Development and Demonstration of the Fusion of GOES-R Legacy Sounding NearCasts with Convective Initiation Products to Improve Convective Weather Nowcasts

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Abstract

The overall goal of the proposed project is to provide a more refined convective initiation (CI) nowcast by incorporating additional environmental information provided by GOES to identify where convection is most likely to form through the fusion of two established convective monitoring GOES-R algorithms. This goal will be accomplished by reducing the false alarms/over-forecasting of the current 0-1 h GOES-R CI algorithm by integrating 0-3 h NearCasts of GOES-R Legacy Sounding Moisture, Temperature and Stability products within the GOES-R CI as a means of better defining areas in which convective clouds are most/least likely to develop into strong convective storms. This approach will maximize the use of all the forthcoming GOES-R Advanced Baseline Imager capabilities: Visible imaging, infrared (IR) imaging, high time-resolution (1-5 min) imagery, as well as the 15-30 min interval clear-air profiles (especially moisture).

The GOES-R CI and NearCast datasets are physically consistent and complimentary, often providing a better depiction of evolving stability patterns in advance of storm development than those available solely from operational numerical weather prediction (NWP) models. It is known that NWP models suffer from significant forecast errors, especially with respect to convective-scale quantitative precipitation forecasts in the first ~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 the CI product providing improved situational awareness of which radar returns are most likely to intensify once cloud growth has commenced. For this demonstration, data (standard and high temporal resolution) from the existing GOES will be used, along with Meteosat Second Generation (MSG) data as a surrogate for the future GOES-R. High-impact severe weather events 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 as part of this project.