



Tracking Radar Indicated Tornadoes With Warning Decision Support System – Integrated System (WDSS-II)

Steve Klapp

**Disaster Assessment Manager
American Red Cross of Central and
Western Oklahoma**



Using GIS and Geospatial Analysis for Tornado Disaster Responses in Disaster Recovery Operations

Steve Klapp

**Disaster Assessment Manager
American Red Cross of Central and
Western Oklahoma**

In the old days, after an event occurred...

- **We started collecting PDA (Preliminary Damage Assessment) and IA (Impact Assessment) information to determine a best estimate for the boundaries, size and scope of the event**
- **Since tornadoes typically occurred in the late afternoon or early evening, collection of visual information would be limited and/or delayed until daylight on the following day.**
- **At night, we were limited to collecting other sources for collection of PDA and IA that later required verification.**
- **We sent out people to verify and collect information.**
- **We interviewed people that came into the chapter about what they saw.**
- **We produced reports based on a best estimate of the number of homes damaged and the degree of damage (destroyed, major, minor, effected).**
- **The PDA process took 1 to 4 days.**

In the old days, after an event occurred...

- **Based on PDA numbers, we would make staffing decisions and requests.**
- **With staffing determined, we then started collecting DDA (Detailed Damage Assessment) information to determine an exact number of homes affected and their degree of damage.**
- **They completed “street sheets” listing each home by address and degree of damage that was used in service centers.**
- **We produced DDA reports that would then be used to determine more information about the type of service delivery would be made.**
- **The DDA process took an additional 1-3 days.**
- **We entered street sheets into computers at additional 1-3 days.**
- **We transmitted reports to National by beating on logs with bones.**
- **The whole process took 3 to 10 days.**

Today in Central and Western Oklahoma...

- We can complete the same process, producing more information, in 12 to 72 hours with GIS and Geospatial Analysis using NSSL's Warning Decision Supplement Services-Integrated Information (WDSS-II) and other tools.
 - First: The May 10, 2010 tornadoes in Norman and Eastern OK County, we completed the DA process in 48 hours with 980 homes damaged.
 - Second: The May 24, 2011 tornado outbreak, we completed the DA process in 48 hours with 1480 homes damaged.
 - Third: The April 13/14, 2012 tornado outbreaks, we completed the DA process in Norman (day 1) in 12 hours and Woodward (day 2) in 12 hours with 680 homes damaged during both storms.
- This is how we did it...



Tracking Tornadoes in Real-time with WDSS-II



Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image IBCAO
Image USDA Farm Service Agency
Image © 2010 TerraMetrics

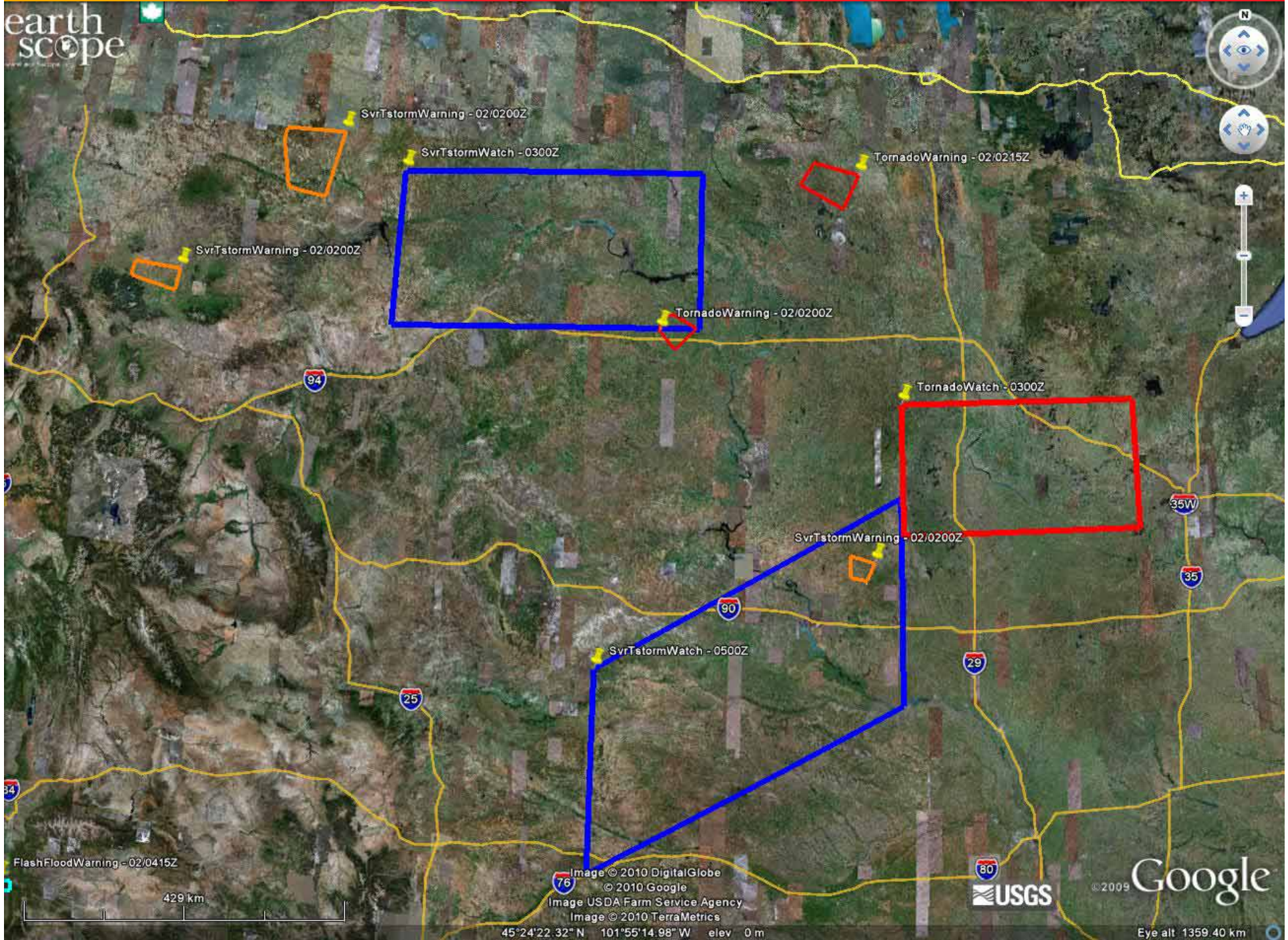
44°13'12.50" N 100°29'03.07" W elev 0 m



©2009

Google

Eye alt 7263.92 km



FlashFloodWarning - 02/0415Z

429 km

Image © 2010 DigitalGlobe
© 2010 Google
Image USDA Farm Service Agency
Image © 2010 TerraMetrics



©2009

Google

45°24'22.32" N 101°55'14.98" W elev 0 m

Eye alt 1359.40 km

Aug 1, 2010 5:43:34 pm

SvrTstormWarning - 01/2330Z

SvrTstormWatch - 0300Z

TornadoWarning - 01/2345Z

SvrTstormWarning - 01/2330Z

TornadoWatch - 0300Z

SvrTstormWarning - 01/2315Z

SvrTstormWarning - 01/2315Z

SvrTstormWatch - 0500Z

438 km

© 2010 Google

Image © 2010 TerraMetrics

Image © 2010 DigitalGlobe

Image USDA Farm Service Agency

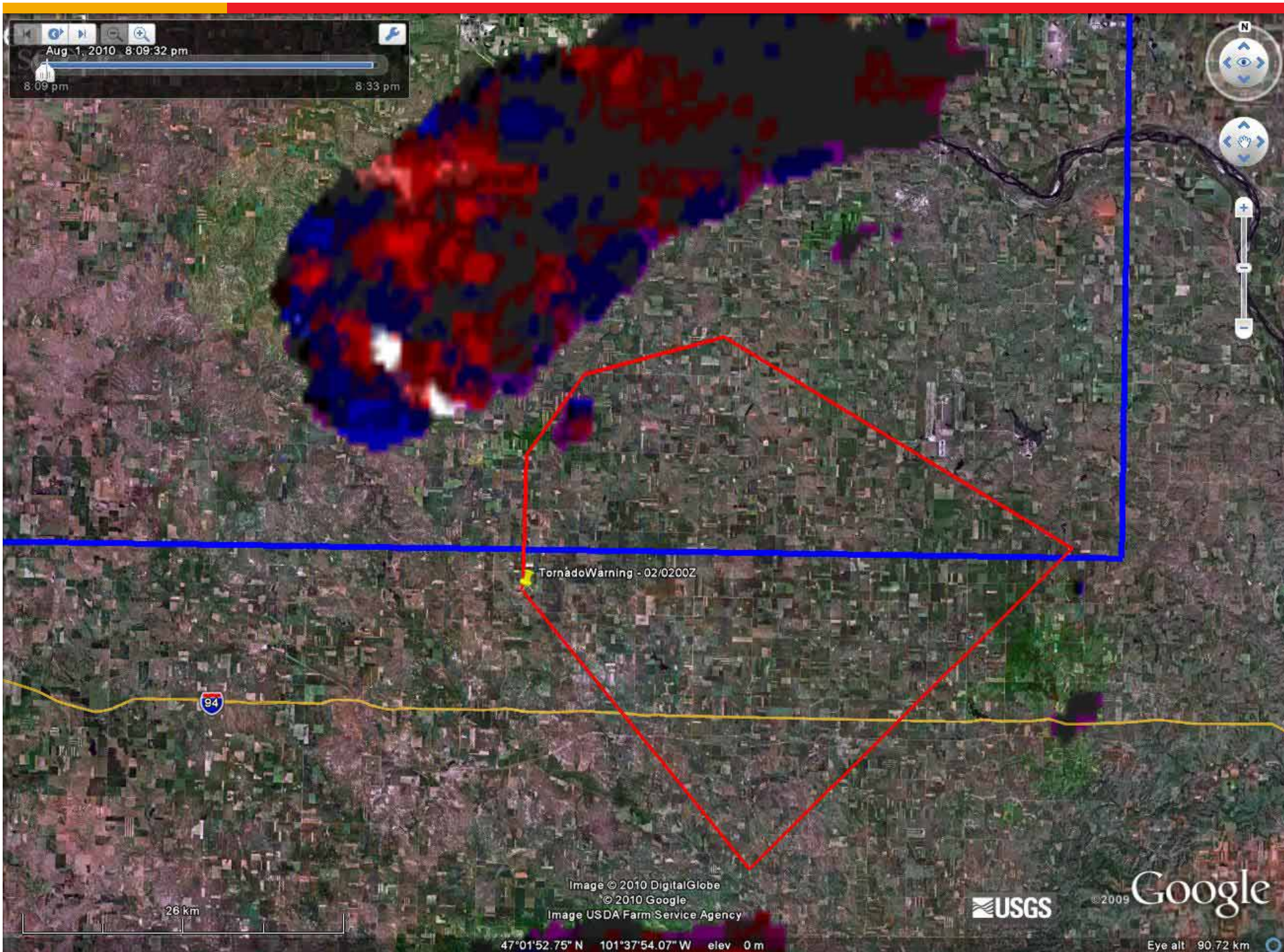
45°16'55.71" N 101°09'28.59" W elev 0 m

USGS

© 2009

Google

Eye alt 1384.51 km



earth
scope

Aug 1, 2010 8:16:01 pm

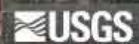


TornadoWarning - 02/0200Z



26 km

Image © 2010 DigitalGlobe
© 2010 Google
Image USDA Farm Service Agency



© 2009

Google

47°01'52.75" N 101°37'54.07" W elev 0 m

Eye alt 90.72 km

earth
scope

Aug 1, 2010 8:33:01 pm

TornadoWarning - 02/0200Z

19.1 km

Image © 2010 DigitalGlobe
© 2010 Google
Image USDA Farm Service Agency

46°57'17.98" N 101°32'47.71" W elev 0 m

USGS

©2009

Google

Eye alt 65.68 km

earth
scope

Aug 1, 2010 8:26:35 pm

TornadoWarning - 02/0200Z

Image © 2010 DigitalGlobe
© 2010 Google

Image USDA Farm Service Agency
46°57'54.97" N 101°31'36.74" W elev 0 m

USGS

2009

Google

Eye alt: 96.65 km

earth
scope

Aug 1, 2010 8:29:04 pm

TornadoWarning - 02/0200Z

Image © 2010 DigitalGlobe
© 2010 Google

Image USDA Farm Service Agency
46°57'54.97" N 101°31'36.74" W elev 0 m

USGS

2009 Google

Eye alt: 96.65 km

Aug 1, 2010 8:31:09 pm
8:23 pm 8:47 pm

Navigation controls including a compass, a hand icon for panning, a vertical zoom slider, and a street view pegman icon.

TornadoWarning - 02/0200Z

94

810

Image © 2010 DigitalGlobe
© 2010 Google

Image USDA Farm Service Agency
46°57'54.97" N 101°31'36.74" W elev 0 m

USGS

2009

Google

Eye alt: 96.65 km

28 km

Aug 1, 2010 8:33:47 pm

8:23 pm 8:47 pm

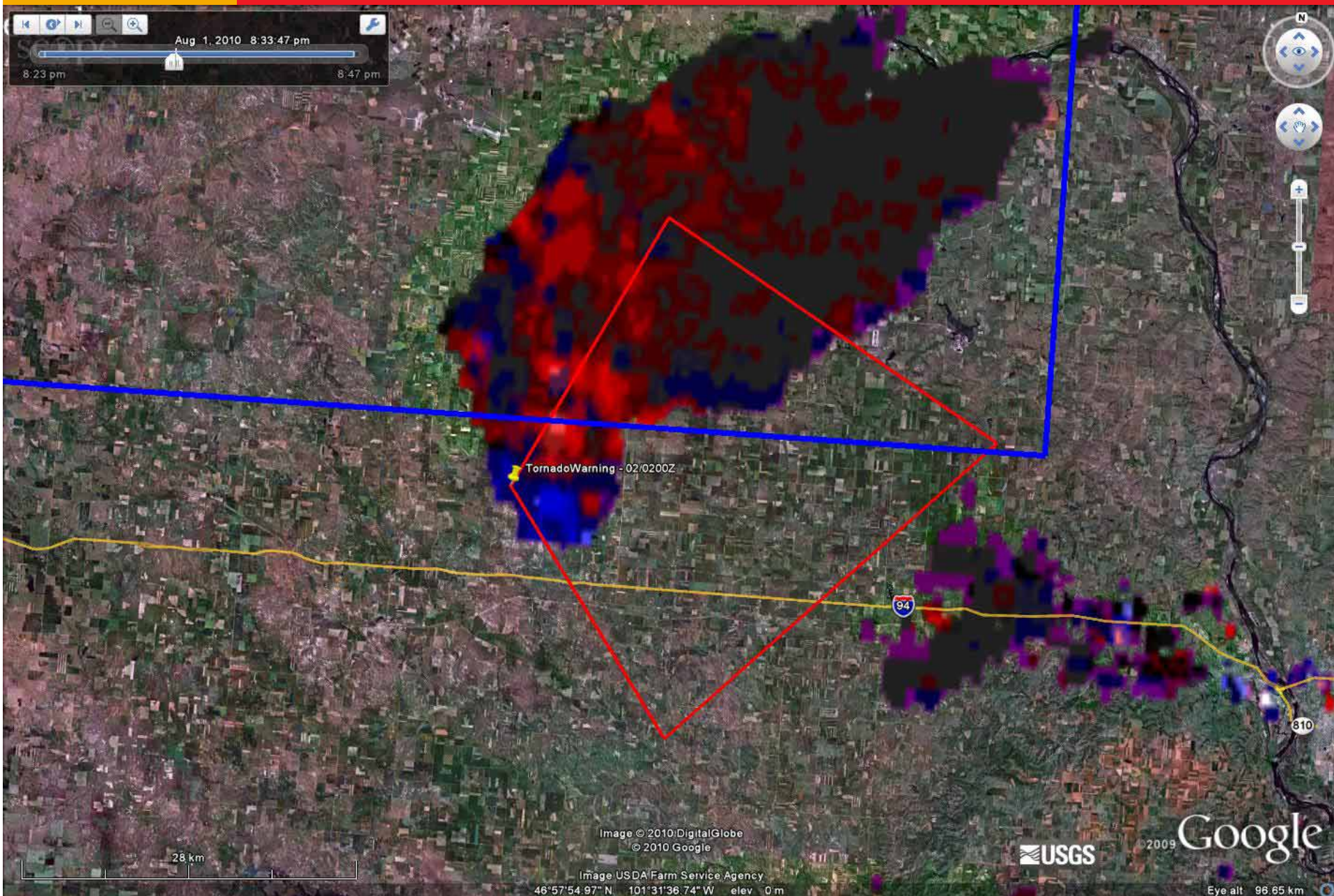


Image © 2010 DigitalGlobe
© 2010 Google

Image USDA Farm Service Agency

46°57'54.97" N 101°31'36.74" W elev 0 m

USGS

2009

Google

Eye alt: 96.65 km

Aug 1, 2010 8:36:32 pm
8:23 pm 8:47 pm

Navigation controls including a compass, a hand icon for panning, a vertical zoom slider, and a street view pegman icon.

TornadoWarning - 02/0200Z

94

810

Image © 2010 DigitalGlobe
© 2010 Google

Image USDA Farm Service Agency

46°57'54.97" N 101°31'36.74" W elev 0 m

USGS

2009

Google

Eye alt: 96.65 km

28 km

earth
scope

Aug 1, 2010 - 8:39:57 pm

TornadoWarning - 02/0200Z

28 km

Image © 2010 DigitalGlobe
© 2010 Google

Image USDA Farm Service Agency
46°57'54.97" N 101°31'36.74" W elev 0 m

USGS

2009

Google

Eye alt: 96.65 km

earth
scope

Aug 1, 2010 8:44:15pm

TornadoWarning - 02/0200Z

28 km

Image © 2010 DigitalGlobe
© 2010 Google

Image USDA Farm Service Agency
46°57'54.97" N 101°31'36.74" W elev 0 m

USGS

2009

Google

Eye alt: 96.65 km

earth
scope

Aug 1, 2010 8:46:16 pm

TornadoWarning - 02/0200Z

28 km

Image © 2010 DigitalGlobe
© 2010 Google

Image USDA Farm Service Agency
46°57'54.97" N 101°31'36.74" W elev 0 m

USGS

2009

Google

Eye alt: 96.65 km

earth
scope

Aug 1, 2010 - 8:47:35 pm

TornadoWarning - 02/0200Z

28 km

Image © 2010 DigitalGlobe
© 2010 Google

Image USDA Farm Service Agency
46°57'54.97" N 101°31'36.74" W elev 0 m

USGS

2009

Google

Eye alt: 96.65 km

earth
scope

Aug 1, 2010 8:47:42 pm

TornadoWarning - 02/0200Z

94

83

810

TornadoWarning - 02/0230Z

Image © 2010 DigitalGlobe
© 2010 Google

Image USDA Farm Service Agency

46°48'58.17" N 101°18'38.35" W elev 0 m

USGS

© 2009

Google

Eye alt 155.96 km

Aug 1, 2010 8:49:54 pm
8:29 pm 8:53 pm

Navigation controls including a compass, a hand icon for panning, a vertical zoom slider, and a full-screen button.

