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One-way Euler equations: a novel spatial marching technique for convective instabilities AARON TOWNE, TIM COLONIUS, California Institute of Technology — The parabolized stability equations (PSE) are a tool for rapid computation of convectively unstable flows. The efficiency of the method is achieved by solving the equations in frequency space using a spatial marching technique in the downstream direction. Unfortunately, the PSE operator contains upstream propagating acoustic modes that cause instability in this march unless these waves are numerically damped. Existing damping techniques introduce additional error into the solution and in particular contaminate the acoustic mid- and far-field. We have developed a method that removes the upstream acoustic modes from the linearized Euler equations without damaging the downstream modes. The upstream and downstream dynamics are decoupled using a recursive filtering technique that was originally developed for generating non-reflecting boundary conditions. The decoupled downstream modes are then evolved in the downstream direction. Our talk will focus on the validation of this method through comparison with PSE and direct solutions of the linearized Euler equations.

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