



Near-surface fluid exchange in the North Atlantic ocean

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Motivated by observations of surface drifters in the N. Atlantic ocean, which show surprisingly small connectivity between the subpolar and subtropical gyres, we have studied near-surface subtropical-to-subpolar-gyre fluid exchange in the N. Atlantic. Our analysis were based on an observationally-based velocity fields consisting of a drifter-derived steady background flow subject to an altimetry-based perturbation. In our studies we have made use of both statistics of simulated trajectories and of dynamical systems ideas. It was shown that, over a time-scale of a few years, exchange from the subtropical to the subpolar gyre is not completely blocked but is limited to certain areas of the N. Atlantic. Fluid participating in the exchange comes from a funnel-shaped region with a long and narrow nozzle extending Southward between the coast and Gulf Stream core. This region is quite narrow to the South of approximately 40 deg N and is likely to be missed by a random seeding of drifters. The neighborhood of the Gulf Stream core acts as a transport barrier under commonly-encountered conditions. This transport barrier is characterized by inhibited horizontal stirring and is associated with a thin band of less chaotic motion, which indicates that this barrier is of the strong-KAM-stability type.