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Seasonal variability of the net water-mass transport among the four major basins

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Global water cycle involves water-mass transport on land, atmosphere, ocean, and among them. Quantification of such transport, and especially its time evolution, is essential to identify footprints of the climate change and helps to constrain and improve climatic models. In the ocean, net water-mass transport among the ocean basins is a key, but poorly estimated parameter presently. We propose a new methodology that incorporates the time-variable gravity observations from the GRACE satellite (2003-2016) to estimate the change of water content, and that overcomes some fundamental limitations of existing approaches. We show that the Pacific and Arctic Oceans receive an average of 1916 (95% confidence interval [1812, 2021]) Gt/month (~0.72 ± 0.02 Sv) of excess freshwater from the atmosphere and the continents that gets discharged into the Atlantic and Indian Oceans, where net evaporation minus precipitation returns the water to complete the cycle. This salty water-mass transport from the Pacific and Arctic Oceans to the Atlantic and Indian Oceans show a clear seasonal variability, with a maximum transport of 3000 Gt/month during boreal summer, a minimum of 1000 Gt/month or less on February, Mars, and November.

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