

The impact of squall line-generated environmental perturbations on isolated convective storms Adam J. French



Two idealized CM1 (Bryan et al. 2002) model simulations:

o **CTL:** An isolated supercell in a horizontally homogeneous, temporally static environment representative of conditions 60 km ahead of a simulated squall line (Fig. 3a).

base-state substitution (BSS)

BSS: An isolated supercell in a horizontally homogeneous, temporally varying environment representative of changing conditions as a simulated squall line approaches (Fig. 3a-c).

Temporally varying environment produced using the base state substitution (BSS) technique of Letkiewicz et al. (2013) (Fig. 2).

- o Soundings taken every 5 minutes ahead of a simulated squall line.
- o Soundings supplied to the supercell simuliaton using the "gradual BSS" method, wherein the simulation is restarted every 5 minutes with a new background environment.





Figure 3: Skew-T log-P diagrams (bottom panels) illustrating the temporally-varying environment applied at (a) t=0, (b) t=50, and (c) t=100 minutes into the BSS simulation. These represent snapshots of the (a) initial, (b) middle and (c) end of the simulation, with additional intermediate soundings being applied to the simulation every 5 minutes to create a gradual evolution of the environment. Top panels illustrate the location of the soundings in the squall line simulation where they were created.

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Past work has shown that:

Supercells have been observed to intensify (e.g., Przybylinski 1995) and increase in low level rotation as a nearby squall line approaches (e.g., French and Parker 2012).

2. Squall lines can modify the local environment well ahead of the line (e.g., Johnson and Hamilton 1988, Fovell 2002, Bryan and Parker 2010), changing the local wind and thermodynamic profiles, both of which are critical to thunderstorm evolution.

Are squall-line generated perturbations to the local environment sufficient to alter the structure, intensity, and severe weather potential of a nearby supercell thunderstorm?





- o Testing different squall line and supercell configurations.

- modifying squall line evolution.

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