

Meteorological and Environmental Factors Contributing to Hail Glaciers on the Southern High Plains

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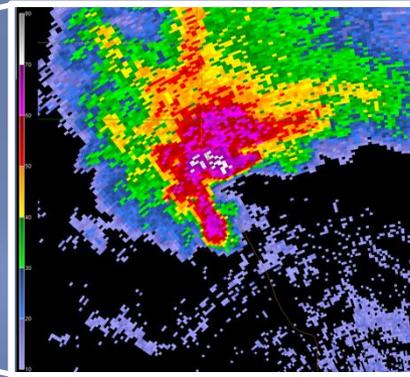
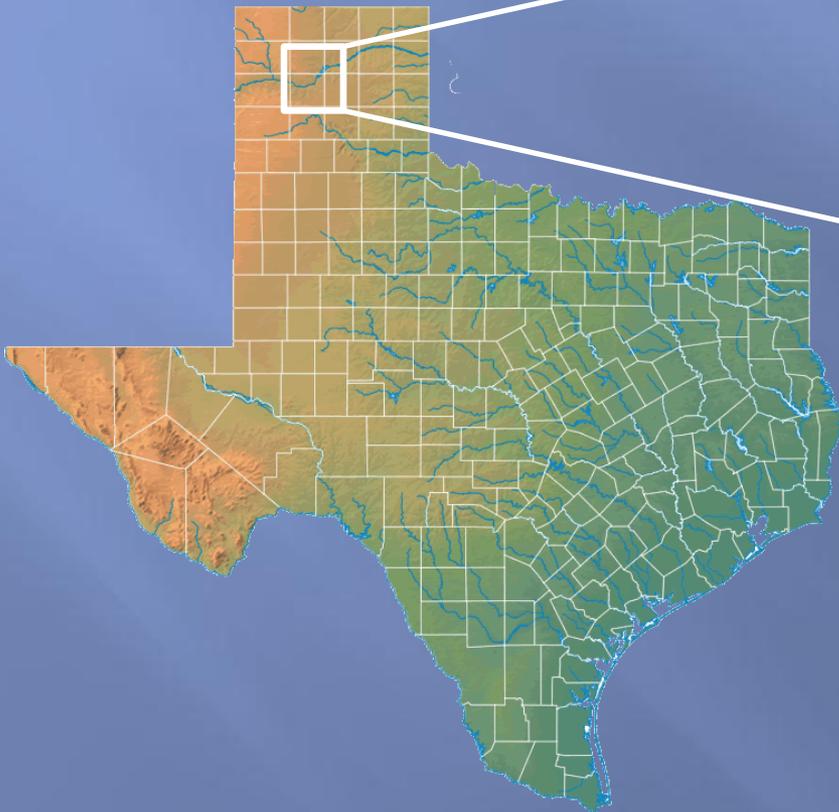
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Hail Glaciers?

11 April 2012 Amarillo Hailstorm –

- A long-lived and slow moving supercell impacted northern Potter County between 1945 and 2300 UTC



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- World-wide media attention followed
- Skeptics said:

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Even Jay Leno noticed...



