Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

Entropy: Combining Boundary Layers and Depth-Averaged Models[1] BENJAMIN YOUNG, STUART DALZIEL, NATHALIE VRIEND, Univ of Cambridge — Deriving robust and accurate closure laws for simplified models of complicated flows is still one of the most significant problems facing fluid dynamicists in the 21st century. Many approaches exist. Many of these approaches, however, often lack physicality, simplicity or are dependent on empirical data. This naturally leads to the question, 'is there a general guiding principle that can be used to derive closure laws for any arbitrary flow model?

We present a generic mean-field/maximum entropy approach that we apply to model the interaction between a boundary layer and free surface. We show that, amazingly, if entropy is maximized subject to mean-field conservation of mass, momentum and energy we can recover analytical solutions to both the Navier-Stokes equations and the granular $\mu(I)$ equations.

Finally, we apply our maximum entropy method to the 'Free-Surface Blasius Problem and compare our model to both numerics and theory. We demonstrate that the mean-field/maximum entropy method is both highly accurate and predicts some previously unseen physical phenomena.

[1]BAY is supported by a NERC ESS DTP studentship and NMV acknowledges support from a Royal Society University Research Fellowship.

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Date submitted: 31 Jul 2020 Electronic form version 1.4