

An assessment of Arctic Ocean freshwater content changes from the 1990s to the 2006-2008 period and beyond

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Unprecedented summer-season sampling of the Arctic Ocean during the period 2006-2008 makes possible a quasi-synoptic estimate of liquid freshwater (LFW) inventories in the Arctic Ocean basins. In comparison to observations from 1992-1999, LFW content relative to a salinity of 35 in the layer from the surface to the 34 isohaline increased by 6000 to 10000 km³ in the Arctic Ocean (water depth greater than 500 m). This is close to the annual export of freshwater (liquid and solid) from the Arctic Ocean reported in the literature. Observations and a model simulation show regional variations in LFW were both due to changes in the depth of the lower halocline, often forced by regional wind-induced Ekman pumping, and a mean freshening of the water column above this depth, associated with an increased net sea ice melt and advection of increased amounts of river water from the Siberian shelves. Over the whole Arctic Ocean, changes in the observed mean salinity above the 34 isohaline dominated estimated changes in LFW content. Observations from 2009-2010 suggest that LFW content is at similar or higher levels relative to 2006-2008. The observed change in LFW is likely to influence the vertical exchange of heat and freshwater exchange in the Arctic Ocean, and hence the modification of the circulating Atlantic Water. Furthermore, the additional LFW must ultimately be released from the Arctic Ocean to the regions of deep-water formation in the North Atlantic in future years.