The status of the Bering Sea in the second half of 1996

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Dr. Phyllis Stabeno, a physical oceanographer at the Pacific Marine Environmental Laboratory of the NOAA, conducts research focused on understanding the dynamics of circulation of the N. Pacific, Bering Sea and their adjoining shelves. By applying her knowledge of physical processes to fisheries oceanography, Dr. Stabeno plays a vital role in the success of NOAA's Fishery Oceanography Coordinated Investigations (FOCI) program. FOCI research focuses on building sustainable fishery resources in the Gulf of Alaska and Bering Sea while maintaining a healthy ecosystem. Phyllis is also a Principal Investigator on several research elements for other programs, including: Southeast Bering Sea Carrying Capacity (Coastal Ocean Program), the Bering Sea Green Belt: processes and ecosystem production (Arctic Research Initiative) and Prolonged Production and Trophic Transfer to Predators: processes at the inner front of the southeast Bering Sea (National Science Foundation). This research seeks to improve our understanding of ecosystems through the integration of physical and biological phenomena.

Wind speed and air temperature during the final quarter of the year determine winter oceanic temperature and sea ice conditions. Ice formation and extent over the eastern and western Bering Sea shelf is closely related to winds. Historically, when storms travel along, or south, of the Aleutian Island Chain, as opposed to moving northward into the Bering Sea, ice production is enhanced and the ice edge is south of its climatological position. The atmospheric conditions responsible for the ice phenomenon also can perturb the mean northward transport through Bering Strait; strong winds toward the south reduce the mean transport and generate reversals that extend over substantial periods. Early sea ice extent does not necessarily determine the maximum extent, however, since the maximum extent occurs in March or April.

Atmospheric conditions over the Bering Sea exhibited anomalous behavior during the last half of 1996. Monthly mean sea level pressure (SLP) was from 4 to 16 hPa higher than usual over the Bering Sea from July through December (as illustrated by the SLP maps for September and December; *Figure 1*). This pattern resulted from storms tracking primarily south of the Aleutian Island Chain. The transient atmospheric disturbances over the Bering Sea included greater anticyclonic activity than usual. These anticyclones are generally of Siberian or Arctic origin and are associated locally with anomalously large equatorward fluxes of cold air. Owing to the coupled nature of the atmospheric-oceanic-sea ice system, the sea level pressure distributions therefore suggest relatively extensive early sea ice formation with higher than normal spatial extent. Data from the Joint Navy/NOAA Ice Center and the National Weather Service in Anchorage, Alaska support this. By January 3, the sea ice extent along 170˚W longitude was ~59˚N, or almost 200 km further south than the climatological position (determined from satellite data obtained between 1972-1995).

The Bering Slope Current (BSC), the dominant circulation feature in the eastern Bering Sea, provides another index of the status of the Bering Sea. Studies of the BSC suggest that two significantly different modes exist. Many hydrographic surveys reveal an ill defined, highly variable flow interspersed with eddies, meanders and instabilities. Other surveys, however, reveal a more regular northwestward flowing current. The trajectories from the more than 50 satellite tracked drifters deployed in the southeast Bering Sea support this dichotomy in the structure of the BSC. They reveal the strong variability in the flow patterns that occur along the shelf break. In some trajectories, the BSC appears as a well behaved current flowing northwestward along the shelf break.

During summer of 1996, a well defined BSC was not evident in satellite-tracked drifter trajectories. Along the shelf-break the flow was weak from July through September, with some evidence of stronger flows occurring in October. The structure of the BSC directly influences both the advection and dynamics along the slope, and also the occurrence of across shelf fluxes, which provide nutrients for the rich productivity of the Bering Sea shelf.

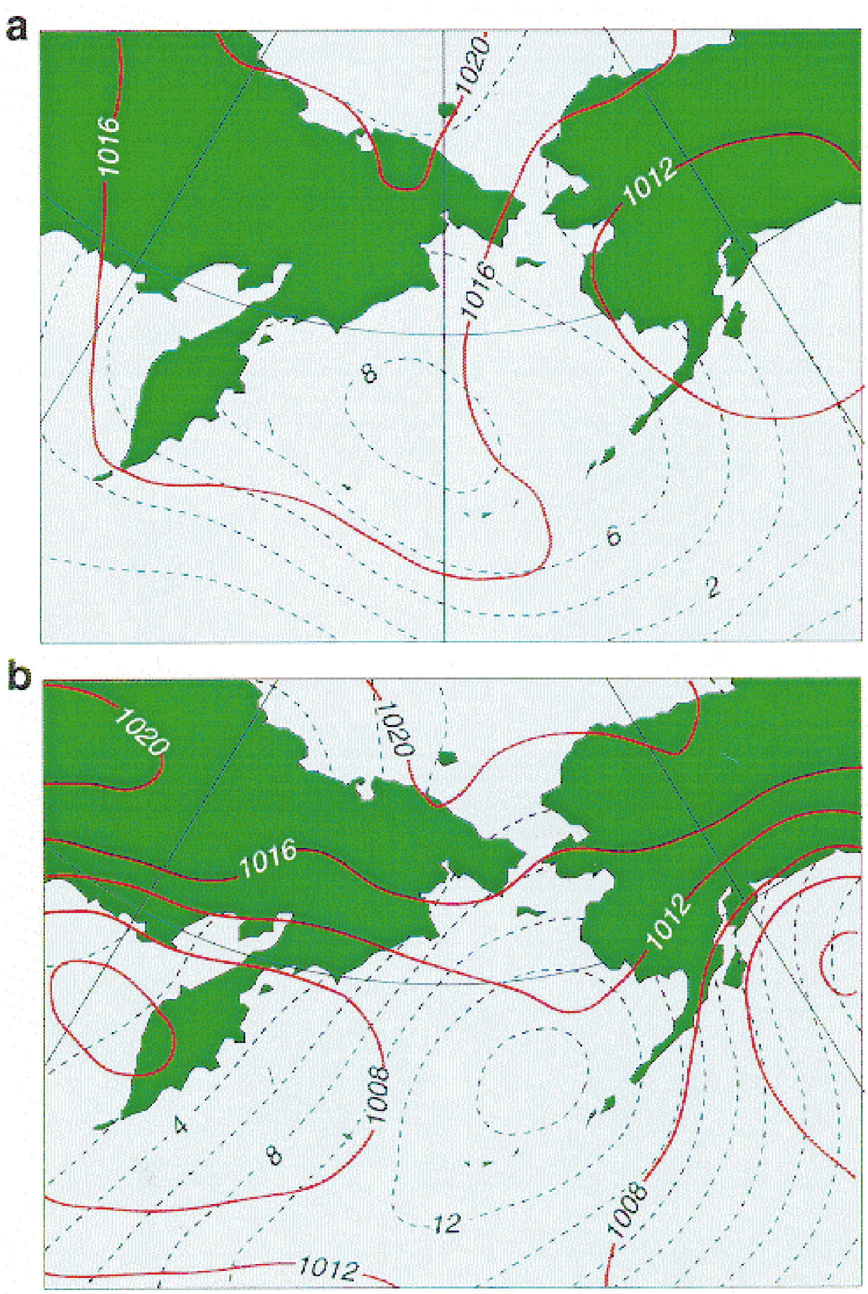

Fig. 1 The northern hemisphere mean and anomalous sea level pressure (hPa) for: (a) September 1996 and (b) December 1996. Solid red lines show the mean (calculated from 1979-1995) and the dashed lines show the anomalies from the mean (Climate Diagnostics Bulletin, Climate Prediction Center NOAA/NWS/NCEP).