May 12\textsuperscript{th}/13\textsuperscript{th} Storms and Flooding

Austin - San Antonio Weather Forecast Office
The combination of rich Gulf moisture, an upper level low pressure system, and a strong and slow moving Pacific cold front came together to produce a line of showers and thunderstorms that moved across South Central Texas on the evening of Monday, May 12\textsuperscript{th} into the early morning of Tuesday, May 13\textsuperscript{th}.

In addition to dew point, another atmospheric variable that measures moisture in the air is precipitable water. It is the total atmospheric water vapor contained in a vertical column. Think of it as a measure of how much water vapor is available in the atmosphere to turn into precipitation at a specific point. The values for May 12\textsuperscript{th} were well above normal.

One thing that kept the severe weather threat minimal was the fact that storms developed along the squall line and in clusters. With the storms developing in close proximity to each other, this reduces the amount of fuel each storm can take in and limits the potential for larger hail, very strong winds, and tornadoes.
Flash Flood Watch

Valid from 7:00 pm on Monday, May 12, 2014 to Tuesday, May 13\textsuperscript{th} at Noon (was canceled at 3:39 am on the 13\textsuperscript{th}).

Issued by the local Weather Forecast Office due to the widespread 2-4 inch rainfall totals predicted. Some totals up to 6 inches also noted as possible. These could lead to flash flooding in urban areas and along rivers/creeks.
Severe Mesoscale Discussions #585, #589, & #593

Issued by Storm Prediction Center in Norman, OK
#585 at 2:38 pm, #589 at 6:08 pm, #593 at 9:19 pm

All three highlighted the marginal and localized threat of severe hail and damaging winds. Threat was kept low due to storms being multi-cellular instead of supercell storms. No Severe Thunderstorm Watch was issued.
Mesoscale Precipitation Discussions

#48, #51

Issued by Weather Prediction Center in College Park, MD... #48 at 2:47 pm and #51 at 9:26 pm

Discussed how the combination of a slowly progressing cold front, high precipitable water values, along with shear and instability were producing a band of thunderstorms that were capable of producing rainfall amounts of 2+” an hour (with even higher rain rates possible later in the evening).

Later discussion mentioned how back-building storms and cell-mergers were increasing the flash flooding threat by promoting 2”-3” an hour rain rates.
Severe Thunderstorm Warning #80

Northwestern Llano County
5:00 pm – 5:45 pm

Reports:
• 5:33 pm...0.25” Hail...10 NW Llano
Severe Thunderstorm Warning #81

Northwestern Burnet and Northwestern Llano Counties

5:38 pm – 6:45 pm

Reports:
• 5:29 pm...0.25" Hail...1 N Llano
Severe Thunderstorm Warning #82

Northwestern Gillespie County

5:59 pm – 6:45 pm

Reports:

Radar Image of the storm

Could use GR2Analyst, NOAA Weather Toolkit

(http://www.ncdc.noaa.gov/wct/), AWIPS, etc.

Warning Graphic from IEM Cow:

http://mesonet.agron.iastate.edu/cow/

Select Correct Dates…Go Cow Go…Scroll down and click on warning ex. SV.1

Under the Google Map tab make sure Local Storm Report and VTEC Product on On, and RADAR is off

Screenshot and crop
Severe Thunderstorm Warning #83

Southwestern Gillespie and Western Kerr Counties

7:25 pm – 8:00 pm

Reports:
- 7:41 pm...0.70” Hail...Ingram
- 7:52 pm...0.25” Hail...Ingram
Flash Flood Warning #2

Southeastern Blanco, North Central Comal, and Western Hays Counties

10:09 pm – 1:00 am (5/13)
Flash Flood Warning #3

Travis County

10:17 pm – 1:15 am (5/13)
Flash Flood Warning #4

Southeastern Travis County

11:10 pm – 1:15 am (5/13)
Flash Flood Warning #5

Eastern Hays and South Central Travis Counties

11:18 pm – 2:15 am (5/13)
Flash Flood Warning #6

Bexar County

11:40 pm – 1:45 am (5/13)
Flash Flood Warning #7

West Central Bastrop, Caldwell, Southeastern Comal, Guadalupe, and Southeastern Hays Counties

11:53 pm – 2:45 am (5/13)
Flash Flood Warning #8

Southern Bastrop, Western Fayette, Extreme Northeastern Gonzales, and South Central Lee Counties

12:37 am (5/13) – 2:30 am (5/13)
Flash Flood Warning #9

Northwestern Atascosa and Southwestern Bexar Counties

1:08 am (5/13) – 4:00 am (5/13)
Most counties along and east/south of I-35 were covered (at least in part) by an Areal Flood Advisory at some point during the event.

