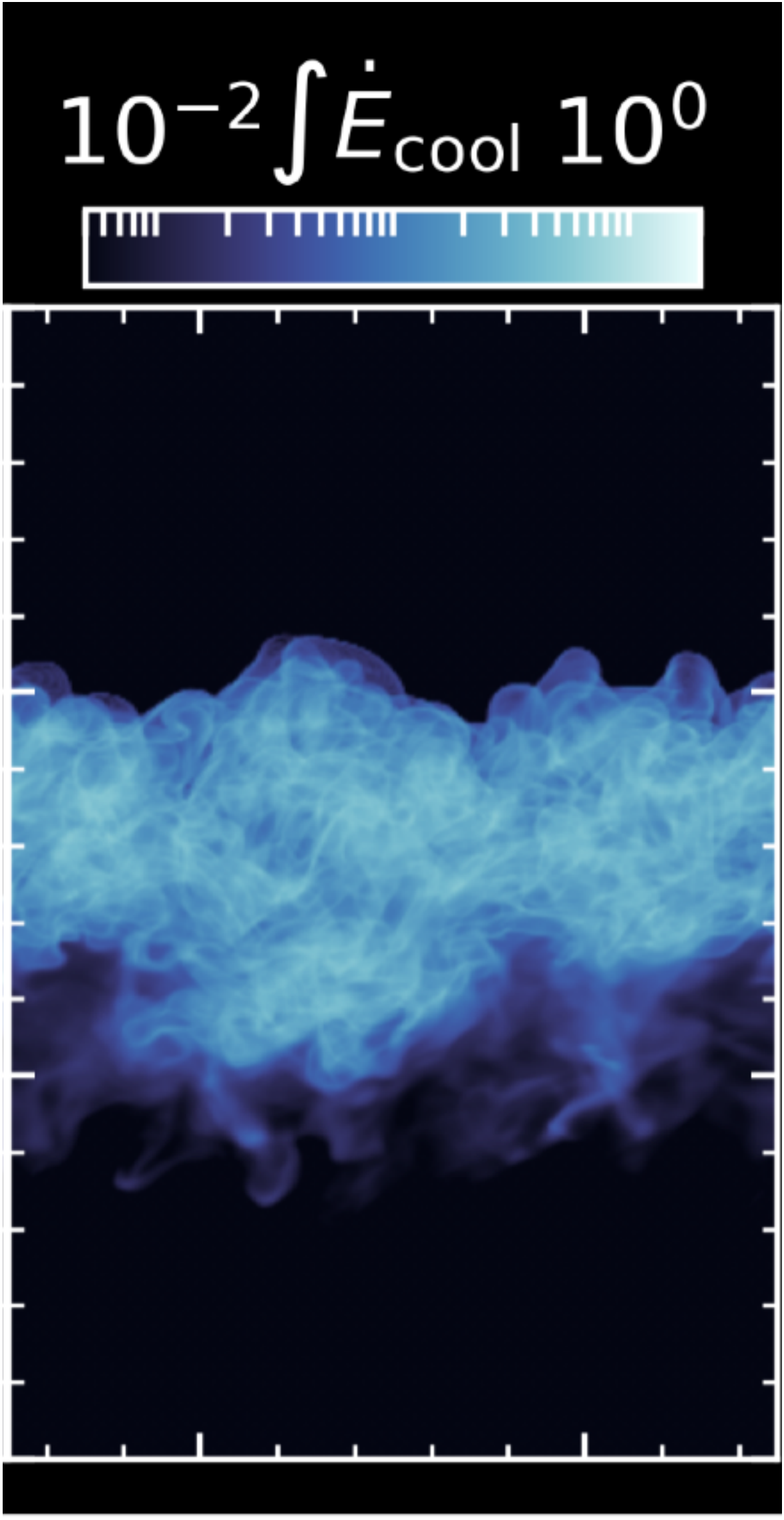
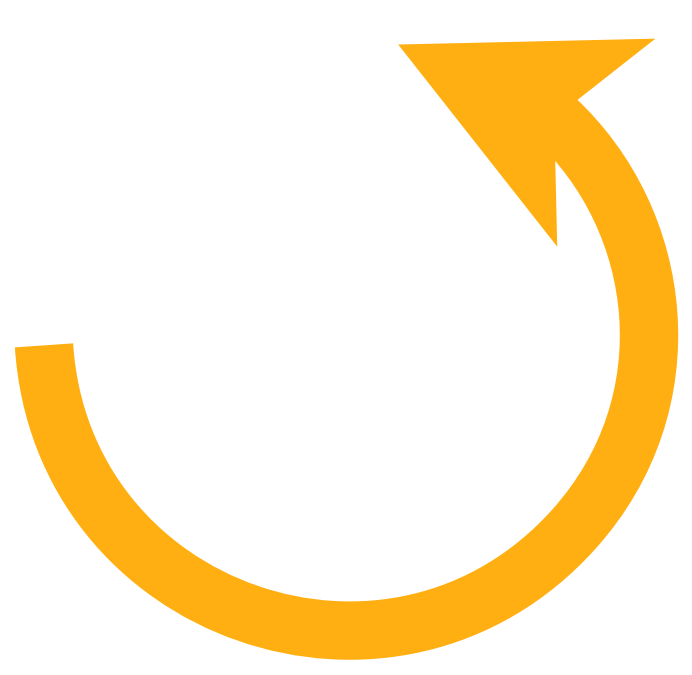
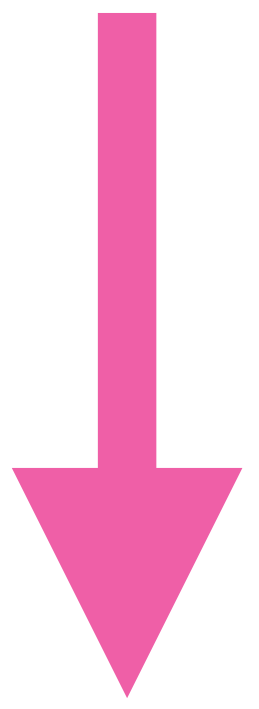
Drummond Fielding

