Abstract Submitted
for the DFD06 Meeting of
The American Physical Society

Three-dimensional coherent structures of surface turbulence SERAFIM KALLIADASIS, Department of Chemical Engineering, Imperial College London, London SW7 2AZ, UK, EVGENY A. DEMEKHIN, EVGENY N. KALAIDIN, S.YU. VLASKIN, Kuban State University, Southern Research Center of Russian Academy of Sciences, Stavropolskaya St. 149, Krasnodar 350040, Russia — The evolution of naturally excited disturbances on a thin liquid film falling down an inclined planar substrate undergoes several transitions between different wave regimes starting from two-dimensional (2D) solitary pulses at small Reynolds numbers to the 'surface turbulence' stage for sufficiently large Reynolds numbers where the surface is randomly covered by localized three-dimensional (3D) coherent structures. Here we analyze the instability of 2D pulses to 3D disturbances and the transitions of 2D pulses to fully developed 3D waves. The main instability mechanism is the Rayleigh instability of well- separated (isolated) 2D solitary waves. On the other hand, the physical mechanism for the 3D instability of 2D periodic waves is due to wave-wave interaction and mass exchange between neighboring waves. These instabilities are characteristic of small inclination angles but under special conditions can be realized for the vertical flow.

Serafim Kalliadasis
Department of Chemical Engineering,
Imperial College London, London SW7 2AZ, UK

Date submitted: 13 Sep 2006 Electronic form version 1.4