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An Initial Assessment of The GOES Microburst Windspeed Potential Index

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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.

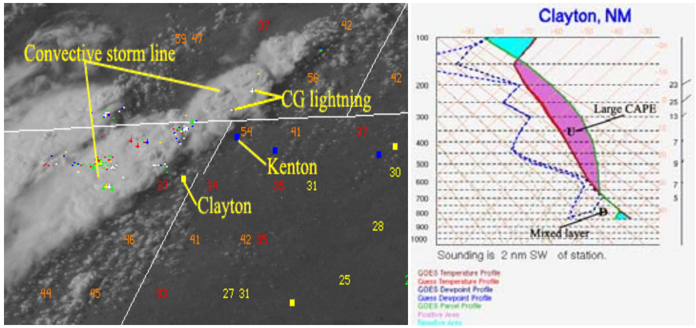

Figure 1. GOES MWPI product image at 2200 UTC 26 July 2007 (left) and corresponding prototypical GOES sounding profile at Clayton, New Mexico (right).

A new diagnostic nowcasting product, the **Microburst Windspeed Potential Index (MWPI)**, is designed to quantify the most relevant factors in convective downburst generation in intermediate thermodynamic environments by incorporating **CAPE**, the **sub-cloud lapse rate** 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

$$MWPI \equiv \underbrace{\{(CAPE/100)\}}_{U}+\underbrace{\{\Gamma+(T-T_d)_{850}-(T-T_d)_{670}\}}_{D}$$

where Γ 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. Although there is not currently an observational requirement for microburst potential for the GOES-R Advanced Baseline Imager (ABI) (Schmit et al. 2005), the ABI does have promising capability to generate a sounding profile with greatly improved temporal and spatial resolution as compared to the existing GOES (8-P) sounders.

2. CASE STUDIES:

Oklahoma PanhandleDownbursts

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.**

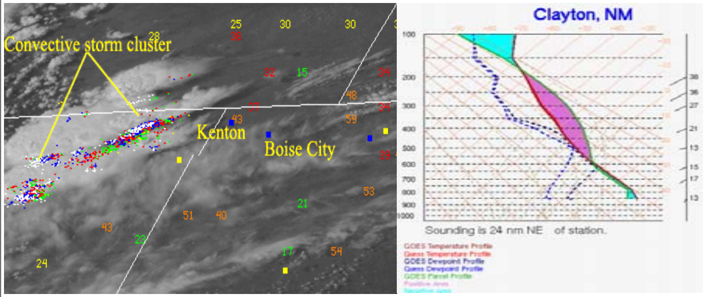

Figure 2. GOES MWPI product image at 2100 UTC 23 August 2007 (left) and corresponding GOES sounding profile at Clayton, New Mexico (right).

West Texas Dryline Downbursts

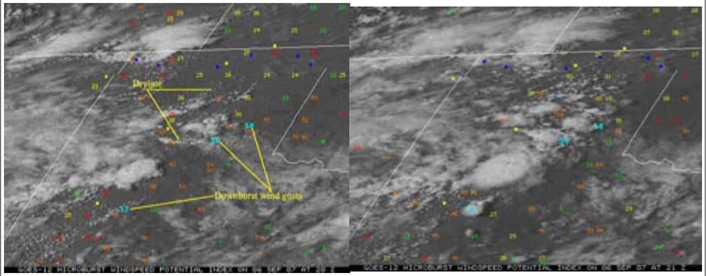

Figure 3. GOES MWPI product image at 2000 UTC (left) and 2100 UTC (right) 6 September 2007.

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.

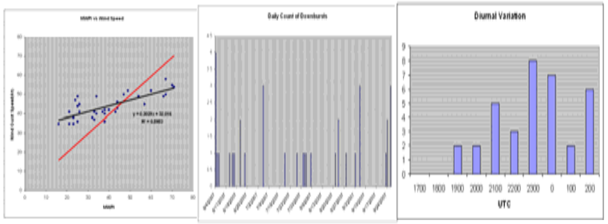

Figure 4. Statistical analysis of validation data over the Oklahoma Panhandle and western Texas domain between June and September 2007: Scatterplot of MWPI values vs. measured convective wind gusts for 35 downburst events (left), daily count of verified downbursts (center), diurnal variation of verified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

4. REFERENCES

Atkins, N.T., and R.M. Wakimoto, 1991: Wet microburst activity over the southeastern United States: Implications for forecasting. *Wea.Forecasting*, **6**, 470-482.

Brock, F. V., K. C. Crawford, R. L. Elliott, G. W. Cuperus, S. J. Stadler, H. L. Johnson and M. D. Eilts, 1995: The Oklahoma Mesonet: A technical overview. *Journal of Atmospheric and Oceanic Technology*, **12**, 5-19.

Pryor, K.L., and G.P. Ellrod, 2005: GOES WMSI - progress and developments. Preprints, *21st Conf. on Wea. Analysis and Forecasting*, Washington, DC, Amer. Meteor. Soc.

Pryor, K.L., 2006a: The GOES Hybrid Microburst Index. Preprints, 14th Conf. on Satellite Meteorology and Oceanography, Atlanta, GA, Amer. Meteor. Soc.

Schaefer, J.T., 1986: The dryline. In Mesoscale Meteorology and Forecasting. P.S. Ray (Ed.), American Meteorological Society, Boston, 549-572.

Schroeder, J.L., W.S. Burgett, K.B. Haynie, I. Sonmez, G.D. Skwira, A.L. Doggett, and J.W. Lipe, 2005: The West Texas Mesonet: A technical overview. *Journal of Atmospheric and Oceanic Technology*, **22**, 211-222.

Schmit, T.J., M. M. Gunshor, W. P. Menzel, J. J. Gurka, J. Li, and A. S. Bachmeier, 2005: Introducing the next-generation advanced baseline imager on GOES-R. *Bull. Amer. Meteor. Soc.*, **86**, 1079–1096.

Wakimoto, R.M., 1985: Forecasting dry microburst activity over the high plains. *Mon. Wea. Rev.*, **113**, 1131-1143.

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