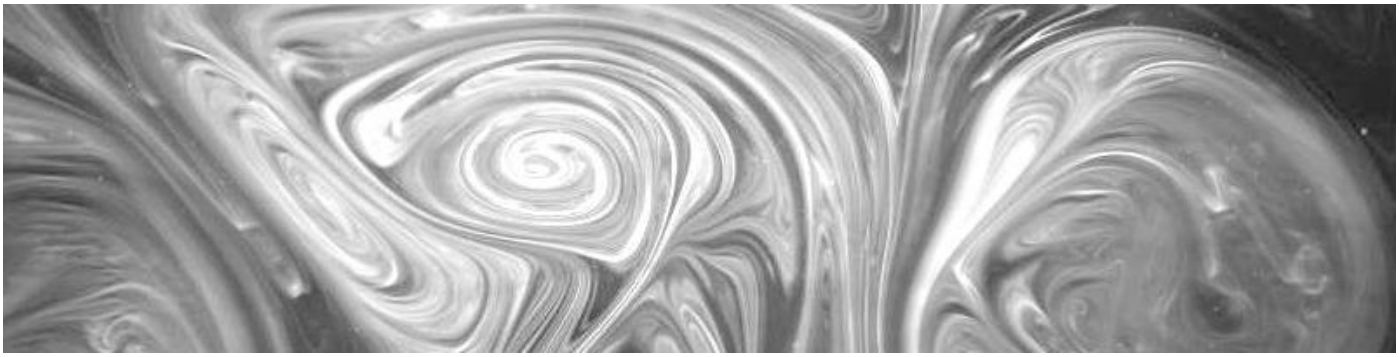
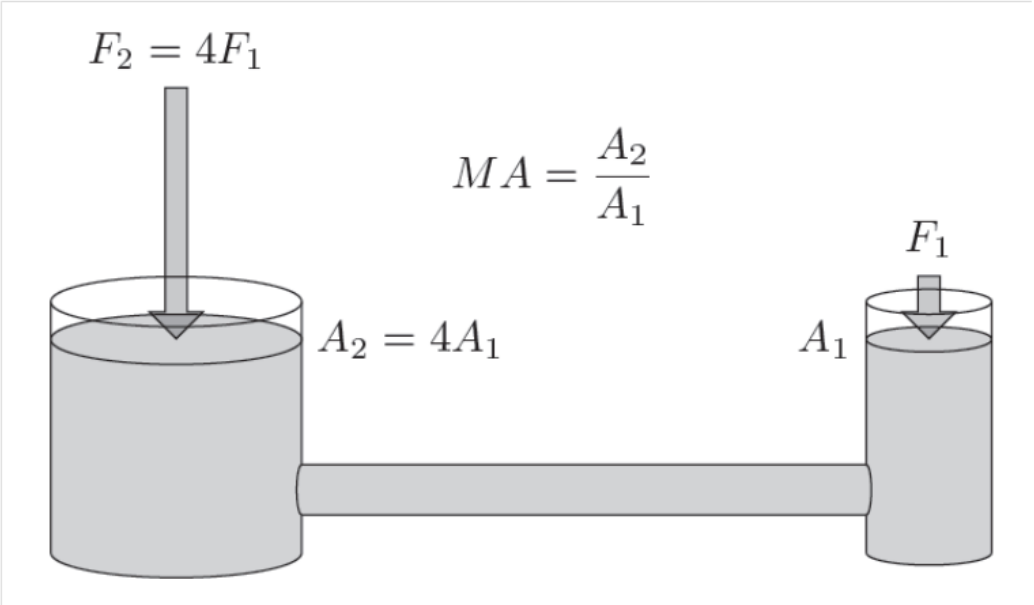
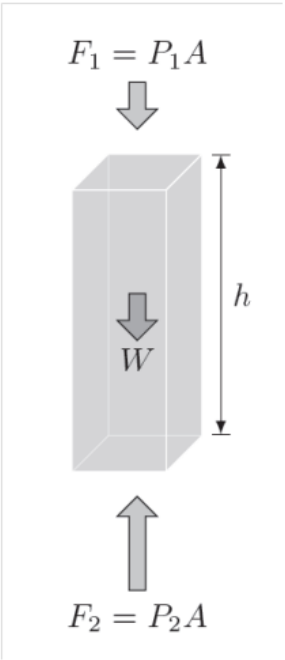
# Fluids



