The 6 June 2020 Western U.S. Derecho

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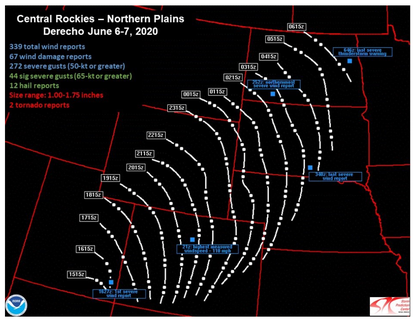
1. Introduction

- Derecho formed in southeast UT in the late morning hours of 6 June 2020; tracked northeast through CO, WY, NE, SD, & ND
- Only third documented derecho west of the Great Plains (Corfidi 2016); only one to cross the Continental Divide



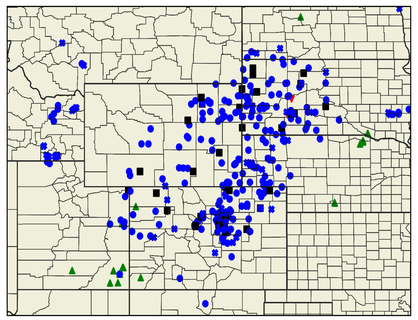


Figure 1 (left): Progression of the derecho *(Source: National Weather Service, SPC).*
Figure 2 (right): Severe reports collected by SPC between 1200 UTC 6 June and 1200 UTC 7 June 2020, including tornado (red downward triangle), severe hail (≥1.00 inch; green upward triangle), severe wind (≥50 kt; blue circle), significant severe wind (≥65 kt; black square), and wind damage (blue X).

2. Data

Analysis was conducted using archived HRRR hourly analyses, ASOS station data, observed upper-air soundings, and Level 2 NEXRAD data where available and applicable.

3. Synoptic Background

- Longwave ridge over Plains, trough over US West Coast
- Strong northeastward-propagating negatively tilted shortwave
- Moisture advecting northward from subtropical Eastern Pacific in advance of trough

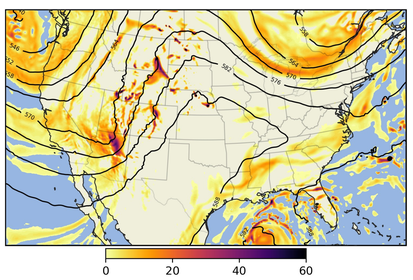


Figure 3: 1500 UTC 500 hPa height (dam, contours), relative vorticity (10^{-5} s^{-1}, positive values, fill).

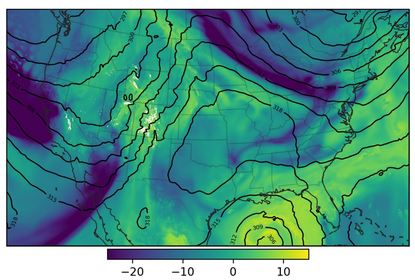
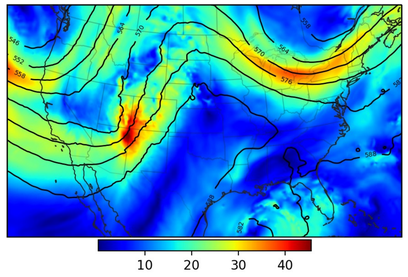
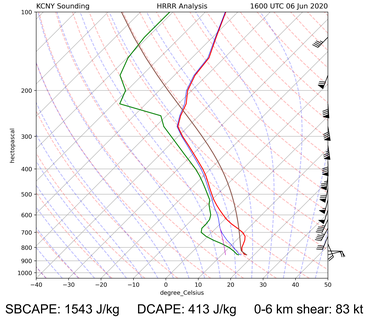


Figure 4: 1500 UTC 700 hPa height (dam, contours), dew point (ºC, fill).

4. Formation Regime (UT, western CO)

- Environment characterized by moderate CAPE and very strong deep layer (0-6 km) shear
- Large-scale lift provided by CVA in advance of shortwave; 300 hPa jet streak right entrance region also contributed
- Cells formed by mid-morning in SE UT, quickly became severe
- Supercell characteristics at times: 1.75 inch hail, 65 kt gusts
- Convection grew upscale into linear system by late morning





SBCAPE: 1543 J/kg DCAPE: 413 J/kg 0-6 km shear: 83 kt

Figure 5 (above left): 1600 UTC 500 hPa height (dam, contours), wind (m/s, fill).
Figure 6 (above): 1600 UTC HRRR analysis sounding near Moab, UT.
Figure 7 (left): 1555 UTC (left) and 1647 UTC (right) KGJX base reflectivity.

