The California Department of Water Resources maintains Delta Simulation Model 2, a one dimensional hydrodynamic and transport model for rapidly simulating flow and water quality in the Sacramento-San Joaquin Delta. Recently, the authors commenced work on a more flexible and more rigorously verified transport component for this suite. Our target problems include river and estuary advection, 1D approximations of common mixing mechanisms and source terms associated with sediment, radiation and non-conservative water quality kinetics.

In this paper, we describe our approach and experiences developing a software verification framework for this model. We begin by describing the motivation and requirements for such a framework, and associate our criteria to concepts from both the software and numerical testing fields. We then describe the components and implementation of the suite, emphasizing the incremental nature of the tests, quantitative criteria for testing and the tension between the silent, automatic perspective of software testing and the verbose, graphical requirements required for public reporting of numerical results.

Our problem domain includes estuaries and river channels and even some open water areas grossly approximated as channels. The mixing mechanisms we anticipate are \*\*\*\*. We anticipate blah to dominate blah, with Blah Numbers exceeding \*\*\*. We also contemplate significant, non-linear source terms. While none are so quickly varying as to constitute truly stiff reactions, we have \*\*\* with \*\*\*\* Numbers of \*\*\*\*.

Our choice of algorithms includes \*\*\*\* advection with \*\*\*\* and \*\*\*\*. The advection and reaction solver are coupled as a predictor corrector pair, and diffusion is implemented using operator splitting.

Both the scaling of the problem and our choice of algorithm influence the components of our test suite.