Turbulent Control of the Thermal Structure in Continental Shelf Seas

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Microstructure measurements made using a buoyancy driven ocean glider are used to investigate the mechanisms controlling the seasonal thermal structure of a temperate continental shelf sea. The autonomous nature of the Ocean Microstructure Glider (OMG) permits resolution of turbulence and mixing within the near surface region. We use these data to investigate the varying controls from wind, wave and buoyancy forcing on the formation and maintenance of seasonal stratification and the contribution from tidal boundary mixing and internal mixing from internal gravity waves and wind-triggered inertial motions. We will characterize the relative effects of wind and wave forcing on turbulence in the upper ocean later using the turbulent Langmuir number (La_t) and examine the observed variability in surface forcing relative to subsequent changes in heat and momentum transfer to the upper ocean and thermocline. We find that wind and wave effects appear well balanced (typified by a La_t~0.3) and that turbulence can be well described by a classic law of the wall profile, scaled with the surface friction velocity alone. During a brief period when waves do dominate we find that turbulence scales directly with Stokes drift. Rather than following an z^{-1} decay, turbulence under these conditions is driven deep into the upper mixed layer. The relative importance of surface driven turbulence on the overall thermal structure is investigated and balanced against contributions from internal and bottom boundary mixing mechanisms.

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