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The impact of mesoscale and submesoscale features on the upper-ocean density and nutrient fields of the North Pacific subtropical gyre

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In this talk, we assess the impact of mesoscale and submesoscale features on the upper-ocean density and nutrient fields near and east of station ALOHA in the eastern North Pacific subtropical gyre . For this purpose, year-long observations of the density and nitrate fields from fixed and semi-Lagrangian positions as well as the output from relatively high-resolution (from 1/10° to 1/30° horizontal resolution) numerical simulations are used. Despite the limited coverage and resolution of the observations and the somewhat limited resolution of the simulations, a consistent picture emerges. Submesoscale fronts in density occur but they are confined to the surface layer (0-100 m). An explosive growth of such features occurs in the winter months when the stratification is weak. These features reach, sometimes, the upper bound of the nutricline (100 m) but stay above its central part (125-175 m). As a consequence, horizontal variations in the potential density field within the nutricline occur mostly at the mesoscale. Furthermore, because nitrate contours are nearly, but not exactly, parallel to density contours, the nitrate field is also dominated by mesoscale structures; its submesoscale component is larger than for the density field and may occur mostly due to horizontal eddy stirring. The suggestion is that the role of submesoscale dynamics in injecting nutrient into the euphotic zone may play a lesser role in the central part of the subtropical gyre than near its northern edge. More observations and numerical simulations, however, are needed to provide quantitative estimates of the rates of exchange between surface and deep waters.