

# Record Setting Hail Event in Vivian, South Dakota on July 23, 2010

[Damage Photos](#)

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## Summary:

During the late afternoon and early evening hours of 23 July 2010, thunderstorms developed over portions of central South Dakota. Several storms quickly became severe in an environment favorable for supercell thunderstorms. In particular, one very strong supercell thunderstorm moved southeastward across portions of Stanley, Jones, and Lyman counties. One of the hardest hit locations was the community of Vivian, South Dakota, where extremely large hail, destructive winds to 80 mph, and a brief tornado were reported.

A record setting hailstone was ultimately discovered in Vivian, measuring 8.0 inches in diameter, 18.625 inches in circumference, and weighing in at an amazing 1.9375 pounds!! This hailstone broke the previous United States hail size record for diameter (7.0 inches - 22 June 2003 in Aurora, NE) and weight (1.67 pounds - 3 September 1970 in Coffeyville, KS). The Aurora, Nebraska hailstone will retain the record for circumference (18.75 inches).

The hailstone's official record dimensions were as of the time personnel from the NWS in Aberdeen first observed and measured it. The stone did shrink considerably (melting and sublimation) between impact and when it was first measured by NWS personnel due in part to a power outage at the residence of the individual who found the stone. It should also be noted that many other stones with diameters exceeding 6 inches were also noted during the storm survey!

To view the official NOAA Press Release regarding this event click [HERE](#).

## Hail and Damage Photos (click to enlarge):



**Diameter = 8.0  
inch**



**Circumference  
= 18.625 inch**



**Weight = 1  
lb 15/16 oz  
(1.9375 lbs)**



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lb 15/16 oz  
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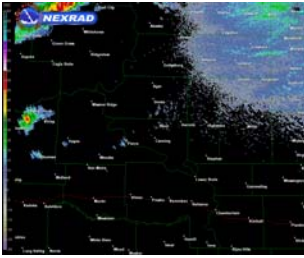


**Hail Divot**

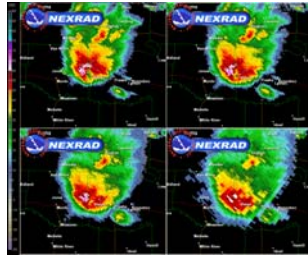


**Hail stone  
crashes  
through**

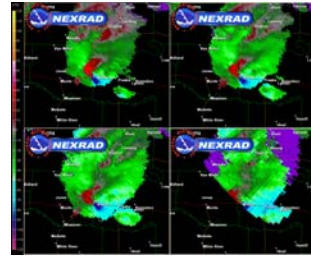
## Radar Imagery (click to enlarge):



**0.5  
Degree Reflectivity  
Loop of Event**



**4 Panel Radar Reflectivity  
valid at 2258 UTC (0.5,  
0.9,  
1.3, 1.8 degrees)**



**4 Panel Storm  
Relative Velocity  
valid at 2258 UTC (0.5, 0.9, 1.3,  
1.8 degrees)**

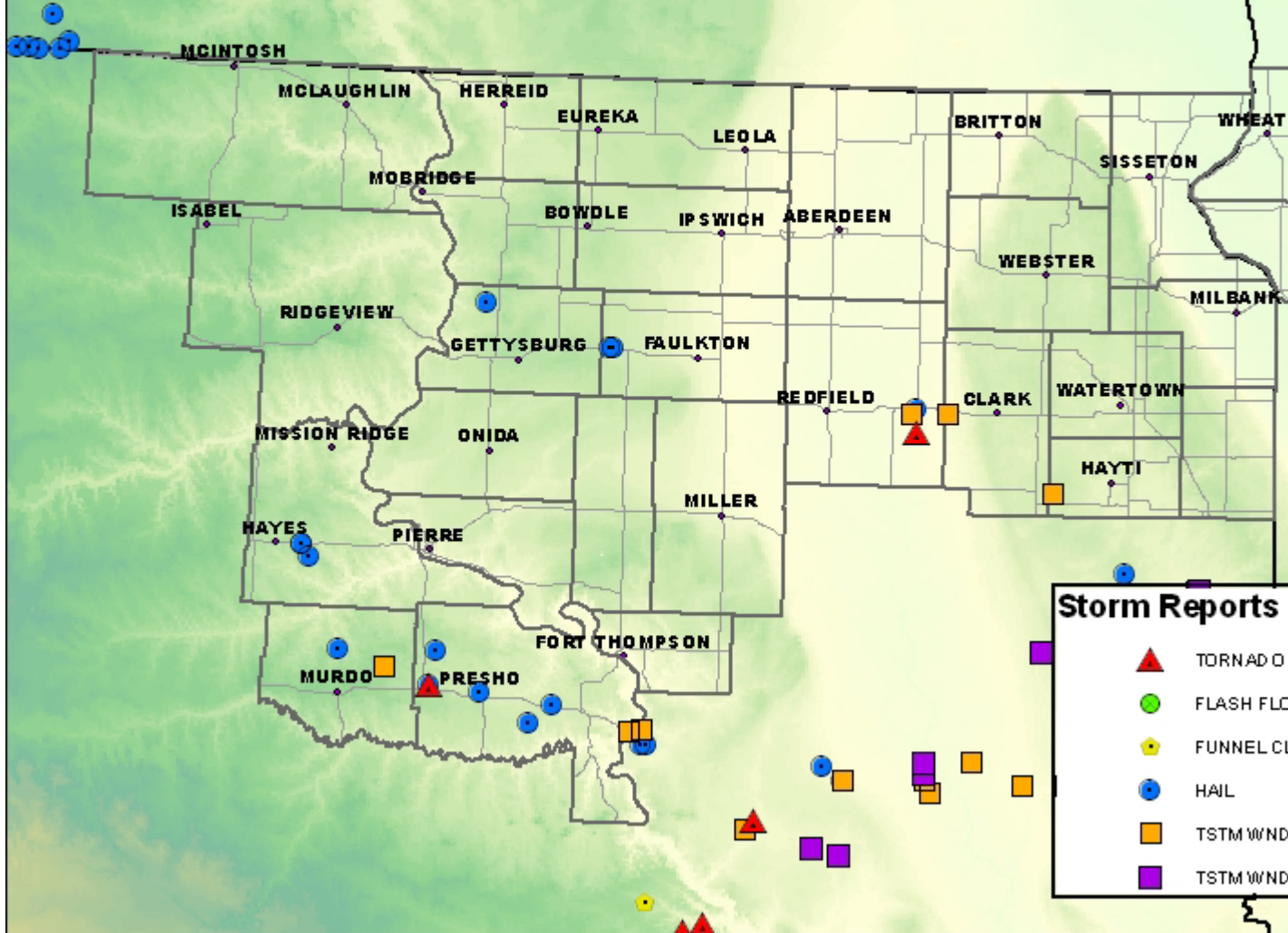
The storm scale structure of the storm was very impressive. In the images above, three body scatter spikes (TBSSs) are noted at several elevation angles at 2258 UTC. In addition, a very pronounced bounded weak echo region (BWER), and very intense mesocyclone are also indicative of a strongly rotating updraft.