Motivation

Show that “hail glacier” storms have occurred before -

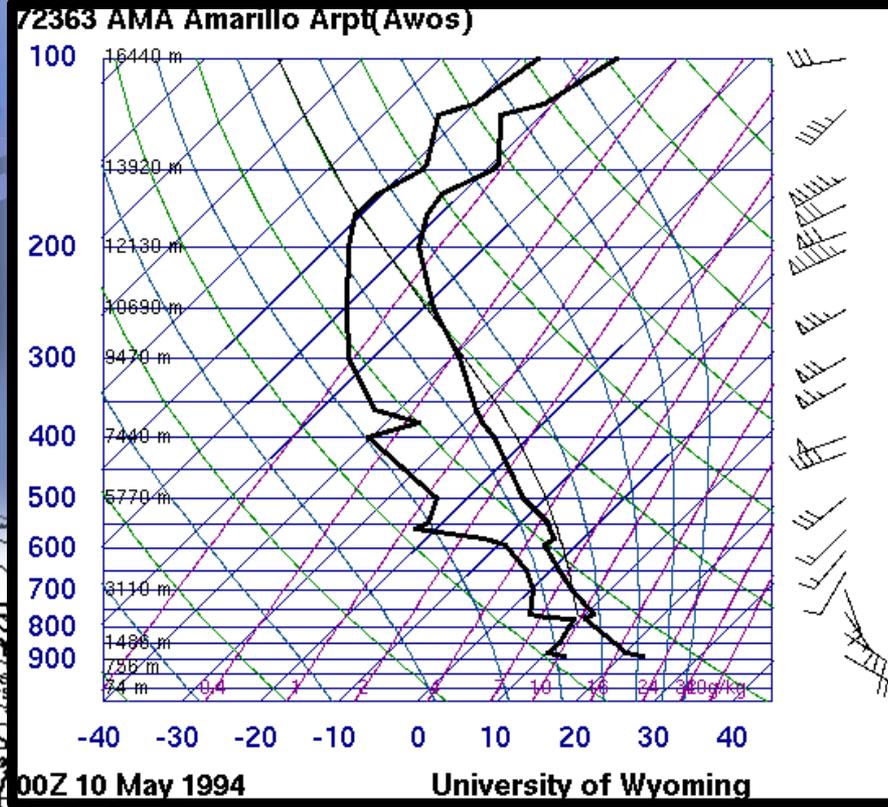
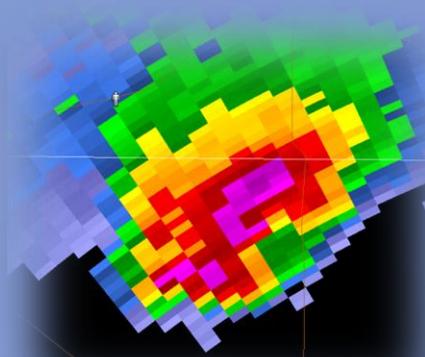
- ❖ Dalhart, Texas – 9 May 1994
 - 1-m deep hail closed Highway 385 for nearly a month.
- ❖ Clayton, New Mexico – 14 August 2004
 - 5-m deep hail covered 800 m². Ice persisted for nearly a month.
- ❖ Amarillo, Texas – 11 April 2012
 - 3-m deep hail closed Highway 287 for 12-hours. Four motorists rescued.

What are common atmospheric and environmental factors to these events?

