



Arctic Ocean liquid freshwater storage trend 1992 – 2012

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The upper Arctic Ocean has experienced significant freshening from the 1990s to late 2000s. A very strong Beaufort Gyre and a temporarily freshened Transpolar Drift raise the question how much longer the Arctic Ocean can accumulate freshwater. Since 2006, autonomous CTD profilers have allowed to estimate upper ocean properties in the Arctic through all seasons. In combination with observations from other platforms, these data show an increase in liquid freshwater into the second decade of the 21st century: the trend from 1992 to 2012 was about $600 \pm 300 \text{ km}^3 \text{ yr}^{-1}$.

Excellent agreement between these observational estimates and results from the North Atlantic Arctic Ocean Sea Ice Model (NAOSIM) prompts us to view this freshwater trend in the context of physical processes in the model: Ekman pumping from the ocean surface stress in the simulation strongly covaries with the vertical movement of the top of the lower halocline, represented by the 34 isohaline. Whereas downward Ekman Pumping shows no noticeable trend in the Eurasian Basin, it shows an increase in the Amerasian Basin from the mid-1990s to 2008.

On basin-scales, the observations show a freshwater increase in the Eurasian Basin and the central and northern Amerasian Basin from the mid-1990s to the middle of the following decade. In the southern Canada Basin, where the Beaufort Gyre dominates the surface circulation, there was a positive trend from about 2002 to 2011.

Our results raise the question where and when this additional freshwater will be released from the Arctic Ocean to the regions of deep-water formation in the North Atlantic in future years.