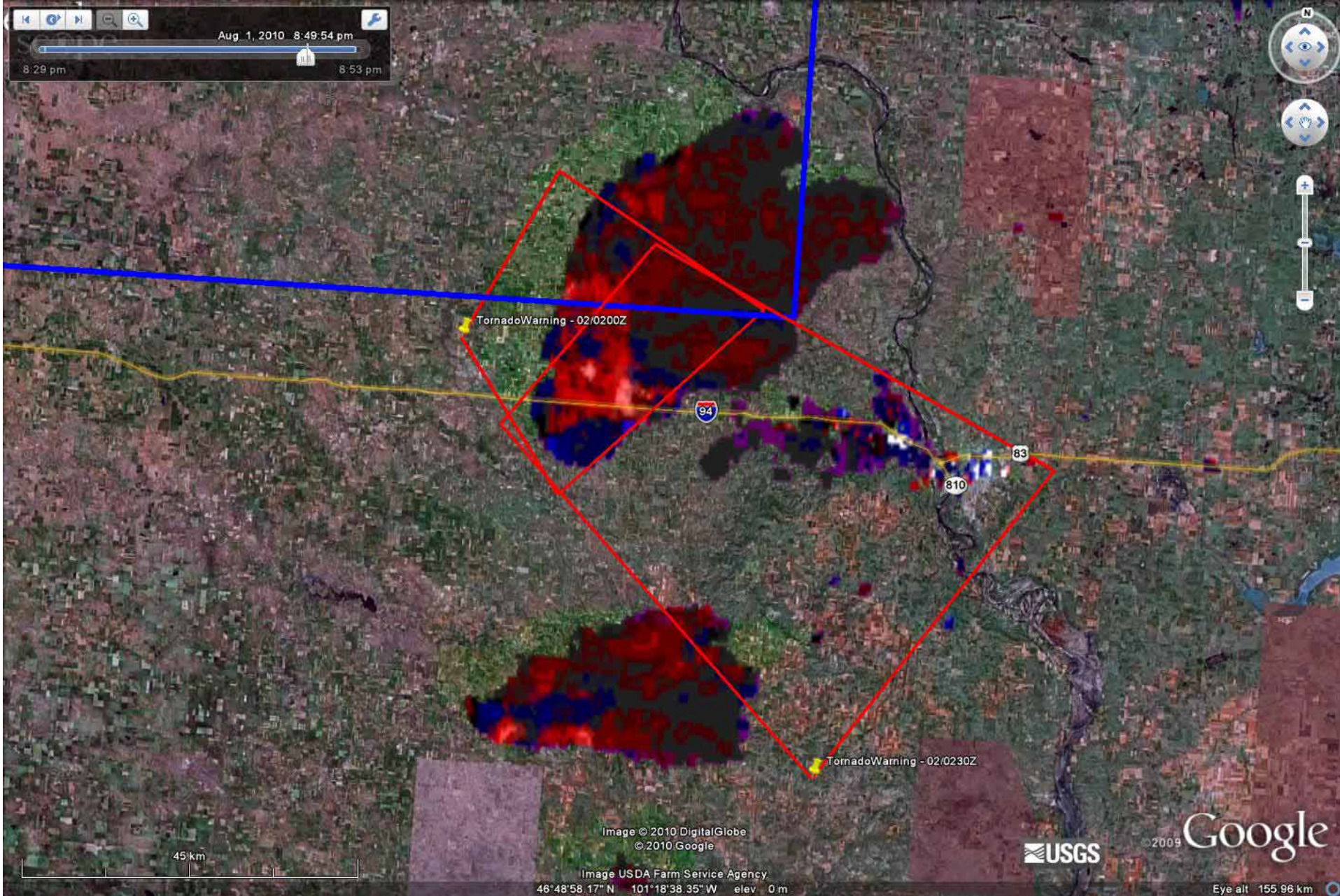


Image © 2010 DigitalGlobe
© 2010 Google

Image USDA Farm Service Agency

46°48'58.17" N 101°18'38.35" W elev 0 m

USGS

© 2009

Google

Eye alt 155.96 km

earth
scope

Aug 1, 2010 8:53:23 pm

TornadoWarning - 02/0200Z

94

83

810

TornadoWarning - 02/0230Z

Image © 2010 DigitalGlobe
© 2010 Google

Image USDA Farm Service Agency
46°48'58.17" N 101°18'38.35" W elev 0 m

USGS

© 2009

Google

Eye alt 155.96 km



warning

warning

TornadoWarning - 02/0230Z

warning

94

83

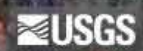
810

32 km

Image © 2010 DigitalGlobe
© 2010 Google

Image USDA Farm Service Agency

46°44'56.56" N 101°03'10.32" W elev 0 m



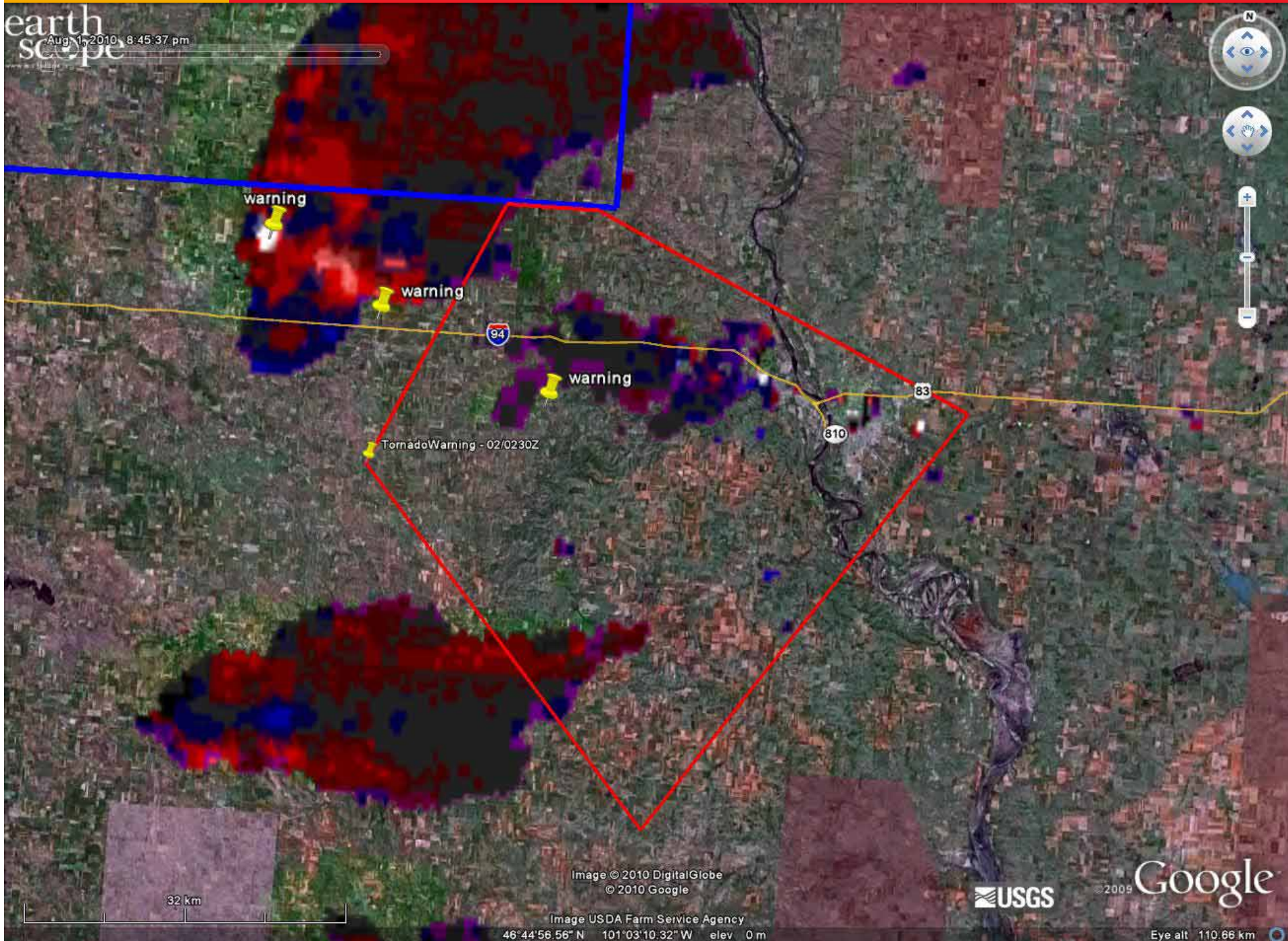
2009

Google

Eye alt 110.66 km

earth
scape

Aug 15, 2010 8:45:37 pm



TornadoWarning - 02/0230Z

warning

warning

warning

32 km

Image © 2010 DigitalGlobe
© 2010 Google

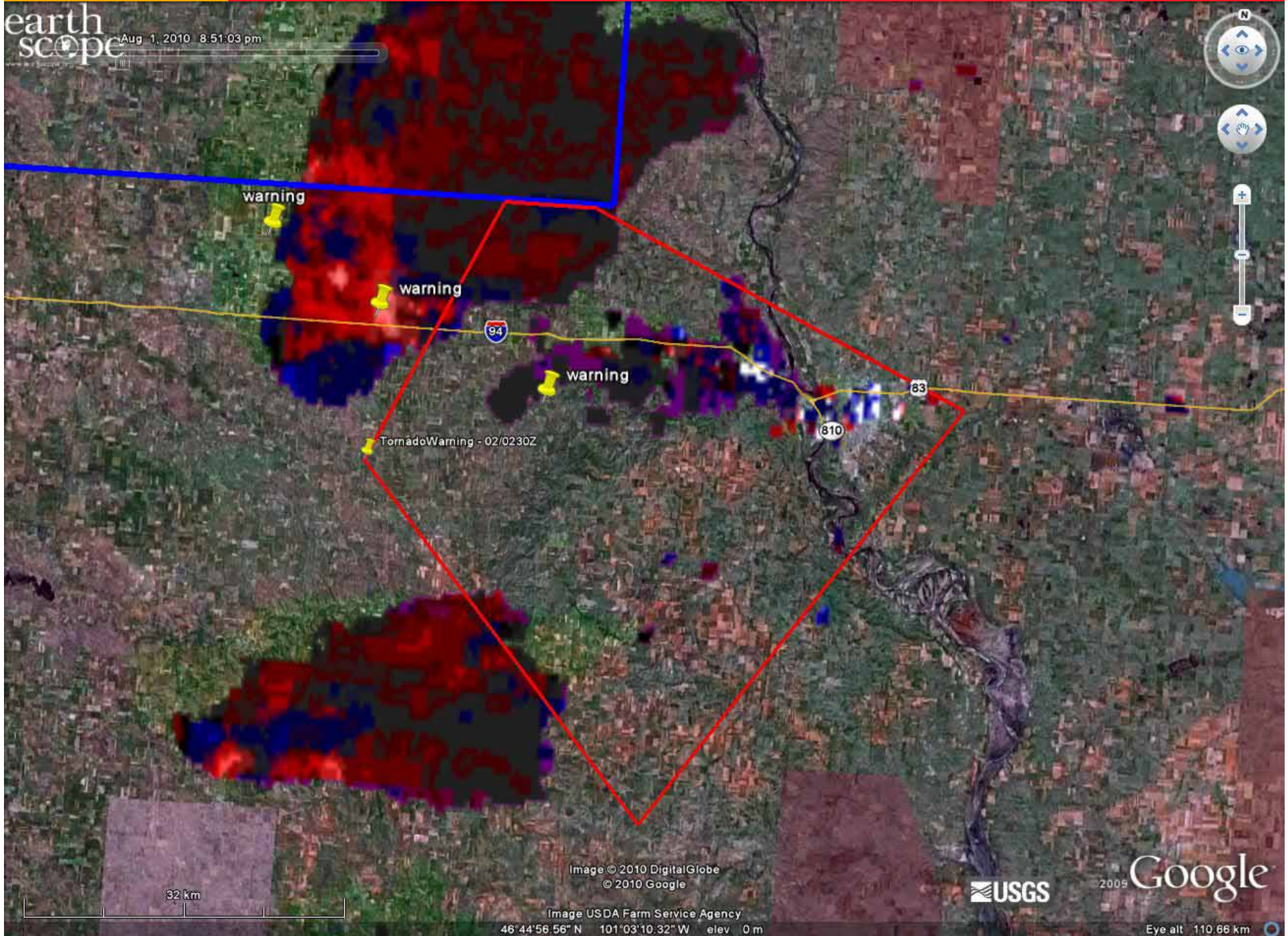
Image USDA Farm Service Agency
46°44'56.56" N 101°03'10.32" W elev 0 m

USGS

2009

Google

Eye alt 110.66 km



TornadoWarning - 02/0230Z

Image © 2010 DigitalGlobe
© 2010 Google

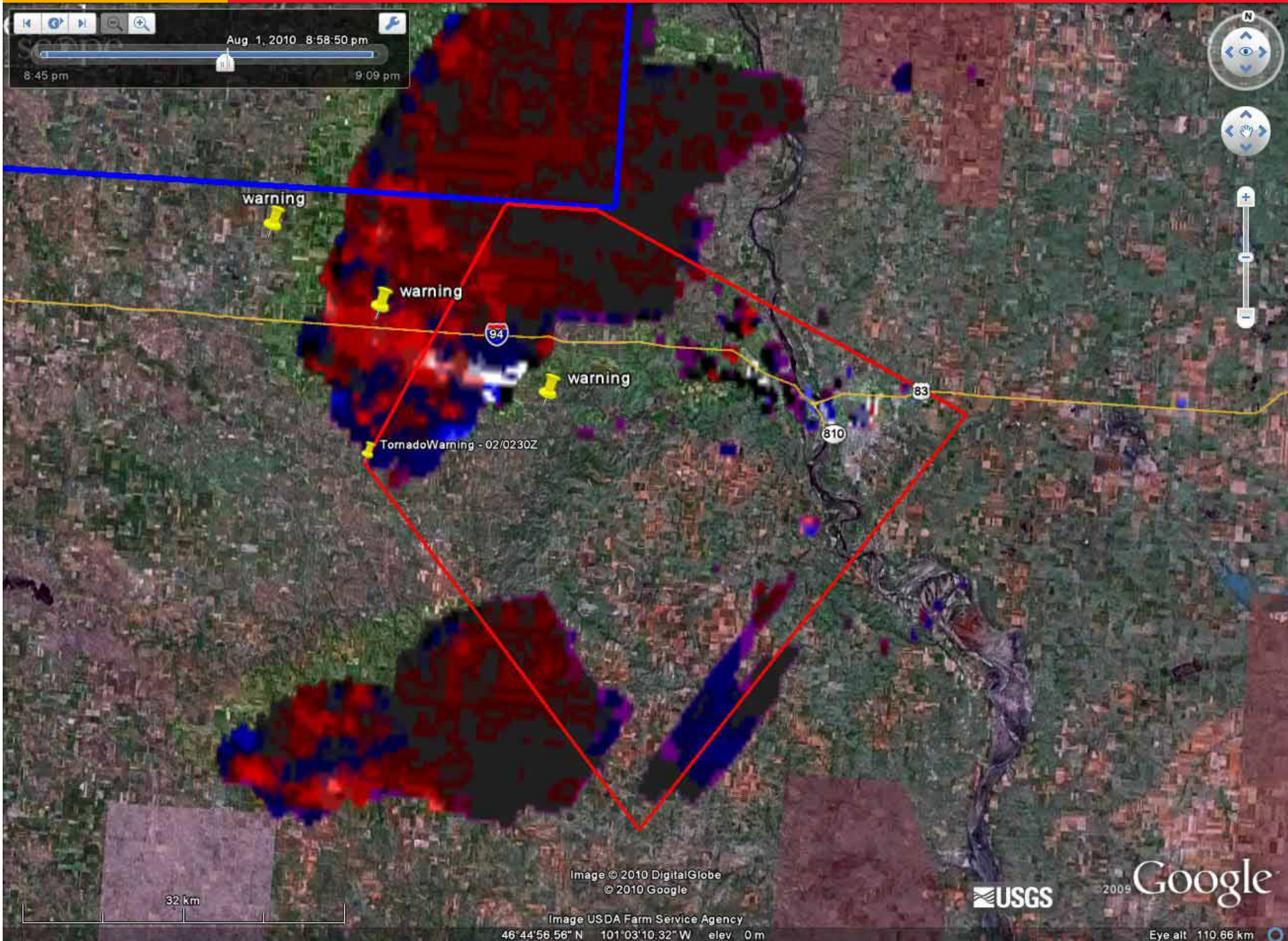
Image USDA Farm Service Agency
46°44'56.56" N 101°03'10.32" W elev 0 m

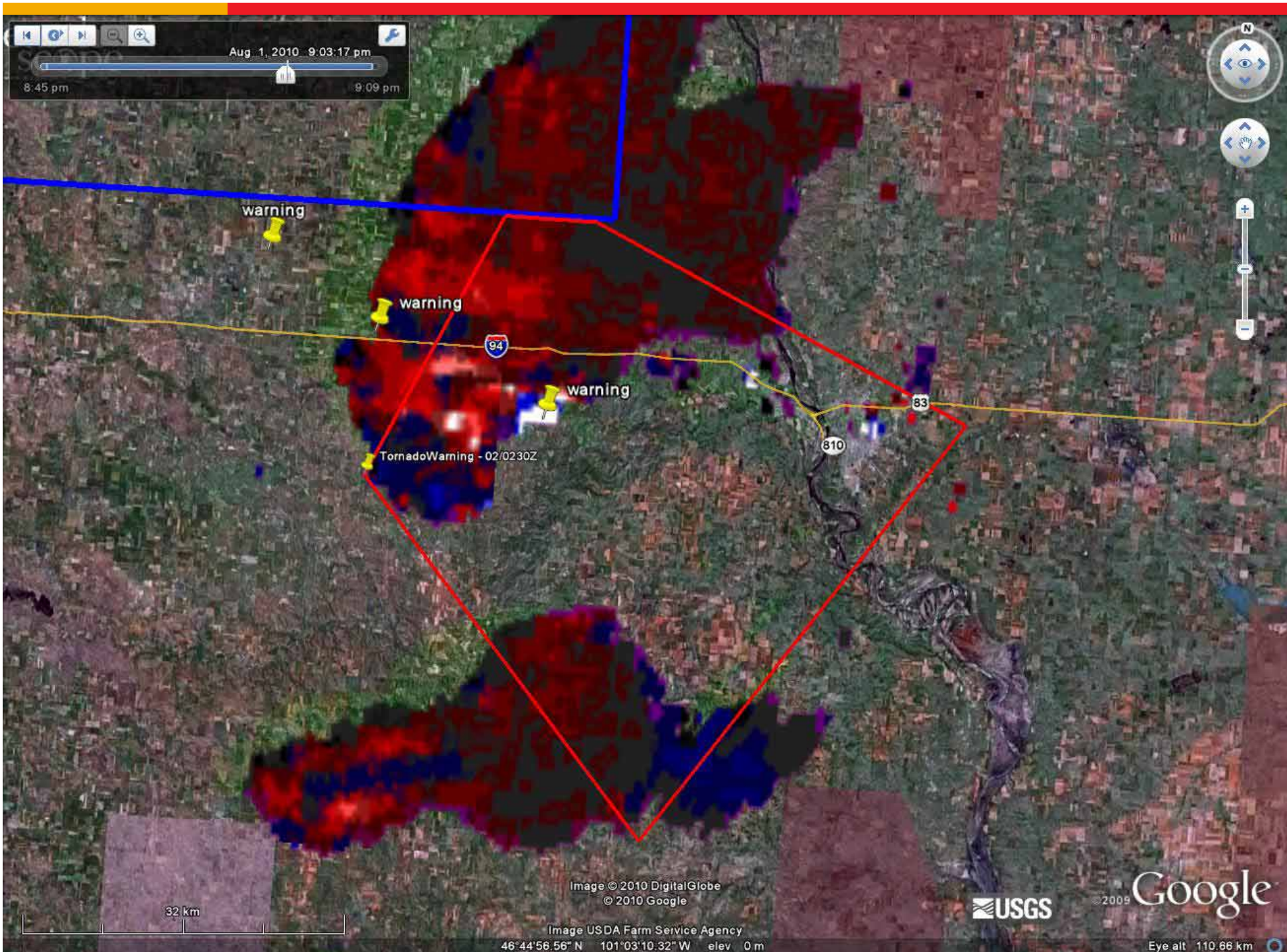
USGS

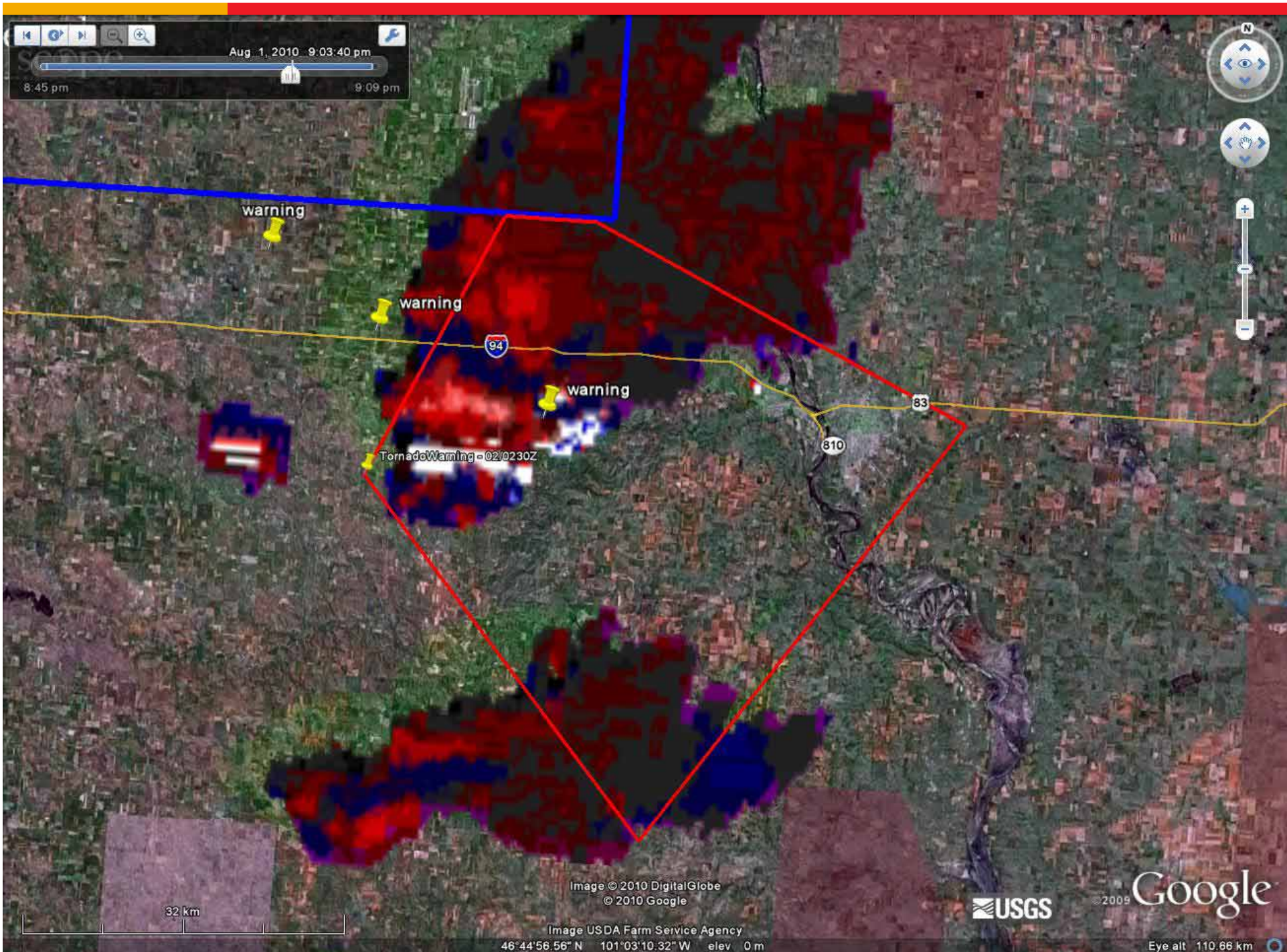
2009

Google

Eye alt 110.66 km







Aug 1, 2010 9:07:07 pm



warning

warning

warning

TornadoWarning-02/0230Z

94

83

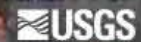
810

32 km

Image © 2010 DigitalGlobe
© 2010 Google

Image USDA Farm Service Agency

46°44'56.56" N 101°03'10.32" W elev 0 m



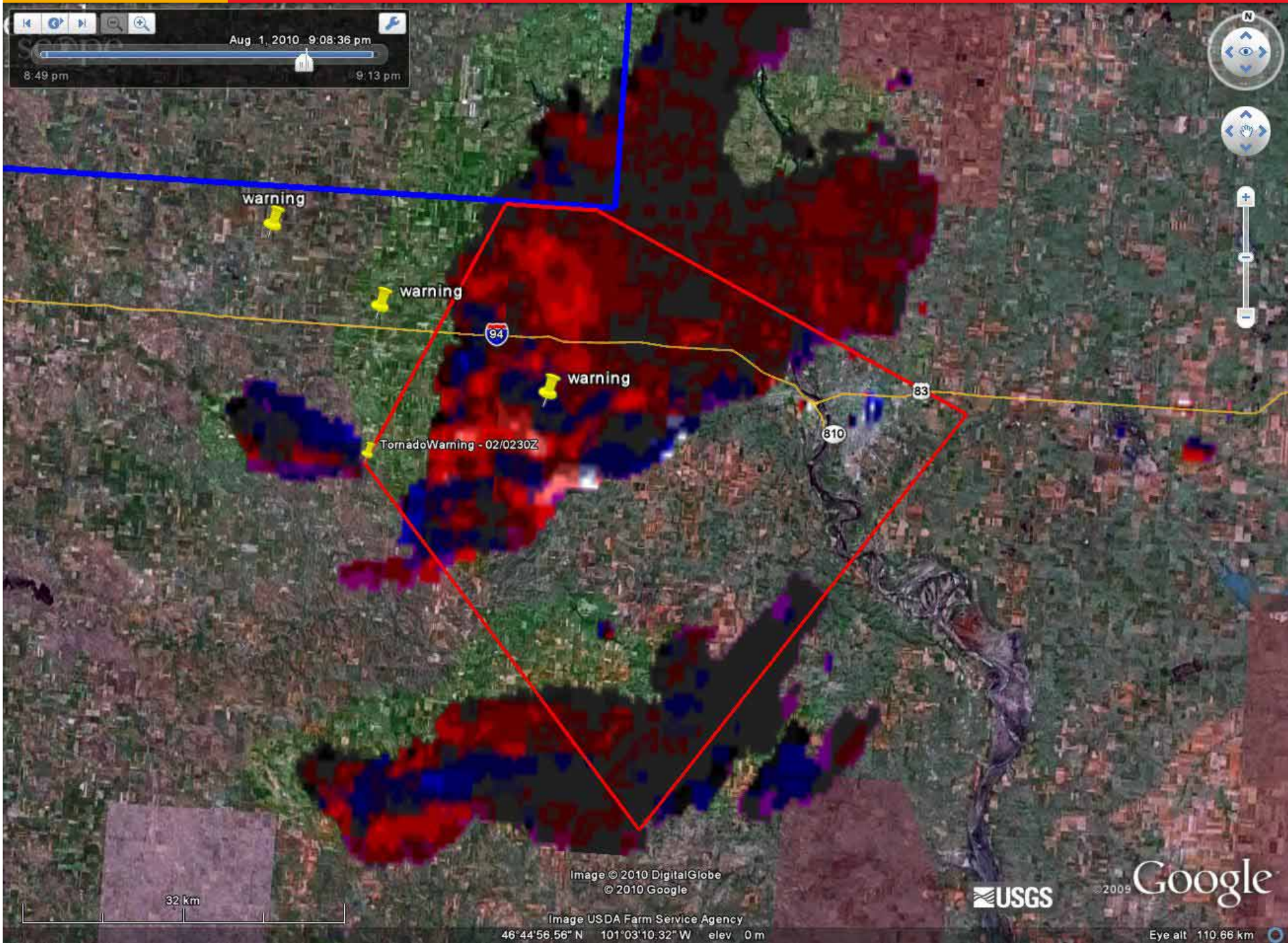
2009

Google

Eye alt 110.66 km

Aug. 1, 2010 9:08:36 pm
8:49 pm 9:13 pm

Navigation controls including a compass, a hand icon for panning, and a vertical zoom slider with '+' and '-' buttons.



