



## Sloping steps Eta: Monotonic horizontal diffusion and Gallus-Klemp test

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Making experiments with a 1-km resolution Eta model an undesirable amount of noise and occasional blow-ups focused attention to the model's horizontal diffusion code. With the Smagorinsky-like nonlinear diffusion scheme used control of either of the problems is not possible by simple changes of the diffusion coefficient. Therefore, a remedy was put in place by preventing the diffusion increment to change the sign of the five point Laplacian of the field being diffused. This resulted in an unconditionally stable and monotonic horizontal diffusion scheme.

In some of the experiments run even using this refined code an unexpected behavior was noticed in that increased input diffusion coefficient led to somewhat increased noisiness. A tentative explanation of this behavior was arrived at and will be reported on.

Inadvertently, attention to the diffusion code led to the discovery of it not having been made aware of the sloping steps upgrade. Once this was addressed the Gallus-Klemp test of the flow over a bell shaped mountain was rerun obtaining velocities down the lee slope very much in line with those that Gallus and Klemp apparently considered appropriate. This can be considered to have fully removed a problem many authors referred to as demonstrating inadvisability of the choice of the eta coordinate for high resolution models.