Initial estimates indicate that the updraft strength in the Vivian hail storm likely ranged from **160-180 mph!**

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**Additional Storm Reports from July 23, 2010:**

# July 23rd Storm Reports



| Time                  | Event                               | Location        | County/State | Remarks/Source                                      |
|-----------------------|-------------------------------------|-----------------|--------------|---|
| 5:15 PM<br>07/23/2010 | 1.50 Inch Hail                      | 10 S<br>Akaska  | Potter, SD   | From: MESONET                                       |
| 5:33 PM<br>07/23/2010 | 1.00 Inch Hail                      | 6 E<br>Hayes    | Stanley, SD  | From: CO-OP OBSERVER                                |
| 5:35 PM<br>07/23/2010 | 1.25 Inch Hail                      | 8 ESE<br>Hayes  | Stanley, SD  | From: TRAINED SPOTTER                               |
| 5:35 PM<br>07/23/2010 | 1.75 Inch Hail                      | 6 E<br>Hayes    | Stanley, SD  | From: TRAINED SPOTTER                               |
| 5:45 PM<br>07/23/2010 | 1.50 Inch Hail                      | 10 N<br>Murdo   | Jones, SD    | DAMAGED SIDING AND BROKE<br>WINDOWS<br>From: PUBLIC |
| 5:48 PM<br>07/23/2010 | 85 mph<br>Thunderstorm<br>Wind Gust | 4 NNE<br>Draper | Jones, SD    | APRS SITE<br>From: MESONET                          |
| 5:57 PM               | Tornado                             | Vivian          | Lyman, SD    | LAW ENFORCEMENT RELAYED A                           |

