Upper-ocean turbulence at meso and submesoscales

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Until the last 10 years, it was thought that the ocean dynamics at mesoscales (horizontal scales of 50-500 km) was driven by interior potential vorticity anomalies. This led to the development of the geostrophic turbulence theory as initiated by Charney (1971). We are now able to revisit these questions with more realistic primitive-equation simulations at very high resolution.
In this talk, I will review our current understanding on this topic and the new dynamical picture that emerges. Surface oceanic layers are characterized by strongly energetic submesoscales (1-30km in width). These structures are important for explaining the properties of turbulent baroclinic flows near the surface. Their dynamics is strongly tight to the surface density anomalies. On the contrary, the ocean interior is governed by the dynamics of the interior potential vorticity anomalies. This has some important consequences for turbulent energy fluxes, ageostrophic processes and for vertical fluxes of tracers.