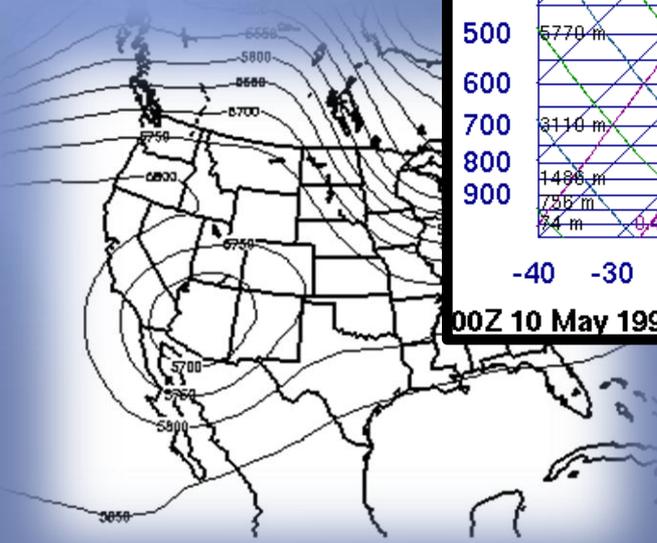


Meteorological Factors

9 May 1994 – Dalhart, Texas

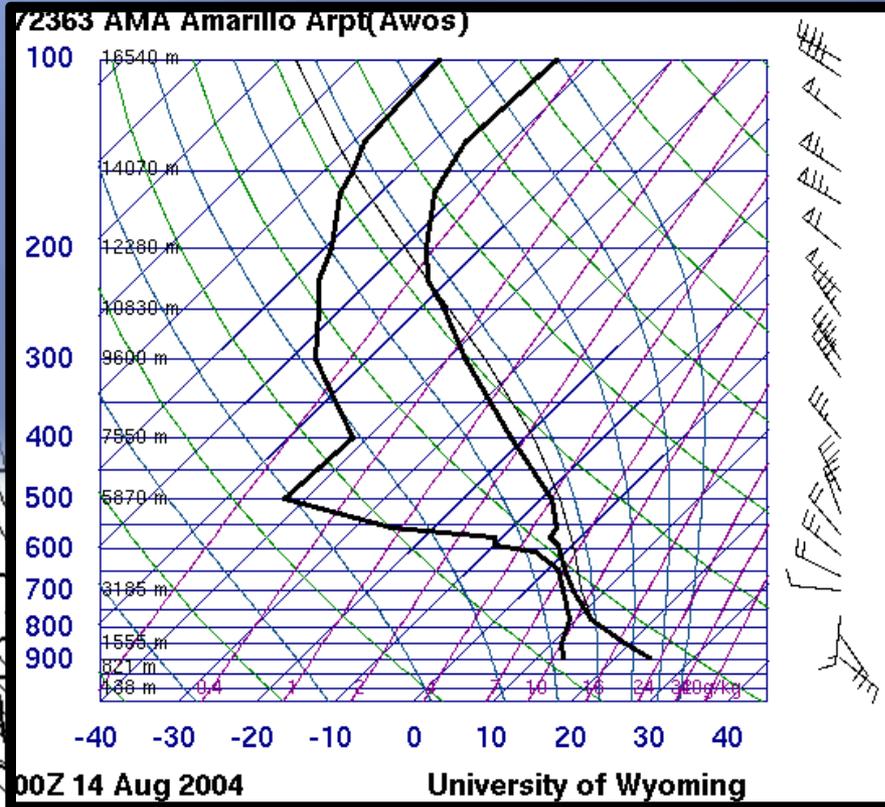
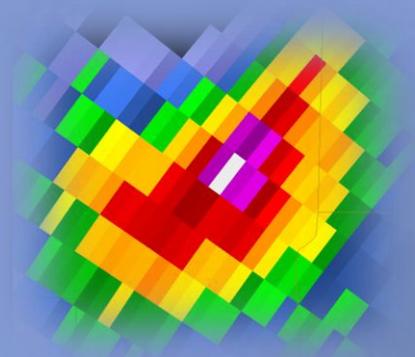


- Diffluent southwest flow in advance of a closed low
- SBCAPE 521 J/kg
- 0-6 km bulk shear 35 m s^{-1} (67 kt)
- PWAT 2.49 cm (0.92 in) $\sim +2\text{SD}$
- Storm Motion (RM) 8 m s^{-1} (16 kt)



