Analysis of the Goose Point area near Lacombe, LA, validates a new geophysical data type - natural sourced electromagnetism (NSEMTM) for detection of lineaments associated with faults and sedimentary features.

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Data and Theory
Lightning Occurs Everywhere
Houston To Miami receives 12 to 28 lighting strikes per square mile per year.

17 Years of NLDN Lightning Strike Data Available

Network Median Location Accuracy Over most of US is 200 meters or less.
Two conducting plates, the storm cloud and the earth
Separated by an insulating dielectric - the atmosphere.
Voltage, created by collision of ice within clouds
Lightning bolts rebalance the charge between the plates.
Lightning Measurements/Attributes, & Wave Form

- Location / Time and Duration / # of Sensors
- Rise Time
- Peak Current
- Peak to Zero
- Polarity
- Chi Squared
- Number of Sensors
Typical Environmental Studies Often Lack a Framework for Integrating Diverse Data Sets

Fault offsets on roads or in the marsh
USGS sparker data
Oil and gas wells from state files
Water well logs
Dissertations and theses
Journals, government reports, gray literature
Baton Rouge Fault System Faults with Surface Expressions

Baton Rouge Fault System
Lacombe Fault Segment

North

Lacombe Fault Segment

Goose Point Fault offsets Hwy 11 Bridge

South

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USGS High Resolution Sparker Seismic - 1998

Sparker interpreted by L. J. Berent (Roth, 1999 UNO Geology Thesis)

Line 19/K-K'
Line 96-4/M-M'
Line 96-3/L-L'
Line 96-12/P-P'
T. A. Cullinan’s 1969 Tulane Dissertation of Big Point Field sparked new interest in fault interpretations.

USGS Water Well Project – 1964-1967
“The Geohazard Problem”

Surface faults can be avoided/designed for if they are recognized.

Engineers do not design for unknown hazards – not imaged by geotech.

NSEM provides connectivity to diverse data sets and may offer cost effective insights on areas that need additional data.
Lightning Attribute Maps provide insight into Rock/Sediment Properties
Google Earth Image
Study Area in Yellow

Geologic Map
McCulloh (2004)

Rate of Rise Time
Strike Density

Attribute Transparency
over Geology Map

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Rise Time over Entire Study Area
110 sq. mi.

Rise Time with Focus Box highlighted with LIDAR
Rise Time Attribute
LIDAR
Annotated LIDAR
Rise Time transparency over Annotated LIDAR
Rise Time Attribute with stream Channels

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Lightning Rock Property Volumes

Apparent Resistivity and Permittivity Volumes, provide a framework for integrating and interpreting multidisciplinary data sets.
Goose Point / Big Point
Field Area
Lightning Attribute
Volumes - Resistivity Data
Conventional Resistivity Profile
NSEM Profile

1971 Seismic Line

2-D Resistivity Imaging

Approximate Fault Location

Silty Sand
Sand
Clay


Lightning Resistivity Faults

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Depth Slice 4,000 feet
Fault interpretation using just using LIDAR, sparker, bridge offsets and NSEM - lightning data

No well data in this interp.
Fault Interpretation with Sparker LIDAR/Soils Limited Well Data and NSEM with new processing algorithm
Conclusion

Lightning provides connectivity between datasets and within a regional geologic framework

Rock property attributes relate to LIDAR and Soils

Resistivity Volumes provide insights into stratigraphy, structure, and rock properties.
Thank You!

Lightning - A Shockingly Powerful Exploration Technology