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Atmospheric Forcing of the Fresh-water Content in the Beaufort Gyre

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Observations showed that the fresh-water content (FWC) in the Arctic Beaufort Gyre has increased substantially since 1990. A leading mechanism for this increase is that the Ekman convergence and pumping has intensified. In this study we analyzed atmospheric data to characterize changes in the curl of surface stress and their relationships to variations in other atmospheric variables. It was found that the leading mode of variations in the surface stress curl, which is primary forcing mechanism for the Ekman pumping and the Beaufort Gyre, could not be characterized by the Arctic Oscillation (AO). The AO represents the leading mode of SLP variability in the northern hemisphere. It does not necessarily describes variations in the wind (which is related to the gradient of SLP) or in the stress curl. The surface wind and stress curl are strongly influenced by other oceanic and sea-ice processes in the Arctic region. The curl of surface stress in the Beaufort Sea was more negative (or greater Ekman pumping) in 2000s than previous 5 decades according to atmospheric reanalyses (e.g., NCEP-NCAR) even though the mean SLP was significantly higher. An oceanic model is used to examine how the Beaufort Gyre responded to changes in the atmosphere.