32 km

Image © 2010 DigitalGlobe
© 2010 Google

Image USDA Farm Service Agency

46°44'56.56" N 101°03'10.32" W elev. 0 m

USGS

2009

Google

Eye alt 110.66 km

Aug 1, 2010 9:11:54 pm



warning

warning

warning

TornadoWarning - 02/0230Z

94

83

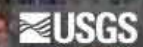
810

32 km

Image © 2010 DigitalGlobe
© 2010 Google

Image USDA Farm Service Agency

46°44'56.56" N 101°03'10.32" W elev 0 m

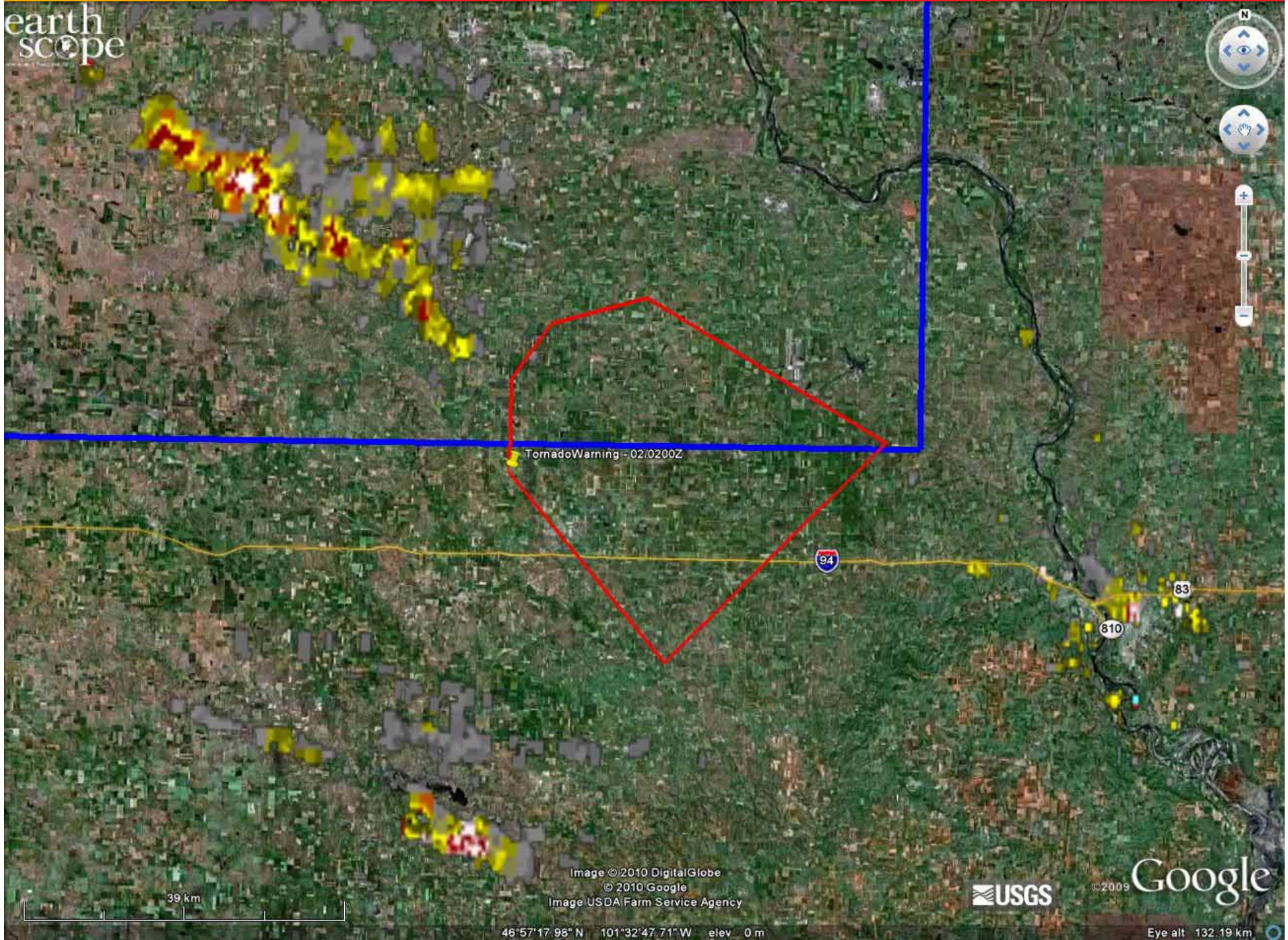


2009

Google

Eye alt 110.66 km

earth
scope



TornadoWarning - 02/0200Z

94

83

810

39 km

Image © 2010 DigitalGlobe
© 2010 Google
Image USDA Farm Service Agency

USGS

© 2009

Google

46°57'17.98" N 101°32'47.71" W elev 0 m

Eye alt 132.19 km



warning

warning

TornadoWarning - 02/0230Z



83

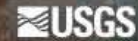
810

48 km

Image © 2010 DigitalGlobe
© 2010 Google

Image USDA Farm Service Agency

46°55'32.24" N 101°24'20.82" W elev. 0 m



© 2009

Google

Eye alt 163.31 km



warning

warning

TornadoWarning - 02/0230Z

warning

94

83

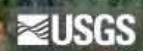
810

32 km

Image © 2010 DigitalGlobe
© 2010 Google

Image USDA Farm Service Agency

46°44'56.56" N 101°03'10.32" W elev 0 m



2009

Google

Eye alt 110.66 km



warning

warning

TornadoWarning - 02/0230Z

warning

94

83

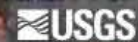
810

32 km

Image © 2010 DigitalGlobe
© 2010 Google

Image USDA Farm Service Agency

46°44'56.56" N 101°03'10.32" W elev 0 m



2009

Google

Eye alt 110.66 km



warning

warning

warning

TornadoWarning - 02/0230Z

94

83

810

32 km

Image © 2010 DigitalGlobe
© 2010 Google

Image USDA Farm Service Agency
46°44'56.56" N 101°03'10.32" W elev. 0 m

USGS

2009

Google

Eye alt 110.66 km

Aug 1, 2010 9:09:08 pm



warning

warning

warning

TornadoWarning - 02/0230Z

94

83

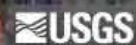
810

32 km

Image © 2010 DigitalGlobe
© 2010 Google

Image USDA Farm Service Agency

46°44'56.56" N 101°03'10.32" W elev 0 m



2009

Google

Eye alt 110.66 km

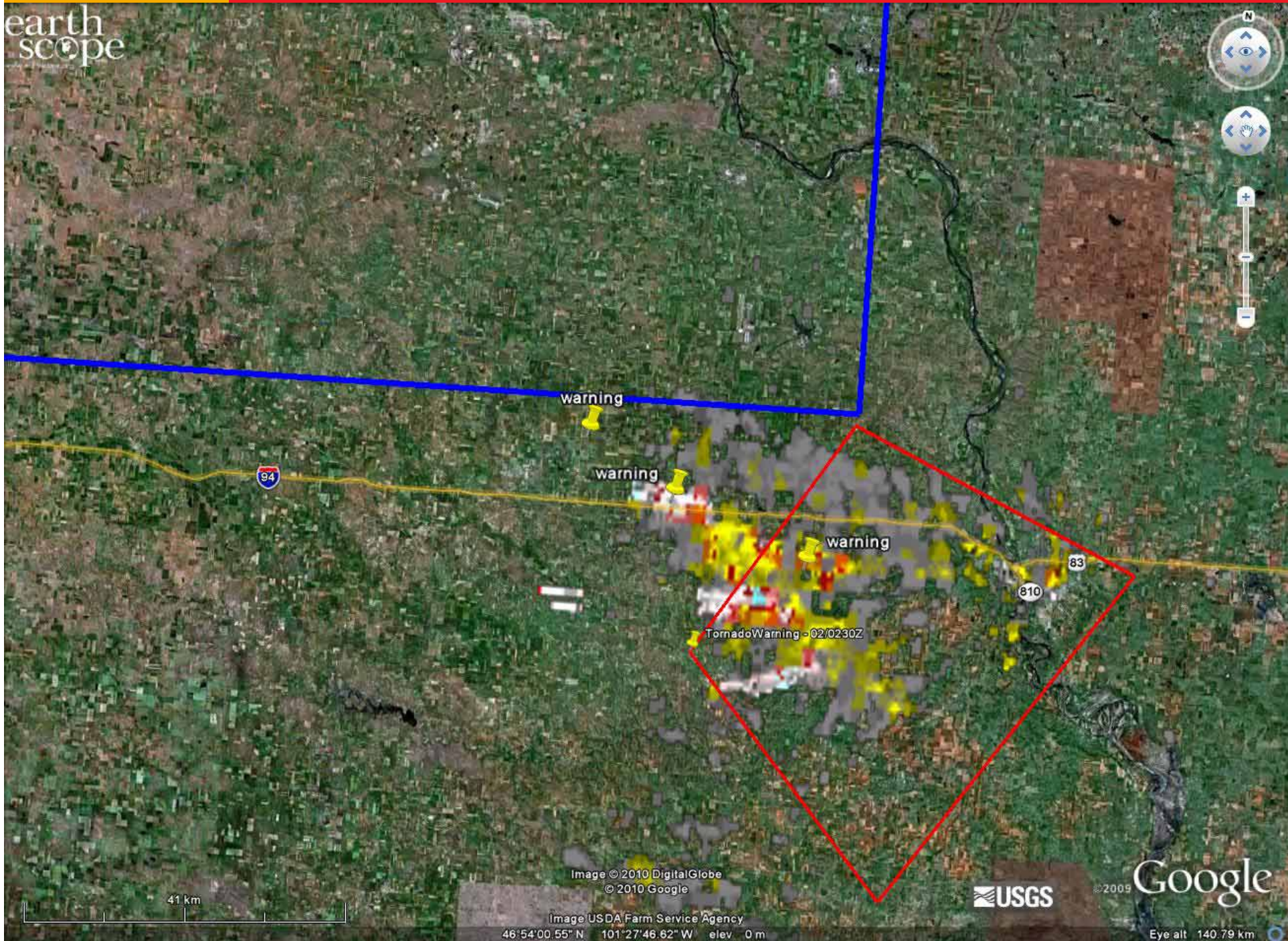


Image © 2010 DigitalGlobe
© 2010 Google

Image USDA Farm Service Agency

46°54'00.55" N 101°27'46.62" W elev. 0 m



© 2009

Google

Eye alt 140.79 km



warning

warning

warning

TornadoWarning - 02/0230Z

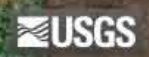


83

810

Image © 2010 DigitalGlobe
© 2010 Google

Image USDA Farm Service Agency
46°54'00.55" N 101°27'46.82" W elev. 0 m



© 2009

Google

Eye alt 140.79 km

41 km



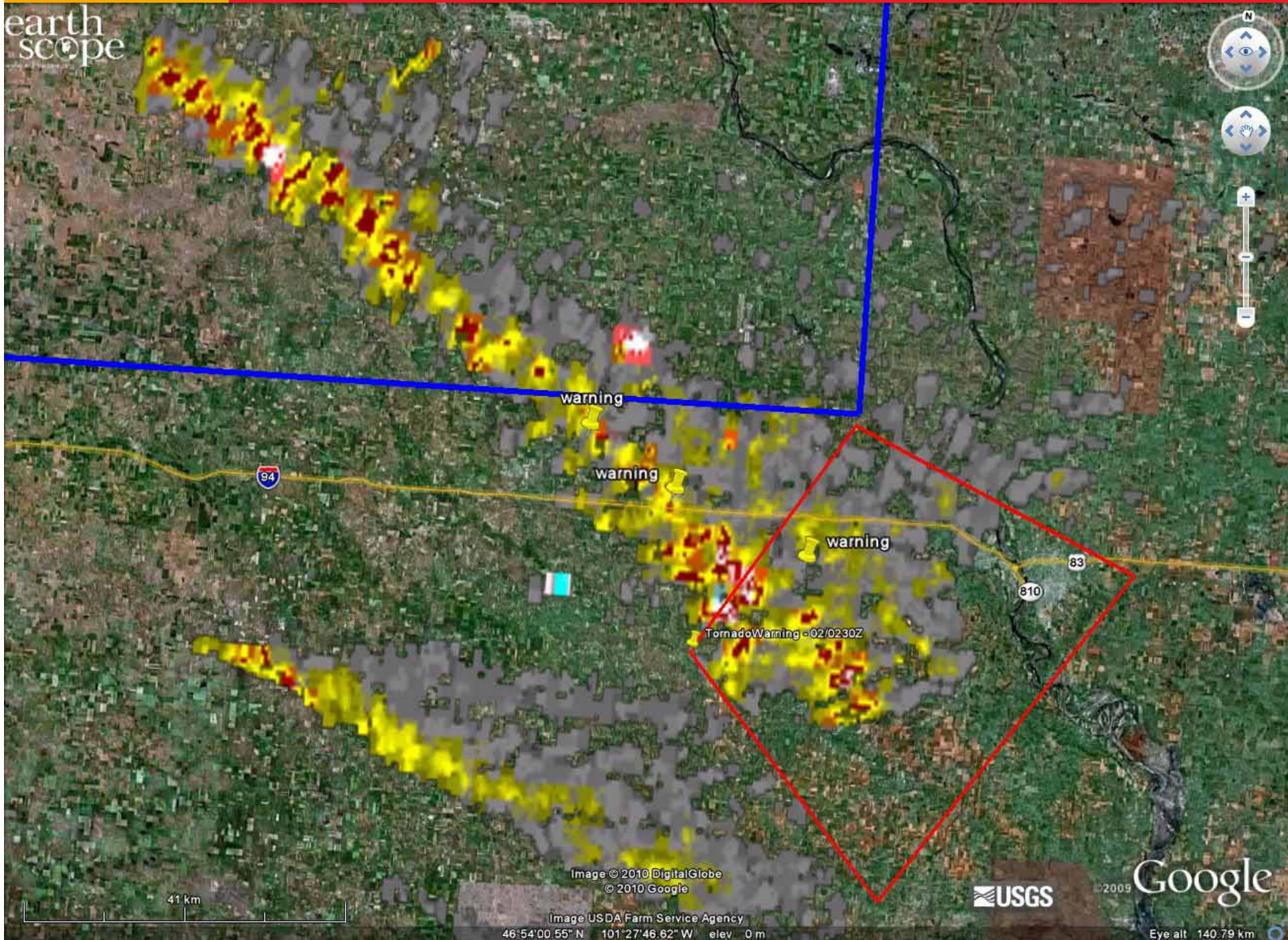
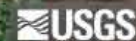


Image © 2010 DigitalGlobe
© 2010 Google

Image USDA Farm Service Agency

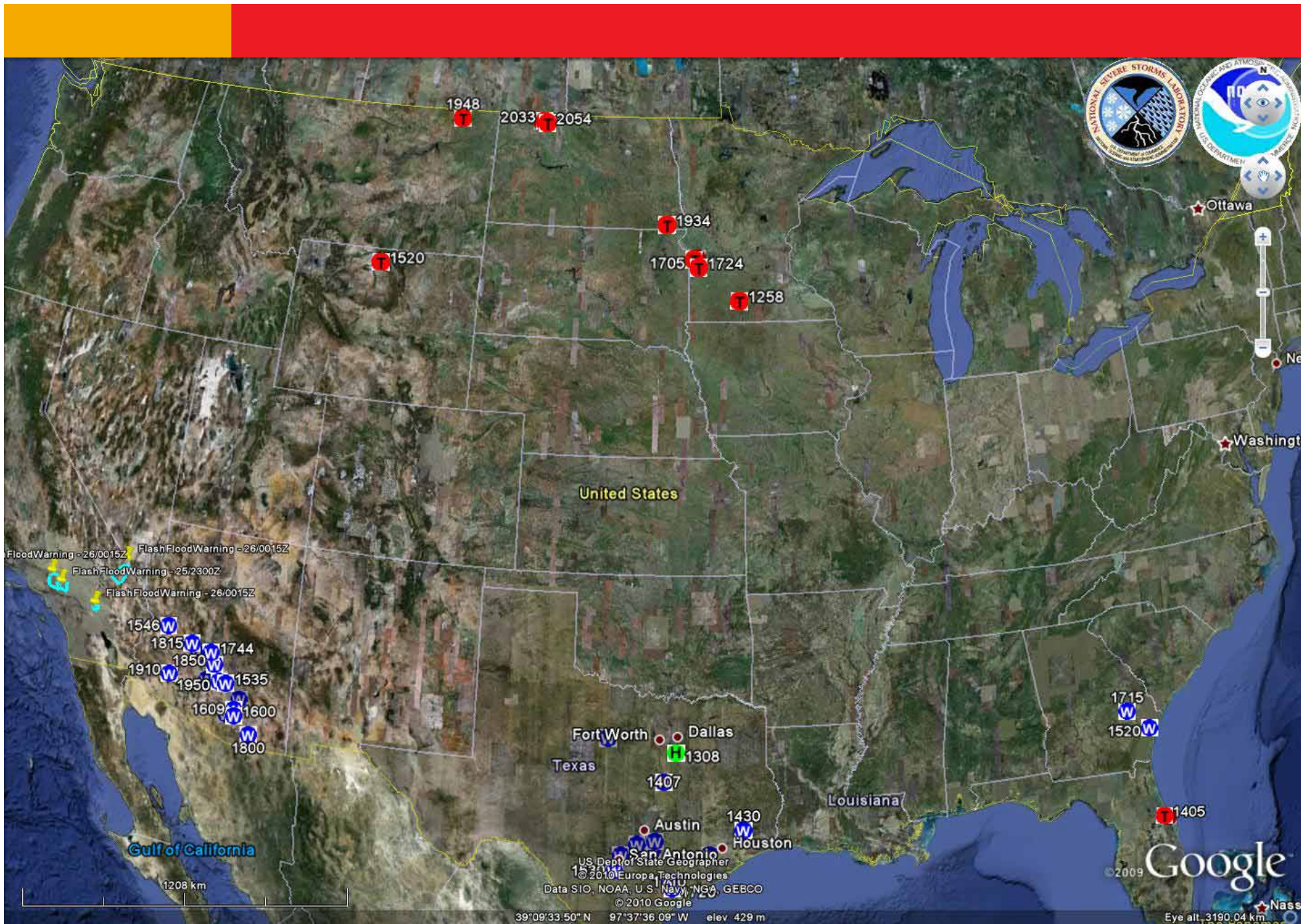
46°54'00.55" N 101°27'46.62" W elev. 0 m



