

December 20/21 2013 Winds



Above Left: Shredded sign across power lines in Matamoros, Tamaulipas, Mexico, just across from Brownsville, Texas. **Right:** Unanchored portable toilet at home construction site in north Brownsville. Photos taken during the morning of December 21st, 2013.

RGV/South Texas “Wind Machine” Ratchets Up Unusual Overnight Gusts ≥ 40 mph in December Cause Minor Damage

Location	Peak Wind Gust	Time
Brownsville/SPI Int'l Airport	48 mph	1059 AM/Dec. 21
Harlingen/Valley Int'l Airport	48 mph	534 AM/Dec. 21
McAllen/Miller Int'l Airport	45 mph	1206 AM/Dec. 21
Bayview/Cameron Co. Arpt	44 mph	956 AM/Dec. 21
Kingsville Naval Air Stn	43 mph	1256 AM/Dec. 21
Alice/Jim Wells	43 mph	1253 AM/Dec. 21
Weslaco/Mid Valley Arpt	41 mph	1155 PM/Dec. 20
Falfurrias/Brooks Co. Arpt	41 mph	1235 AM/Dec. 21
South Padre Island Heliport	40 mph	1015 AM/Dec. 21
Hebbronville/Jim Hogg Co	36 mph	1155 PM/Dec. 20
Edinburg/Int'l Airport	35 mph*	935 PM/Dec. 20
Laredo/Int'l Airport	24 mph	1056 PM/Dec. 20

*Observation ceased at 935 PM, December 20.

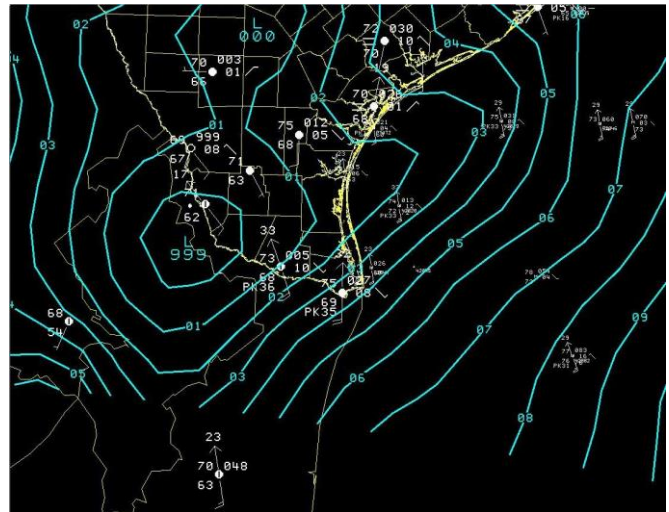
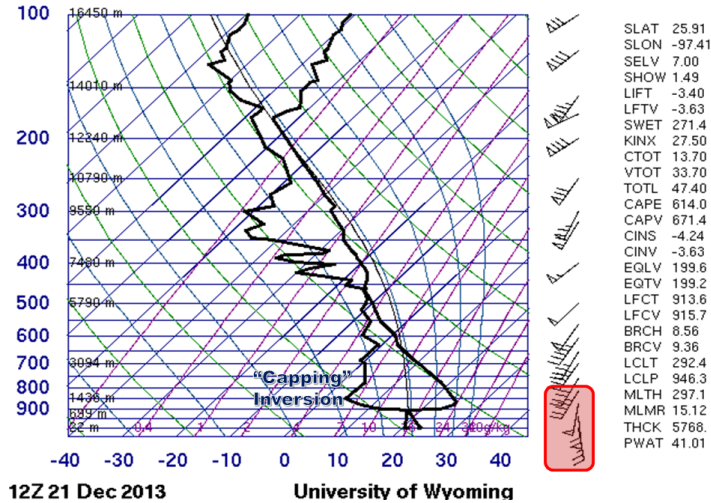
Overview

For the first time in nearly six years, a vigorous non-tropical upper level system, accompanied by relatively strong low pressure near the earth's surface that moved across the Rio Grande Valley during the pre-dawn hours of December 21st, brought persistent sustained winds from the south near or just above 30 mph with long duration gusts of 40 mph or higher – in some cases (Harlingen/Valley Airport) for nearly all of 12 hours - in many locations along the U.S. 77/Interstate 69-E corridor. Unique were the *overnight* peak winds, as shown in the table above. The last time similar strong nighttime winds occurred outside of a tropical cyclone was on [March 17/18, 2008](#).

Rarer still was the occurrence in late *December* – when the difference between springtime warming near the surface and a still cool atmosphere and Gulf of Mexico can produce tropical storm to near hurricane force winds just above the surface, which was the case on [March 18, 2008, a little after 6 AM CDT](#) (note the values under “SKNT/knot,” which reached as high as 68 knots, or 78 mph). On December 21st, the peak winds just off the surface were 58 knots (67 mph) a little after 5 AM CST (see image, next page), which were able to mix to the ground, especially areas exposed to the south.

