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On the dynamics of a response to volume flux forcing

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The dynamical impact of surface volume flux forcing on the global oceans circulation is investigated for the period 1949-2011. As part of the study an ocean circulation model is forced in two ways using NCEP surface freshwater forcing: a virtual salt flux version and a volume flux version. The resulting differences in the circulation can be described by the Goldsbrough-Stommel circulation. This barotropic circulation is on the order of 1 Sv, weakens the mean flow of the world oceans and changes the sea level. The meridional freshwater and heat transport differences between these two versions are about 5% of the mean transports. Decomposing these transports into overturning and gyre components, reveals that it is the overturning component that dominates the transport differences that are caused by the volume flux forcing. The overturning freshwater and heat transports induced by the volume flux weaken the mean overturning related transports of the world oceans expect for the southern Pacific-Indian oceans. Furthermore, the volume flux also has impact on the meridional overturning circulation. The overturning transport differences are on the order of 0.1 Sv, which at the surface are described by the volume transports of the volume flux forcing.