Meteorological Factors

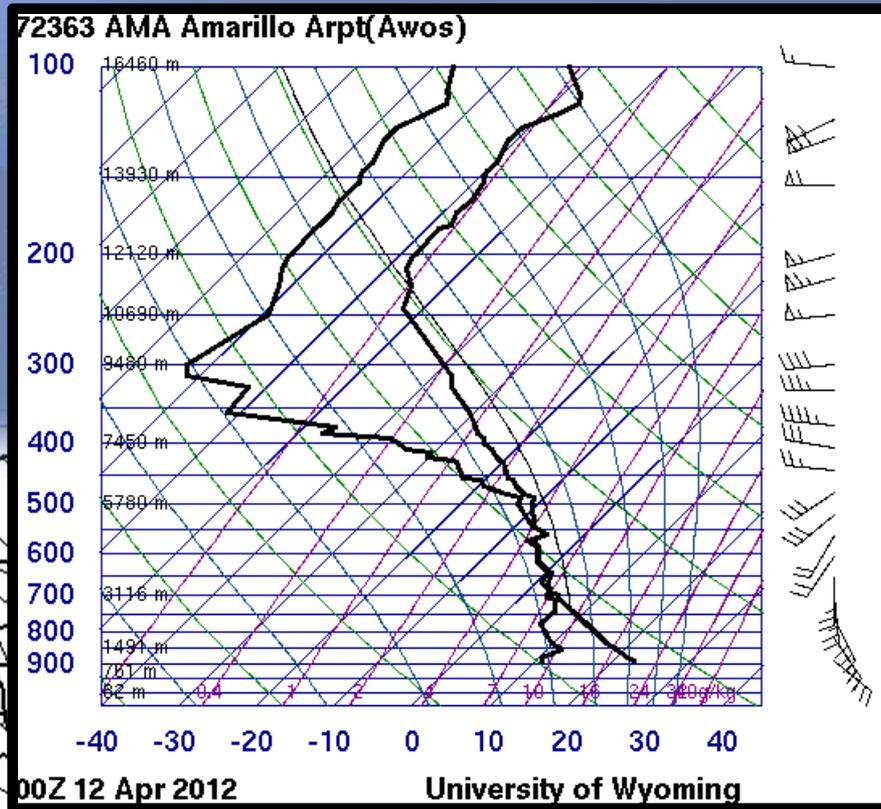
14 August 2004 – Clayton, New Mexico



- Northwesterly flow aloft east of ridge
- SBCAPE 652 J/kg
- 0-6 km bulk shear 25 m s⁻¹ (49 kt)
- PWAT 2.73 cm (1.07 in) ~ 50th percentile
- Storm Motion (RM) 10 m s⁻¹ (20 kt)

Meteorological Factors

11 April 2012 – Amarillo, Texas



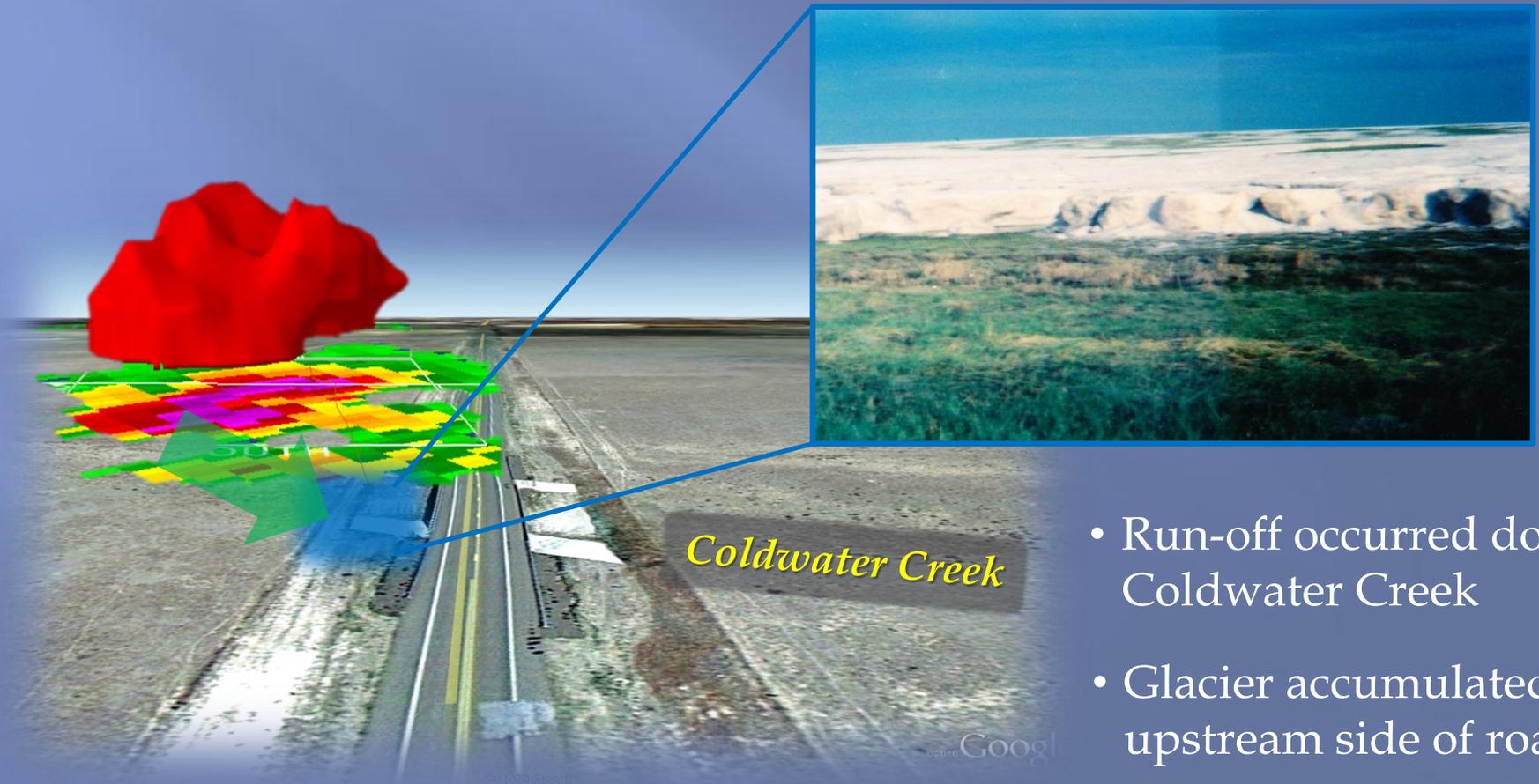
- Onset of southwest flow in wake of ridge axis
- SBCAPE 929 J/kg
- 0-6 km bulk shear 23 m s^{-1} (44 kt)
- PWAT 2.83 cm (1.11 in) ~ climo max
- Storm Motion (RM) 3 m s^{-1} (5 kt)

