Submesoscale processes in the surface Mixed Layer

TRR 181 Energy transfers between Atmosphere and Ocean

***E. Chrysagi, P. Holtermann, L. Umlauf, H. Burchard**, Leibniz Institute for Baltic Sea Research, Warnemünde*

In Short

- Submesoscale processes in the mixed layer will be studied
- Instabilities in areas with strong lateral density gradients and the restrafication processes by mixed layer instabilities will be investigated
- Model validation and parameter studies affecting the mesoscale and submesoscale processes within the model

This application is part of the TRR 181 project "Energy transfers between Atmosphere and Ocean" and specifically, part of the T2 subproject, which focuses on the energy budget of the ocean surface mixed layer.

The first goal of this study is to investigate the submesoscale eddies, fronts and filaments in the surface mixed layer by using realistic, high resolution (600 m) hindcast simulations of the central Baltic Sea (Figure 1). The numerical model that wil be used is based on the hydrodynamic model of GETM, “General Estuarine Transport Model“[1]. Although the main setup has already been performed [2] and the model seems capable to reproduce fronts and filaments (Figure 1), a model validation along with parameter studies is considered crucial since those structures are highly sensitive to the atmosperic forcing and the Smagorinsky formulation.

The second aim is to investigate the restratification of the ocean mixed layer that results from mixed layer instabilities in areas with lateral density gradients such as fronts and filaments [3]. Those instabilities are usually subgrid scale and in order to resolve them a very high resolution model O (100 m) is required [4]. Furthermore, data from a 2017 (EMB169) scientific cruise in the Baltic show submesoscale fronts and filaments of O (100 m). Consequently, it will be tested to what degree the current 600 m model can reproduce mixed layer instabilities and submesoscale processes and a second setup with 100 m horizontal resolution will be tested.

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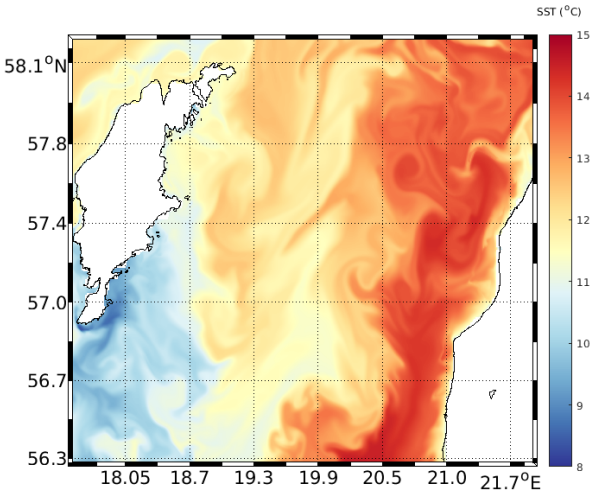

***Figure 1:** Simulated surface SST in the Gotland Basin for 20 October 2017.*

More Information

[1] H. Burchard and K. Bolding, *GETM: A General Estuarine Transport Model; Scientific Documentation* European Commission, Joint Research Centre, Institute for Environment and Sustainability, 2002.

[2] P. Holtermann, H. Burchard, U. Gräwe, K. Klingbeil, L. Umlauf. Deep-water dynamics and boundarymixing in a nontidal stratified basin: Amodeling study of the Baltic Sea, *Journal of Geophysical Research: Oceans*, no. 2, pp. 3134–3157, 2014.

[3] G. Boccaletti, R. Ferrari, B. Fox-Kemper. Mixed Layer Instabilities and Restratification, *Journal of Physical Oceanography*,vol. 37, no. 9, pp. 2228–2250, 2007.

[4] B. Fox-Kemper, R. Ferrari, R. Hallberg. Parameterization of Mixed Layer Eddies. Part I: Theory and Diagnosis, *Journal of Physical Oceanography*,vol. 38, no. 6, pp. 1145–1165, 2008.

Project Partners

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