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Development of a Coupled GOES-R Legacy Sounding NearCast with Convective Initiation Products to Improve Convective Weather Nowcasts

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A project is described to reduce false alarms and over-forecasting with in the current version of the 0-1 h GOES-R convective initiation (CI) algorithm. This is accomplished by incorporating 1-9 h NearCasts of GOES-R Legacy Sounding Moisture and Temperature products within GOES-R CI as a means of better differentiating areas in which storms are most likely to grow from those where growth is less likely. The procedure maximize use of all capabilities of the forthcoming GOES-R Advanced Baseline Imager (ABI) Visible, infrared (IR), high time-resolution (1-5 min) imagery, as well as the 15-30 min interval clear-air profiles (especially moisture). The CI and NearCast datasets are physically consistent and complimentary, often providing a better depiction of evolving stability patterns in advance of storm development than are available from NWP. It is known that NWP models suffer from significant forecast errors, especially with respect to convective-scale quantitative precipitation forecasts in the first 1-9 h of a forecast, and in summer when operational Threat Scores can be as low as 12%. GOES-R CI and NearCast methods are designed to mitigate these NWP forecast deficiencies, with NearCast providing a consistent, frequently updated depiction of the vertical and horizontal distribution of moisture in the pre- and near-storm environment and CI providing improved situational awareness of which radar returns are most likely to grow once cloud growth has commenced. For this demonstration, data from the existing GOES and Meteosat Second Generation (MSG) instrument will be used. High-impact severe weather event days over the U.S. (using input from the SPC and AWC GOES-R Proving Grounds) and Europe (using the European Severe Weather Database-ESWD) will be evaluated.

Through combining GOES-R CI and NearCast, forecasters will gain several advantages over using both products individually, including low-level moisture and boundary detection, which becomes a means of enhancing GOES-R CI performance. The ability of NearCasts to improve the depiction of water vapor features and gradients at the full resolution provided by the satellite observations will help isolate boundaries of moisture in the near-storm environment that lead to CI and upscale convective storm development. These fields will provide additional input the GOES-R CI (in a logistic regression framework), information that is presently lacking in GOES-R CI.

Progress to date on several related goals will be presented:
– Develop GOES-R CI probabilities of occurrences into NearCast toward improving the NearCast “regions of focus” for new/future CI: The Lagrangian-transported NearCast temperature and moisture fields (used to create potential instability maps) show general regions that are favorable for CI over the coming few hours. The GOES-R CI fields are then used within NearCast to pinpoint small meso-scale ($\sim$10-100 km) regions where CI is imminent.
– Use of 1-min GOES SRSO data: Within the GOES-R CI algorithm, the IR CI-predictors over 2-5 min time periods would be used to gain more rapid lead-times for CI. In doing so, updated CI nowcasts become available $\sim$2-5 min after a SRSO GOES image are available, and therefore the lead-time for the CI nowcasts can be extended, as compared to the 15-min data with current GOES.
– Validation of the coupled CI-NearCast product with GPS moisture and NWP fields: This additional validation information will not only assist forecasters in the subjective use of NearCasts, but will also enhance the utility of NearCast parameters within the enhanced CI algorithms. Similarly, near real-time comparisons to Storm Prediction Center and ESWD reports would be performed, which would have the added benefit of training the GOES-R CI algorithm toward nowcasting “convective intensity” (i.e. identifying clouds that possess locally strong updrafts and growth rates).