Environmental Factors

9 May 1994 – Dalhart, Texas

** Not to scale. Objects may be larger than they appear!*

- Intense rain and hail fell west of Highway 385



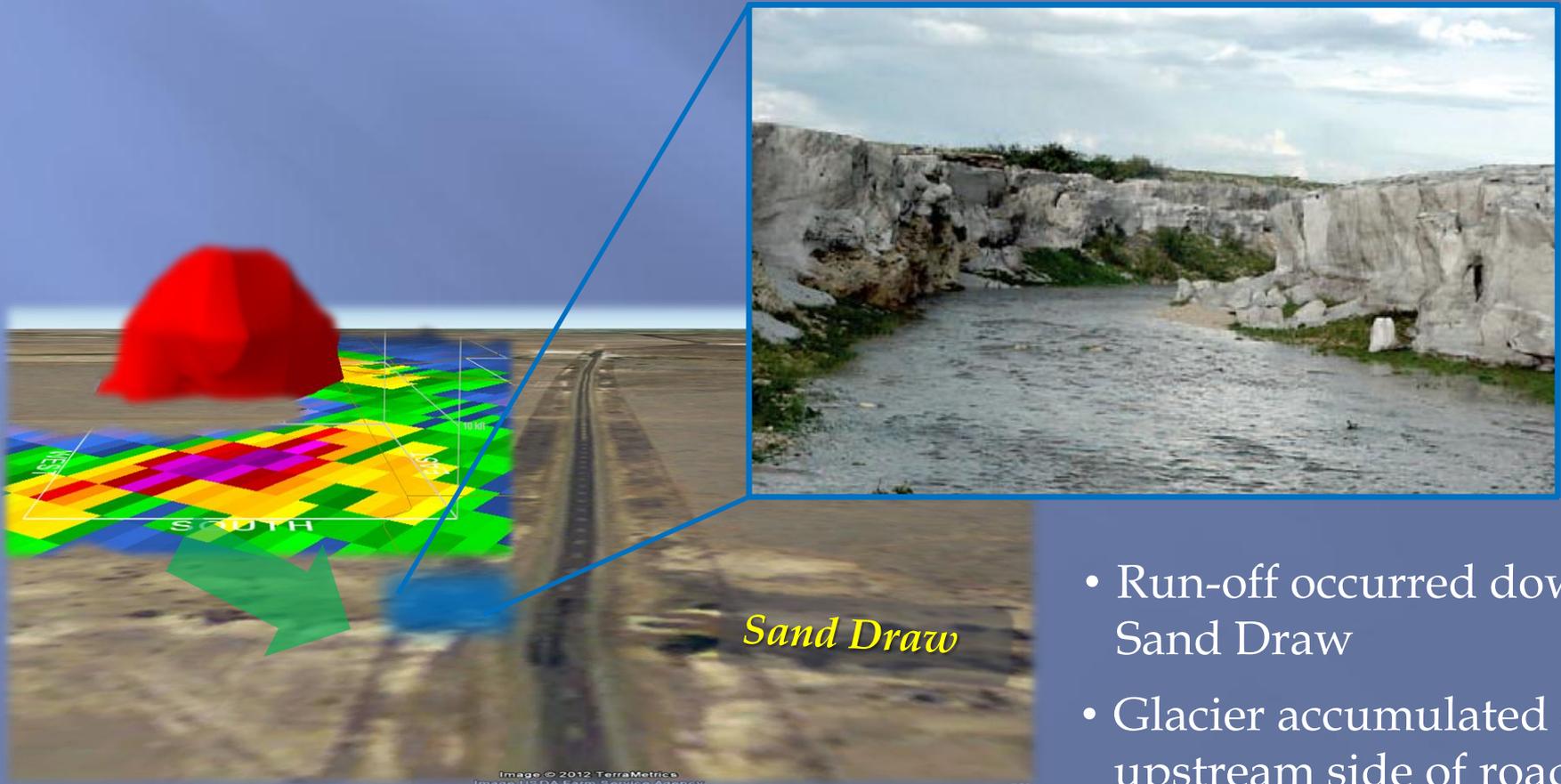
- Run-off occurred down Coldwater Creek
- Glacier accumulated on upstream side of road

