

Wintertime variability of the Beaufort Gyre in the Arctic Ocean derived from CryoSat-2/SIRAL measurements

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The monthly dynamic ocean topography (DOT) of the Arctic Ocean was successfully estimated .by using the sea surface height measured by the SAR / Interferometric Radar Altimeter (SIRAL) on board CryoSat-2 (CS-2). The CS-2 monthly DOT showed the interannual and monthly variability of the Beaufort Gyre (BG) during winter between 2010/2011 and 2014/2015. Estimated BG in the Pacific Sector of the Arctic Ocean indicates that the northward flow at the western edge of the BG was primarily estimated over the Chukchi Borderland (CBL). However, in the winter of 2012/2013, the BG extended across the CBL (see figure). Our analyses revealed a significantly variable BG in response to changes in the sea surface stress field. Our analysis suggests that 1) sea ice motion, driven by wind fields, acts as a driving force for the BG when sea ice motion was intensified during winter and 2) sea ice motion can also act as an inhibiting force for the BG when sea ice motion is weakened during winter. In addition, the relationship between the DOT, steric height and ocean bottom pressure implied that the DOT during winter responded to varying wind stresses through baroclinic and also barotropic adjustments. According to a tracer experiment based on our monthly CS-2 DOT and derived geostrophic velocity field, we inferred that in the winter of 2012/2013, the Pacific-origin water carried into the BG through the Barrow Canyon was transported to the northern shelf and shelf break of the Chukchi Sea rather than the CBL, which is where the Pacific-origin water had been transported in the other years of the observation period.

Keywords: Beaufort Gyre, CryoSat-2/SIRAL, Dynamic ocean topography

