PERCOLATION EFFECTS AND COHERENT STRUCTURES IN TURBULENT FLOW

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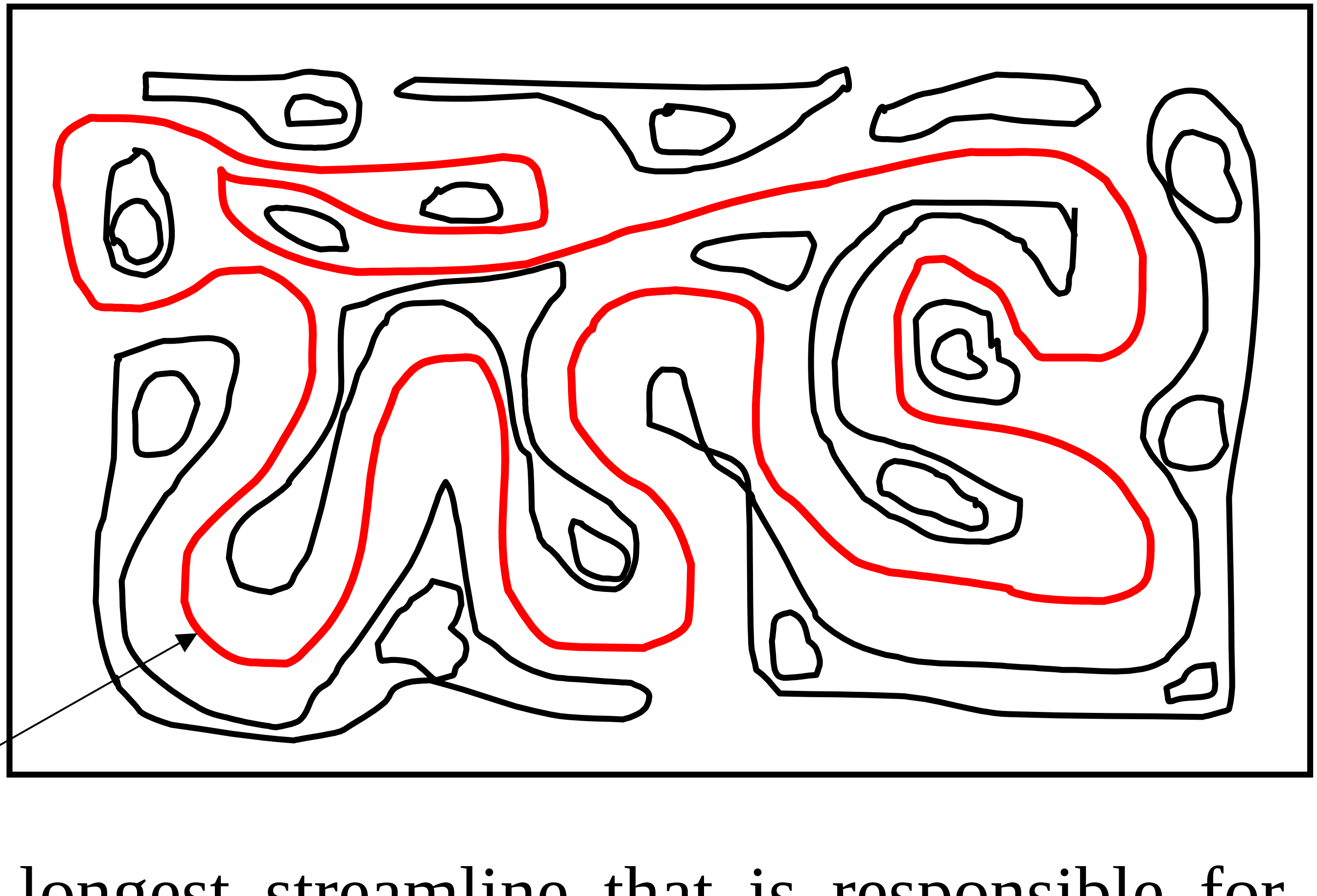
- There is a deep connection between transport and correlation effects. Correlations are responsible for anomalous diffusion in complex systems.

- The effective way to describe turbulent transport is the use of scaling representation of characteristic parameters to interpret experimental results.

- Here, we discuss the expression for the effective diffusivity, which describes transport in random flow in the presence of drift, compressibility, and time dependence effects.

The two-dimensional random flow near the percolation threshold



• The longest streamline that is responsible for anomalous transport

The percolation estimates of turbulent transport

- The quasi-linear approach

$$D_T(t) = \frac{1}{2}\frac{d}{dt}\left\langle x^2 \right\rangle = \int_0^t C_L(t)dt = \frac{V_0^2}{\omega}$$

- Weak compressibility effects

$$D_{eff} \approx \lambda V_0 \left(\frac{U}{V_0}\right)^{\frac{1}{\nu+2}} \propto V_0^{\frac{7}{10}}$$

- Drift and time dependence effects

$$D_p \approx V_0 \Delta(\varepsilon) \approx \lambda V_0 \left(\frac{\lambda\omega}{V_0}\right)^{\frac{1}{3(\nu+1)}} \left(\frac{U_d}{V_0}\right)^{\frac{2}{3(1+\nu)}} \propto U_d^{2/7} V_0^{4/7} \omega^{1/7}$$