Lightning data analysis provides geologic insights at South Carolina EPA Superfund Site

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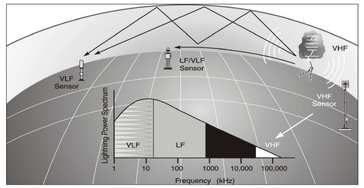
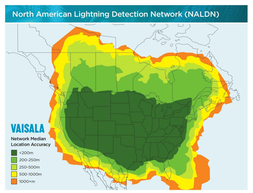
http://www.dynamicmeasurement.com

Vaisala Lightning Data is foundation of new non-invasive tool for natural resources exploration.

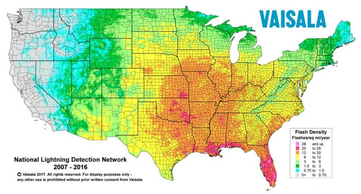
Images from Vaisala



Electromagnetic Pulse Emitted by Lightning Strikes Generates LF - VLF Frequency Radio Waves



Strike Location Accuracy

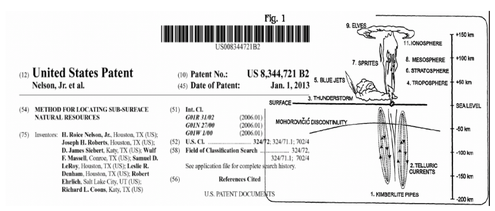


2007-2016 Flash Density Flashes / sq mi / year

Yellow Area: 6 to 12 strikes / sq mi / year

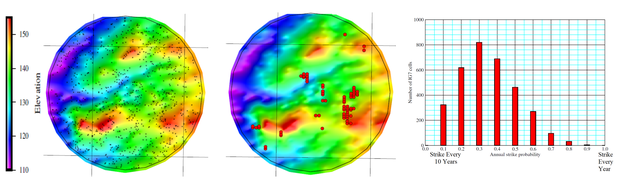
Dynamic Measurement, LLC

Uses lightning Strikes To Search For Natural Resources



Dynamic Measurement Patent Pending - Risk Points

Barite Hill Example of Risk Points



Strikes

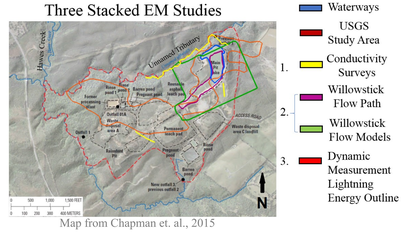
Risk Points

Probability of Strikes

Index Map

Map from Chapman et. al., 2015

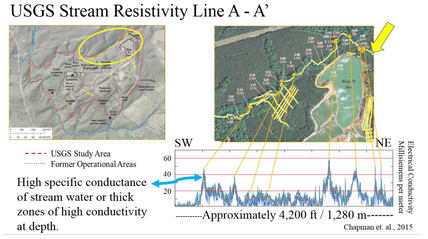
Three Stacked EM Studies



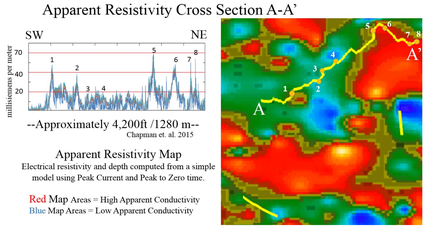
Map from Chapman et. al., 2015

Base from U.S. Geological Survey (USGS) and South Carolina Department of Natural Resources 10-foot digital elevation model (produced from lidar data), 2012; and USGS and U.S. Department of Agriculture image, 2011;Lambert Conformal Conic projection.

USGS Stream Resistivity Line A - A'



Apparent Resistivity Cross Section A-A'

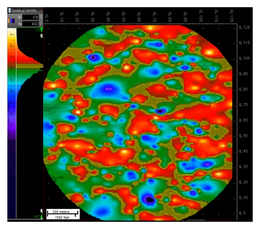


Apparent Resistivity Map

Electrical resistivity and depth computed from a simple model using Peak Current and Peak to Zero time.

Red Map Areas = High Apparent Conductivity

Blue Map Areas = Low Apparent Conductivity



Sub-Regional Apparent Resistivity Map

Red Areas = Low Apparent Resistivity / High Conductivity

Ore Bodies, Buried Waste Rock and/or Contaminated Regolith Groundwater (dissolved ions and metals)

Blue Areas = High Apparent Resistivity / Very Low Conductivity

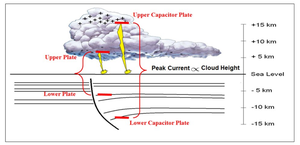
Bedrock

Lightning Data in 4 Dimensions

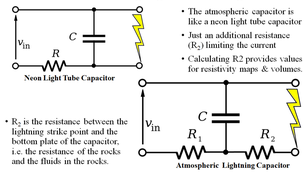
Rock Property & Attribute Maps & Volumes

