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Turbulent controls on the onset and development of shelf sea seasonal stratification.

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We present new data from a series of ocean glider deployments on the European continental shelf to investigate the mechanistic control of the vertical structure of density stratification in shelf seas. Central to this presentation is a nine-month, 120 km long repeat transect between mid-shelf and the shelf break that shows how variable controls by surface forcing, internal waves and topography drives spatial and temporal variability in temperature, salinity and density structure. We use coincident hydrography and turbulence results from Ocean Microstructure Gliders (OMG), combined with measurements from a nearby buoy fitted with meteorological and ocean surface sensors to explicitly resolve the influence of the different forcing mechanisms at two different locations.

Intuitively, our results show that tidal forcing provides the dominant source of bottom mixed layer control, with the spring-neap cycle and relative changes in topography causing the majority of observed variability. The ocean surface boundary layer is predominantly controlled by wind driven mixing balanced by buoyancy input from solar heating and atmospheric cooling. While an active internal wave field is observed throughout stratified periods, we find only weak internal mixing, except in regions close to extreme topography such as at the shelf break. We therefore employ a simple 1-D model to predict vertical structure based on observed boundary layer forcing alone, using the Obukhov length scale (representing a balance between wind mixing and buoyancy forcing) to set surface layer mixing depths. Results are compared with observations to test the ability of this simple dynamical model in replicating the seasonality of the vertical shelf sea structure.