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Observation of the surface horizontal thermohaline variability at meso- to submesoscales in the North-Eastern Subtropical Atlantic Ocean

Nicolas Kolodziejczyk (1), Gilles Reverdin (1), Jacqueline Boutin (1), and Olga Hernandez (2)
(1) LOCEAN, paris, France (nicolas.kolodziejczyk@gmail.com), (2) LEGOS, Toulouse,France

The seasonal variability of the surface horizontal thermohaline structure is investigated in the North-Eastern Atlantic Surface Salinity Maximum (SSM) at length scales from five to hundreds of kilometers, i.e. at submeso- to meso-scales. The near-surface temperature and salinity data from merchant ship thermosalinograph (TSG) transects across the Atlantic are used to compute the horizontal temperature, salinity and density fluctuations, and the density ratio. During late winter in the north-eastern SSM, thermohaline compensation is observed for wavelengths from 5 km to more than 200 km; in spite of large and sharp surface thermohaline fronts a weak density surface horizontal gradient is observed. Temperature and salinity exhibit an energetic spectra in k-2 slope scale between 20-100 km scale and a steeper slope at shorter wavelengths, while density spectra exhibit lower energy level with a clear k-3 slope below 20 km, consistent with interior quasi-geostrophic turbulence. During summer in the north-eastern SSM, salinity and temperature gradients are no longer compensated due to strong atmospheric heating of the upper ocean. In comparison with winter, the surface density spectrum is enhanced with a flatter slope between k-2-k-3 between 5 and 20 km.