the International Bathymetric Chart of the Arctic Ocean (IBCAO) data set, an average cross-stream bottom profile was then constructed for the region. Each section was then mapped onto this average bathymetric coordinate system, and objectively interpolated onto a uniform grid. Finally, the interpolated synoptic sections were combined to form mean sections of various hydrographic variables. Standard deviation fields were also produced.

RESULTS

The composite hydrographic sections reveal the unique nature of the Beaufort shelfbreak. In the upper layer (< 50 m) there are two distinct temperature extrema (Figure 1b, color): a narrow core of warm water at the shelfbreak, and a broader area of warmer water further offshore. The inshore signal has a much higher standard deviation, which indicates that warm Bering Strait Summer Water is present intermittently at the shelfbreak. By contrast, the cold subsurface water mass just seaward of the upper slope (centered near 100 m) is more stationary. The origin of this water is still under investigation. The mean potential density section (Figure 1b, contours) reveals a baroclinic jet situated against the upper slope. The sense of the shear implies maximum baroclinic eastward flow near 150-m depth. The current meter data will be used to quantify this.

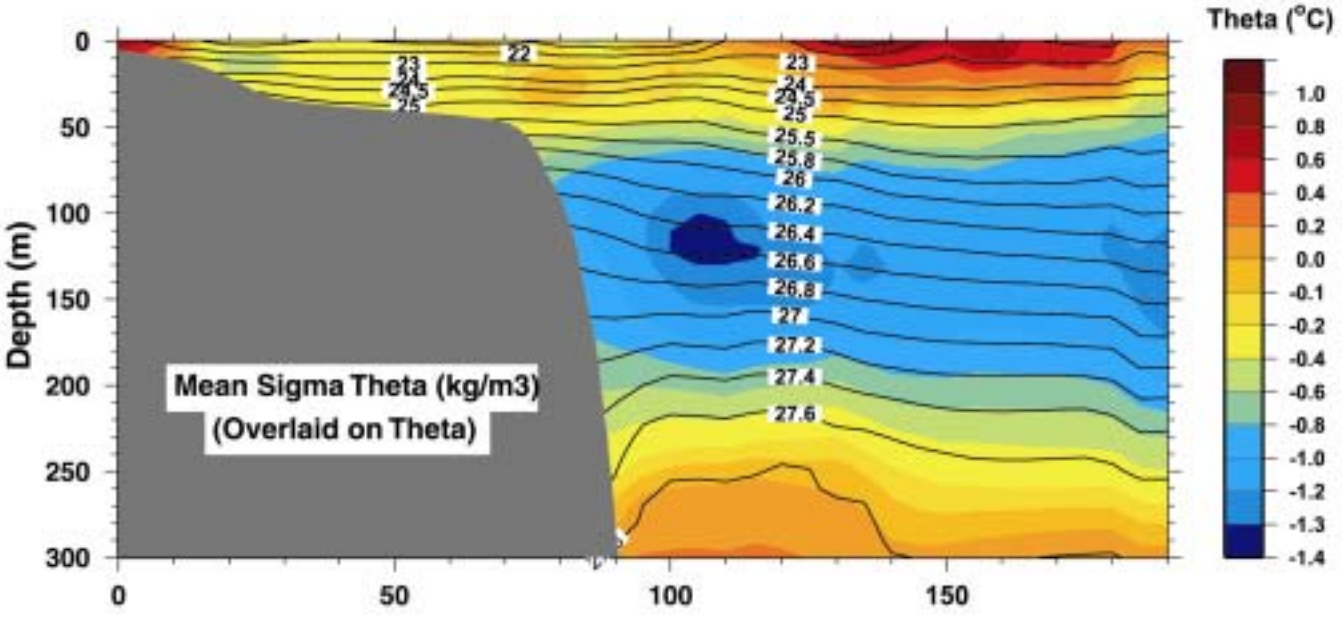

Figure 1b. Mean section of potential temperature (color), overlaid on potential density (contours).

IMPACT/APPLICATIONS

The mean hydrographic sections have demonstrated the existence of the Beaufort shelfbreak jet, implying that much of the Bering Strait Pacific water "turns the corner" at Barrow Canyon and flows eastward. This suggests that the export directly out of Barrow Canyon into the open Arctic may be less than previously thought. Alternative exchange mechanisms that could transport the water offshore will be investigated in the future using these historical data.

TRANSITIONS

None

RELATED PROJECTS

This project is being carried out in conjunction with the western Arctic Shelf-Basin Interactions Program (jointly sponsored by NSF and ONR).

REFERENCES

None.

PUBLICATIONS

None.