© 2009

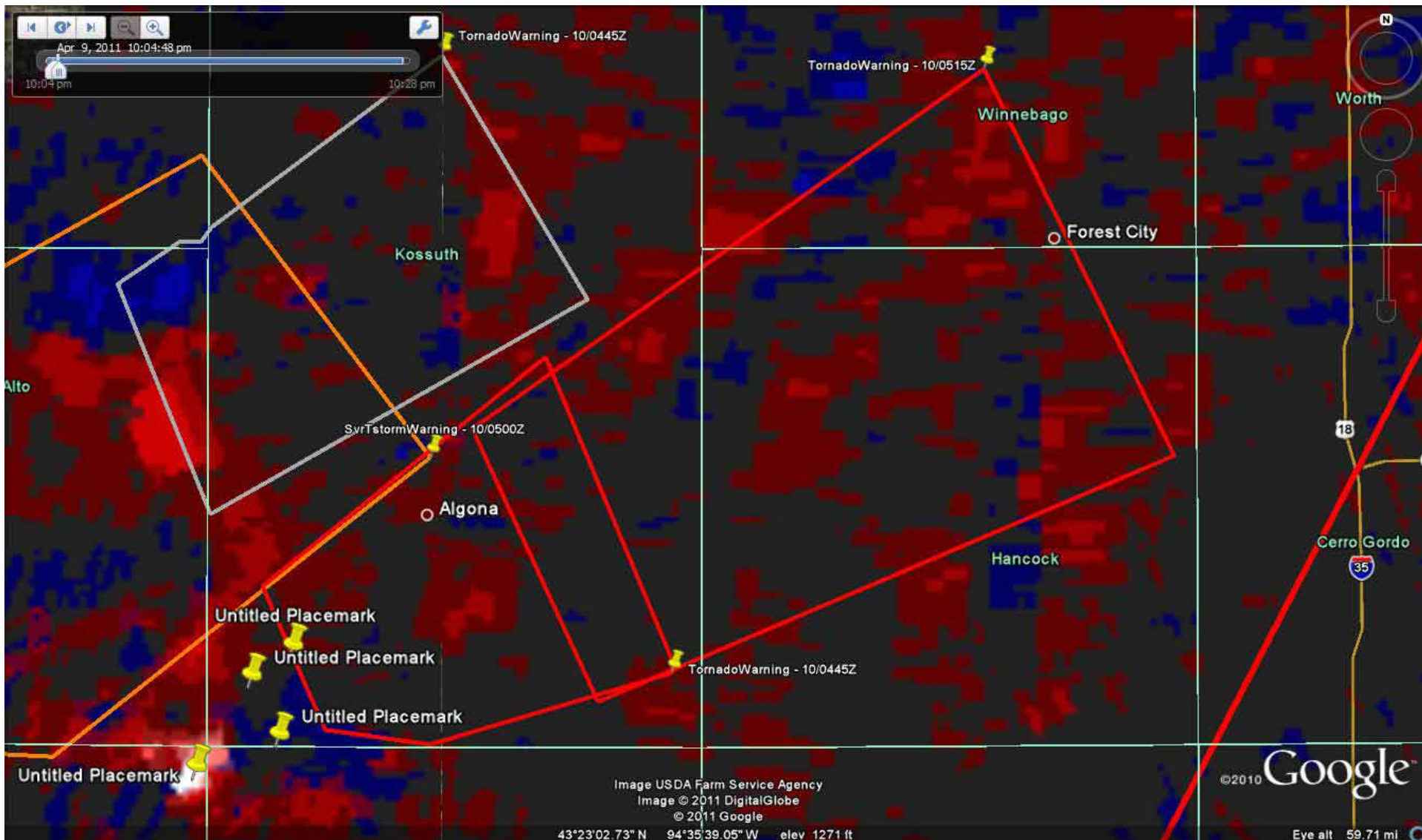
Google

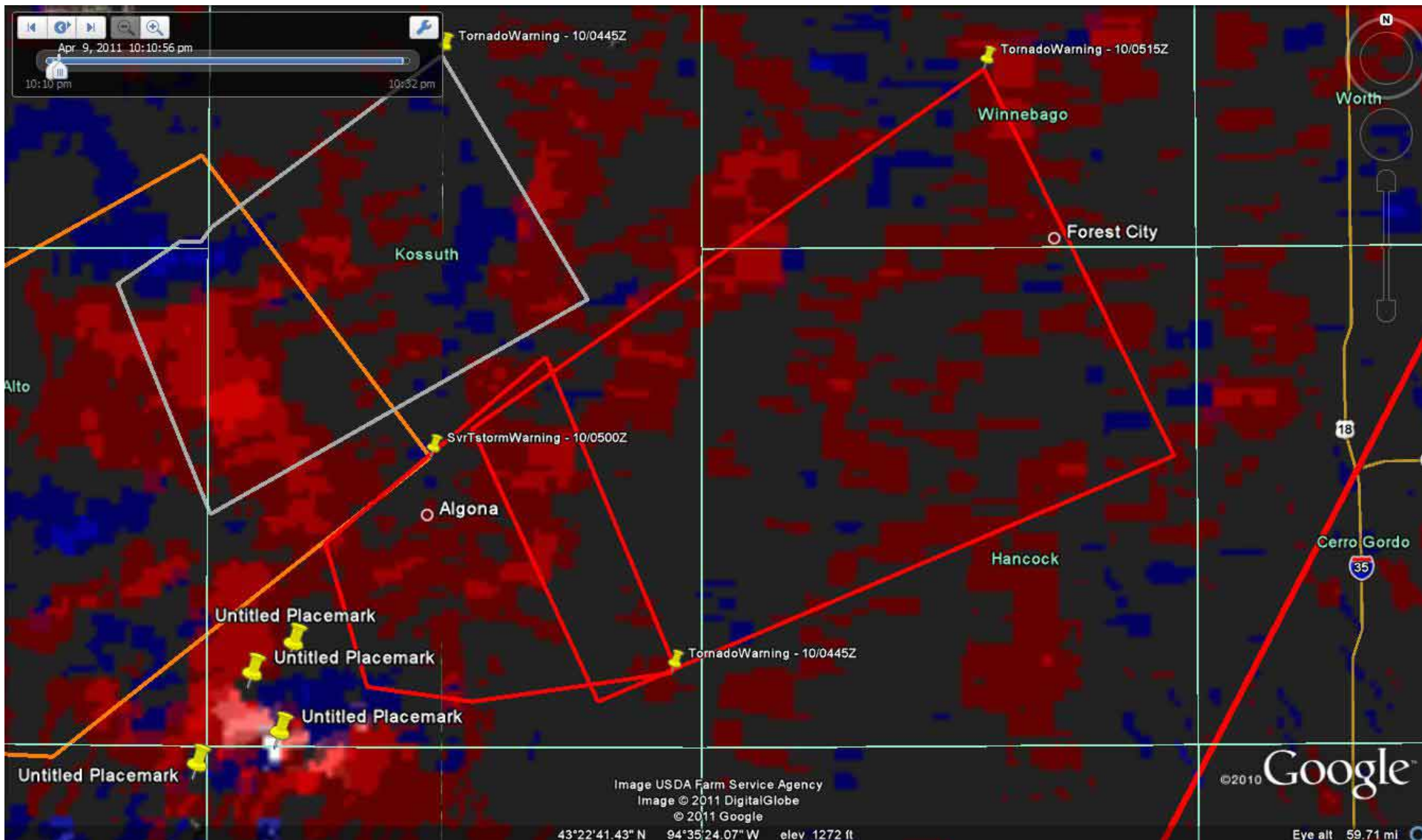
Eye alt 140.79 km

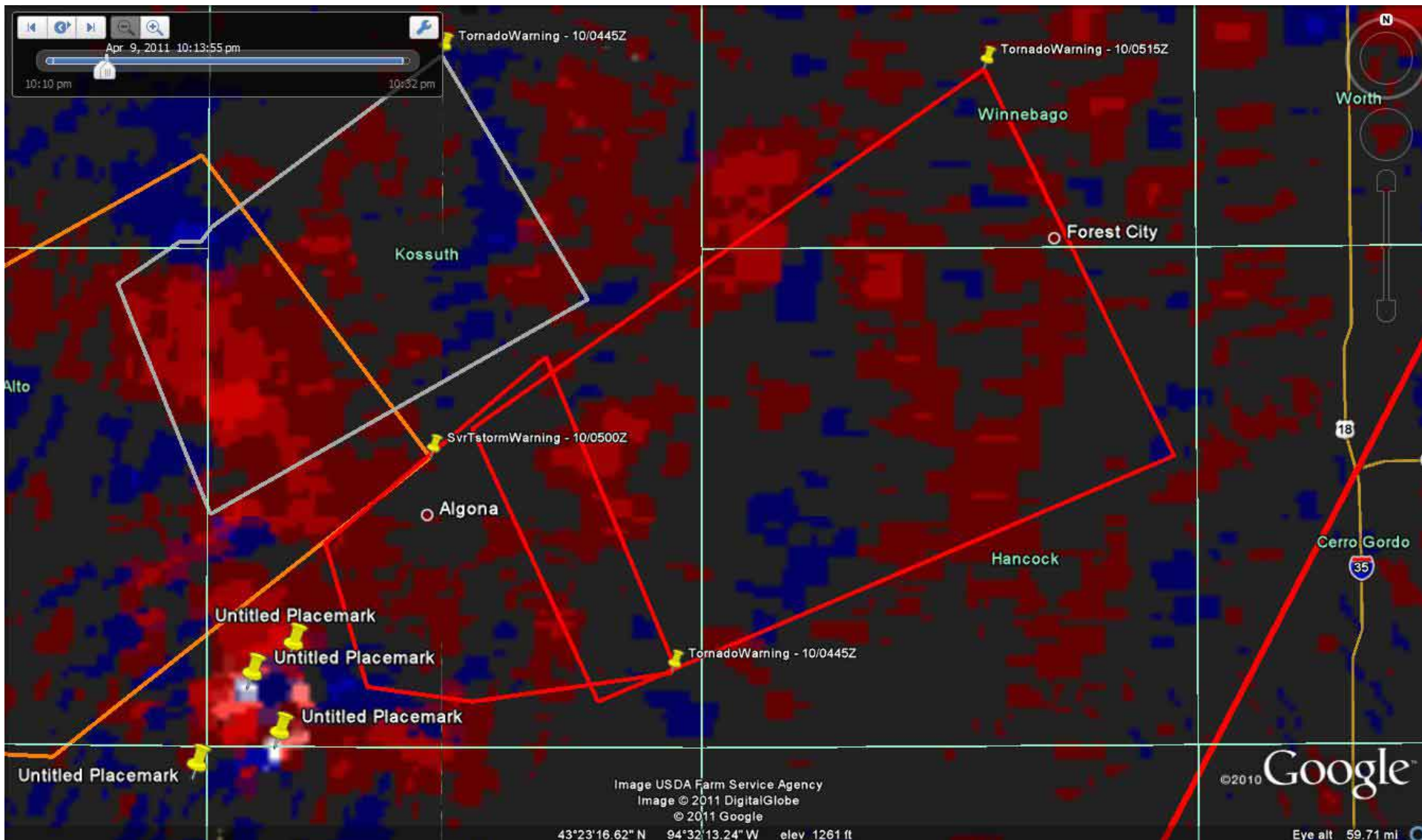




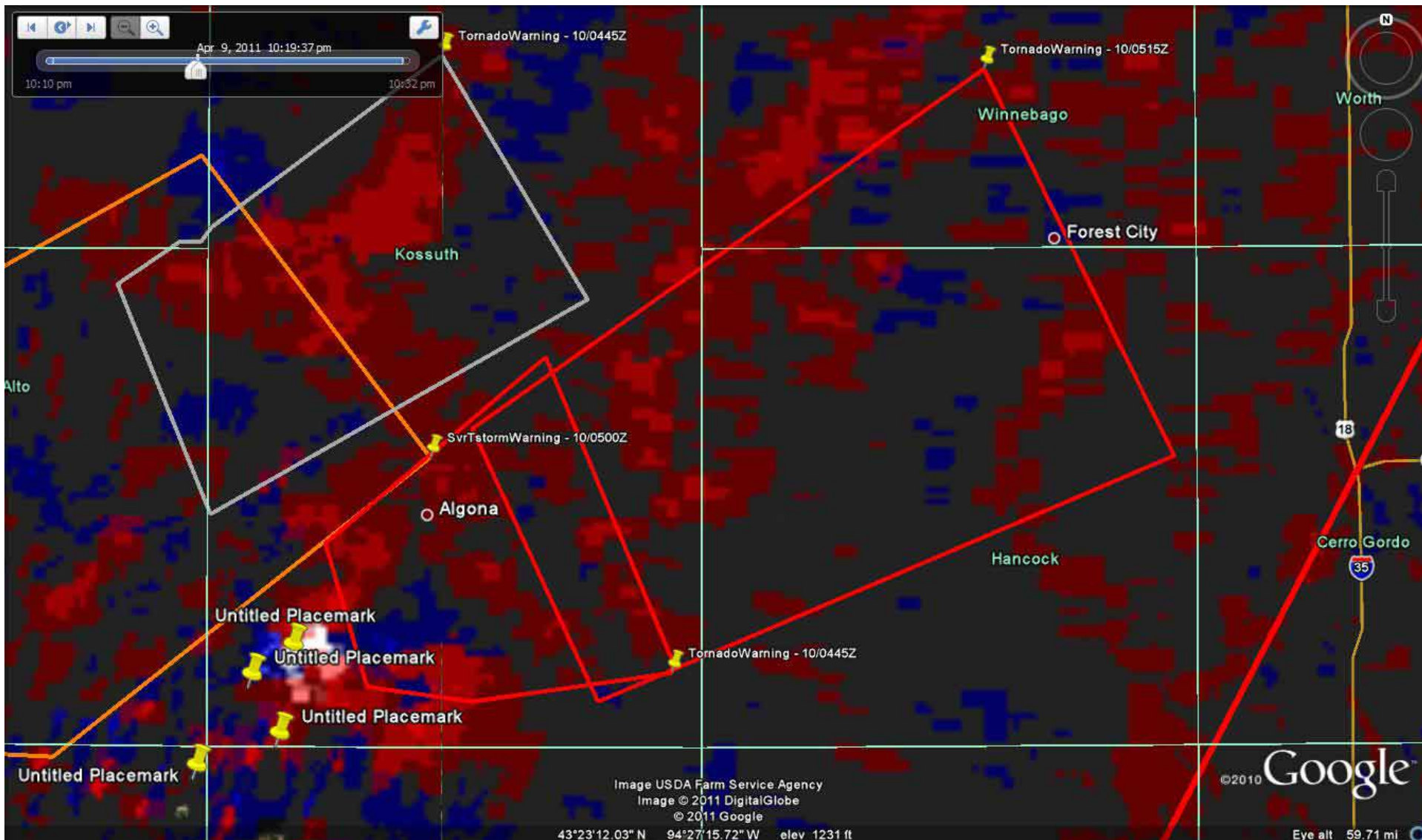
One More Example

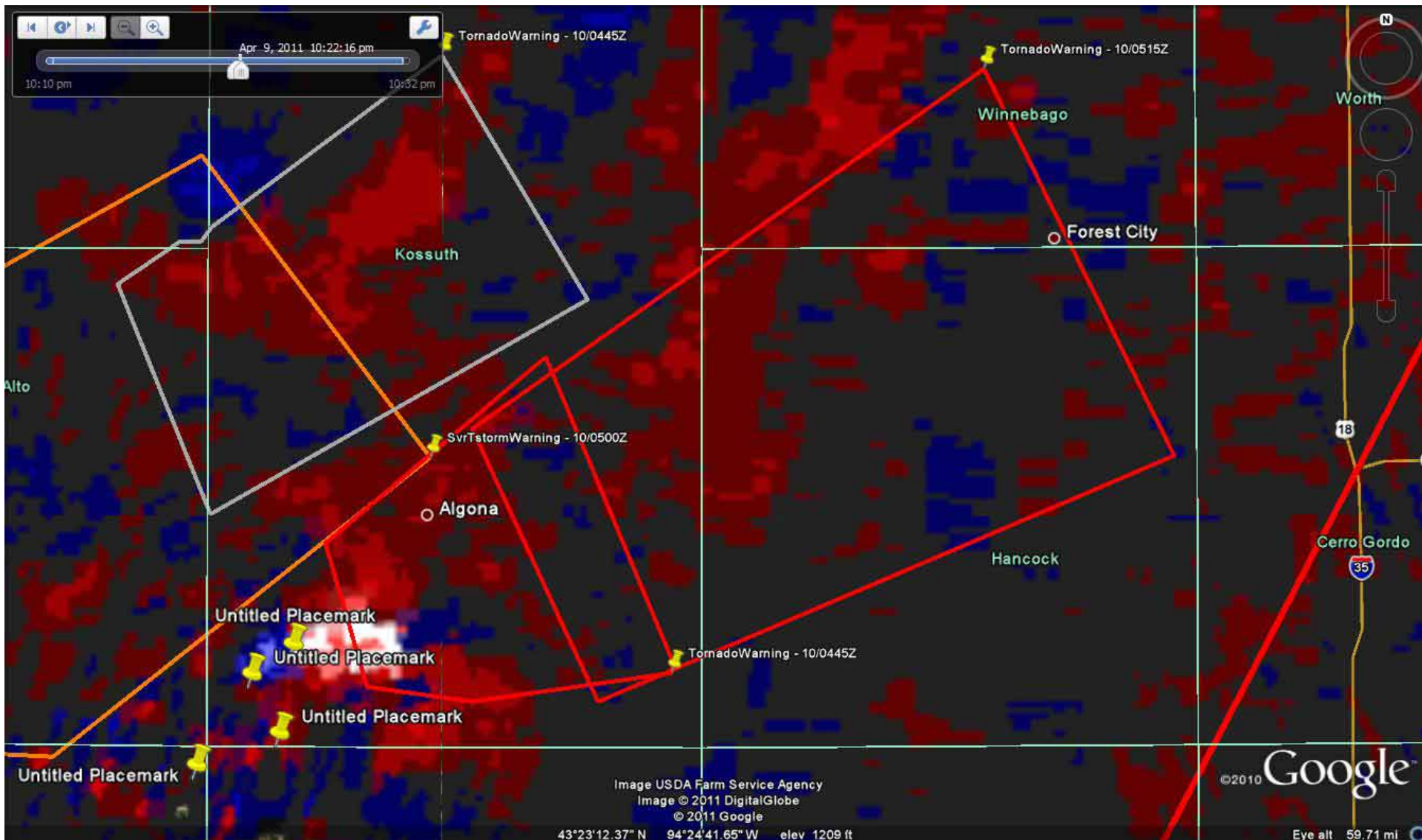


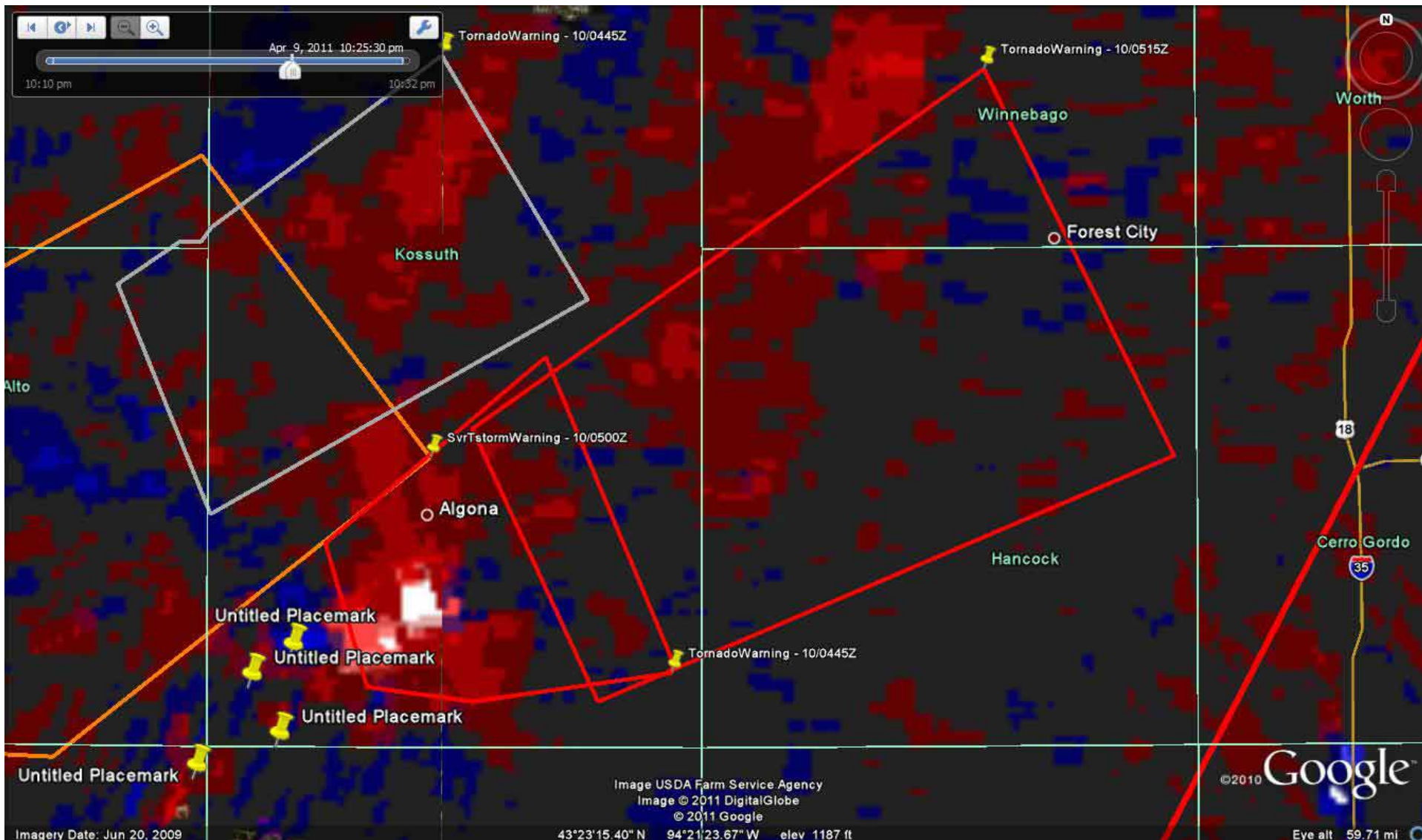