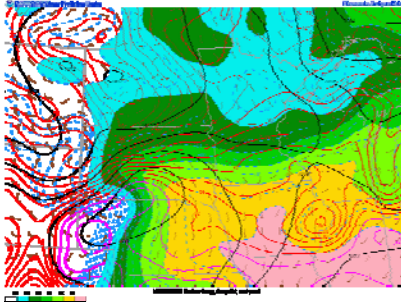
|                       |                                     |                |            |   |
|-----------------------|-------------------------------------|----------------|------------|---|
| 07/23/2010            |                                     |                |            | PUBLIC REPORT OF A TORNADO EAST OF DRAPER...NEAR VIVIAN<br>From: LAW ENFORCEMENT  |
| 6:00 PM<br>07/23/2010 | 1.75 Inch Hail                      | 8 N Vivian     | Lyman, SD  | GOLFBALL HAIL<br>From: PUBLIC   |
| 6:10 PM<br>07/23/2010 | 1.75 Inch Hail                      | 1 W Seneca     | Faulk, SD  | From: LAW ENFORCEMENT   |
| 6:10 PM<br>07/23/2010 | 4.75 Inch Hail                      | Vivian         | Lyman, SD  | SOFTBALL SIZE HAIL. POSSIBLE TORNADO SPOTTED 2 SOUTH OF VIVIAN.<br>From: LAW ENFORCEMENT                                  |
| 6:10 PM<br>07/23/2010 | 1.75 Inch Hail                      | 1 W Seneca     | Faulk, SD  | From: LAW ENFORCEMENT   |
| 6:15 PM<br>07/23/2010 | 1.75 Inch Hail                      | Seneca         | Faulk, SD  | From: CO-OP OBSERVER  |
| 6:22 PM<br>07/23/2010 | 1.75 Inch Hail                      | Presho         | Lyman, SD  | HAIL AND 70 MPH WINDS<br>From: CO-OP OBSERVER   |
| 6:35 PM<br>07/23/2010 | 2.00 Inch Hail                      | Lyman          | Lyman, SD  | GOLFBALL TO HEN EGG SIZE HAIL WITH 60 MPH WINDS<br>From: STORM CHASER   |
| 7:00 PM<br>07/23/2010 | 3.00 Inch Hail                      | 6 SSE Kennebec | Lyman, SD  | COCORAHS SPOTTER...DURATION OF HAIL 20 MINUTES<br>From: TRAINED SPOTTER   |
| 7:04 PM<br>07/23/2010 | 73 mph<br>Thunderstorm<br>Wind Gust | Oacoma         | Lyman, SD  | From: MESONET   |
| 7:49 PM<br>07/23/2010 | 60 mph<br>Thunderstorm<br>Wind Gust | 2 SW Doland    | Spink, SD  | From: PUBLIC  |
| 7:50 PM<br>07/23/2010 | Tornado                             | 6 S Doland     | Spink, SD  | MINOR DAMAGE TO FARMSTEAD AND TREES. PRELIMINARY WIND SPEED ESTIMATED AT 80MPH CONSISTENT WITH EF0 RATING<br>From: PUBLIC |
| 7:50 PM<br>07/23/2010 | 1.75 Inch Hail                      | Doland         | Spink, SD  | From: PUBLIC  |
| 8:00 PM<br>07/23/2010 | 60 mph<br>Thunderstorm<br>Wind Gust | 3 SSW Raymond  | Clark, SD  | From: PUBLIC  |
| 8:58 PM<br>07/23/2010 | 60 mph<br>Thunderstorm<br>Wind Gust | 2 N Bryant     | Hamlin, SD | DIME HAIL REPORTED WITH THESE WINDS<br>From: TRAINED SPOTTER  |

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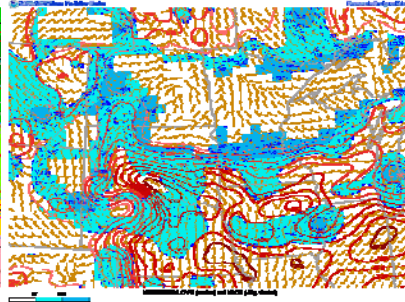
**Meteorological Analysis (click to enlarge):**

The images below depict the synoptic and mesoscale environment at 22:00 UTC (6PM CDT) - about one hour before the record hailstone fell in Vivian. Note that the

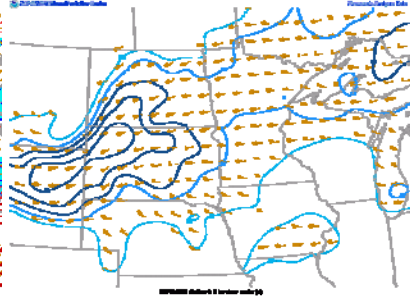
kinematic and thermodynamic environment was very supportive of supercell thunderstorms due to the high shear and high CAPE environment.



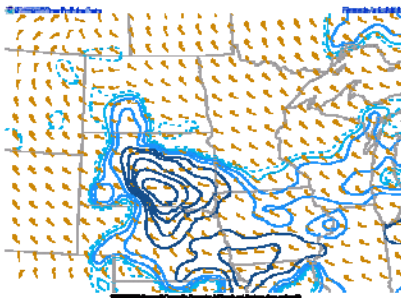
**22Z - Surface MSLP, Temperature, Dewpoint**



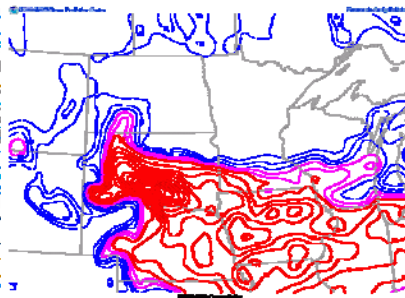
**22Z - Lowest 100mb MLCAPE**



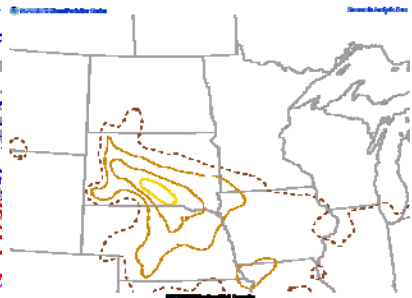
**22Z - 0-6KM Bulk Shear Magnitude**



**22Z - Supercell Composite Parameter**



**22Z - Craven/Brooks Significant Severe (MLCAPE\*0-6KM Shear)**



**22Z - Significant Hail Parameter (SHIP)**