**Pascal's principle: any pressure change will flow through the entire fluid equally**



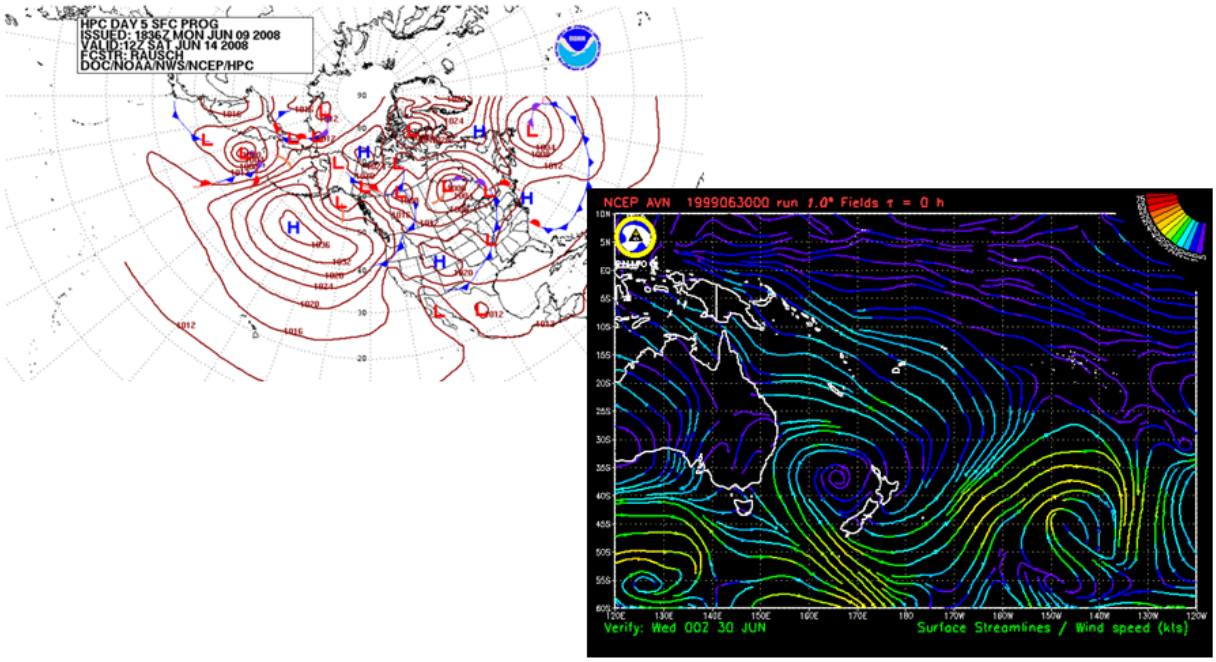
## Archimedes' principle: vertical pressure differentials provides the force of buoyancy



