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Developing Parameters to Nowcast Intense Storms within the 0–1 hour Timeframe

John Mecikalski (1) and Daniel Rosenfeld (2)

(1) University of Alabama in Huntsville, United States (johnm@nsstc.uah.edu), (2) The Hebrew University, Jerusalem, Israel

Two independent methods for predicting initiation (e.g., Mecikalski and Bedka 2006; Mecikalski et al. 2010) and the near-term intensity of convective storms (Rosenfeld et al. 2008) are combined into one comprehensive method that will be able to nowcast both the initiation of locally intense/severe convective storms. Convective storm initiation (CI) has been predicted using a combination of geostationary-based infrared (IR) "interest fields" that were statistically found to have the most predictive capability for diagnosing which cumulus clouds later became thunderstorms over the forthcoming 30-60 min. Adding to the interest fields, satellite retrieved cloud parameters such as effective radius (Re), optical depth and indicators of cloud-top phase was subsequently shown recently to add skill to the CI nowcast by improving our understanding of the physical processes important to the CI processes, such as increasing cloud depth over time, updraft integrity, and glaciation related to precipitation production (Mecikalski et al. 2011).

The severity of the storm is determined to a large extent by the atmospheric instability, which in turn affects the potential updraft intensity. The most direct dynamic feature that manifests the storm intensity is the updraft speed, which determines the maximum size of the hailstones that can be produces by the storm, and also the intensity of the low level convergence and downdrafts that may be responsible to tornadoes and downbursts. Updraft intensity can be inferred indirectly by the fact that cloud drops in stronger updrafts have shorter time to grow and glaciate, thereby having smaller effective radii (Re) for a given cloud top temperature (T), and also colder glaciation temperature (Tg). The Re at Tg is smaller for stronger updrafts (Rosenfeld et al. 2008).

The SATellite Convection AnalySis and Tracking (SATCAST) 0-1 hour CI nowcasting methodology (Mecikalski and Bedka 2006; Mecikalski et al. 2010) uses up to 15 key fields IR from SEVIRI to diagnose updraft strength, cloud-top glaciation and cloud depth for cumulus clouds. This methodology subsequently relies upon linear extrapolation of current trends to nowcast CI. SATCAST is presently automated, processing 5-15 min GOES or MSG data, whereas new work ongoing at EUMETSAT is toward making SATCAST realtime. Parameterizing the T-Re relations and Tg into additional sets of predictors adds information on the intensity of the new convective storms that are nowcasted to occur, and in effect, produce an "intensity of CI" diagnostic, or a set of diagnostic predictors that occur in order as cumulus clouds deepen in time. Using these diagnostics, the goal is to predict a potential for severe storm formation. SATCAST then would provide CI nowcasts that would include a parameter that indicates the potential for a given CI event to become a severe thunderstorm.

The validation of the predictions is made against satellite attributes such as overshooting tops, cold-rings and V-shapes (enhanced-V) anvil-level features, and against surface reports of the ESSL and other potential sources of weather information. We will use the definition of a "severe" storm to include tornadoes, $\geq$2 cm hail, or winds $\geq$25 ms-1. The presentation will show results for a $\sim$250 CI-event database collected during summers 2010 and 2012 over Europe.