Geophysical Research Abstracts
Vol. 15, EGU2013-11709, 2013
EGU General Assembly 2013

Lagrangian pathways and reemergence of newly formed Eighteen Degree Water

Young-Oh Kwon (1), Stefan F. Gary (2), Jong-Jin Park (3), and M. Susan Lozier (2)

(1) Woods Hole Oceanographic Institution, Physical Oceanography Department, Woods Hole, MA, United States (yokwon@whoi.edu), (2) Duke University, Division of Earth and Ocean Sciences, Durham, NC, United States, (3) Kyungpook University, Oceanography Department, Sangju, Kyungpook, Korea

The Eighteen Degree Water (EDW, also called the North Atlantic Subtropical Mode Water) is produced as a result of intense air-sea fluxes during winter near the Gulf Stream. Due to its large volume with almost homogeneous temperature around 18 degree Celsius and as its significant portion being outcropped every winter, its significant role in the interannual climate variability has been assumed in many previous studies. In this study, we examine Lagrangian pathways of newly produced EDW based on an eddy-resolving ocean general circulation model and observation to quantify one aspect of EDW's contribution to interannual climate variability: How much of the EDW outcropped in one winter re-outcrop in subsequent years and provide the memory of past winters' air-sea interaction?

Using the eddy-resolving model output, about 5000 e-particles are seeded within the outcropped EDW in every winter for 10 years and the Lagrangian trajectory of each e-particle is calculated for 5 years. The calculation suggests about 62 % of EDW particles re-outcrop in the next winter, which is consistent with a Lagrangian float observation during the recent CLIMODE field campaign. The e-particles with 1-year re-outcropping time scale tend to exhibit relatively more eddy-like advection, while the ones with longer re-outcropping time scale follow the anti-cyclonic subtropical gyre circulation more closely. When the Lagrangian trajectory calculation is repeated only based on the climatological mean velocity field, 1-year re-outcropping is reduced to 52%, while small but significant gain is found at 4-5 year re-outcropping. The e-particles with re-outcropping time longer than 1 year tends to originate from the southwestern portion of the overall EDW outcropping region, so that they are more likely to escape from the outcropping region and subduct into the gyre interior. Dominant 1-year re-outcropping time scale of EDW implies that one year's anomalous winter condition could persist within the EDW and influence next winter's air-sea interaction.