13 different advisories issued between 6:50 pm on May 12, 2014 through 4:00 am on May 13, 2014.

Typically issued for flooding that develops more gradually, usually from prolonged and persistent moderate to heavy rainfall. They indicate minor flooding problems, and are a good transition product as flooding increases (prior to a Flash Flood Warning).

<table>
<thead>
<tr>
<th>Event</th>
<th>Product Issued</th>
<th>VTEC Issued</th>
<th>Initial Expire</th>
<th>VTEC Expired</th>
<th>Area km²2</th>
<th>Locations</th>
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<td>May 12, 2014 6:50 PM CDT</td>
<td>May 12, 2014 6:50 PM CDT</td>
<td>May 12, 2014 9:30 PM CDT</td>
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<td>7904</td>
<td>Llano [TX], Gillespie [TX], Burnet [TX]</td>
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<td>May 12, 2014 9:01 PM CDT</td>
<td>May 13, 2014 12:00 AM CDT</td>
<td>May 13, 2014 12:00 AM CDT</td>
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<td>Williamson [TX], Travis [TX]</td>
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<td>13</td>
<td>May 13, 2014 12:00 AM CDT</td>
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<td>May 13, 2014 3:00 AM CDT</td>
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<td>17</td>
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<td>May 13, 2014 1:54 AM CDT</td>
<td>May 13, 2014 4:00 AM CDT</td>
<td>May 13, 2014 4:00 AM CDT</td>
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<td>Bexar [TX]</td>
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</table>
**All Hail Reports / Pictures**

<table>
<thead>
<tr>
<th>Time</th>
<th>Type</th>
<th>Location</th>
<th>Latitude</th>
<th>Longitude</th>
<th>Source</th>
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<tbody>
<tr>
<td>0533 PM</td>
<td>HAIL</td>
<td>10 NW LLANO</td>
<td>30.85N</td>
<td>98.79W</td>
<td>TX CO-OP OBSERVER</td>
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<tr>
<td>05/12/2014</td>
<td>E0.25 INCH</td>
<td>LLANO</td>
<td></td>
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<tr>
<td></td>
<td>PEA SIZED HAIL ONGOING.</td>
<td></td>
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<tr>
<td>0629 PM</td>
<td>HAIL</td>
<td>1 N LLANO</td>
<td>30.77N</td>
<td>98.67W</td>
<td>TX PUBLIC</td>
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<td>05/12/2014</td>
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<td>LLANO</td>
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<tr>
<td></td>
<td>A BIT OF PEA SIZED HAIL FELL WITH LOTS OF RAIN.</td>
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<tr>
<td>0646 PM</td>
<td>HAIL</td>
<td>6 N MOUNTAIN HOME</td>
<td>30.25N</td>
<td>99.38W</td>
<td>TX COCORAHS</td>
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<tr>
<td>05/12/2014</td>
<td>E0.25 INCH</td>
<td>KERR</td>
<td></td>
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<tr>
<td></td>
<td>RAIN JUST BEGINNING...BIT OF PEA SIZED HAIL MIXED IN.</td>
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<tr>
<td>0718 PM</td>
<td>HAIL</td>
<td>4 WSW HARPER</td>
<td>30.28N</td>
<td>99.30W</td>
<td>TX AMATEUR RADIO</td>
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<tr>
<td>05/12/2014</td>
<td>E1.00 INCH</td>
<td>KERR</td>
<td></td>
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<tr>
<td></td>
<td>QUARTER SIZE HAIL WITH VERY HEAVY RAIN. 1.00 INCH OVER THE LAST 45 MINUTES.</td>
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<tr>
<td>0730 PM</td>
<td>HAIL</td>
<td>1 W HARPER</td>
<td>30.30N</td>
<td>99.27W</td>
<td>TX COCORAHS</td>
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<tr>
<td>05/12/2014</td>
<td>E0.50 INCH</td>
<td>GILLESPIE</td>
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<td></td>
<td>PEA TO MARBLE SIZED HAIL MIXED WITH VERY HEAVY RAIN AND SOME GUSTY WINDS.</td>
<td></td>
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<tr>
<td>0741 PM</td>
<td>HAIL</td>
<td>INGRAM</td>
<td>30.08N</td>
<td>99.24W</td>
<td>TX PUBLIC</td>
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<tr>
<td>05/12/2014</td>
<td>E0.70 INCH</td>
<td>KERR</td>
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<tr>
<td></td>
<td>MARBLE TO DIME SIZE HAIL REPORTED IN INGRAM.</td>
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<tr>
<td>0752 PM</td>
<td>HAIL</td>
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<td>05/12/2014</td>
<td>E0.25 INCH</td>
<td>KERR</td>
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<tr>
<td></td>
<td>PEA SIZED HAIL FALLING IN INGRAM.</td>
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</tbody>
</table>