5. Northern Regime (WY)

- Shallow convection, with limited to no lightning activity due to low CAPE (some pre-squall line temperatures near 50ºF!)
- Despite lack of instability, >65 kt gusts still occurred

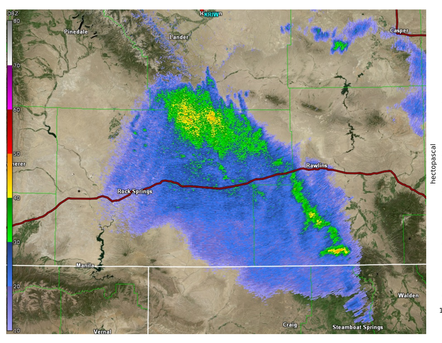
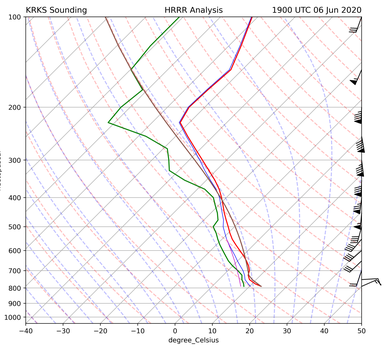


Figure 8: 2018 UTC KRIW base reflectivity.

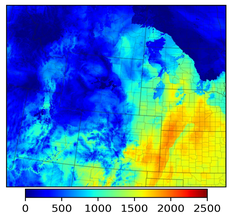


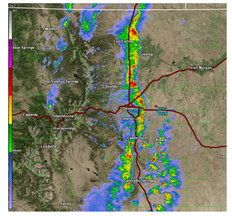
SBCAPE: 190 J/kg DCAPE: 296 J/kg 0-6 km shear: 86 kt

Figure 9: 1900 UTC HRRR analysis sounding at Rock Springs, WY.

6. Southeastern Regime (eastern CO, NE)

- Inverted V soundings, moderate DCAPE (~1000 J/kg)
- Dry microburst environment; limited precipitation at surface





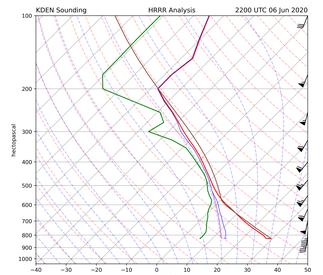
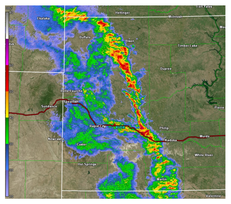


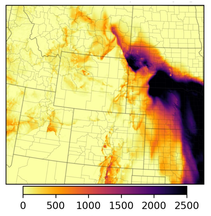
Figure 10 (left): 2200 UTC DCAPE (J/kg, fill)
Figure 11 (center): 2156 UTC KFTG base reflectivity.
Figure 12 (right): 2200 UTC HRRR analysis sounding at Denver, CO.

SBCAPE: 458 J/kg DCAPE: 897 J/kg
0-6 km shear: 32 kt

7. Northeastern Regime (SD, ND)

- Greater low-level moisture than other areas → higher CAPE
- Derecho weakened when it moved into more stable environment





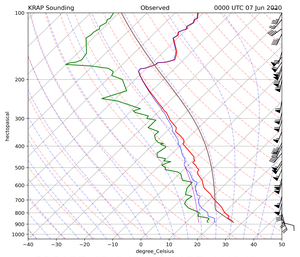


Figure 13 (left): 0157 UTC KUDX base reflectivity.
Figure 14 (center): 0000 UTC 90-0 mb CAPE (J/kg, fill).
Figure 15 (right): 0000 UTC sounding at Rapid City, SD.

SBCAPE: 2715 J/kg DCAPE: 1115 J/kg
0-6 km shear: 48 kt

8. Conclusions

- Environmental conditions very unusual for this area
- Derecho largely a product of the overlap of winterlike trough and jet dynamics with summerlike low- and mid-level moisture
- Very strong mid-level flow, downward momentum transfer, and strong DCAPE accounted for the strength of the winds
- Local derecho characteristics varied depending on environmental conditions of surrounding region

Acknowledgements

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References

Corfidi, S. F., R. H. Johns, and M. A. Darrow, 2016: The Great Basin Derecho of 31 May 1994. *Wea. Forecasting*, **31**, 917–935, https://doi.org/10.1175/WAF-D-15-0178.1.
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