EGU22-9226
https://doi.org/10.5194/egusphere-egu22-9226
EGU General Assembly 2022

Study of Submesoscale Coherent Vortices (SCVs) in the Atlantic Ocean along different isopycnals

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The ocean is densely populated with energetic coherent vortices of different sizes. Mesoscale and submesoscale vortices contribute to stirring of the ocean, transporting and redistributing water masses and tracers (active and passive), affecting ventilation pathways and thus impacting the large-scale circulation. Submesoscale Coherent Vortices (SCVs), i.e. vortices with radii between 1-30 km have been detected via satellite and in-situ measurements at surface or at depth (usually not more than ~2000 m depth). They are found to be of different shapes and sizes depending upon latitude and place of origin. Previous studies mostly describe the surface mesoscale and submesoscale eddies rather than the deep SCVs (> 2000 m). This study focuses on SCVs below the mixed layer along four different isopycnal surfaces: 26.60, 27.60, 27.80, and 27.86, which lie in the depth range of 10-500 m, 200-2000 m, 1200-3000 m, and 1800-4500 m, respectively. We aim to quantify their physical characteristics (radius, thickness, bias in polarity: cyclones versus anticyclones) in different parts of the Atlantic ocean, and analyze the dynamics involved in the generation and destruction of the SCVs throughout their life-cycle. We use the Coastal and Regional Ocean COmmunity model (CROCO) ocean model in a high resolution setup (3 km) of the Atlantic Ocean. The detection of SCVs are done every 12 hr using the Okubo-Weiss parameter along the isopycnal surfaces using the eddy-tracking algorithm by Mason et al., 2014. We consider only structures living for more than 21 days. The census of SCVs shows that there are in total more cyclonic than anticyclonic SCV detections. However cyclones are on average smaller and shorter lived, such that there is a dominance of anticyclones while considering long-lived and larger distance travelling SCVs. We concentrate on the strongest and longest lived SCVs among which meddies that we compare to previous in-situ observations. This study is the first step in the understanding of the formation, occurrences and structure of SCVs in the Atlantic Ocean, and their impact on the large-scale ocean circulation.