1046-35-1296 **Jenny Suckale*** (suckale@mit.edu), Office 54-617, MIT, Massachusetts Ave 77, Cambridge, MA 02139, and **J.C. Nave** and **B.H. Hager**. *How to make the most out of level sets for geodynamical modeling.*

A key challenge in geodynamical modeling is to represent interfaces between different fluids in 2D and 3D, such that (1) no restrictions on the interface deformability are imposed, (2) mass is conserved, and (3) discontinuous jumps in fluid properties at the interface are maintained. We present a new level set approach, providing efficiency, robustness, accuracy, and topological change. A key aspect of our algorithm is an extension velocity approach, accurately coupling flow dynamics to the interface, and avoiding spurious mass loss and artificial front repositioning that plague reinitialization schemes. A new scheme for Stokes equation in a ghost fluid setup is presented, obviating the need for smoothing of sharp discontinuities: interfaces are represented sharply with sub-grid interpolation. Correct flow fields are computed, even in the presence of huge and discontinuous jumps in material parameters, such as viscosity contrasts of several orders of magnitude. We study several geodynamical problems, and validate our code by reproducing the benchmarks for the isothermal Rayleigh-Taylor instability by van Keken et al. 1997. We compare our approach to particle, marker, and color function methods, detailing advantages and demonstrating complex structures in evolving flows. (Received September 16, 2008)