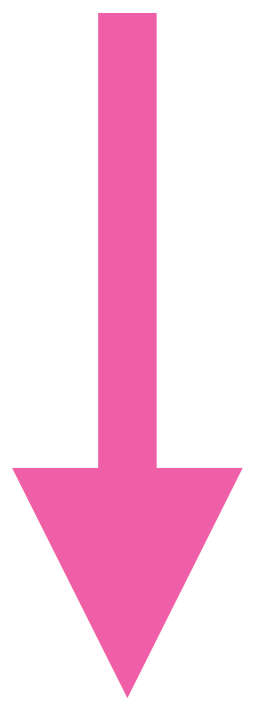
3 Oct 2019

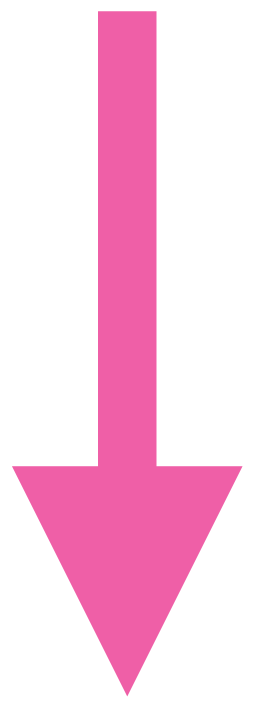

$10^{-2} \int \dot{E}_{\mathrm{cool}}\ 10^{0}$

turbulence





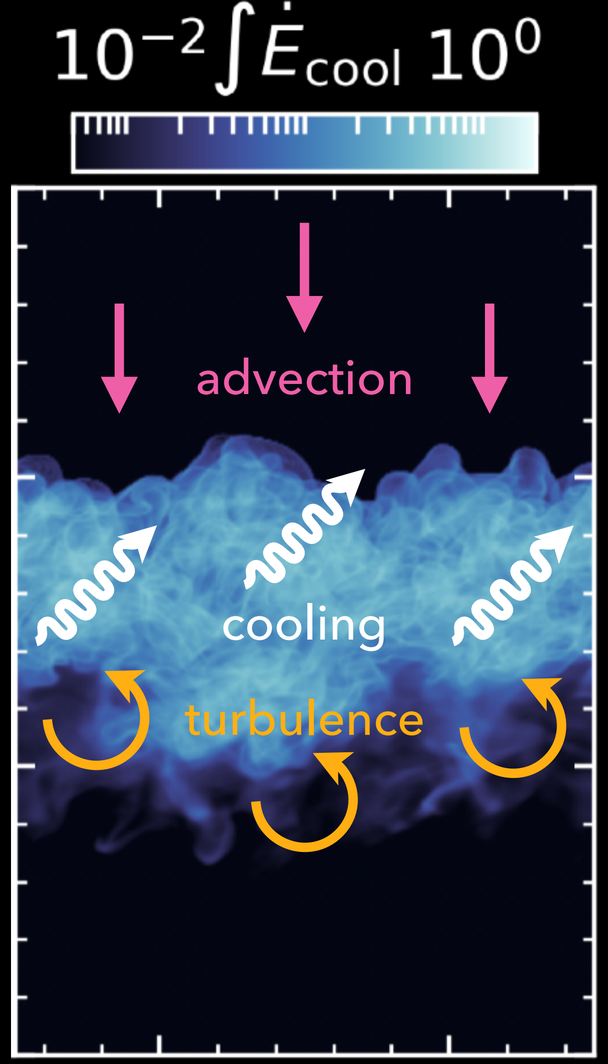




advection

$$v_z = \left(L v_{mix}^3 \Big/ t_{cool} \right)^{1/4}$$

cooling, growth, & acceleration



advected enthalpy replenishes radiated energy, bringing with it fresh supply of mass & momentum

$$\partial_z P v_z \approx \dot{E}_{cool} \approx P/t_{cool}$$

$$\Rightarrow P v_z L^2 \approx \int \dot{E}_{cool} \approx h \, \text{Area} \, P/t_{cool}$$

$$\Rightarrow v_z \approx \frac{\text{Area}}{L^2} \frac{h}{t_{cool}},$$

$$\frac{\text{Area}}{L^2} \sim \left(\frac{v_{mix} t_{cool}}{L} \right)^{1/4} \text{ and } h \sim L \sqrt{\frac{v_{mix} t_{cool}}{L}}$$

Finally, $v_z = \left(L v_{mix}^3 \Big/ t_{cool} \right)^{1/4}$

cooling, growth, & acceleration

$$v_z = v_{mix}\left(\frac{L}{v_{mix} t_{cool}}\right)^{1/4}$$

$$\dot{E}_{cool} \propto P v_z$$

$$\dot{M}_{cold} \propto \rho_{hot} v_z$$

$$\dot{P}_{cold} \propto \rho_{hot} v_{rel}\, v_z$$