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Submesoscale processes in the central Baltic Sea

Evridiki Chrysagi, Peter Holtermann, Lars Umlauf, and Hans Burchard
Leibniz Institute for Baltic Sea Research, Warnemuende, Physics, Germany (evridiki.chrysagi@io-warnemuende.de)

Submesoscales play an important role in the cascade of energy, by providing a pathway, along which the energy can be transferred from the large mesoscale regime, to the small scales, where viscous dissipation can act. In this research we will focus on the surface mixed layer, where submesoscales are particularly dominant and specifically in areas with strong lateral buoyancy gradients, such as submesoscale fronts and filaments. The study area is the central Baltic Sea where a realistic, high-resolution hindcast simulation has been applied, based on the General Estuarine and Transport Model (GETM). Satellite data, along with in-situ data from stations are available and have been used for model validation.

The model results are compared with a high resolution shear microstructure transect of a filament, obtained during a winter 2017 scientific cruise in the Eastern Gotland Basin. During this period a strong thermohaline gradient is found between the west and east part of the Eastern Gotland Basin creating a soup of fronts and filaments, that can be nicely reproduced by the model. Areas with intense lateral density gradients, high cyclonic vorticity, strong convergence and downwelling have been identified for the period of interest, providing evidence of submesoscale activity. So, the scope of this study is to investigate the evolution and lifetime of those submesoscale fronts and filaments, to analyze the different types of instabilities that occur through loss of balance and may lead to the restratification of the mixed layer and to assess the importance of submesoscales in the Baltic Sea.