Environmental Factors

14 August 2004 – Clayton, New Mexico

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- Heavy hail and rain fell west of State Highway 402



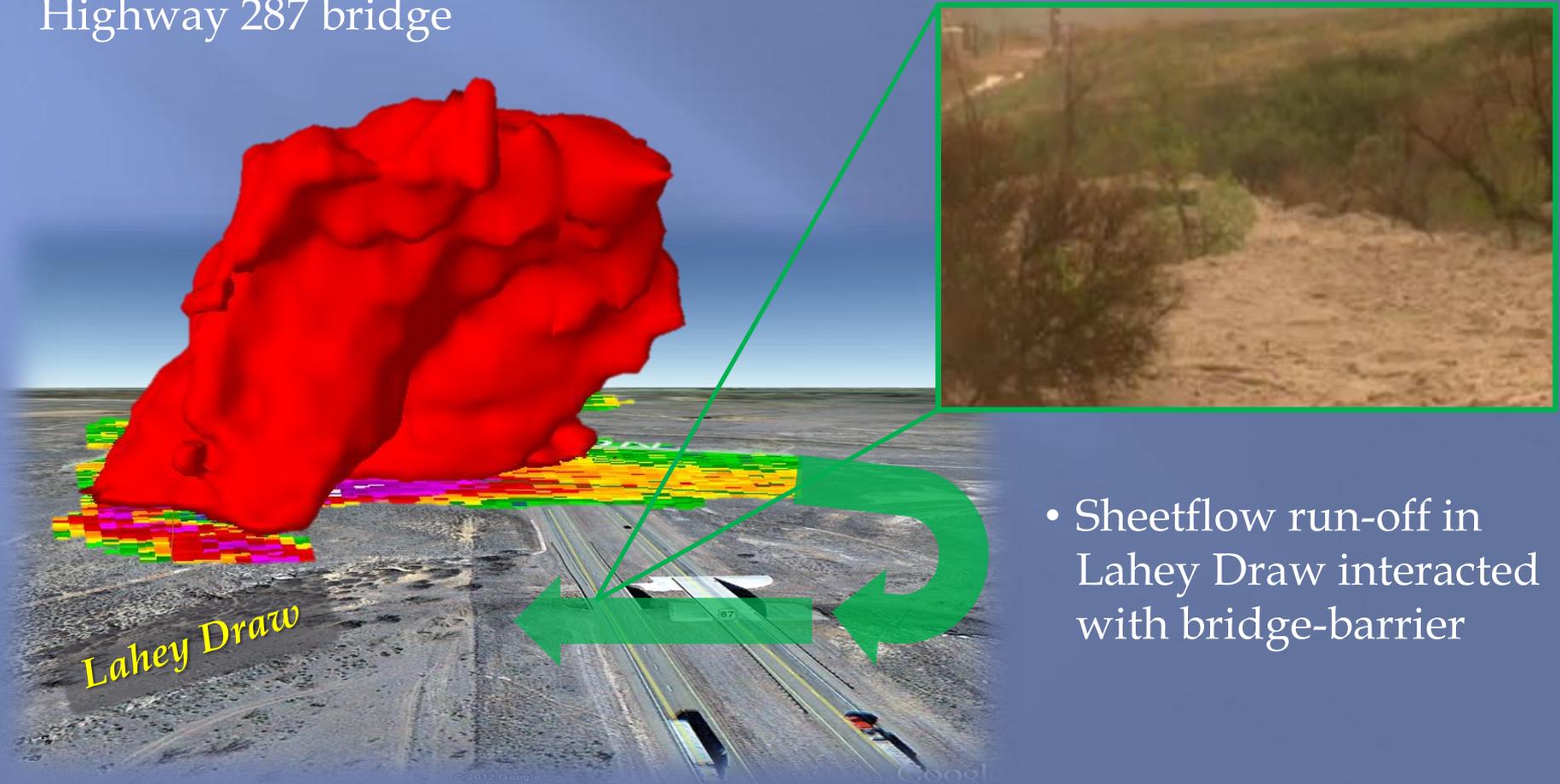
- Run-off occurred down Sand Draw
- Glacier accumulated on upstream side of road

