Wrap-Around (Nonlinear) Mechanism Based on Entropic Balance Theory for Tornadogenesis

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Tornadogenesis is the nonlinear and discontinuous atmospheric phenomena of causing natural disaster, which requires development of new data assimilation technology for needed accuracy of prediction.

Recent advanced observations and successful computer simulations clearly indicated need of super high spatial and temporal resolutions to solve full set of governing equations of motion, mass continuity, thermodynamics and cloud-physics by computer.

However, it took weeks of computer time to simulate tornado evolution of few hours by the super computer available in present days. Accordingly the author developed in the earlier publications entropic balance theory for tornadogenesis which may becomes a basis for practical, computer-efficient simplified model for tornado data assimilation and prediction.

Based on the entropic balance theory, “wrap-around mechanism” is developed to explain the nonlinear and discontinuous process of tornadogenesis. Such a nonlinear and discontinuous process is so far not common in the data assimilation. In order to develop technology of handling such nonlinear and discontinuous phenomena in data assimilation, it is important to understand better the process. The author clarifies in this article the wrap-around mechanism how it get active and what are the consequences. The results are consistent with advanced observations and successful tornado simulations such as radar hock-echo, discontinuous transition from supercell to tornadoic stages as baroclinic to barotropic stages and increase of the relative helicity to 1, the maximum value, and touching the ground in the

perpendicular direction.

The wrap-around mechanism is analogous to the nonlinear process so-called the Baker's transformation, and the transition from baroclinic to barotropic stages of trapping the baroclinic core is discontinuous like a nonlinear attractor. Consequently, it is a new challenge for data assimilation and prediction.