



1. INTRODUCTION

A suite of products has been developed and evaluated to assess hazards presented by convective downbursts (Fujita 1985) to aircraft in flight derived from the current generation of Geostationary Operational Environmental Satellite (GOES 8-P). The existing suite of GOES-sounder derived microburst products are designed to accurately diagnose risk based on conceptual models of favorable environmental profiles. Pryor and Ellrod (2005) outlined the development of a Geostationary Operational Environmental Satellite (GOES) sounder-derived wet microburst severity index (WMSI) product to assess the potential magnitude of convective downbursts over the eastern United States, incorporating convective available potential energy (CAPE) as well as the vertical theta-e difference (TeD) (Atkins and Wakimoto 1991) between the surface and mid-troposphere. In addition, Pryor (2006a) developed a GOES Hybrid Microburst Index (HMI) product intended to supplement the GOES WMSI product over the United States Great Plains region.

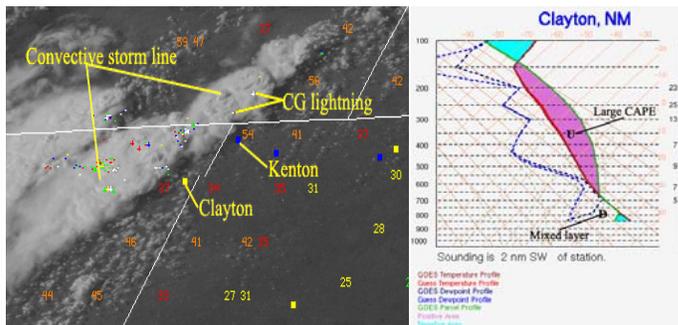


Figure 1. GOES MWPI product image at 2200 UTC 26 July 2007 (left) and corresponding prototypical GOES sounding profile at Clayton, New Mexico (right).

A new diagnostic nowcasting product, the Microburst Windspeed Potential Index (MWPI), is derived from merging the WMSI and HMI algorithms and designed to infer the presence of sufficient positive buoyant energy and a well-mixed CBL. The MWPI algorithm incorporates CAPE, the sub-cloud lapse rate between the 670 and 850 mb levels, and the dew point depression difference between the typical level of a convective cloud base near 670 mb and the sub-cloud layer at 850 mb. The MWPI that accounts for both updraft (U) and downdraft instability (D) in microburst generation is defined as

$$MWPI \equiv \left\{ \frac{CAPE}{100} \right\} + \left\{ \Gamma + \frac{(T - T_d)_{850} - (T - T_d)_{670}}{D} \right\}$$

where  $\Gamma$  is the lapse rate in degrees Celsius (C) per kilometer from the 850 to the 670 mb level, and the quantity  $(T - T_d)$  is the dewpoint depression (C). The prototype sounding profile that illustrates the MWPI algorithm is displayed in Figure 1.

2. CASE STUDIES:

Oklahoma Panhandle Downbursts

During the afternoon of 26 July and 23 August 2007, convective storms developed along a cold front that extended from southeastern Colorado into northern New Mexico. Particularly intense storms tracked east into the western Oklahoma Panhandle, producing strong downburst wind gusts of 49 knots on 26 July and 41 knots on 23 August as observed by the Kenton, Oklahoma Mesonet station. As shown in Figures 1 and 2, comparison of late afternoon GOES MWPI imagery to the location of the observed downbursts revealed that the MWPI effectively indicated the potential for strong downburst wind gusts.

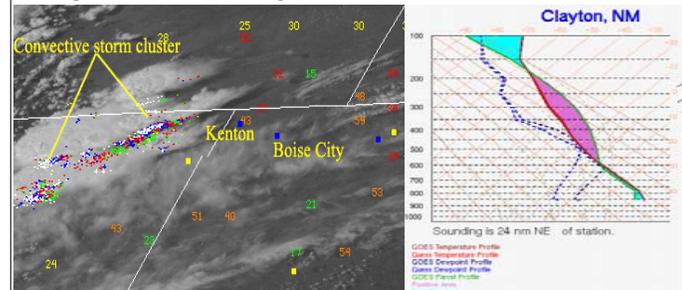


Figure 2. GOES MWPI product image at 2100 UTC 23 August 2007 (left) and corresponding GOES sounding profile at Clayton, New Mexico (right).

West Texas Dryline Downbursts

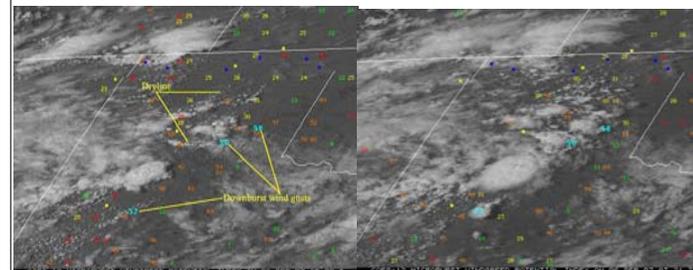


Figure 3. GOES MWPI product image at 2000 UTC (left) and 2100 UTC (right) 6 September 2007.

Strong downbursts were observed over western Texas during the afternoon of 6 September 2007. During the afternoon of 6 September, convective storms developed near the dryline (Schaefer 1986) over western Texas. Strong downburst wind gusts, recorded by Slaton, Clarendon, and McLean (West Texas) mesonet stations, were observed in close proximity to local maxima in GOES MWPI values, indicated in product imagery one to two hours prior to the observed events. These downburst events demonstrated strong correlation between MWPI values and the magnitude of convective wind gusts recorded by West Texas Mesonet stations. Figure 3, the 2000 UTC MWPI image, displayed a regional maximum in index values along the dryline over western Texas reflecting an increase in vertical mixing and a resultant increase in CBL depth.

3. METHODOLOGY AND VALIDATION

The objective of this validation effort was to qualitatively and quantitatively assess and intercompare the performance of the GOES sounder microburst products by employing classical statistical analysis of real-time data as illustrated in Figure 4. Data from the GOES HMI, MWPI and WMSI products was collected over the Oklahoma Panhandle and western Texas for downburst events that occurred between 1 June and 30 September 2007 and validated against surface observations of convective wind gusts as recorded by Oklahoma and West Texas Mesonet (Brock et al. 1995; Schroeder et al. 2005) stations.

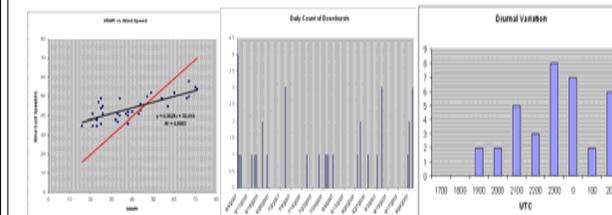


Figure 4. Statistical analysis of validation data over the Oklahoma Panhandle and western Texas domain between June and September 2007: Scatterplot of MWPI values vs. measured convective wind gusts for 35 downburst events (left), daily count of verified downbursts (center), diurnal variation of verified downbursts (right).

4. REFERENCES

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Corresponding author address: Mr. Kenneth Pryor, Satellite Meteorology and Climatology Division, Operational Products Development Branch, NOAA/NESDIS/STAR, Room 711, 5200 Auth Rd., Camp Springs, MD 20746-4304  
E-mail: Ken.Pryor@noaa.gov  
<http://www.orbit.nesdis.noaa.gov/smd/opdb/kpryor/bio.html>