Abstract Submitted
for the DFD06 Meeting of
The American Physical Society

Dynamic modeling for LES of turbulent jet mixing in spherical coordinates without explicit test filtering O.S. SUN, L.K. SU, Johns Hopkins Univ., T.M. BURTON, U.S. Naval Academy — The dynamic model for LES requires explicit test filtering of grid-resolved quantities to compute model coefficients. On a regular, Cartesian grid, the test filter at any location in the computational domain is usually implemented by taking a local average of quantities at neighboring grid points. In complex flows involving irregular or unstructured grids, or simulations performed in non-Cartesian coordinate systems, the test filtering operation is less intuitively interpreted. Another approach (Chester, Charlette, Meneveau (2001)) approximates test filtering by expanding grid-resolved quantities locally in a truncated Taylor series. In this work, we implement this test filter approximation in LES of scalar mixing in a round turbulent jet. This approach provides a more robust and consistent definition of the test filter on the spherical coordinate grid used in the simulation, and allows more accurate determination of the dynamic coefficient for the subgrid scale (SGS) models. Previous studies have shown the resolved-scale scalar field to be particularly sensitive to the numerics of the simulation, including the spatial discretization scheme, filter width, as well as the amount of 'backscattering' allowed by the subgrid scalar flux model. We aim to determine how the evolution of the dynamic coefficients for the SGS stress and SGS scalar flux models influences the mixing properties of the simulated turbulent jet, at both the resolved and subgrid scales, and how closely the resulting velocity and scalar fields correlate with experimental measurements.

O. S. Sun
Johns Hopkins Univ.

Date submitted: 07 Aug 2006 Electronic form version 1.4