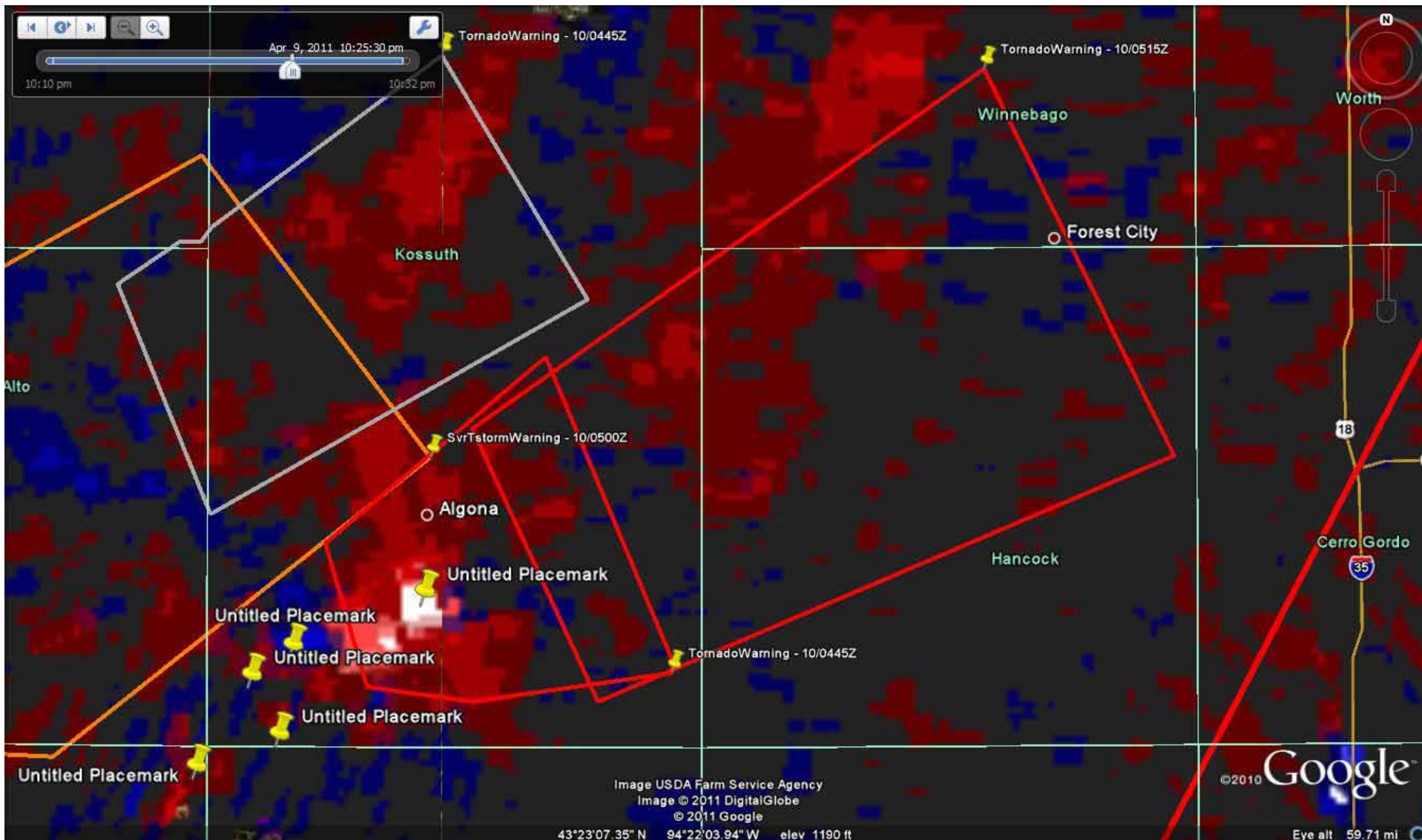


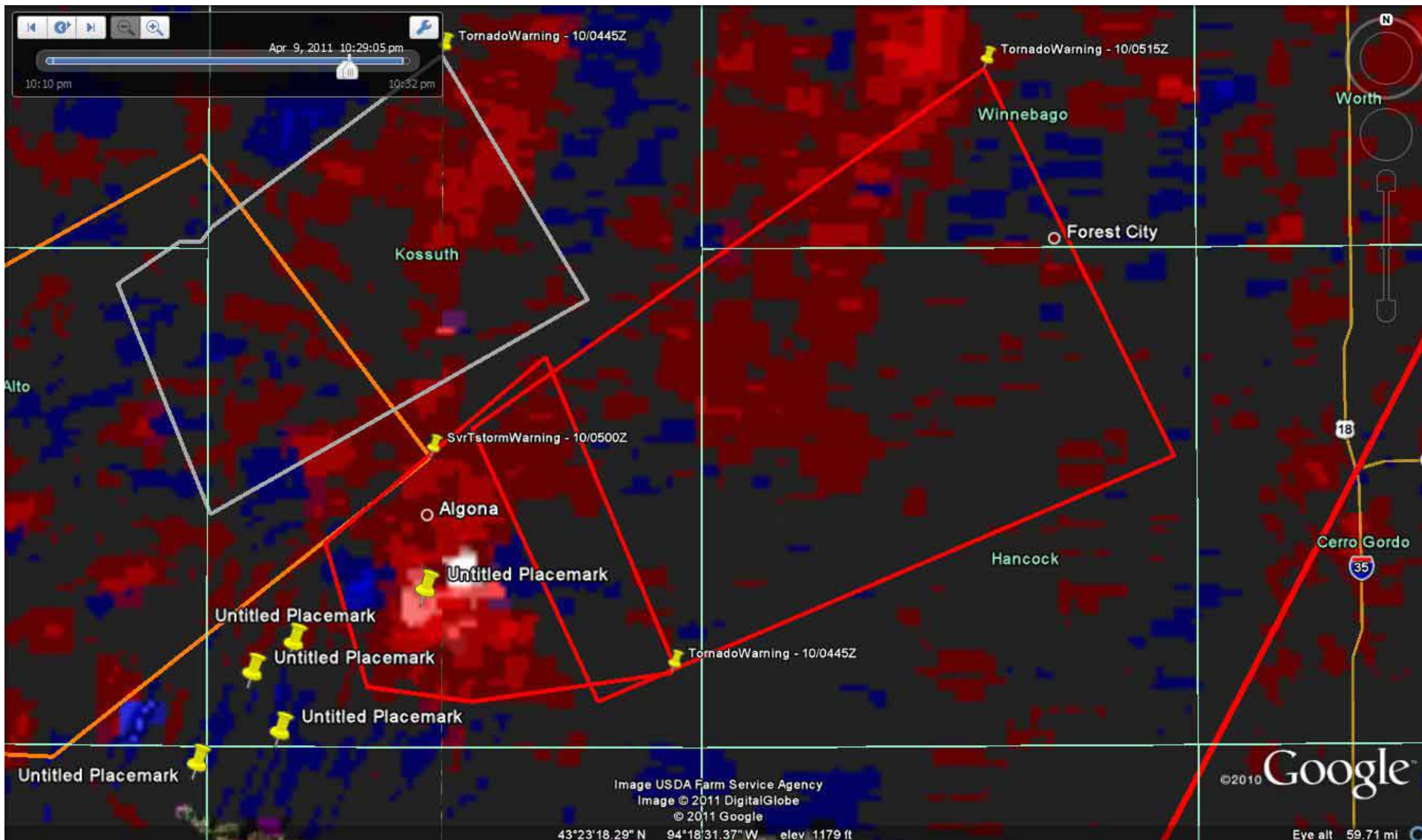


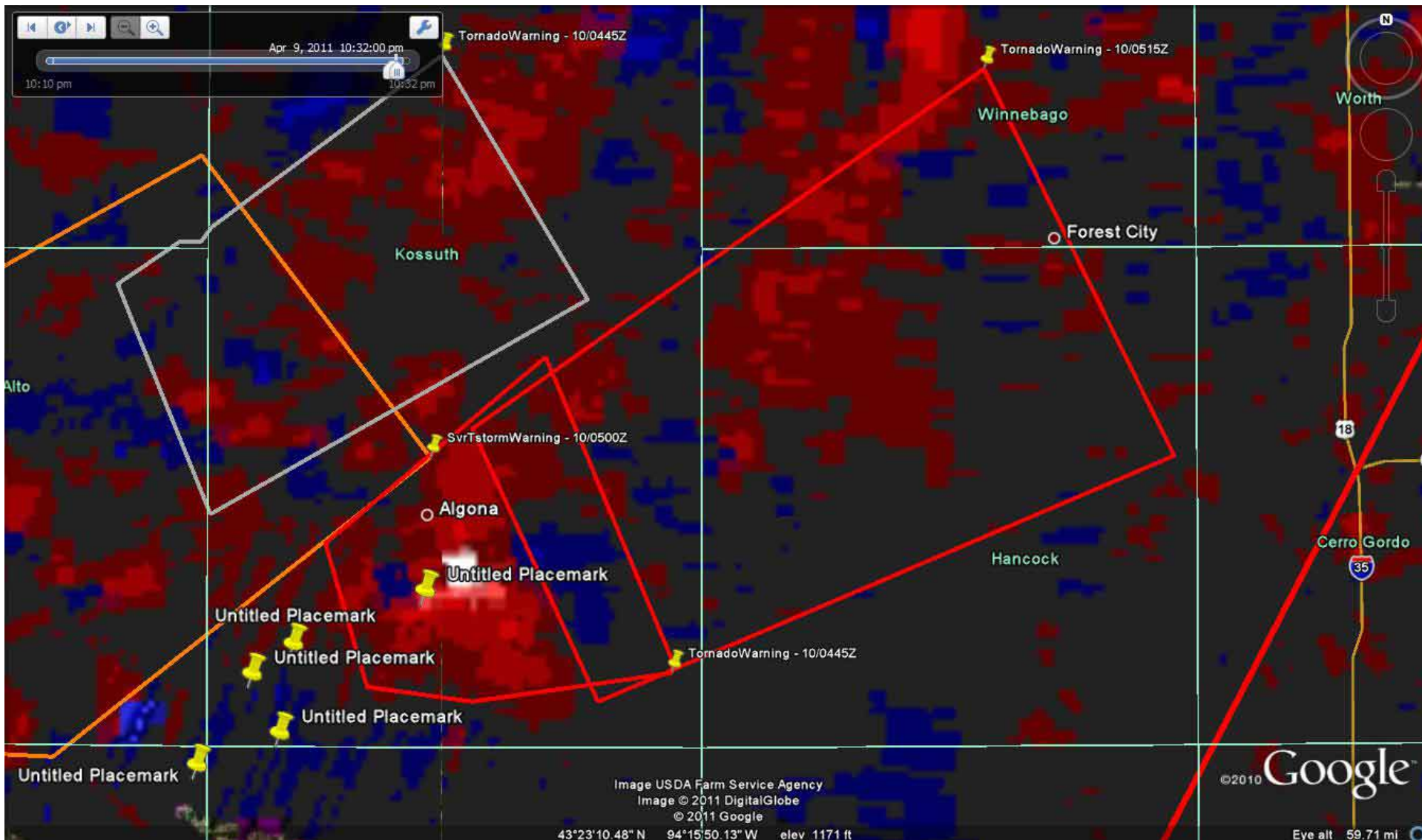


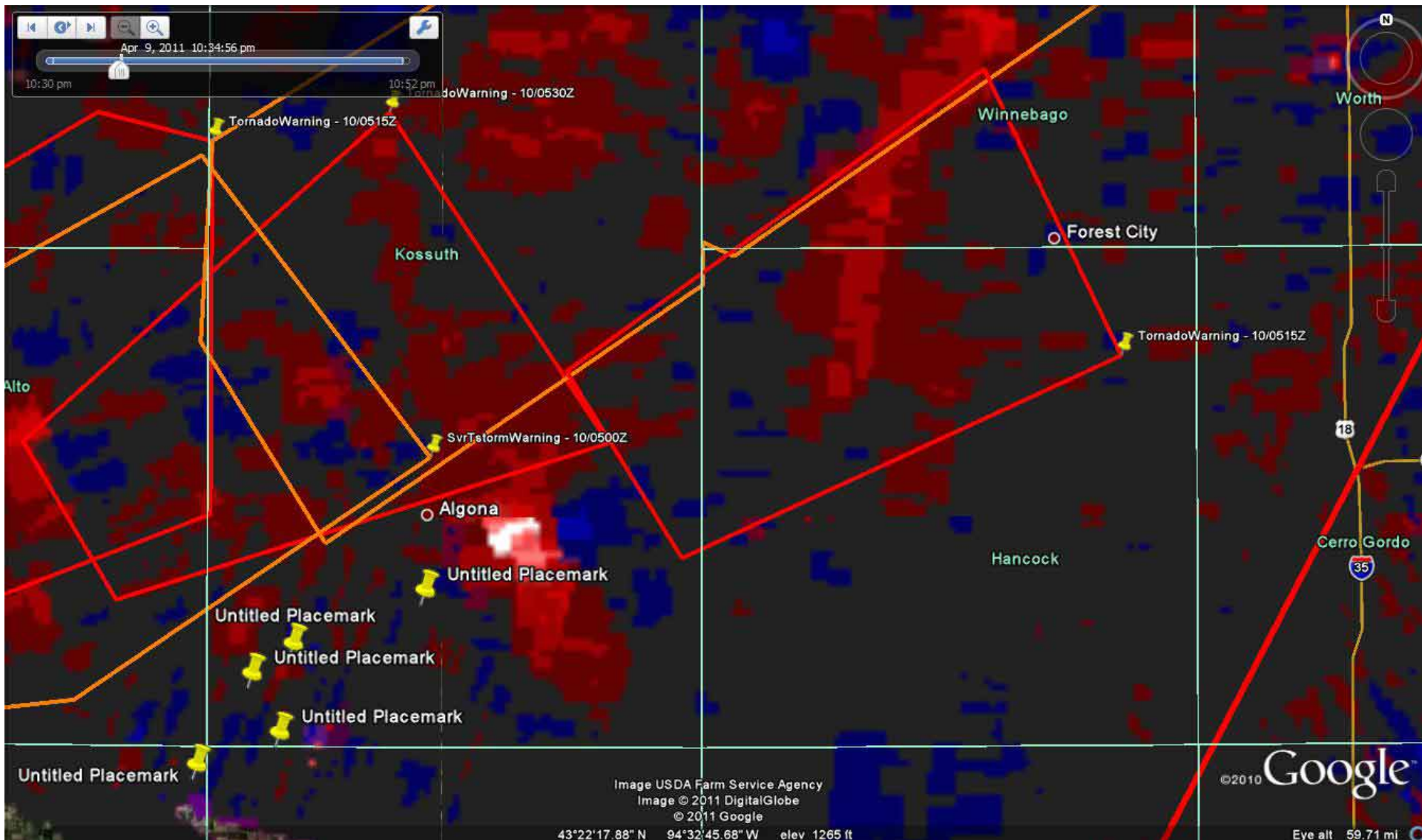


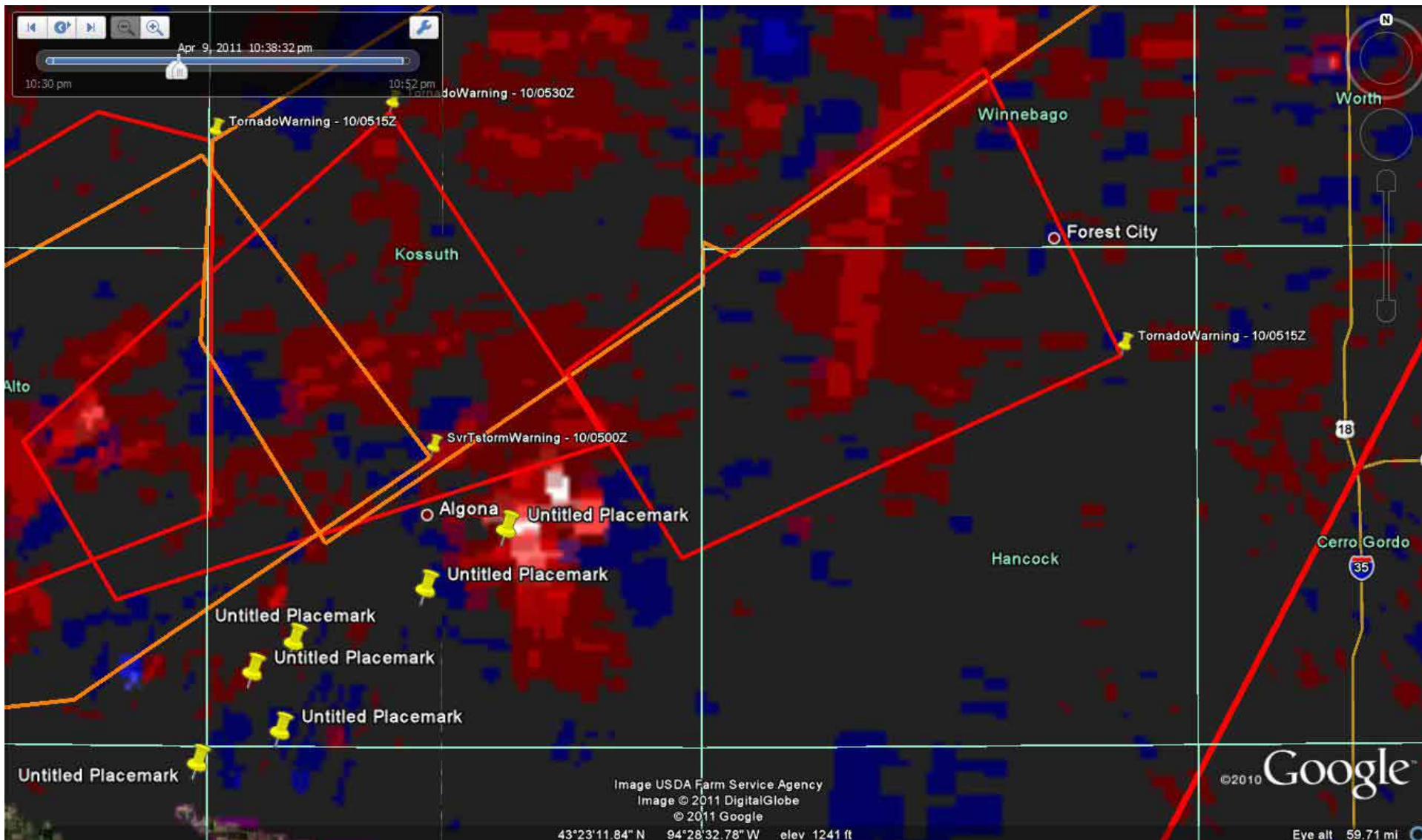


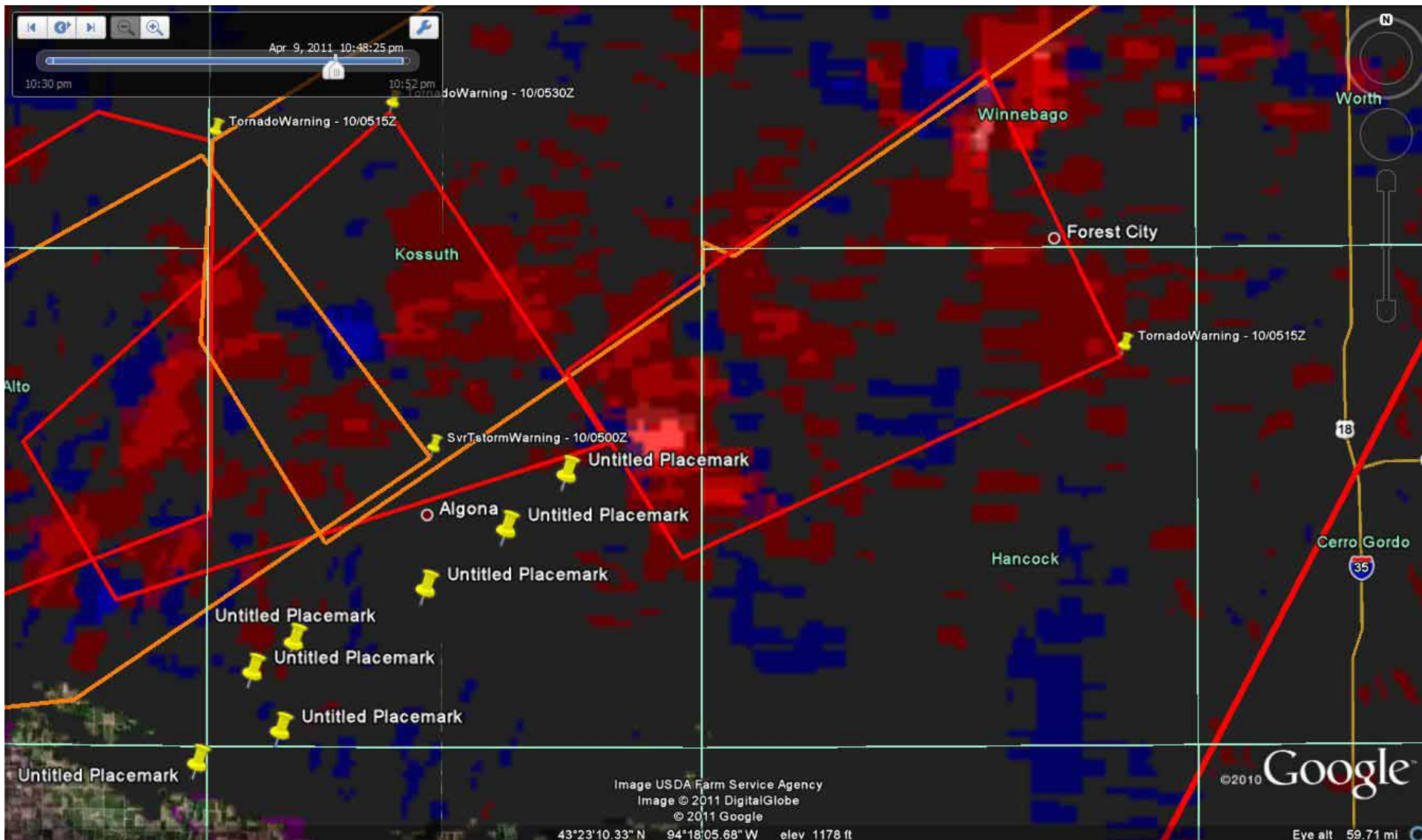


