EGEE 470: More on rate processes.

FLOW in PIPES

Non-dimensional velocity, \( u/U \)

Typical nocturnal (stable)
Typical diurnal (unstable)

as Re↑, turbulence ↑

idealized profiles of transferred property \((\nu, T, c)\)

(laminar flow)
\( Re < 200 \)
- parabolic velocity profile
- all BL flow
- no mixing

(turbulent flow)
\( Re > 4000 \)
- different residence time distributions for parcels, molecules, particles, etc.
- no axial mixing
- perfect radial mixing

plug flow
(well-behaved turbulent flow; no eddies)

Earth's surface

E.g., heat transfer: \( q = k A \frac{dT}{dz} = k A \frac{\Delta T}{\Delta x} = h A \Delta T \)

mass transfer: \( \Theta \rightarrow \sigma \) (dispersion) \( \rightarrow \) C.P.M.