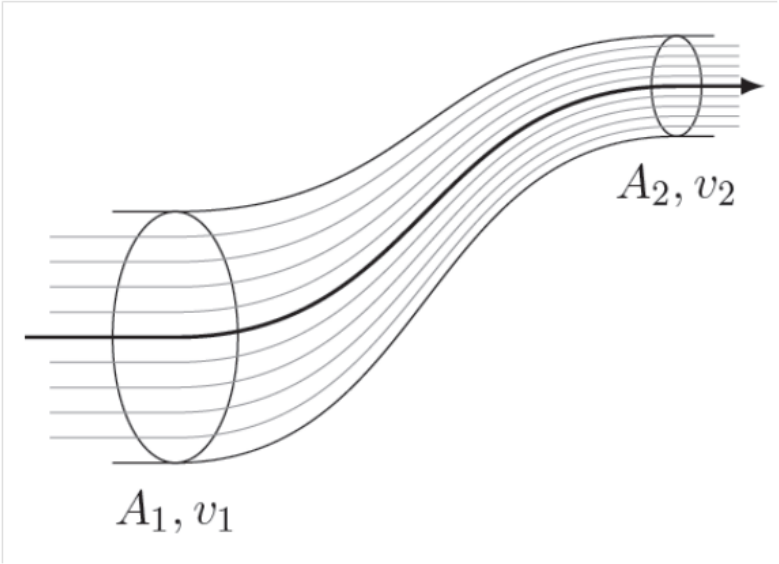

$$\Delta P = \rho g h$$

$$B = \rho V g$$

**Pressure differentials cause flow; steady flow moves along streamlines of current**



**The steady flow of an ideal fluid is both incompressible and non-viscous**

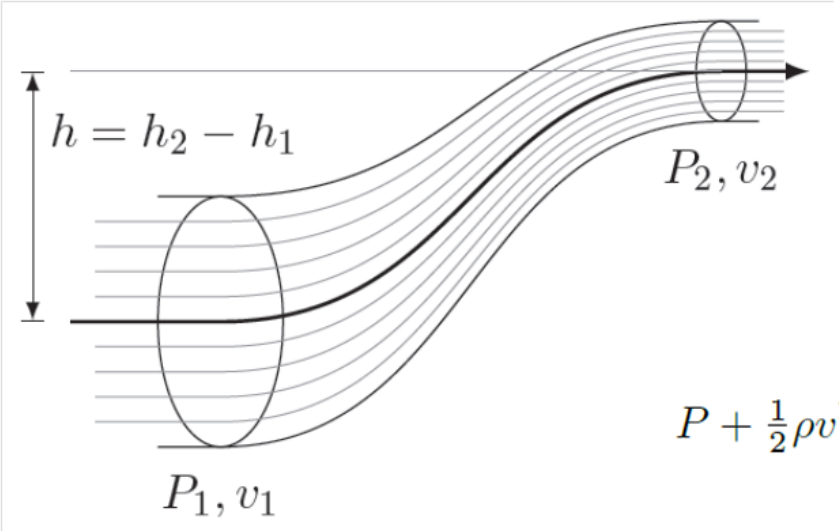



$$Q = Av$$

$$\Delta m/\Delta t = \rho v A$$

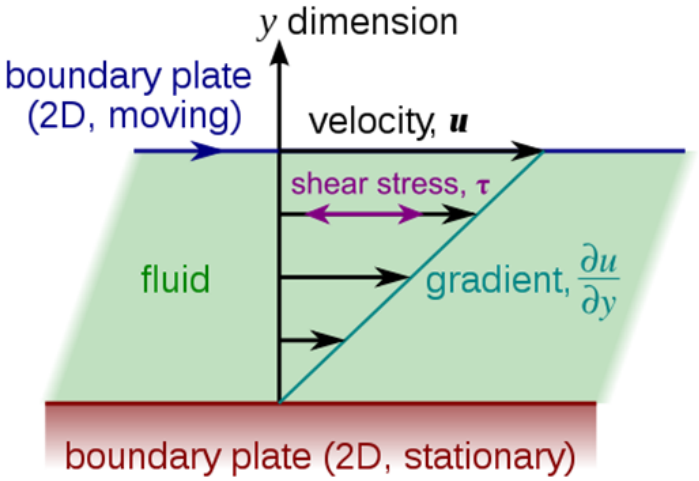
$$\rho A_1 v_1 = \rho A_2 v_2 \implies A_1 v_1 = A_2 v_2$$

**Bernoulli's equation describes the pressure differentials in a ideal fluid that is flowing**



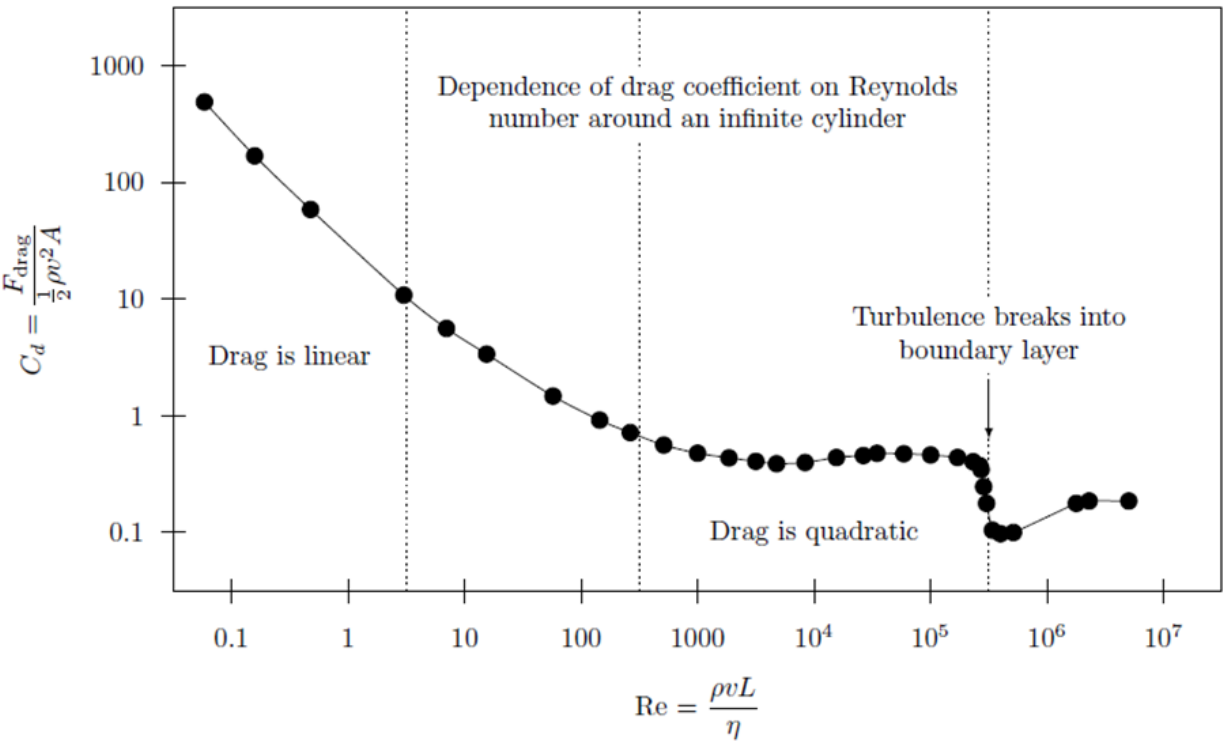

$$P + \tfrac{1}{2}\rho v^2 + \rho g h = \text{const.}$$

**Viscosity is fluid friction; leads to air drag and requires extra pressure for flow**




$$F = \eta A v/d \qquad F = 6\pi\eta R v \qquad \Delta P = \frac{8\eta L Q}{\pi r^4}$$

**Turbulence driven by speed and size of the object, viscosity and density of the fluid**



## Navier-Stokes equations go beyond Bernoulli, but are very difficult to solve