Abstract Submitted
for the DFD13 Meeting of
The American Physical Society

Dynamics of temporally-evolving shear layers on the interface between a porous medium and a pure fluid[1] PANAGIOTIS D. ANTONIADIS, MILTIADIS V. PAPALEXANDRIS, Université catholique de Louvain — In this talk we present results from our study on the dynamics of flows at the macroscopic interface between a porous medium and a pure fluid. To this end, we employ a variation of the unsteady Darcy-Brinkman equation, which is valid both inside and outside the porous medium. The major advantage of this approach is that it does not require additional interface conditions. In the first part of the talk, we present a linear stability analysis for unbounded shear layers on the interfaces of interest. According to our analysis, these layers are unconditionally unstable, regardless of the porosity of the medium. Subsequently, we present results of three-dimensional simulations of such shear layers. According to these simulations, the velocity gradients across the interface result in the onset of a Kelvin-Helmholtz instability which grows over time, leading to spanwise roller formation and pairings. There is also concurrent formation of thin "rib" vortices, as in the case of single-phase plane mixing layers. Important characteristics of the flow, such as self-similarity and growth rate of the shear layer, are also discussed.

[1]This work is supported by the National Fund for Scientific Research (FNRS), Belgium.

Panagiotis D. Antoniadis
Université catholique de Louvain

Date submitted: 01 Aug 2013 Electronic form version 1.4