Geophysical Research Abstracts
Vol. 21, EGU2019-8045, 2019
EGU General Assembly 2019

Using satellite observations to investigate the extent, shape, and location of the Beaufort Gyre between 2003 and 2014

Heather Regan (1), Camille Lique (1), and Thomas Armitage ()

(1) LOPS, CNRS-Ifremer-UBO-IRD, Brest, France (heather.regan@ifremer.fr), (2) Jet Propulsion Laboratory, California Institute of Technology, Pasadena, USA

The Beaufort Gyre, in the Canadian Basin of the Arctic Ocean, is a significant reservoir of freshwater. The gyre plays a role in modulating freshwater export to the North Atlantic, which could have the potential to affect global thermohaline circulation, and therefore the wider climate system. In recent decades, its freshwater content has increased as a consequence of spin-up and extension of the gyre, but despite this, the exact dynamical behaviour of the gyre is not fully understood. It has been shown that changes in sea surface height (SSH) reflect changes in halocline freshwater distribution in the Canada Basin, and thus the SSH field can give useful insights about the 3D structure of the Beaufort Gyre and its variability. Based on this, we make use of an Arctic-wide dataset of SSH that includes data under sea ice to characterise the time-varying extent, shape, strength, and location of the Beaufort Gyre. We show that the gyre expands towards the north-west between 2003 and 2014, while the maximum SSH, at the centre of the gyre, is raised significantly after 2007. The maximum SSH and gyre strength respond to the intensity of the surface forcing, and in particular, the strength is most correlated with the integrated surface stress over the previous three months. Meanwhile, the area of the gyre is additionally affected by the location of the Beaufort Sea High. This means that the observed freshwater content variations can manifest as both changes to the size of the gyre and maximum SSH at the gyre centre, but these two manifestations do not always occur at the same time. We additionally find that the north-west expansion results in asymmetry as the gyre becomes constrained by the shallow bathymetry of the Chukchi Plateau. We highlight this previously overlooked role of bathymetry on gyre dynamical behaviour and discuss the potential impacts of our findings on the physical properties in the Canada Basin.