Visible Satellite and radar from 4:30 pm on May 12th. You can see the bright white cumulonimbus clouds and associated storms lining up along the front across Texas (orange ovals). In addition, on the satellite you can see the thunderstorms being sparked off by the mountains in Northern Mexico to the west of the Rio Grande.
0800 PM    HAIL    KERRVILLE   30.04N  99.14W
05/12/2014    E0.25 INCH   KERR    TX    TRAINED SPOTTER

FEW MINUTES OF PEA SIZE HAIL...HAS NOW LET UP.

0902 PM    HAIL    4 NW ROUND ROCK   30.56N  97.72W
05/12/2014    E0.50 INCH   WILLIAMSON   TX    TRAINED SPOTTER

PEA TO MARBLE SIZE HAIL. ONLY LASTED ABOUT A MINUTE.

1041 PM    FLASH FLOOD    AUSTIN    30.27N  97.74W
05/12/2014    TRAVIS    TX    CITY OFFICIAL

LOW WATER CROSSINGS AT 15TH AND RED RIVER AND AT 3523 MCNEIL DRIVE IN AUSTIN CLOSED DUE TO FLOODING.

1055 PM    FLASH FLOOD    1 ENE CREEDMOOR   30.10N  97.73W
05/12/2014    TRAVIS    TX    PUBLIC

MAHA CREEK AT 1327 AND EVELYN ROAD IS FLOODING OVER THE ROADWAY.

1059 PM    HAIL    6 SSE SAN ANTONIO   29.35N  98.44W
05/12/2014    E0.70 INCH   BEXAR    TX    TRAINED SPOTTER

DIME SIZED HAIL...NOT ACCUMULATING.

1107 PM    HEAVY RAIN    6 WSW BOERNE   29.77N  98.83W
05/12/2014    M3.02 INCH   KENDALL   TX    COCORAHS

3.02 INCHES IN 70 MINUTES.

It was nice to see a lot of rain in area rain gauges. This picture came to us from “atx weather girl” via Twitter. She received 2.51” in Lakeway, TX (Travis County).
All Reports / Pictures

1136 PM  FLASH FLOOD  SAN ANTONIO  29.43N  98.49W
05/12/2014  BEXAR  TX  BROADCAST MEDIA

TXDOT CLOSING THE LOWER LEVELS OF I-35 IN DOWNTOWN DUE TO FLOODING.

1213 AM  TSTM WND DMG  5 SSE SOMERSET  29.15N  98.63W
05/13/2014  ATASCOSA  TX  PUBLIC

A FEW TREE LIMBS DOWN.

1215 AM  FLASH FLOOD  4 NNW DRIPPING SPRINGS  30.24N  98.12W
05/13/2014  HAYS  TX  COUNTY OFFICIAL

BELL SPRINGS ROAD AT BARTON CREEK HAS .75 FEET OF WATER OVER THE ROAD. REPORT FROM HAYSINFORMED.COM. CORRECTED APPROX. EVENT CLOSING TIME.

1230 AM  HEAVY RAIN  3 W LEMING  29.07N  98.53W
05/13/2014  M4.75 INCH  ATASCOSA  TX  AMATEUR RADIO

RECEIVED 4.75 INCHES OF RAIN IN 90 MINUTES

0103 AM  FLASH FLOOD  SAN ANTONIO  29.43N  98.49W
05/13/2014  BEXAR  TX  COUNTY OFFICIAL

SEVERAL LANE CLOSURES ON BOTH THE NORTH AND SOUTH SIDE OF SAN ANTONIO DUE TO FLOODING.

