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## Annual subduction/obduction rate of the North Pacific and its interannual variation

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Annual subduction/obduction rates based on observations have been estimated using climatologiacl data. Temperature and salinity profile data provided by the Argo array, which resolve seasonal evolution of the basin-scale upper ocean stratification, enable us to estimate annual subduction/obduction rates for individual years. The annual subduction/obduction rate of the North Pacific (15-45N) for each year from 2005 to 2009 was calculated by using dynamic method. The calculation was performed using Lagrangian coordinate in the same manner introduced by Huang and Qiu (1994). The data set of temperature and salinity field was from MOAA_GPV (Grid Point Value of the Monthly Objective Analysis using the Argo data) provided by JAMSTEC, and wind stress data was from JRA25/JCDAS reanalysis. The annual subduction rate varied drastically over the 5 years. In the region where Subtropical Mode Water (STMW) typically forms, the subduction rate substantially decreased from 2005 to 2009. On the other hand, in the region where Eastern Subtropical Mode Water typically forms, the subduction rate increased significantly. To present a more quantitative picture, we divided the study region into two parts: the region A (20-35N, 120E-170W) containing the STMW distribution area and the region B (the other region) containing the ESTMW distribution area. Then the subduction/obduction rate integrated in each sigma-theta class with a 0.1 kgm-3 interval was calculated for each region. The subduction rate in the region A for the density range of STMW (25.0-25.5 sigma-theta) decreased from 5.6 Sv in 2005 to 1.4 Sv in 2009. On the other hand, the subduction rate in the region B for the density range of ESTMW (24.5-25.0 sigma-theta) increased from 2.7 Sv in 2005 to 5.5 Sv in 2009. In contrast, there was no substantial interannual change in obduction rate. The volume of permanent pycnocline integrated in each sigma-theta sigma-theta class was also estimated for each region. Both for the regions A and B, the interannual variations of the volume change were very similar to those of subduction rate quantitatively, suggesting that the subduction process predominantly controls the volume of the permanent pycnocline for each sigma-theta class.