The long duration of gusts 40 mph or higher produced pockets of damage to unanchored light weight/high center-of-gravity objects, including portable toilets, basketball goals, and more. Unfastened signs were shredded or blown down, as were at least two poorly fastened roofs, one in Harlingen and another at Brownsville/South Padre Island International Airport. Power outage information was unavailable as of this writing.

72250 BRO Brownsville Intl



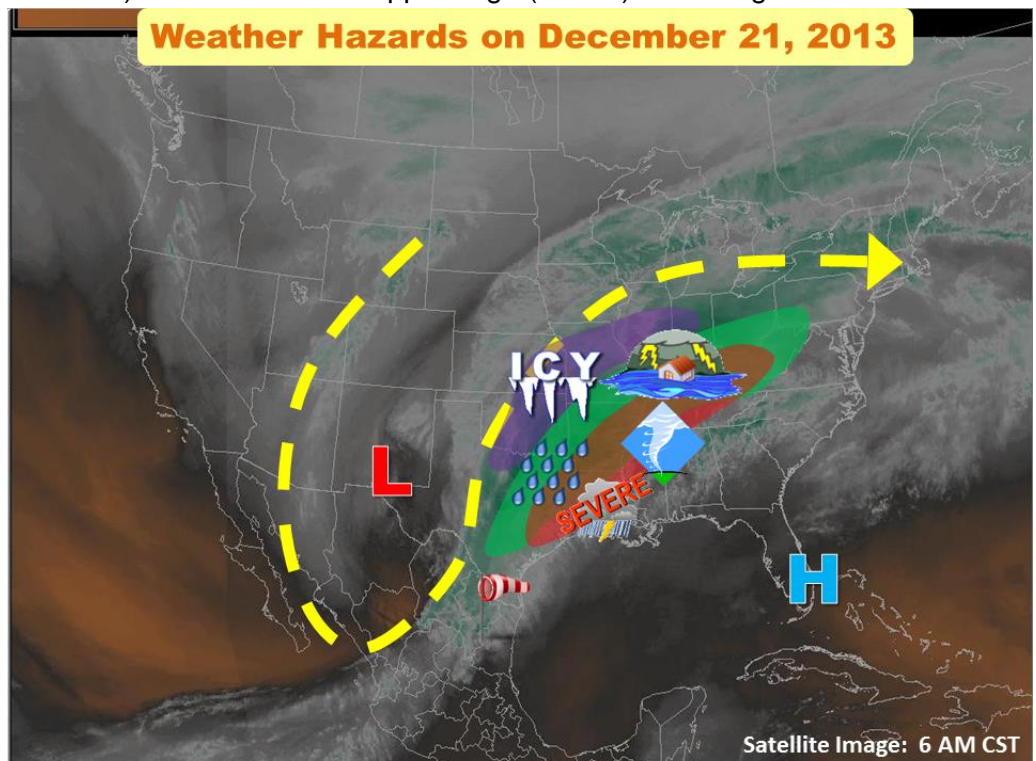
Above Left: 6 AM CST December 21, 2013 atmospheric sounding from Brownsville. Underneath the “Capping” Inversion (the bottom of what looks like a Christmas Tree shape), winds of 58 to 68 mph (line with small triangles, or “flags”, in the red shaded area) were able to mix toward the surface. **Right:** Low pressure moving along the Rio Grande near Falcon Dam at 6 AM CST. Note the “packing” of the blue lines of equal pressure across the Lower Valley; the closer the lines, the stronger the wind. Wind flows toward the low pressure, or from the south, in this case.

The Why of the Weather

The winds were caused by a combination of features that synergized into a massive storm system that produced the Valley Wind Machine, a pre-Christmas ice storm in Oklahoma, flooding rains in portions of the Ohio and Mississippi River Valleys, and even damaging wind and tornado producing squall lines across portions of Kentucky, Tennessee, Mississippi, and Alabama. The two players were the deepening upper low pressure system (U-shaped yellow arrow) and the stubborn upper ridge (blue H) extending from Florida into south Georgia and Alabama.

Between the two systems, diverging air high in the atmosphere meant converging air was needed to fill the gap; such convergence decreases air pressure at the surface. The farther south an upper level disturbance “digs”, and the shorter the difference between the trough and ridge, the lower the surface pressure will get farther south – sometimes, into northern Mexico.

The wind is a direct result of the relatively short distance between the high and low pressure systems, at all levels of the atmosphere.