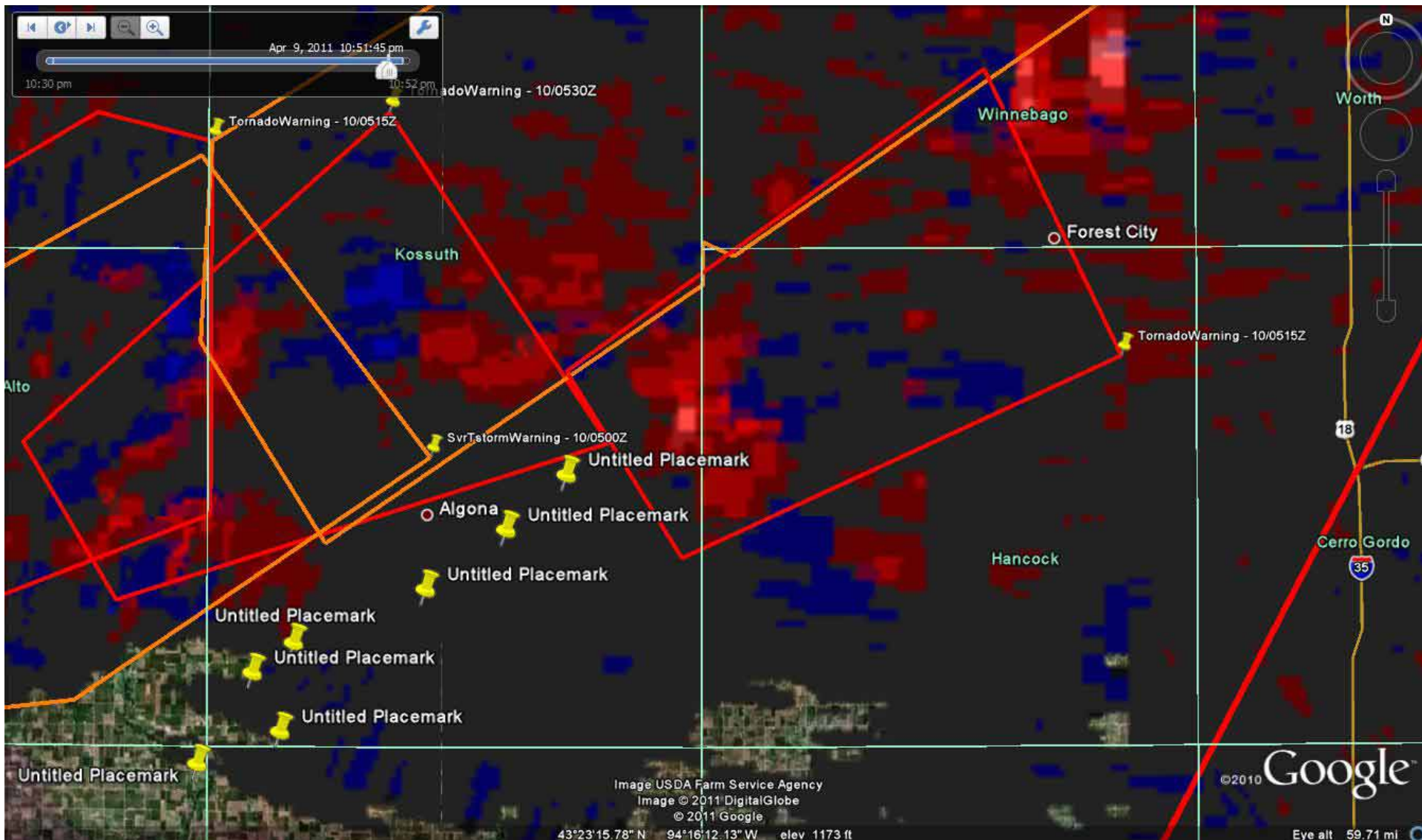


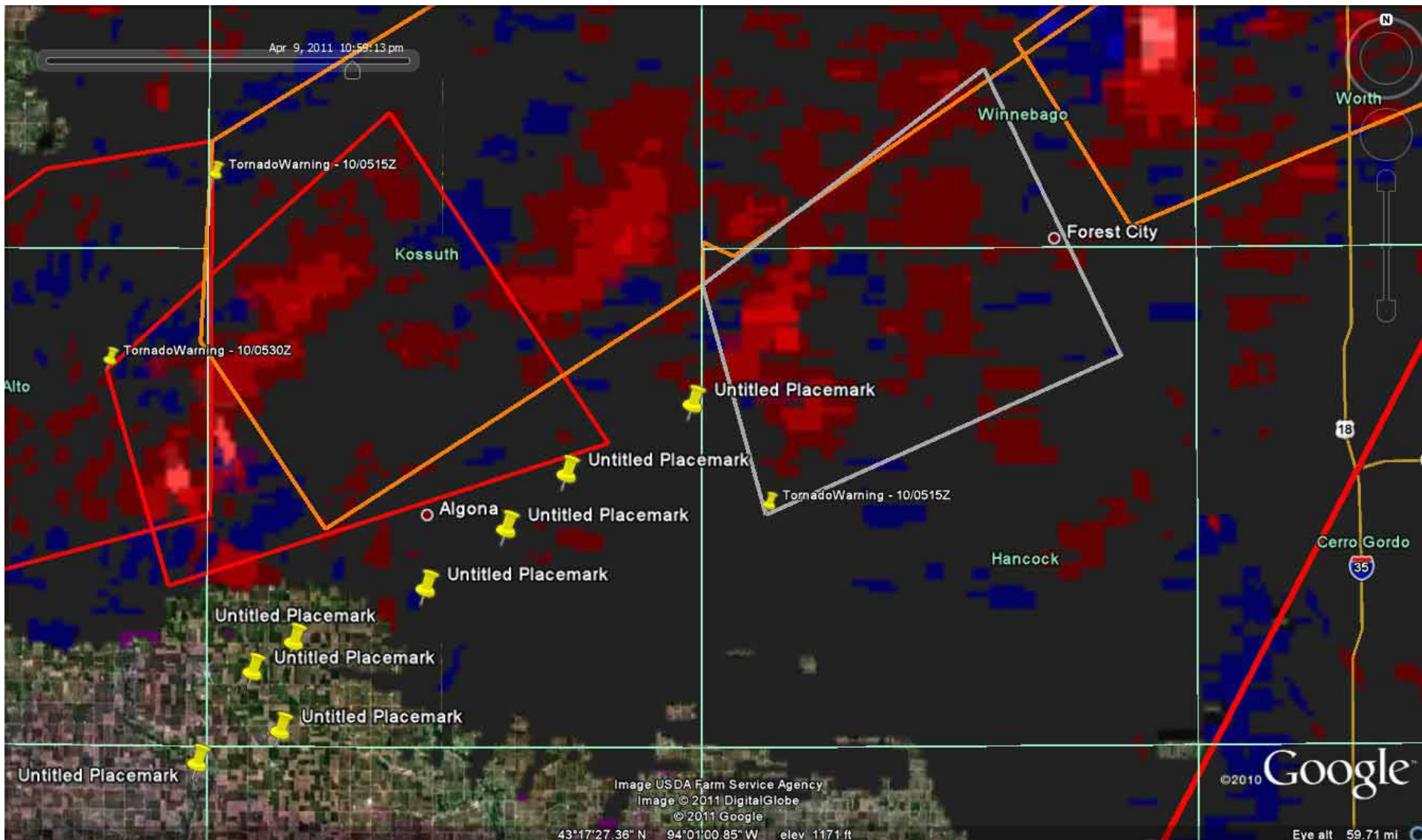








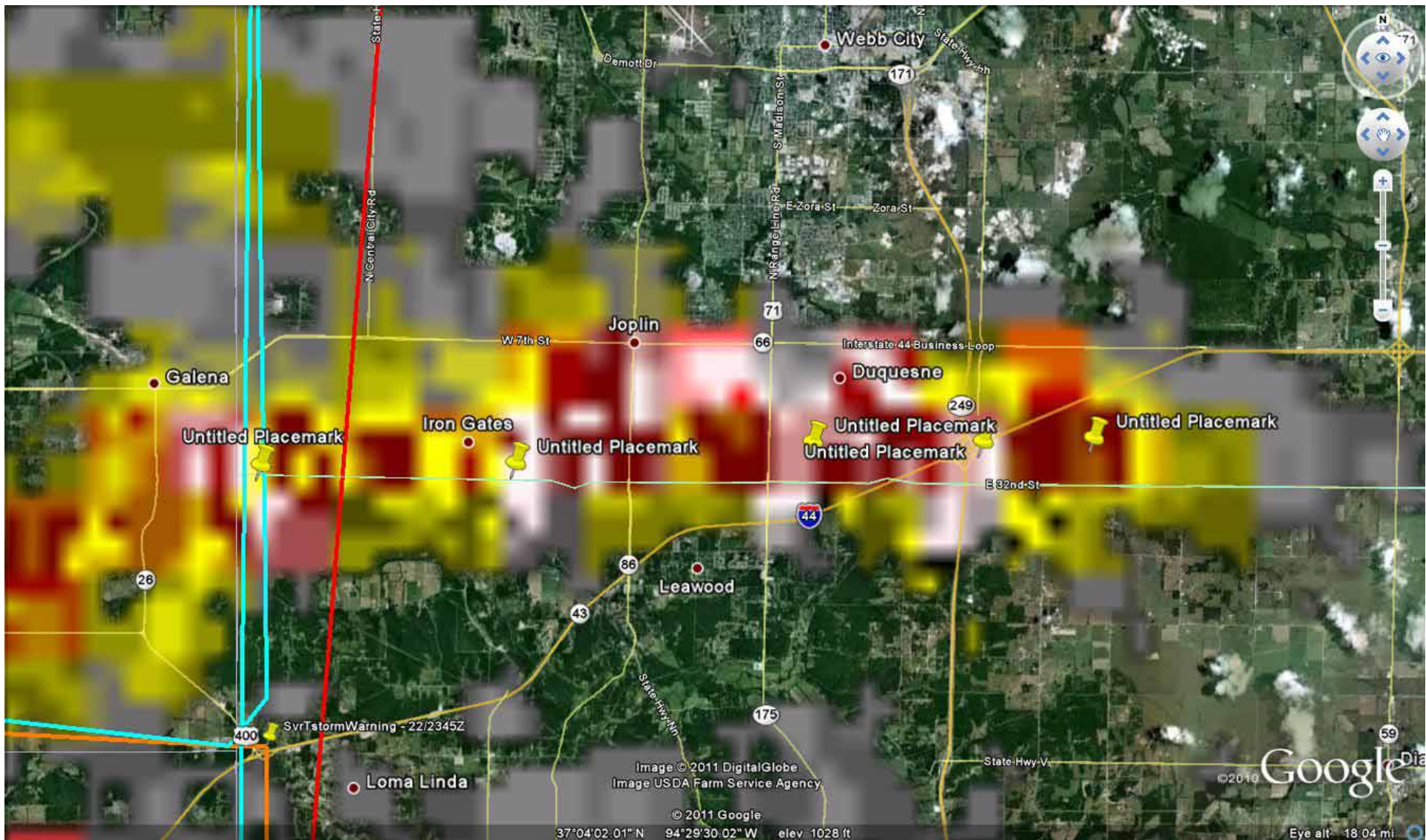


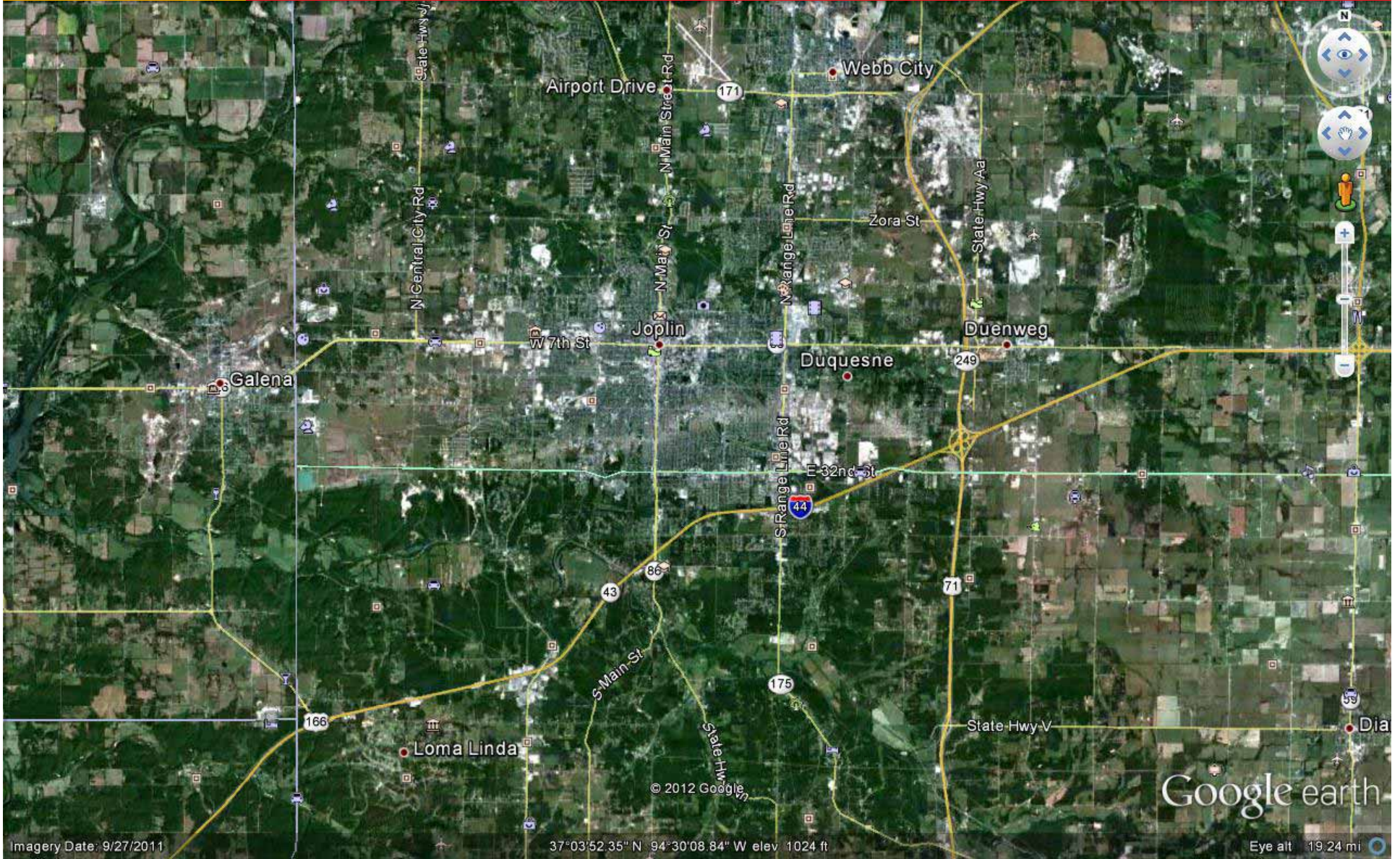


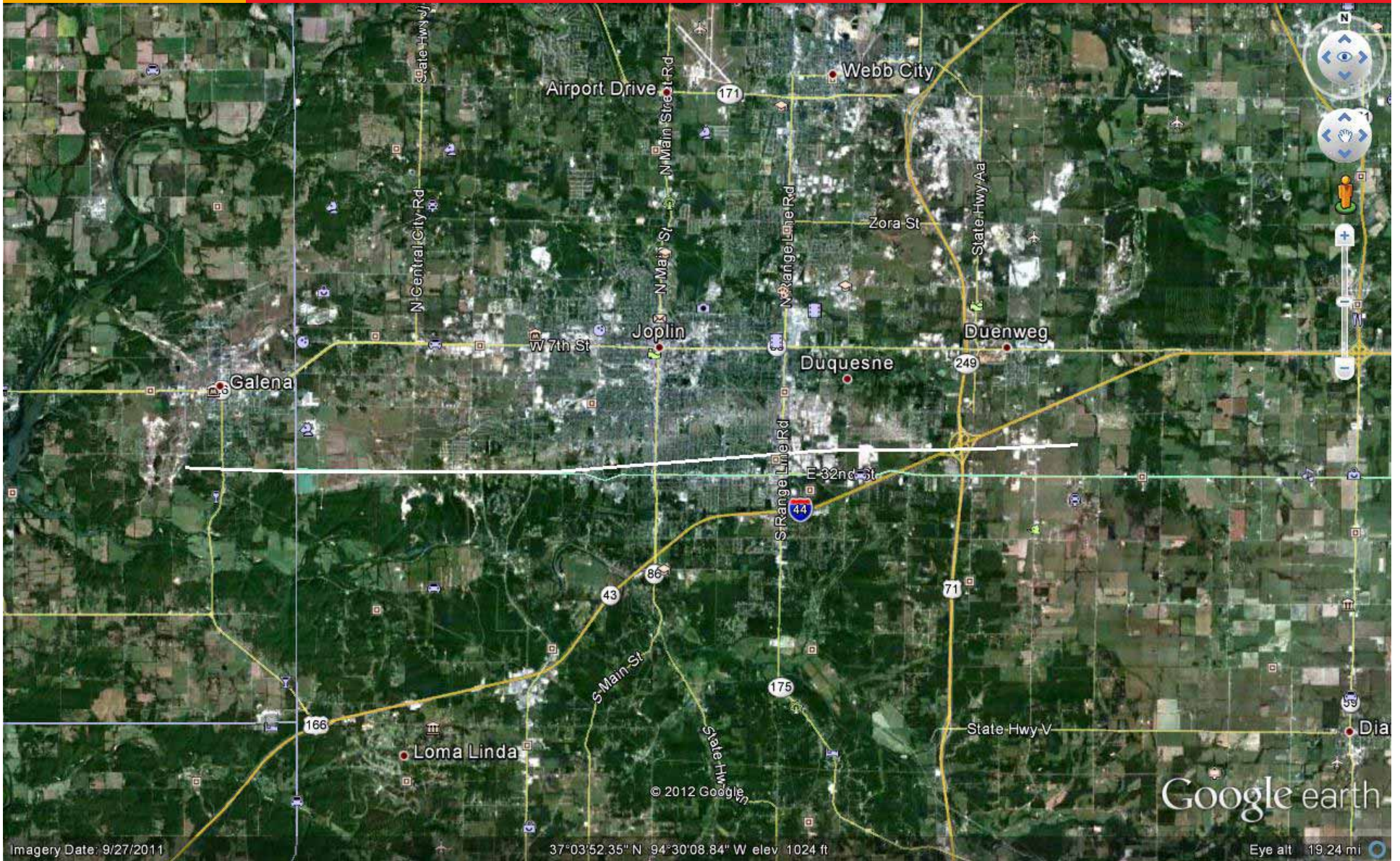


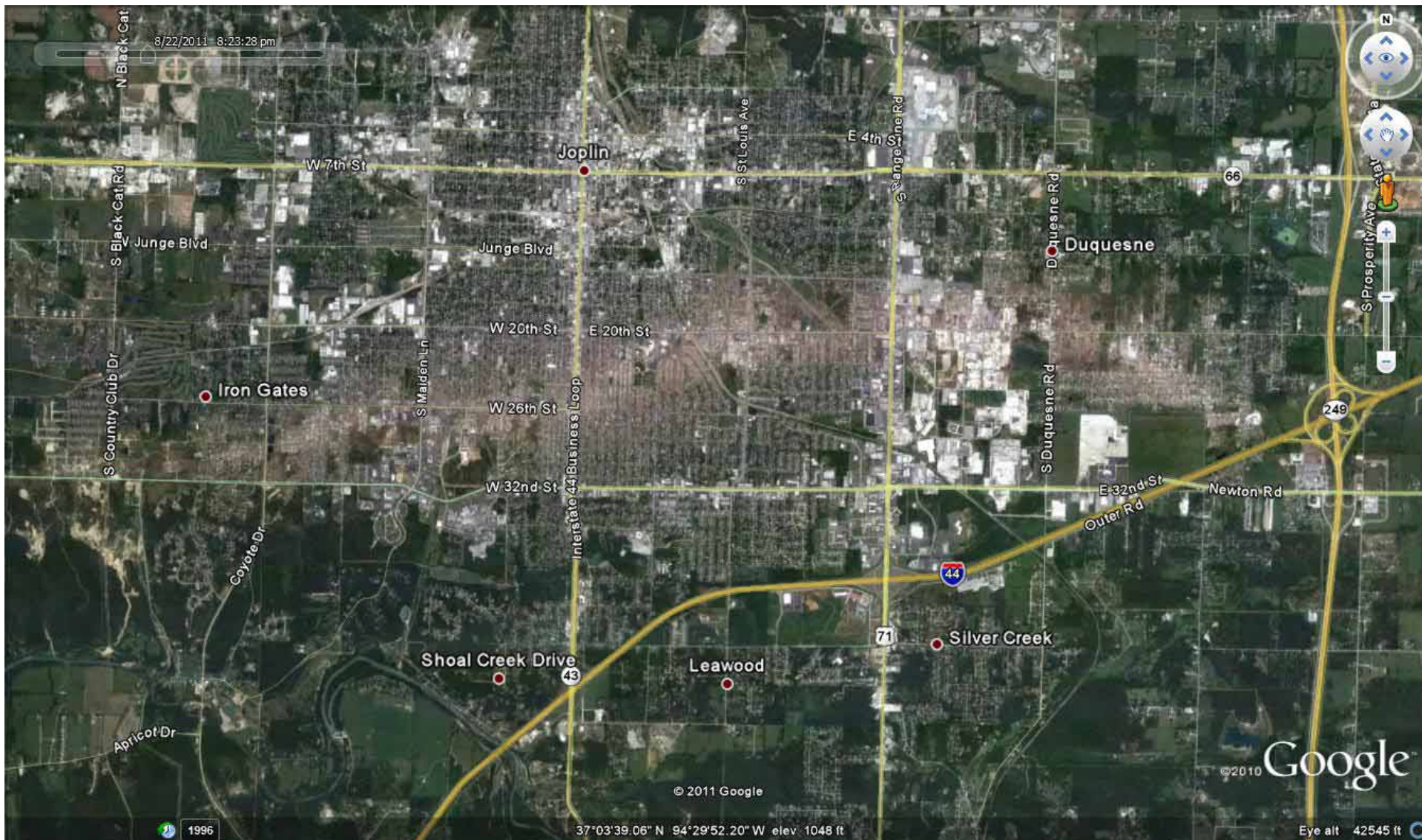
Tracking Tornadoes In Real Time...

