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Sinking, wedging, spreading – viscous spreading on a layer of fluid NICO BERGEMANN, ANNE JUEL, MATTHIAS HEIL, The University of Manchester — We study the axisymmetric spreading of a sessile drop on a pre-existing layer of the same fluid in a regime where the drop is sufficiently large so that the spreading is driven by gravity while capillary and inertial effects are negligible. Experiments performed with 5 ml drops and layer thicknesses in the range 0.1 mm $\leq h \leq$ 1 mm show that at long times the radius of the drop evolves as $R \propto t^n$, where the spreading exponent n increases with the layer thickness h. Numerical simulations, based on the axisymmetric free-surface Navier-Stokes equations, reveal three distinct spreading regimes depending on the layer thickness. For thick layers the drop sinks into the layer, accompanied by significant flow in the layer. By contrast, for thin layers the layer ahead of the propagating front is at rest and the spreading behaviour resembles that of a gravity-driven drop spreading on a dry substrate. In the intermediate regime the spreading is characterised by an advancing wedge, which is sustained by fluid flow from the drop into the layer.

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