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Quasi-two-dimensional turbulence observations in a stratified fjord

Volker Fiekas (1), Lars Arneborg (2), Michaela Knoll (1), and Hartmut Prandke (3)

(1) Technical Centre for Ships and Naval Weapons, Naval Technology and Research, Eckernförde, Germany (HeinzVolker Fiekas@bwb.org), (2) Department of Earth Sciences, Göteborg University, Göteborg, Sweden (laar@gvc.gu.se), (3) ISW Wassermesstechnik, Fünfseen, Germany (hartmut.prandke@isw-wasser.com)

In-situ measurements of oceanic turbulence are usually based on free-falling vertical profilers at hydrographic stations or ship-towed horizontal profilers along specified tracks. Limited on one spatial coordinate, the separate use of these instruments is not suitable for quasi-synoptic surveys of the spatial character of the oceanic turbulence. For reliable statements on spatial coherence of the variability of stratification, ocean phenomena have to be surveyed rapidly over a long distance and down to a certain depth with appropriate high spatial resolution, before significant changes occur along the survey route.

Our approach for the concept of measurement combines both measuring methods. For that purpose a towed underwater vehicle called TIMOS (Towed Instrument for Microstructure Ocean Soundings) was developed as a carrier of microstructure profilers. Equipped with highly resolving microstructure and turbulence sensors, standard CTD sensors as well as sensors for the control of alignment, stability and vibration, and two downward and upward looking ADCPs, the prototype yields horizontal turbulence profiles and spectra from selected depths along ship's track. Combined with a vertically profiling microstructure profiler continuously deployed by means of a fast special winch at the same time, this system allows to survey sections of oceanic turbulence and microstructure down to a depth of 200 m with high vertical and horizontal resolution at towing speeds of 3 knots.

On the basis of a survey near the sill and in the deep basin of the Gullmar Fjord, we present the spatial variability of the turbulent mixing and the difference between lateral and vertical scales of turbulent patches by means of the measured dissipation rate of turbulent kinetic energy.