Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

Direct numerical simulation of turbulent core-annular flow in a vertical pipe[1] KIYOUNG KIM, HAECHEON CHOI, Seoul Natl Univ — The core-annular flow has been considered as a useful tool to effectively transport highly viscous oil by having lower viscous fluid such as water near the pipe surface. There have been several studies to investigate turbulent core-annular flows but most of them have been conducted experimentally. We solve the three-dimensional Navier-Stokes equations in a cylindrical coordinate and use the level-set method for interface tracking between two fluids (oil and water). A few different flow parameters such as the superficial velocity of fluids and mean pressure gradient are considered in a vertical pipe. The results show that the oil core region is nearly a plug flow and the water region experiences high shear rates, which generate turbulence structures different from those of single phase flow. The interface wave suppresses the near-wall coherent structures but produces complex fluid motions caused by its interaction with the wall. The phenomenon of maximum drag reduction and the effect of water turbulence on total drag will be discussed at the presentation.

[1]We gratefully acknowledge financial support from the NRF programs(No. 2012M2A8A4055647), Mest, Korea

Giyeong Kim
Seoul Natl Univ

Date submitted: 29 Jul 2014 Electronic form version 1.4