Dissipation of geostrophic eddies and generation of mixing in the Southern Ocean

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High-resolution simulations with rough bottom topography are used to investigate energy pathways and dissipation mechanisms in the Southern Ocean. Simulations explicitly resolve processes of energy transfer from balanced to unbalanced motions such as submesoscale instabilities in the upper ocean and internal waves generation at rough topography in the deep ocean. Results show that flow-topography interactions effectively catalyze dissipation of balanced flows by direct generation of internal waves and other small-scale motions, accounting for about two-thirds of the total energy dissipation. The rest of the energy dissipation takes place mostly in the upper ocean and is attributed to submesoscale processes. Energy dissipation by the bottom boundary layer, parameterized here with quadratic bottom drag, is small compared to the dissipation by resolved motions. The implications of these results for ocean mixing and the global overturning circulation will be discussed.