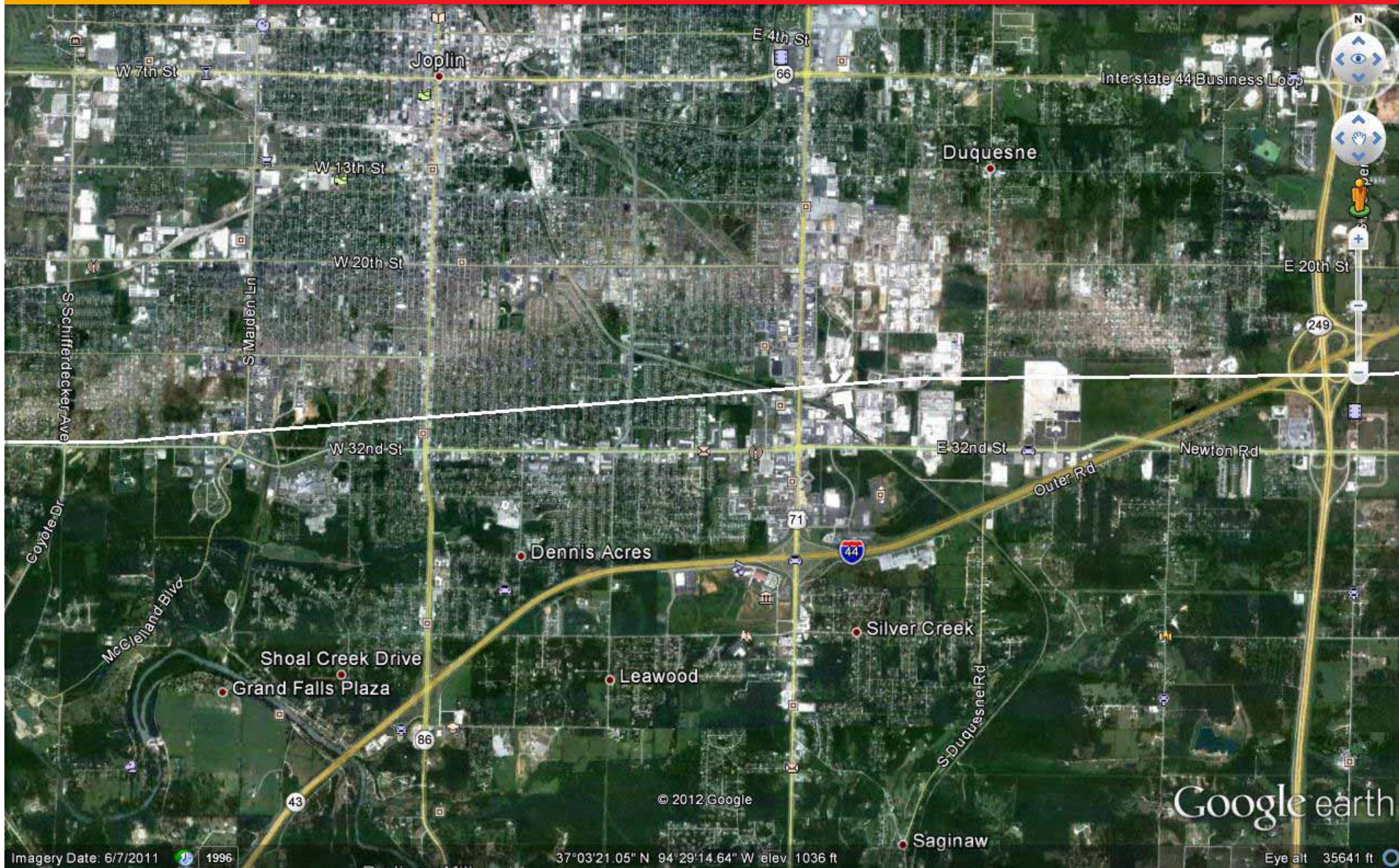
JOPLIN MO.





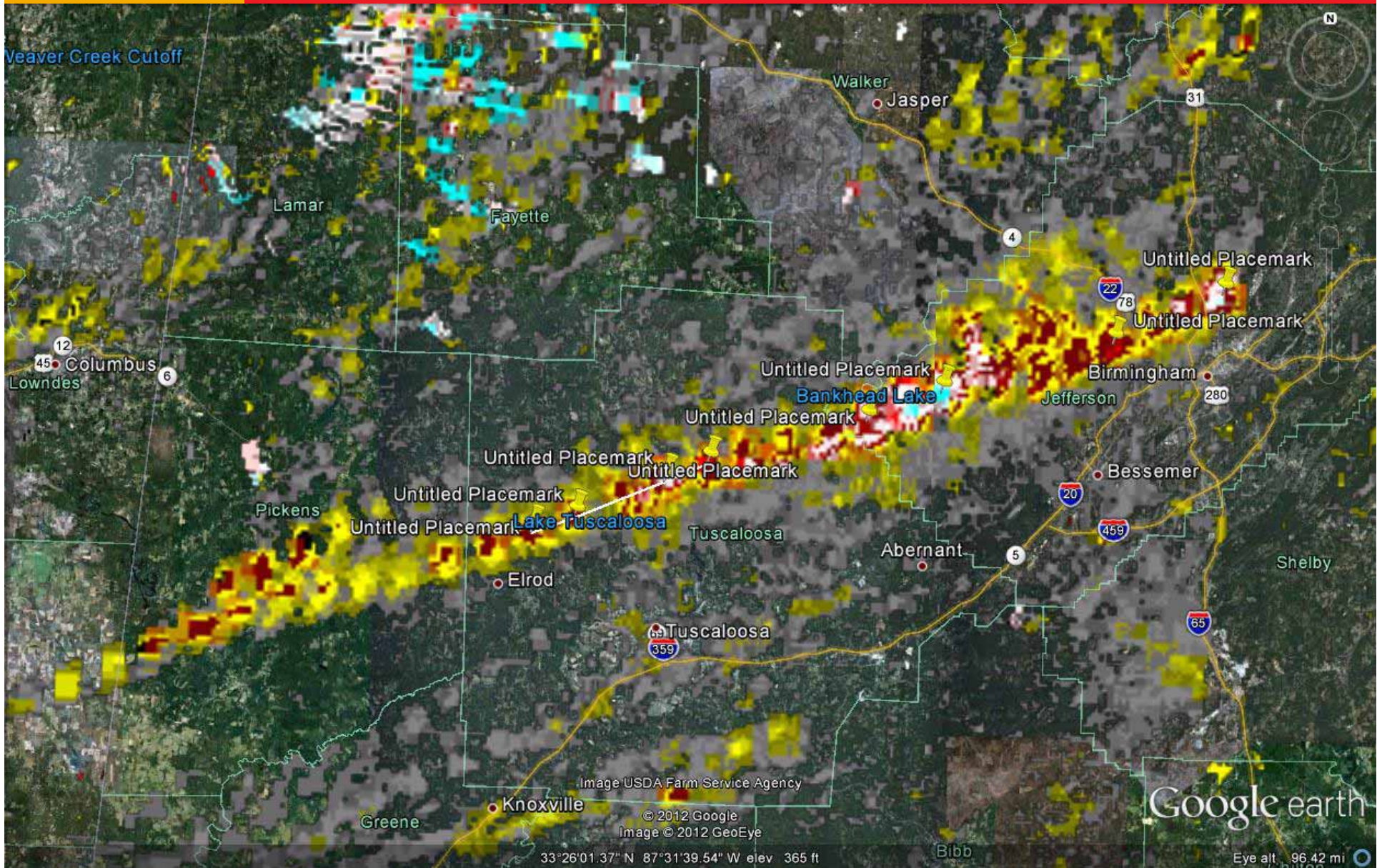


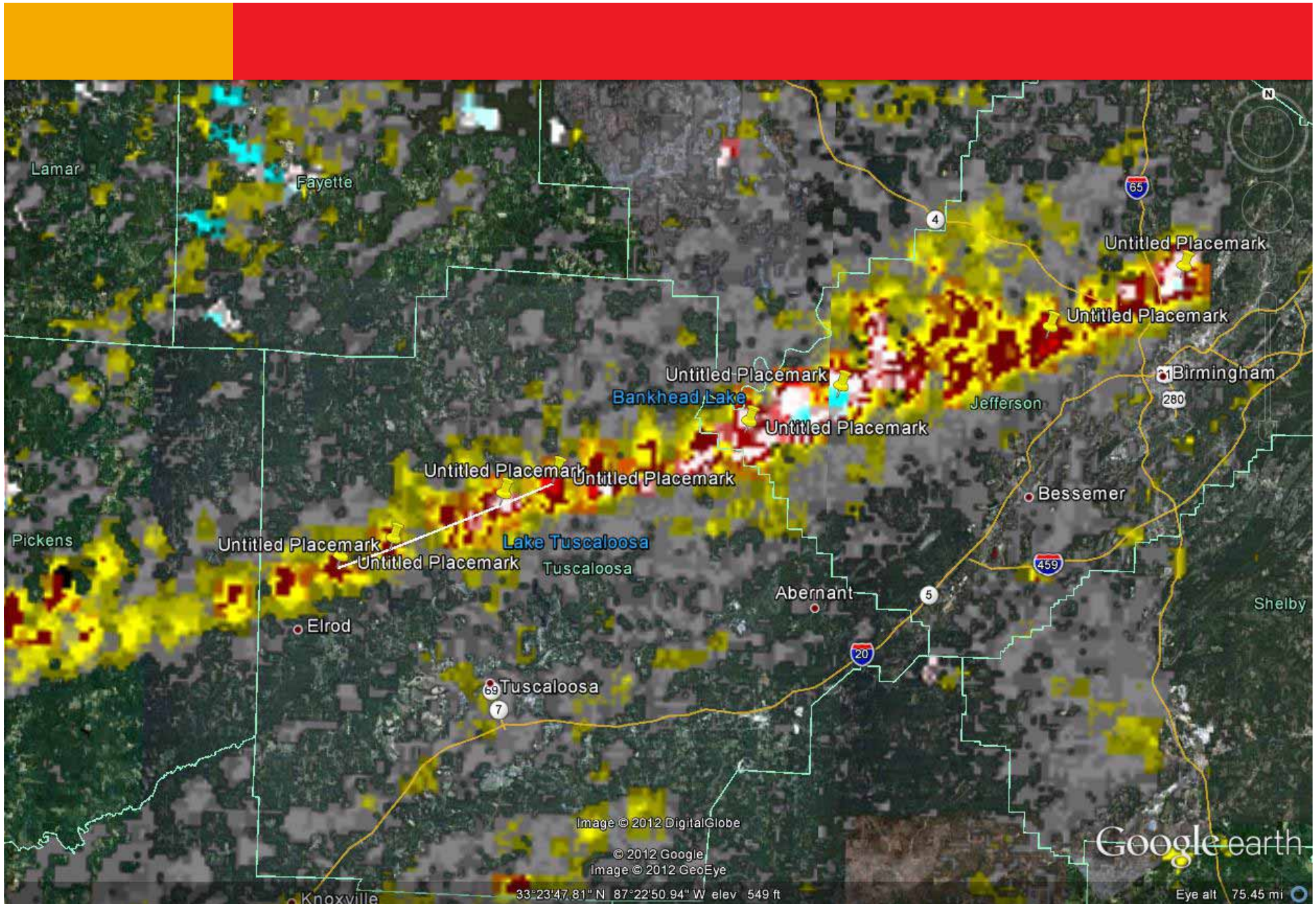






Birmingham Alabama



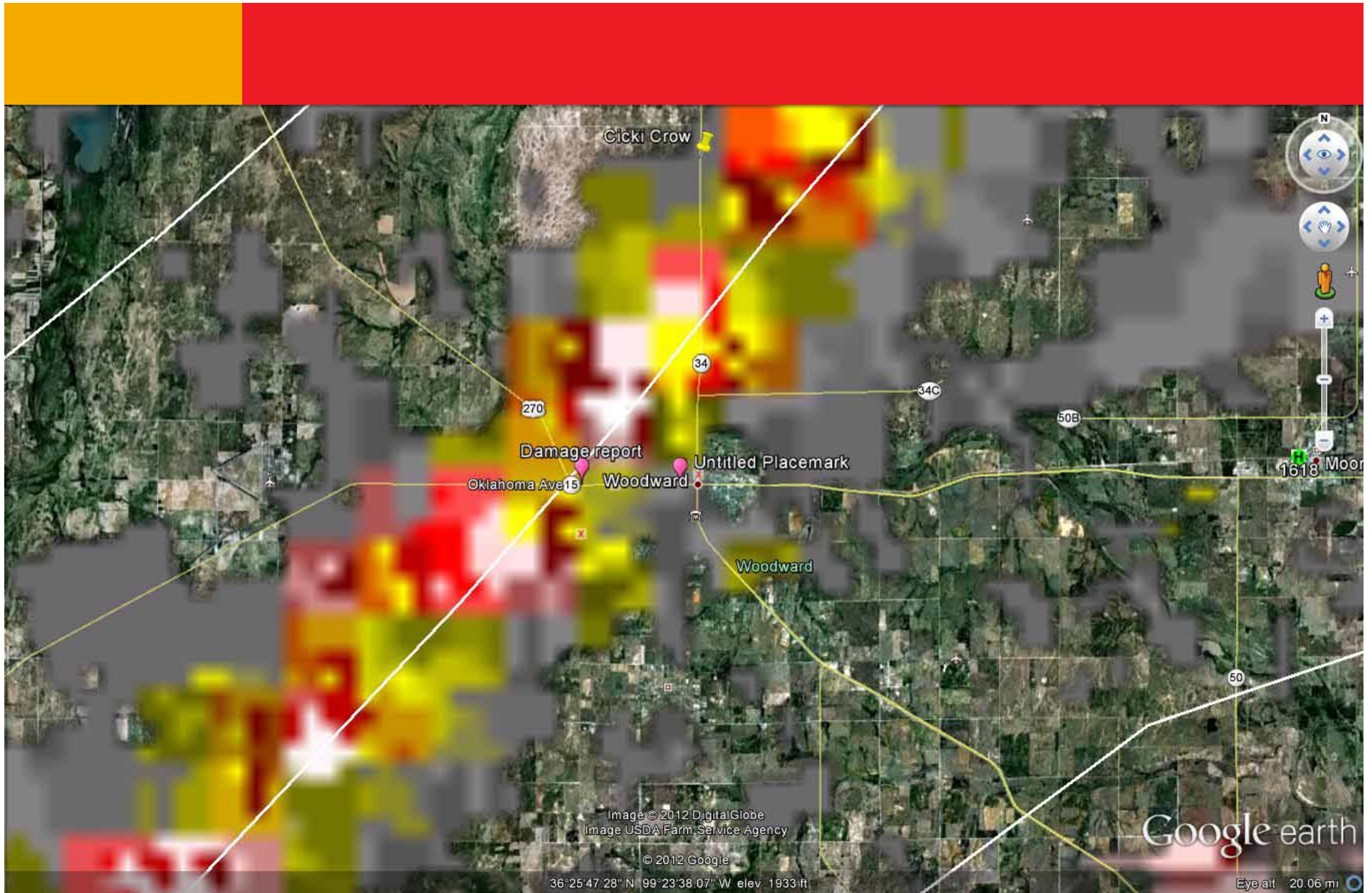


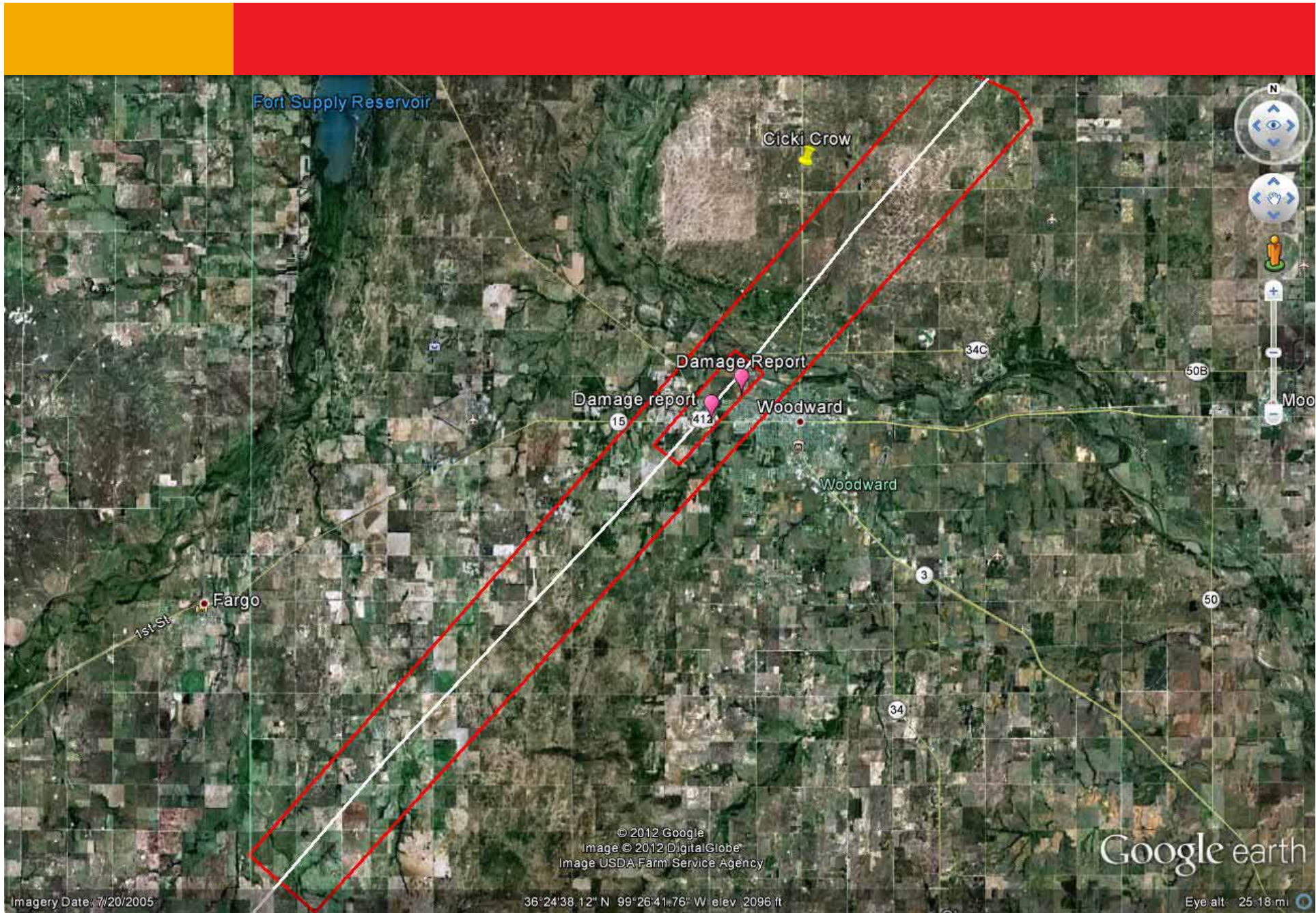


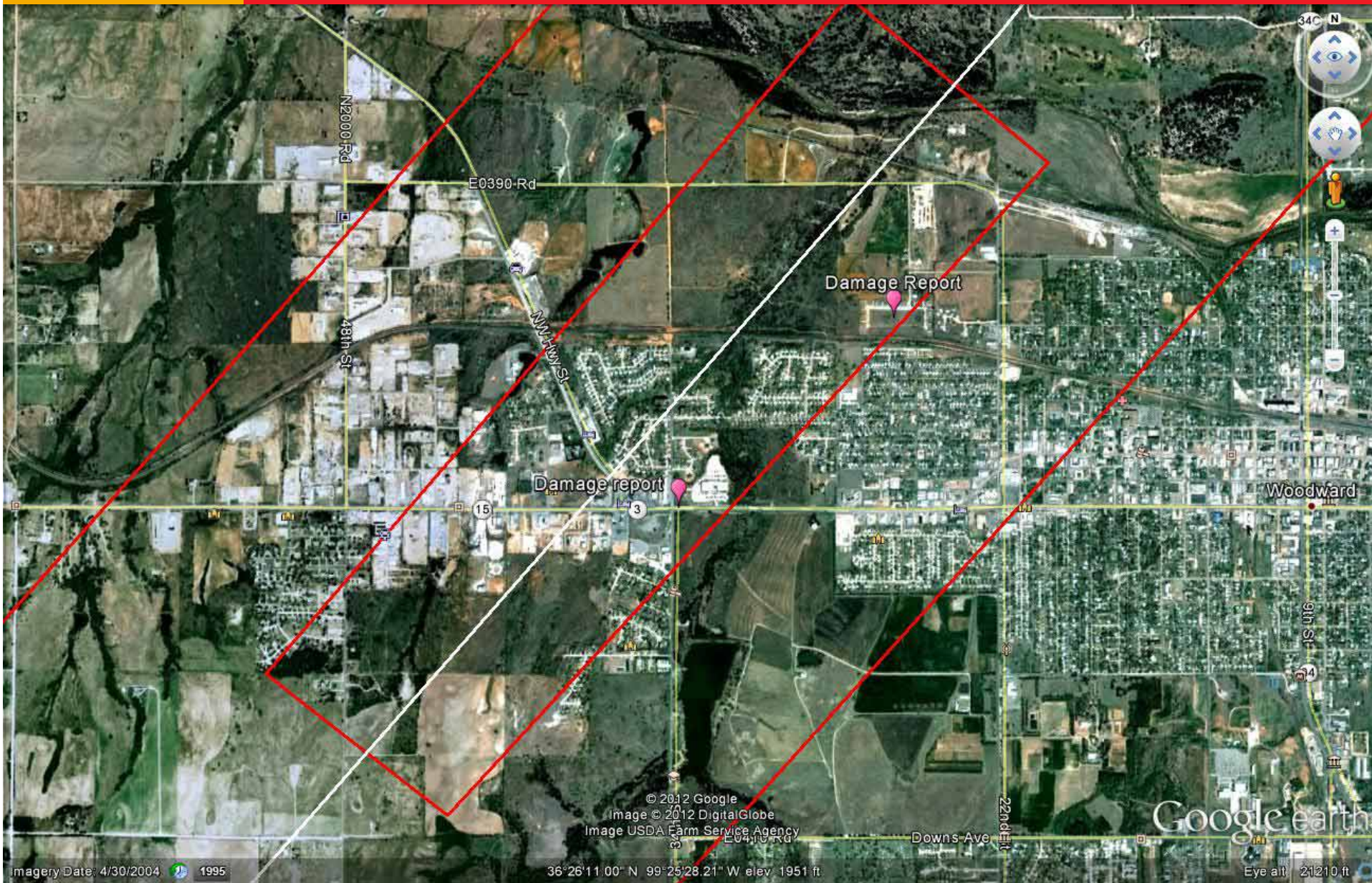
Tracking Tornadoes In Real Time...