0109 AM  FLASH FLOOD  NEW BRAUNFELS  29.70N  98.12W
05/13/2014  COMAL  TX  EMERGENCY MNGR

8 ROADS WITHIN NEW BRAUNFELS CITY LIMITS HAVE BEEN CLOSED AND BARRICADED DUE TO FLOODING.

Want to submit rain, hail, and snow reports to us on a daily basis? Become a CoCoRaHS volunteer observer by going to www.cocorahs.org! The image above is of all of our CoCoRaHS rainfall reports from the last 24 hours. Even though the map is full of reports we could always use more!

Through the site you can buy a discounted rain gauge like the one on the previous slide. Then you just measure how much rain you received and submit it daily!
All of the Flash Flood Warnings (Lime Green – 7 Pictured) and Urban/Small Stream Flood Advisories (Jungle Green – 7 pictured) at the height of the flooding around 1:00 am on May 13th.

We issued a total of 8 Flash Flood Warnings and 13 Areal (Urban/Small Stream) Flood Advisories for this event.
San Antonio River at Elmendorf Hydrograph. The river level increased quickly from 9 feet to 37 feet on the morning of Tuesday, May 13th. Action Stage is 33’ and Minor Flood Stage is 35’, so some minor flooding occurred. The river is expected to be back below flood stage by the morning of Wednesday, May 14th.
All Reports / Pictures

0629 AM  HEAVY RAIN  2 SW ROUND ROCK  30.50N  97.70W
05/13/2014  M3.75 INCH  WILLIAMSON  TX  COCORAHS

24 HOUR TOTAL

0647 AM  HEAVY RAIN  7 SE SMITHVILLE  29.94N  97.07W
05/13/2014  M6.42 INCH  FAYETTE  TX  COCORAHS

0648 AM  HEAVY RAIN  ROUND TOP  30.06N  96.70W
05/13/2014  M5.40 INCH  FAYETTE  TX  COCORAHS

0700 AM  HEAVY RAIN  6 N SAN MARCOS  29.97N  97.93W
05/13/2014  M4.10 INCH  HAYS  TX  COCORAHS

0700 AM  HEAVY RAIN  1 S BRUSHY CREEK  30.50N  97.74W
05/13/2014  M3.19 INCH  WILLIAMSON  TX  COCORAHS

0700 AM  HEAVY RAIN  5 SW HENLY  30.15N  98.28W
05/13/2014  M5.70 INCH  BLANCO  TX  COCORAHS

0700 AM  HEAVY RAIN  5 ENE WIMBERLEY  30.02N  98.02W
05/13/2014  M4.75 INCH  HAYS  TX  COCORAHS

0700 AM  HEAVY RAIN  2 NW SERENADA  30.72N  97.72W
05/13/2014  M4.58 INCH  WILLIAMSON  TX  COCORAHS

0805 AM  HEAVY RAIN  6 SSE SAN ANTONIO  29.35N  98.45W
05/13/2014  M4.46 INCH  BEXAR  TX  ASOS

STINSON AIRPORT 24 HOUR TOTAL

0822 AM  HEAVY RAIN  5 E NEW BRAUNFELS  29.70N  98.03W
05/13/2014  M3.18 INCH  GUADALUPE  TX  NWS OFFICE

You can view a full list of area rainfall totals here. The totals are broken down by county:

24Hr Rainfall Ending 7AM May 13, 2014

Map showing rainfall distribution with different colors indicating varying precipitation amounts.
Predicted Rainfall Totals from our forecast grids 24 hours before the event. Our bullseye for the heaviest rain was a little south and west of where the heaviest rain fell, but the forecast matches up very well with the ground truth reports from the previous slides.
Climate Records for May 12th and May 13th:
• A RECORD RAINFALL OF 3.07 INCHES WAS SET AT AUSTIN BERGSTROM FOR MAY 12TH. THIS BREAKS THE OLD RECORD OF 1.66 SET IN 2011.

• A RECORD RAINFALL OF 2.10 INCHES WAS SET AT SAN ANTONIO FOR MAY 12TH. THIS TIES THE OLD RECORD OF 2.10 SET IN 1893.

• A RECORD LOWEST MAX TEMPERATURE OF 66 DEGREES WAS SET ON MAY 13TH AT SAN ANTONIO. THE PREVIOUS RECORD LOWEST MAX TEMPERATURE WAS 67 DEGREES SET IN 1953.