Lightning Data: a new geophysical data type

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Recorded Lightning Strikes Confirmed

27 Sep 2011, Hockley Dome Harris County, TX
Lightning provides a rich data set to analyze, explore, & compare with other data sets, enhancing exploration of subsurface geology.

Cloud-to-Cloud lightning travels 250+ km or 2 1/2 times more distance than Sprite & Elves.

Lightning strikes go to ground where they do because of geologically controlled telluric currents.

Of the 1+ billion annual lightning strikes, 350 million are cloud-to-ground strikes.
NLDN (National Lightning Detection Network)

Historical Use: Insurance, Meteorology, & Safety
~330 Sensors record U.S. NLDN lightning strikes with +/- 100-500 foot location resolution
Lightning Measurements Include:

- Location
- Time and Duration
- Rise Time
- Peak Current
- Peak-to-Zero
- Polarity
- Reliability
- Number of Sensors
Lightning Strikes vs Local Relief
North Dakota, 1999-2008

Number of Strikes

Local Relief (m)

Lightning Strikes vs Local Relief
North Dakota, 1999-2008

Strikes above local mean/Strikes below local mean

Local Relief (m)
Steubens County, New York
Zoom on Southeast Quadrant Showing All Strokes & Positive Strokes under Air Mag Faults

Steubens County, New York
Cross Sections of Strokes / Air Mag & of Seasons

Steubens County, New York

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Buda Limestone Outcrop & Strike Location

Approximate Limit Buda Limestone

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Lightning Clusters Continue Offshore

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Lightning Maps Provide Regional Context

Michigan Topography

Lightning Strike Density identifies fault locations

red = gas fields    green = oil fields    red = high density    blue = low density    black = interpreted transverse faults
Lightning Maps Define Play Fairways

Peak Current of Lightning Strikes at high lunar tide

Pershall, Beaver Lodge, Antelope, and Blue Butte fields, Montrail County, ND

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Colorado County, TX
Area of Lightning Data Coverage & 3-D Survey

GeoMap oil and gas production: Colorado County, Texas

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Lightning patterns do not tie topography

Colorado County Topography and Lightning Peak Current

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Lightning Attribute Maps Correlate with Seismic

Rise Time
0  1.5  3.0  4.5 miles

Average Peak Current
0  1.5  3.0  4.5 miles

Peak-to-Zero
0  1.5  3.0  4.5 miles

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18
Lightning Density Shows Consistency Over Time