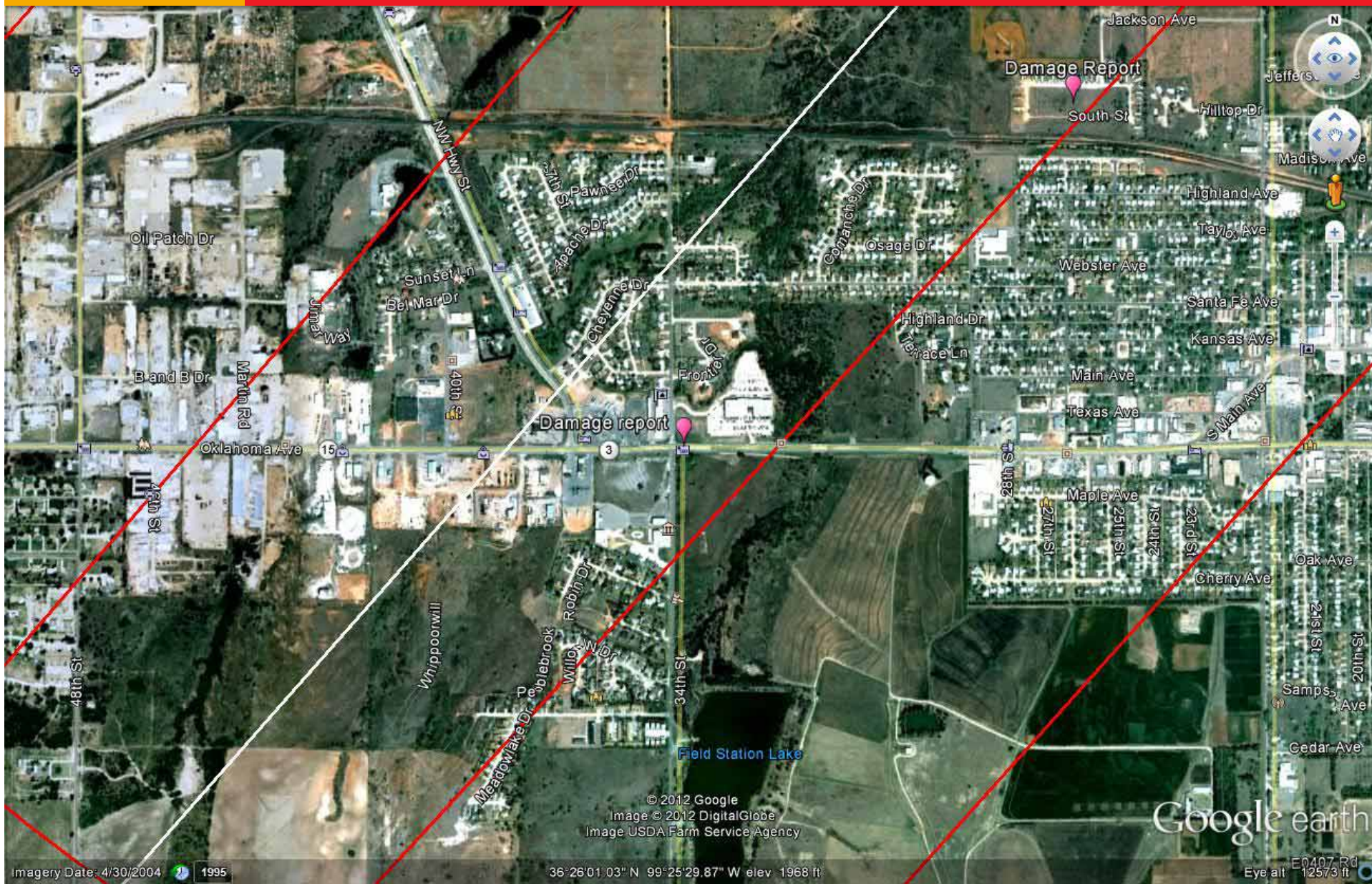
Woodward, OK.

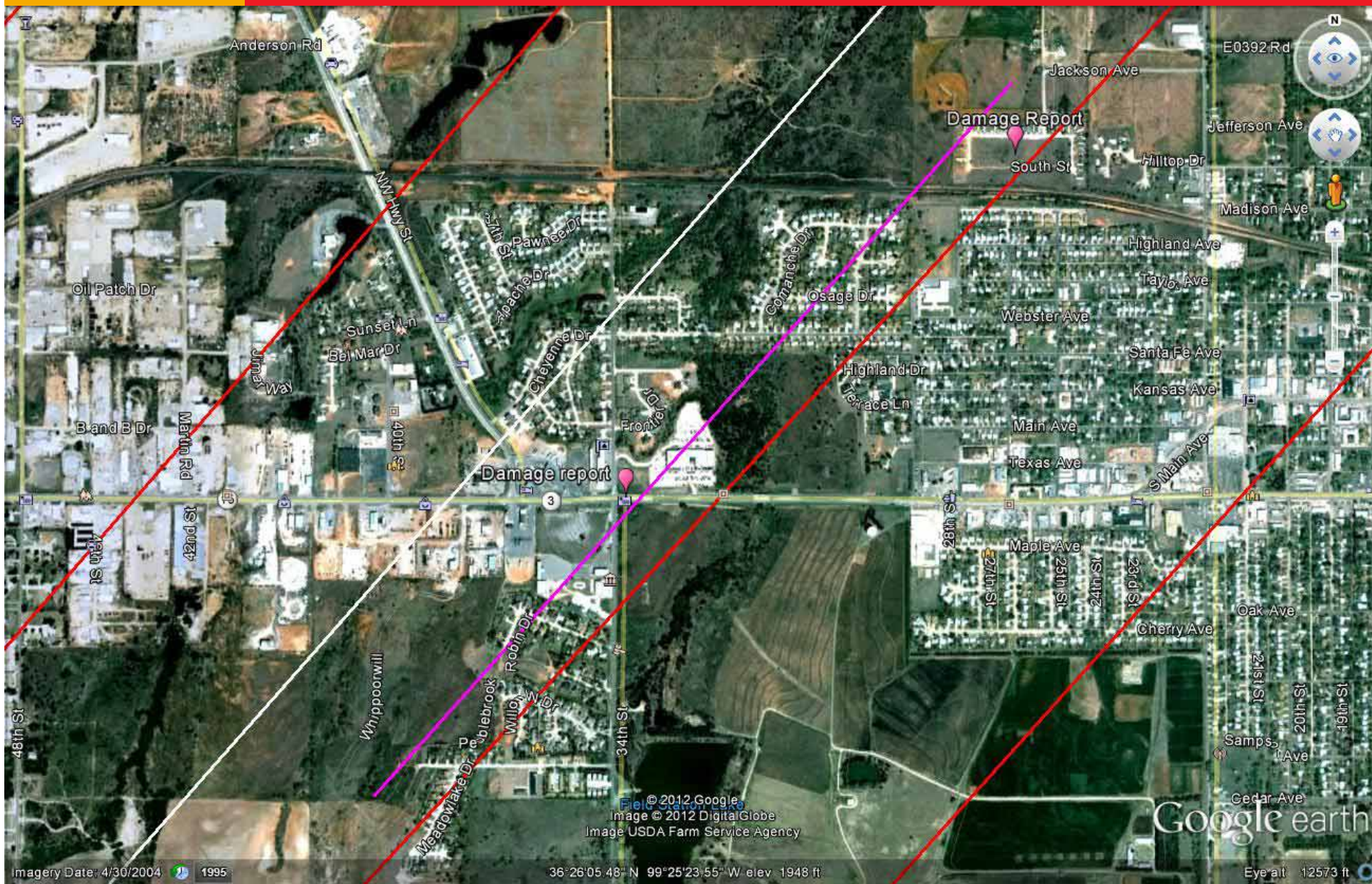
The PDA Process











Imagery Date: 4/30/2004 1995

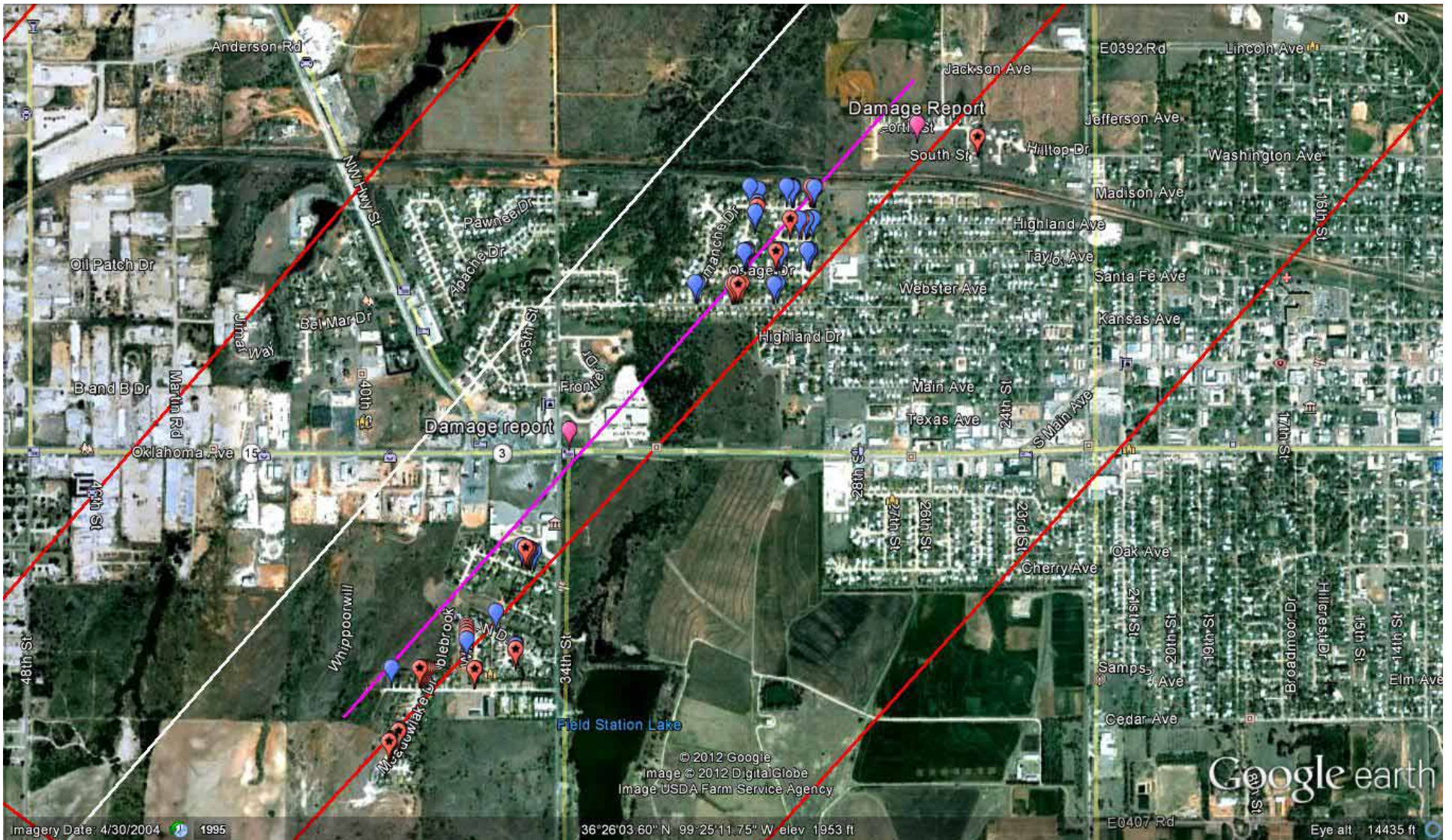
36°26'05.48" N 99°25'23.55" W elev. 1948 ft

© 2012 Google
Image © 2012 DigitalGlobe
Image USDA Farm Service Agency

Google earth

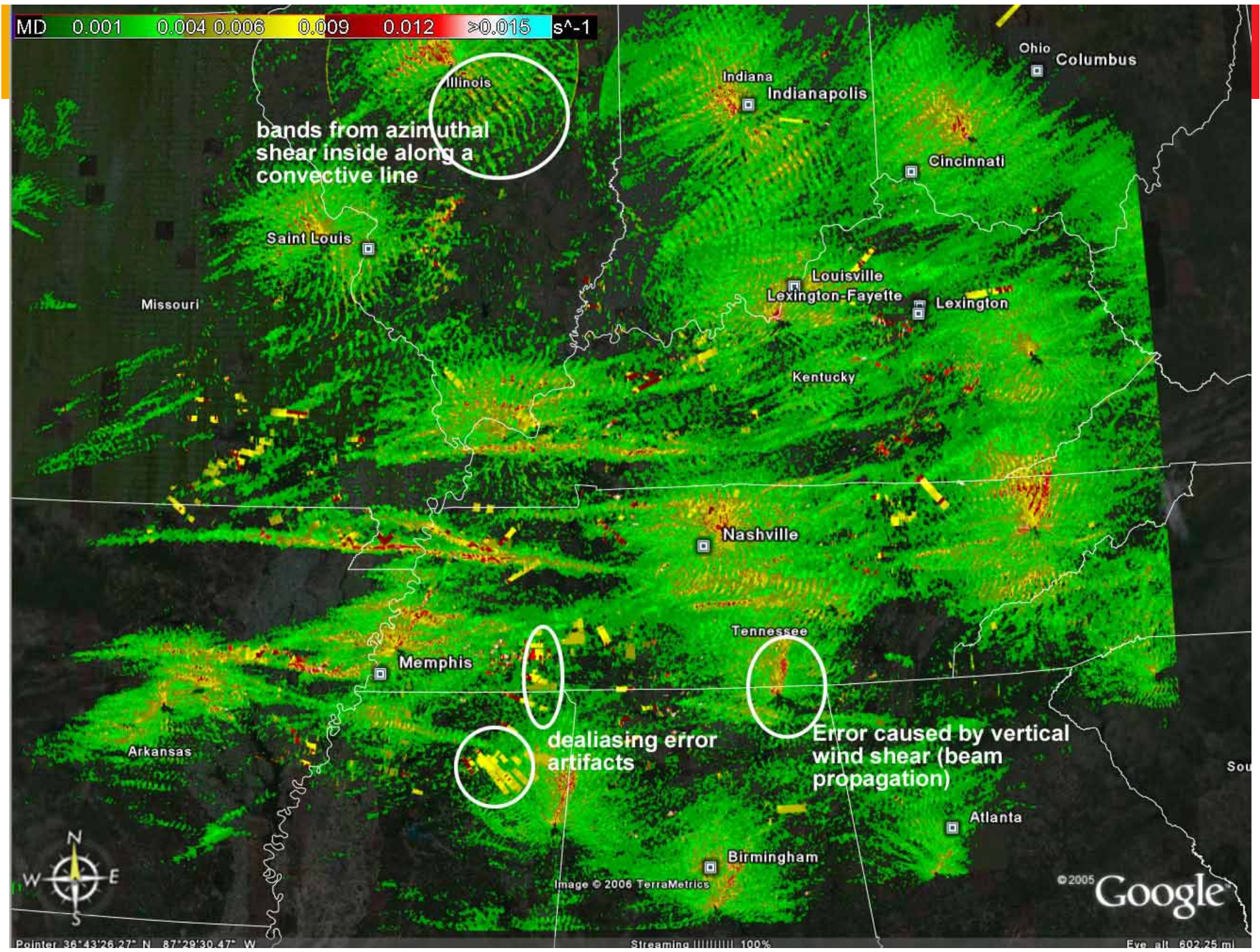
Eye alt: 12573 ft





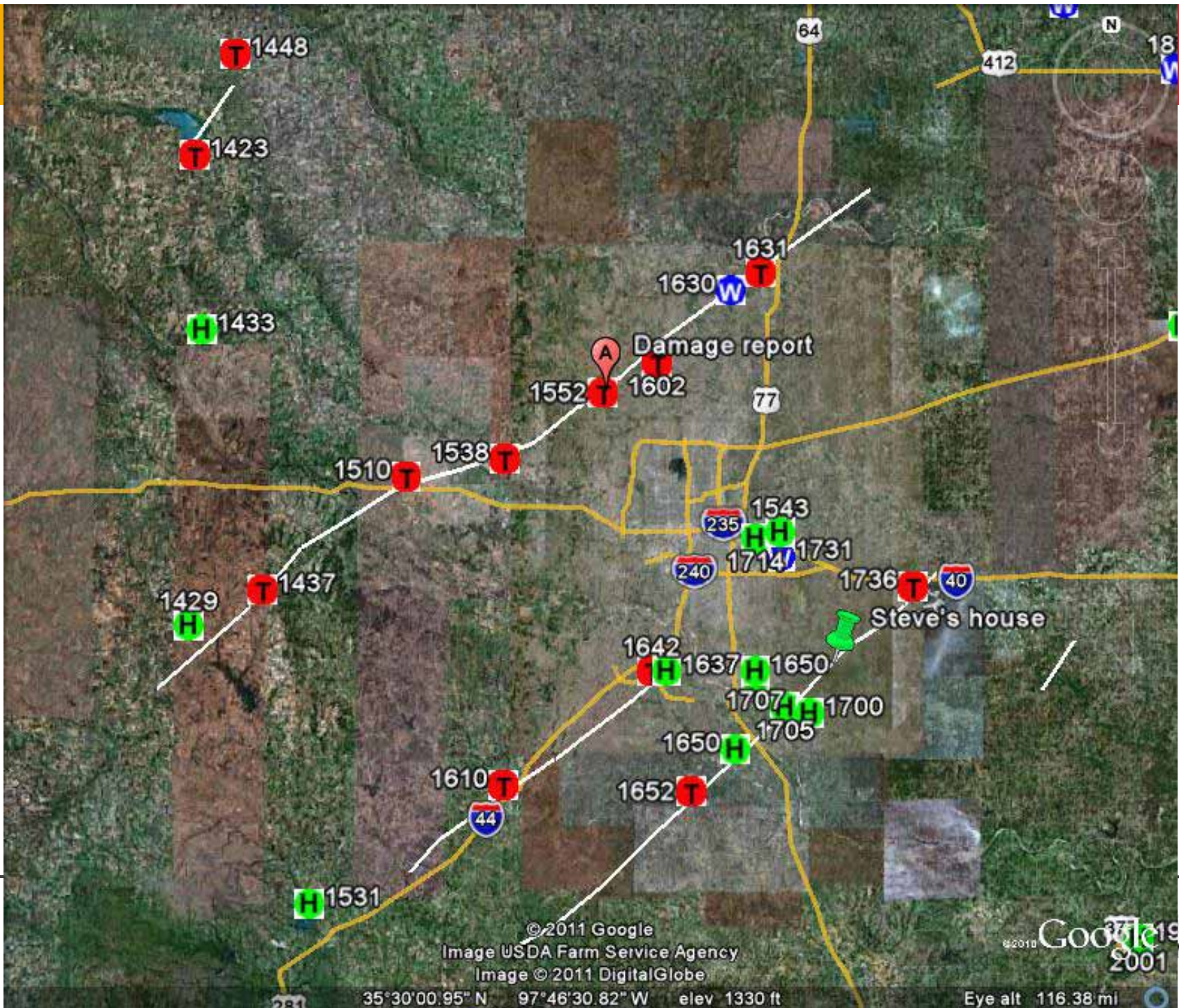


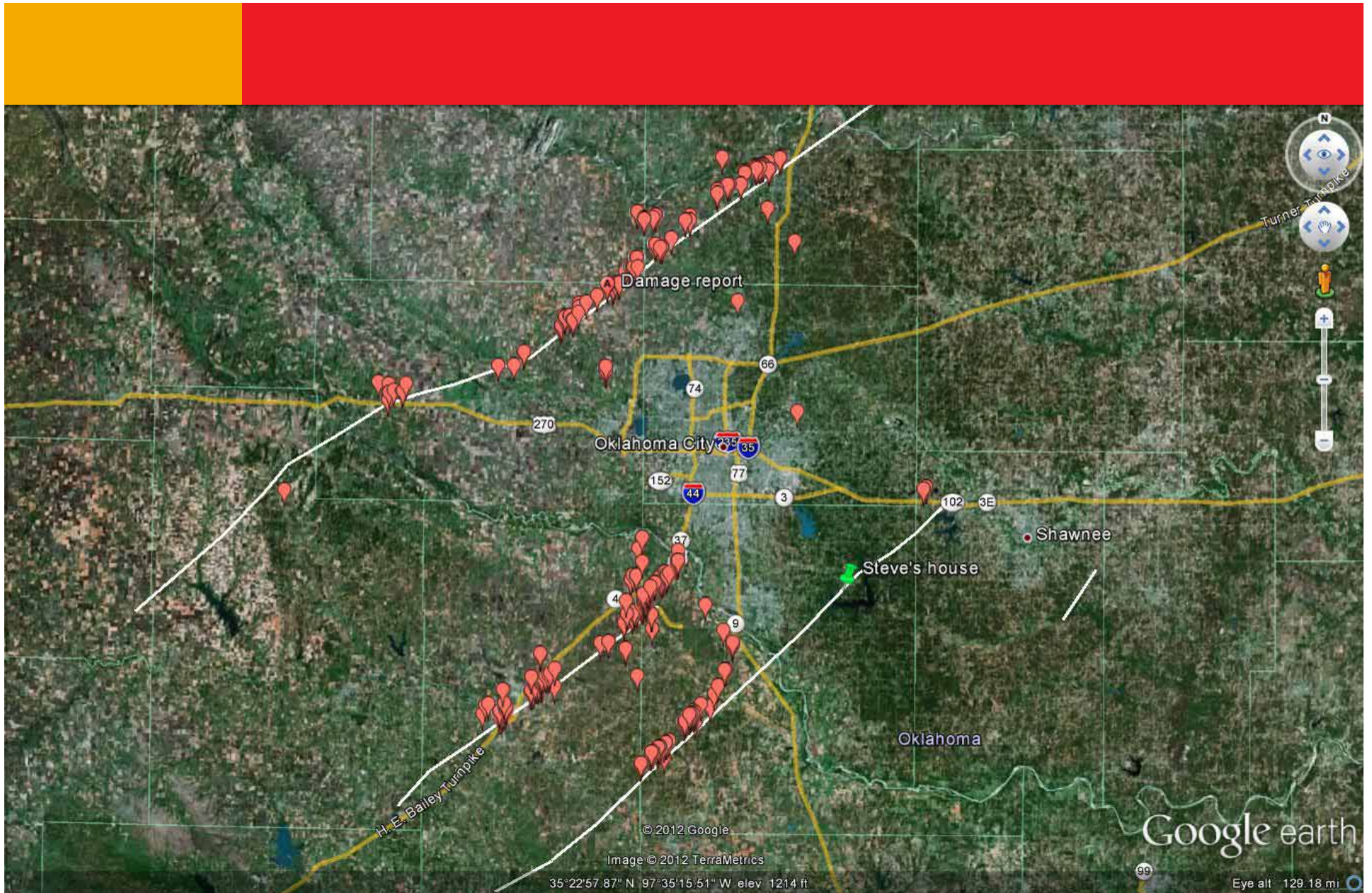
Errors with WDSS-II...



Errors with WDSS-II...

- **Curvature of the Earth.**
- **Distance from the radar.**
- **Available beam strength.**
- **Tilt of the storm.**
- **Speed of the storm.**
- **Interference.**









Questions?



Thank you for attending!

Steve Klapp

Steve.Klapp@Redcross.org

WWW.WDSSII.ORG