Using NCSA/LEAD’s Workflow

Broker to Study Storm Interaction with WRF

Brian F. Jewett1, Robert B. Wilhelmson1,2, Jay C. Alameda2 and Albert L. Rossi2

Univ. of Illinois: 1Department of Atmospheric Sciences 2Nat’l Center for Supercomputing Applications (NCSA)

Storm Interaction and Supercell Behavior
- Supercells often form near or are influenced by other storms
- Example at right: tornado follows forward-flank merger
- Simulations: presence of another cell has a strong impact on behavior, incl. subsequent surface rotation properties
- Our interest: mesocyclogenesis and tornado occurrence

Methodology
• WRF2.2.1. nested; inner Δx=500m; 70 levels
• Two thermals at T=0 used to initiate convection
• One-thermal case is “isolated” control case
• All other cases: each simulation started with pair of thermals of varying orientation (see example at left)
• Attributes of each run summarized, plotted on map of initial cell locations to relate cell configuration, behavior

500-m Results
75 runs w/control; strong #24 shown.
- Fig. A: Red shading - peak sfc vorticity for lifetime of each run, on map of initial 2-cells.
  Ten shading; rotation ≥ 9.2×10⁻² for at least 36 min.
- Fig. B: Sorted peak surface wind, all cases.
- Fig. C: One case, run #24, at strongest time.
- Fig. D: Time series for a rotation center, run #24.

Summary
• Preferred (NE-SW) configuration is evident
  that yields strong rotation of varying longevity
• Presence of a second cell results in stronger rotation and stronger winds over larger area
• Some runs (e.g. #24): strong, lasting rotation; further nesting (below, to 100m) shown below

Supercell research supported by NSF ATM-0449753. Workflow broker development and testing has been supported by LEAD, a NSF ITR (ATM-0331578 and others), and SCI03-30554, SCI04-38712, and SCI96-19019.

Research efforts within the LEAD (Linked Environments for Atmospheric Discovery) program include workflow orchestration and fault tolerance for use with WRF; data mining; and on-demand and adaptive computing. For more info: <leadproject.org>