Abstract Submitted
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Simple models for shear flow transition DWIGHT BARKLEY, University of Warwick — I will discuss recent developments in modeling transitional shear flows with simple two-variable models. Both pipe flow and plane Couette flow are considered. The essential insight is that most large-scale features of these shear flows can be traced to a change from excitability to bistability in the local dynamics. Models are presented in two variables, turbulence intensity and mean shear. A PDE model of pipe flow captures the essence of the puff-slug transition as a change from excitability to bistability. Extended models with turbulence as deterministic transient chaos or multiplicative noise reproduce almost all large-scale features of transitional pipe flow. In particular they capture metastable localized puffs, puff splitting, slugs, localized edge states, a continuous transition to sustained turbulence via spatiotemporal intermittency (directed percolation), and a subsequent increase in turbulence fraction towards uniform, featureless turbulence. A model that additionally takes into account the symmetries of plane Couette flow reproduces localized turbulence and periodic turbulent-laminar bands.

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