Advancement of Satellite-Detected Overshooting Top (OT) Decision Support Products Probabilistic Multispectral OT Detection Algorithm Development

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Abstract

Objective overshooting cloud top (OT) and enhanced-V signature detection is a "Future Capability" algorithm that was delivered to the GOES-R Aviation Algorithm Working Group in 2011. It has been demonstrated that OTs within vigorous convection can be accurately detected within geostationary and low-Earth-orbiting (LEO) satellite data using the GOES-R algorithm (Bedka et al. (*JAMC*, 2010)). This algorithm uses a combination of 11 μm IR window channel brightness temperatures (BT) and their spatial gradients, a NWP model tropopause temperature forecast, and knowledge of the characteristic OT size and surrounding cirrus anvil cloud temperature from detailed analysis of OT-producing storms observed by LEO imagers. The final output is a yes/no binary mask with ancillary confidence information derived from the magnitude of the IR BT gradient near an OT detection.

Selected weather analysis and prediction centers have been provided output from the GOES-R OT detection algorithm for evaluation in daily operations. As the detection product is currently a binary mask, differing algorithm settings were required to meet the needs of each of the forecast center. For example, NOAA OPC, HPC, and NESDIS SAB are currently evaluating a product that could be described as "deep convective updraft" detection that uses less strict thresholds than the OT-specific detection described by Bedka et al. (2010). In the meantime, forecasters at the GOES-R HWT and European Severe Storms Laboratory Summer Testbed consider an accurate OT detection (i.e. you see it in visible imagery) a "false alarm" if the storm did not produce severe weather. NHC/TAFB is interested in a product that primarily identifies very strong updrafts associated with vigorous tropical convection for tropical cyclone applications. While these adaptations and product branches are need driven, they are often derived from separate algorithm runs and can lead to product confusion. In addition, use of fixed detection thresholds can adversely impact product performance, i.e. thresholds that work consistently well across the Southeast U.S. where the convection is quite vigorous may be ineffective for convection in a less unstable environment over the Northeast U.S.

This GOES-R Risk Reduction project seeks to improve upon the original "Version 1" GOES-R OT detection algorithm through incorporation of advanced pattern recognition methods and additional NWP fields to transform the output from a yes/no binary OT mask to a probabilistic OT product. An additional advancement will be automated detection of OT-induced texture in the visible channel, a capability present in no other detection algorithm. Lastly, satellite OT detection interest fields will be combined with NWP information to attempt to derive a "Probability of Severe Weather" field to be associated with each OT.