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Rotors in inviscid flow JOHN MCHUGH, University of New Hampshire, ROBERT SHARMAN, NCAR — Rotors are large coherent vortex structures that form in the lee of a mountain ridge. They are known to be strongly turbulent, and a severe hazard to aircraft. Rotors are also believed to be responsible for stirring up large quantities of dust and other pollutants, transporting it to higher altitudes. The onset of rotor flow is poorly understood. Queney (1955) suggested that a rotor will appear behind a mountain as a result of steep mountain waves, which should be predictable by inviscid theory. The wave amplitude that results in a vertical stream line is the critical amplitude, and larger wave amplitudes will have rotors, according to Queney (1955). However, recent inviscid simulations using mesoscale models with very large amplitude waves fail to show the expected rotor, as reported by Doyle and Durran (2002). Doyle and Durran successfully initiate rotor flow, but only with viscosity and the no-slip condition at the bottom boundary. Recent simulations have revisited the inviscid case by considering initial conditions that are not uniform, including flows with discrete vortices. Simulations with an idealized mountain show rotor-like behavior in the lee of the mountain for some of these initial conditions. The primary conclusion is that a rotor may form in inviscid flow given the proper choice of initial conditions. The strength of the stratification is also important.

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