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Low-dimensional modeling for both temporally and spatially developing free shear layers MINGJUN WEI, New Mexico State University, CLARENCE ROWLEY, Princeton University — In this study, both temporally and spatially developing two-dimensional free shear layers are modeled. A modified version of proper orthogonal decomposition/Galerkin projection is used to allow the basis functions to scale along cross-stream direction in time (temporal model) or downstream (spatial model) as the shear layers develop. The solution is scaled at each time (temporal model) or downstream location (spatial model) to match a pre-selected template function. The scaling variable is calculated simultaneously to minimize the difference between the current solution and the template. Projection of incompressible Navier-Stokes equations onto the first two POD modes of the lowest one or two wavenumber/frequency gives a 2-mode or 4-mode temporal/spatial model. It is indicated that at least two POD modes with opposite symmetric behavior are needed to describe the dynamics properly. The incompressibility of each modes is enforced during the scaling, and this turns out to be crucial in successful modeling.

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