Key Assumptions:

1. Lightning occurs when there is sufficient charge to bridge the capacitor.
2. Lightning is affected by geology to a depth proportional to cloud height, as derived from Peak Current



The mathematics of a Lightning strike is the same mathematics describing a giant Neon Light Tube



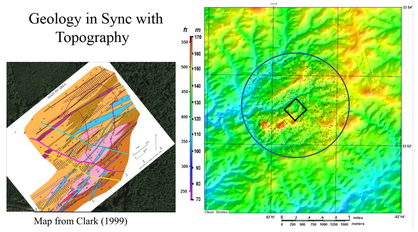
Barite Hill

Lightning Attribute Map Study

Red=Lightning Feature, Yellow=Conductivity Surveys, White=Faults, Blue= Fractures, Purple = Flow Path

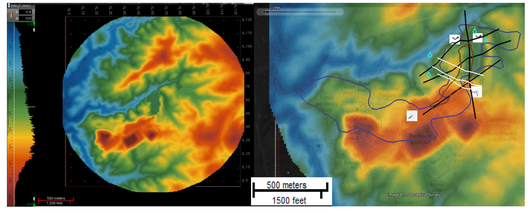
Geology - Topography - Fracture Sets - Attributes

Geology in Sync with Topography



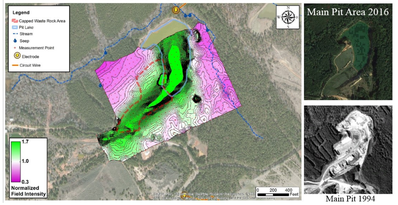
Map from Clark (1999)

Elevation over Study Area - Red= High 163m Blue=Low 107m



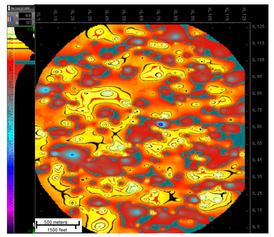
Proven Industry Flow Path Detection Methods

Willowstick Groundwater Flow Path

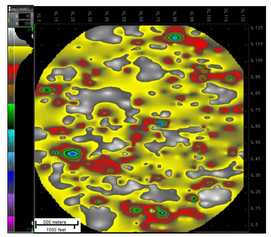


From Andros et.al.,

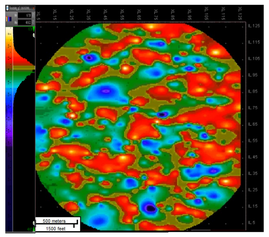
Dynamic Measurement Lightning Attribute Data Covers 2 Square Miles



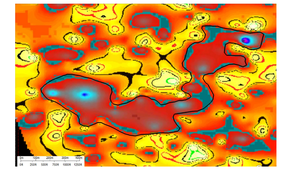
Energy

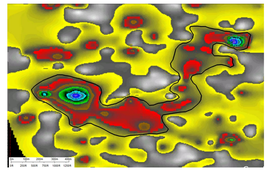


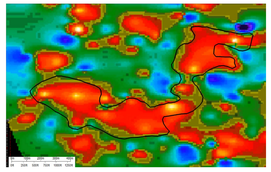
Peak Current Absolute

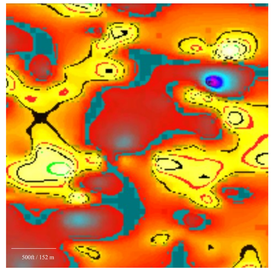


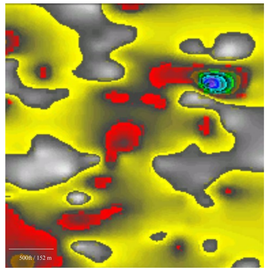
Apparent Resistivity

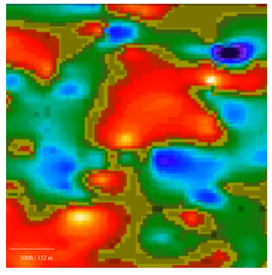


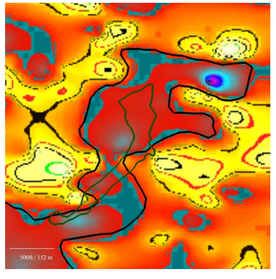


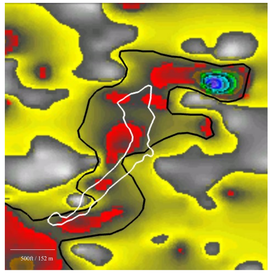


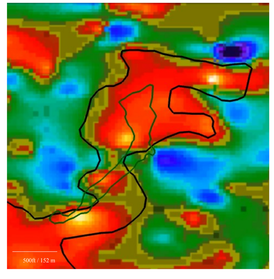












Thank You!

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