Satellite Image: 6 AM CST

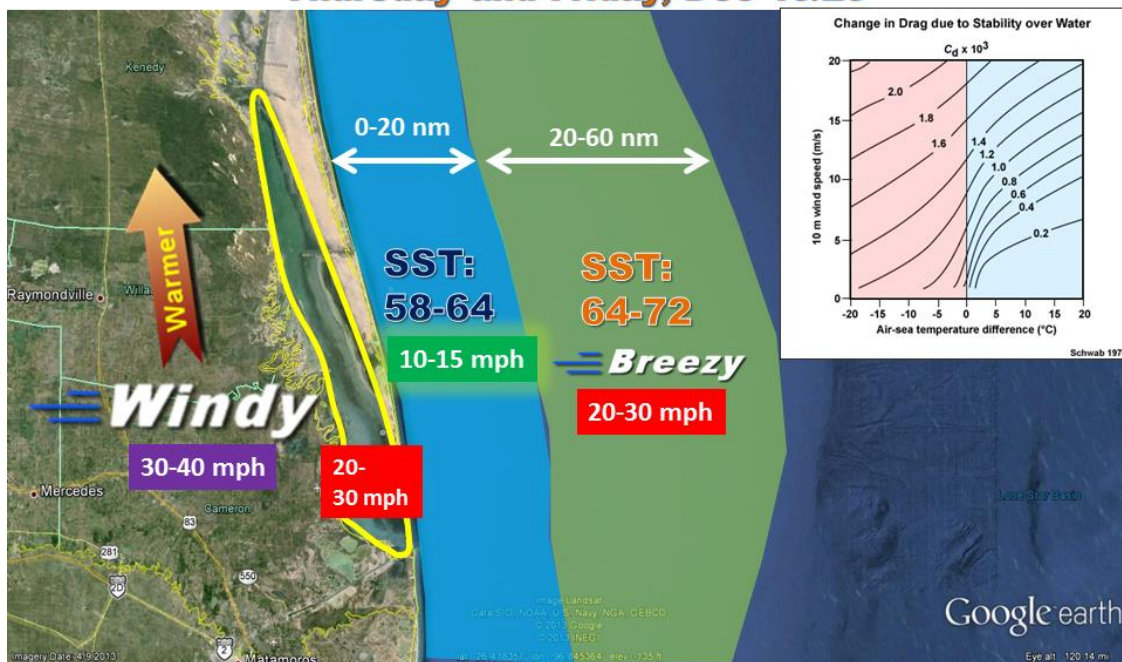
The Marine Layer

One other parameter may have influenced the strength of the surface wind on land. The prolonged raw, chilly weather of early December brought inshore (Laguna Madre Bay) and nearshore (within 10 miles of the beach) water temperatures down into the low to mid 50s prior to the resurgence of warming winds from the south. As the air temperatures from Brownsville to McAllen surged into the 80s each afternoon on December 19th and 20th, Laguna Madre water temperatures began in the upper 50s to lower 60s, and the much deeper nearshore Gulf began in the mid to upper 50s. The nearly 30°F difference between inland locations and the nearshore waters may have enhanced the low level pressure difference enough to contribute additional “energy” to the wind field near the surface (~1000 to 3500 feet or so). The depth of the nearshore Gulf both enhanced the marine layer and kept water temperatures from rising very fast; by the end of the event, temperatures in the nearshore Gulf water had only reached 61°F vs. 65 to 70° in the shallow Laguna.



Prior to the arrival of the strongest low level winds, the difference between winds over the cold nearshore waters, the South Padre Island shoreline, and Brownsville/Harlingen were striking. On both December 19 and 20, 1 minute average winds reached 30 mph and gusted over 40 mph during the afternoon at Harlingen/Valley Airport; winds on the beach were estimated at 16-18 mph with gusts in the lower 20s (above), and winds at a buoy just 8 miles east northeast of the beach were generally 10 to 15 mph! For this case, wind differences when temperature variation was nearly 30 degrees between land and sea were anywhere from 15 to 25 mph lower near/over the water than on land. Is this always the case? Not necessarily. More data will be collected from similar events to get a more accurate analysis.

The Marine Layer and Influence on Surface Wind Thursday and Friday, Dec 19/20



SST= Sea Surface Temperature.

Wind in all areas came from the south, bringing warm and humid air from the tropics.

Above: Schematic of the marine layer and impact on wind (and wave) for the Lower Texas Gulf coastal waters. The shallowness of Laguna Madre and proximity to land on all sides reduces the wind only slightly. Waves are also impacted by the marine layer; the greater the difference between air several hundred to 2-3 thousand feet above the water and sea surface temperature can reduce wind drag. In this case, observed soundings (page 2) suggest a 15 to 20 degree difference (blue shading) and a sharp reduction in wind drag due to lesser wave action.