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Reduced Order Estimation of the Atmospheric Boundary Layer Using POD-LSE JONATHAN NAUGHTON, MANJINDER SINGH, University of Wyoming, EDWARD PATTON, PETER SULLIVAN, National Center for Atmospheric Research — The complimentary POD-LSE (proper orthogonal decomposition – linear stochastic estimation) technique has been used to develop a reduced order model from large eddy simulations (LES) of the atmospheric boundary layer. The technique allows modeling of the coherent turbulence that is inherent to real atmospheric flows, where older spectrum based methods fail. The usefulness of POD is the low number of modes required to capture the energy containing structure in the flow. The power of LSE lies in its ability to estimate the time-dependent flow field using sparsely distributed data points. For the daytime unstable atmospheric boundary layer studied here, approximately 90% of the total energy was captured by accurate estimation of less than 2% of the POD modes. Although the approach was developed using a Large Eddy Simulation as input, the approach provides the foundation for designing a field experiment. The POD modes would be determined from spatially-resolved measurements that lack time resolution, and the flow field dynamics would then be estimated using a few optimally placed sensors providing time-dependent information.

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