Environmental Factors

11 April 2012 – Amarillo, Texas

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- Intense hail and rain fell northwest and north of Highway 287 bridge



- Sheetflow run-off in Lahey Draw interacted with bridge-barrier

Summary

Common Contributing Factors –

Meteorological –

- ❖ Favorable environment for supercells
- ❖ Deep layer flow supportive of slow storm motions $\leq 10 \text{ m s}^{-1}$ (20 kt)
- ❖ High PWATs favoring intense precipitation rates $\sim 2.5+$ cm (1+ in)
- ❖ Presence of pre-existing boundary?



Environmental –

- ❖ Intense rain-hailfall and/or runoff into a previously dry creek, draw, or minor tributary - vegetation?
- ❖ Presence of a down stream obstruction (i.e. bridge or road)

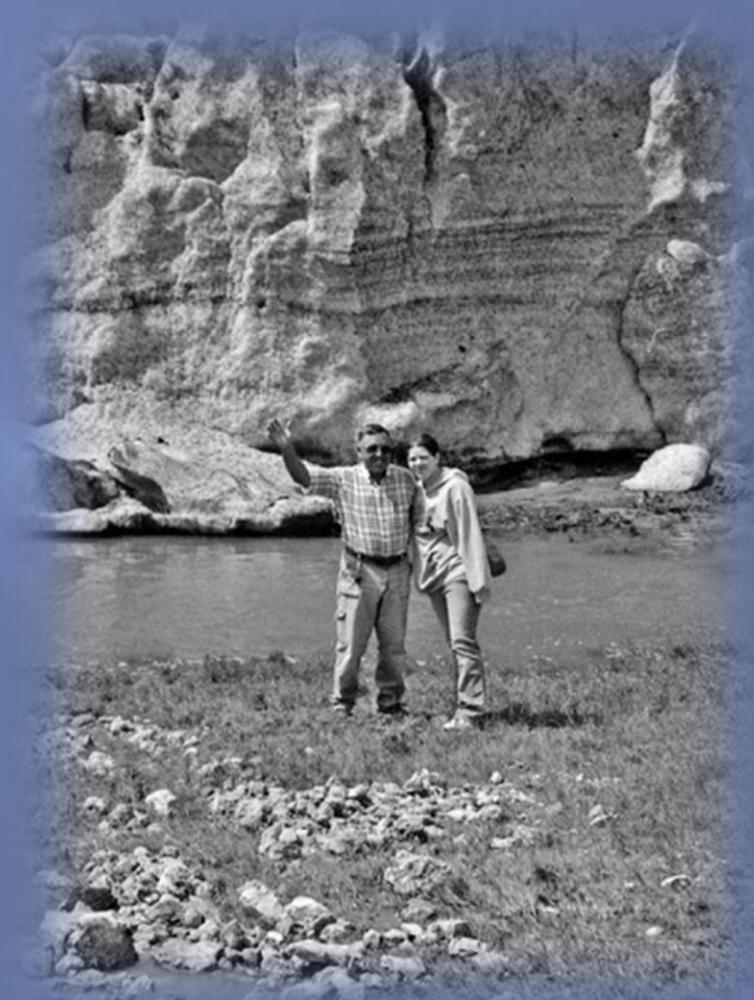


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Clayton, New Mexico – August 2004