Abstract Submitted
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Dynamics and stability of turbulent falling films[1] ALIKI MAVROMOUSTAKI, LENNON O'NARAIGH, OMAR MATAR, Imperial College London — We study the dynamics of thin turbulent films falling under the action of gravity. A base state, corresponding to a waveless film, is obtained by balancing gravity against viscous drag. The latter includes turbulent viscosity contributions characterised by a simple mixing length model. A linear stability analysis of this base state is then carried out leading to the derivation of an Orr-Sommerfeld-type eigenvalue problem. Numerical solutions of this problem reveal a Reynolds number-dependent competition between destabilising contributions arising from the turbulent base state and stabilising ones from the turbulent stresses at the interface and in the bulk. An energy budget analysis demonstrates clearly that the destabilising mode corresponds to an interfacial one. Our results also reveal that the most dangerous mode is in the long-wave regime. This provided motivation for the derivation of a long-wave model for the nonlinear film dynamics, which represents an extension of the Shkadov equations for turbulent falling films. The results of a brief parametric study of this model are presented.

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