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Ring-waves dominate mass transport in air-driven core-annular flows JEFFREY OLANDER, ROBERTO CAMASSA, GREG FOREST, UNC, LONG LEE, University of Wyoming, JOHN MELLNIK, H. REED OGROSKY, UNC — To better understand the movement of mucus through the trachea that arises as a result of air flow, we perform a series of experiments to emulate mucus movement by an air-driven vertical flow of high- viscosity silicone oil through a thin glass tube. When a constant flux of air is delivered through the bottom of the tube, instabilities arise, generating upward moving waves at the oil/air interface. We present experiments and theory that demonstrate that these waves are actually vortex ring waves of annular fluid rolling up the tube between the liquid substrate layer and gas core. A long-wave asymptotic model is developed that exhibits this mass-transport wave behavior. The region of parameter space where such mass transport waves exist is found. In addition, wavelength, wave speed, and mean thickness of the oil lining the tube are found as a function of air speed. A comparison is made between the model and the experiments. These results give insight into the clearing of mucus in the trachea by air flows.

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