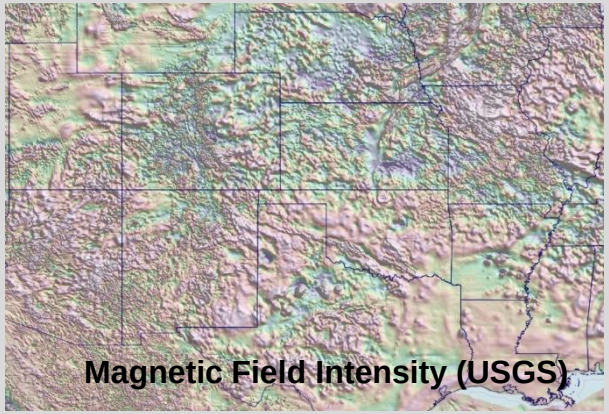
Flamingo Seismic Solutions

Euler Decon Introduction

Euler Angle Stack Imaging (EASI)

Geology From Potential Fields



- Measurements of Earth's Gravity and Magnetic Fields have long been used in Geophysical Prospecting.
- Among the useful information in this data are linear features (**lineaments**) which can be caused by several types of geology, including faults.
- A machine algorithm for automatically identifying lineaments in gravity & magnetic data was published in 1982 (Euler Decon).
- To provide a less noisy product, Flamingo has an enhancement, **E**uler **A**ngle **S**tack **I**maging.

Similar Technologies

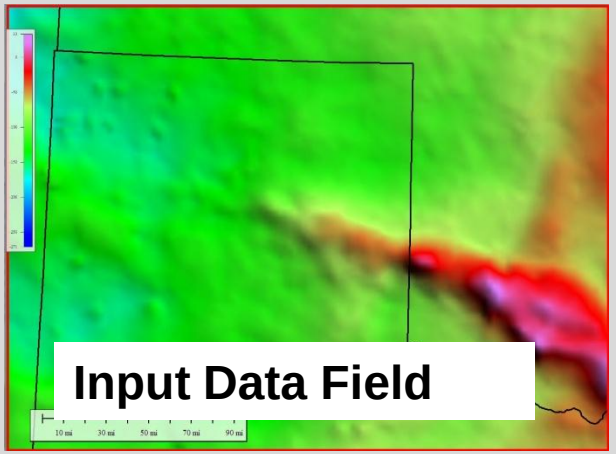
EASI has similarities to technologies used in a variety of fields where low signals are extracted from high levels of noise

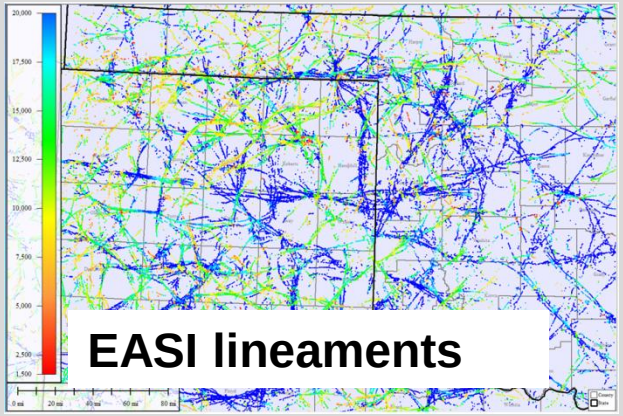
- Deep Space Communication (e.g. Voyager)
- Radar
- Vibroseis
- Seismic Wavelet Deconvolution
- Facial Recognition

EASI Example

The process steps through a grid of data identifying where the field satisfies Euler's equation for a lineament, and locates the origin of the lineament in x, y, z space.

It detects many features that are not readily visible on the input data.





Some Possible Causes of Euler Lineaments

- Faults
- Fractures/relief
  e.g. in crystalline basement
- Lateral lithology changes
- Intruded plutons
- Remineralization along fractures and faults

EASI Lineament Analysis Applications

Some of the benefits which have come from potential field lineament analysis:

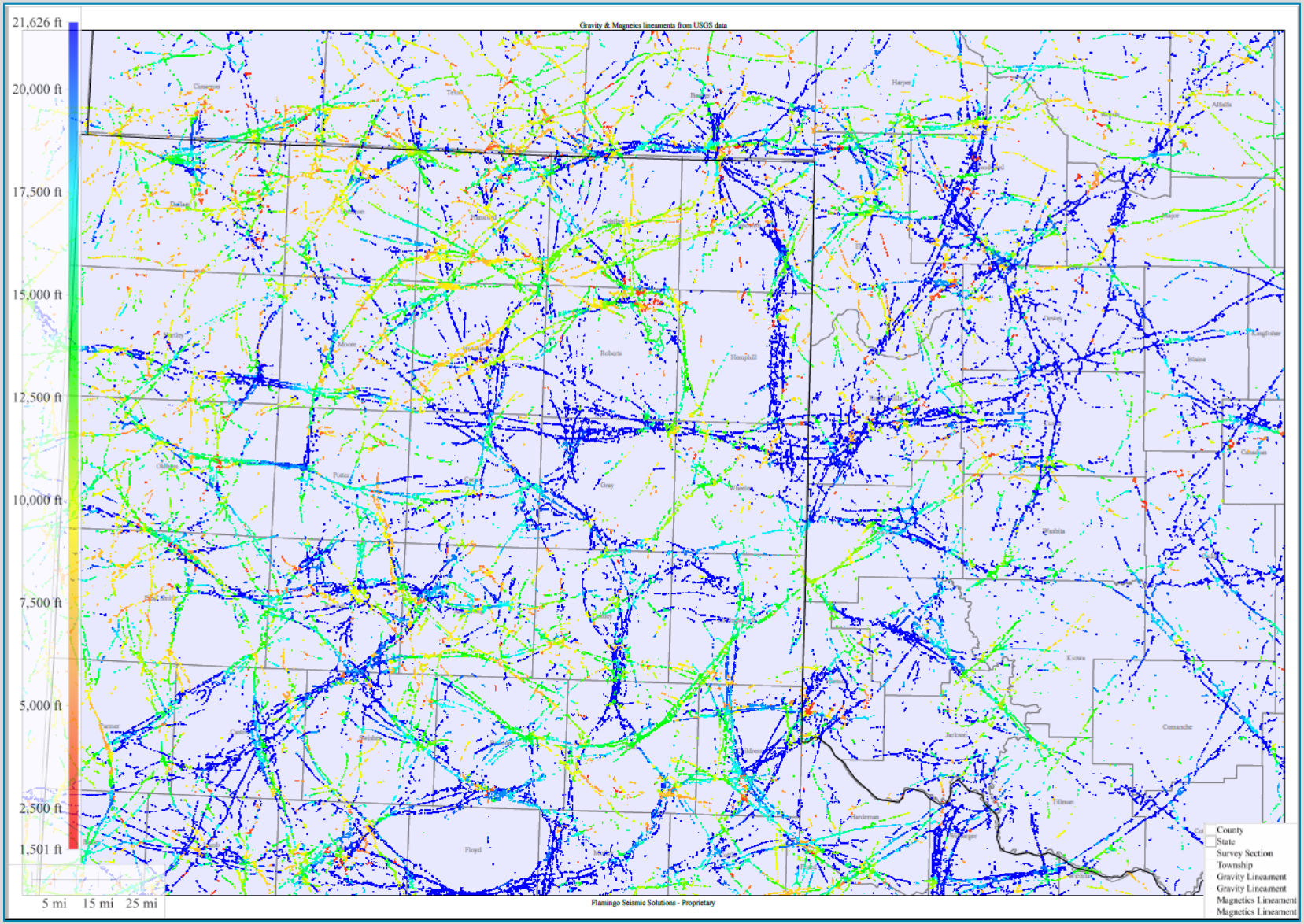
- Dip-slip fault mapping
- Strike-slip fault mapping – based on further interpretation of truncations, offsets & depth changes
- Relative depth/age of intersecting faults
- Delineation of faulting in difficult seismic areas, e.g.:
  - Sub-salt
  - Sub-volcanics
  - Hardpan/Sand dunes/other surface issues
- Wildcat sites based on lookalike features of fault systems to known field
- Delineation of stress field orientations
- **Filling in "white space" between and around seismic coverage**
  - Extension of 3D seismic interpretation along faults
  - Connecting of faults from 2D regional seismic lines

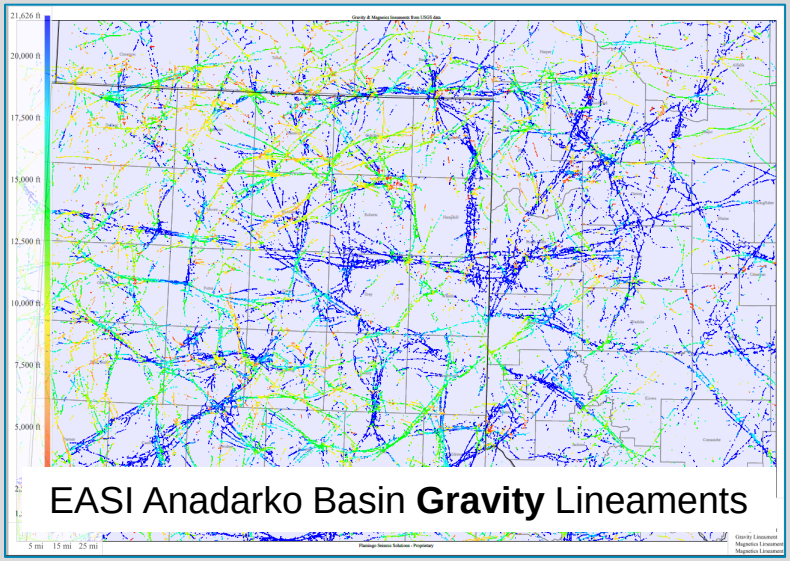
Flamingo is available for consulting on interpretation of the processed results

Gravity vs. Magnetics vs. Seismic

- Measure independent characteristics
- Often image different features
- Sometimes image same features
- Often see terminations/depth changes in one dataset coincide with features in the other dataset

EASI Anadarko Basin **Gravity** Lineaments

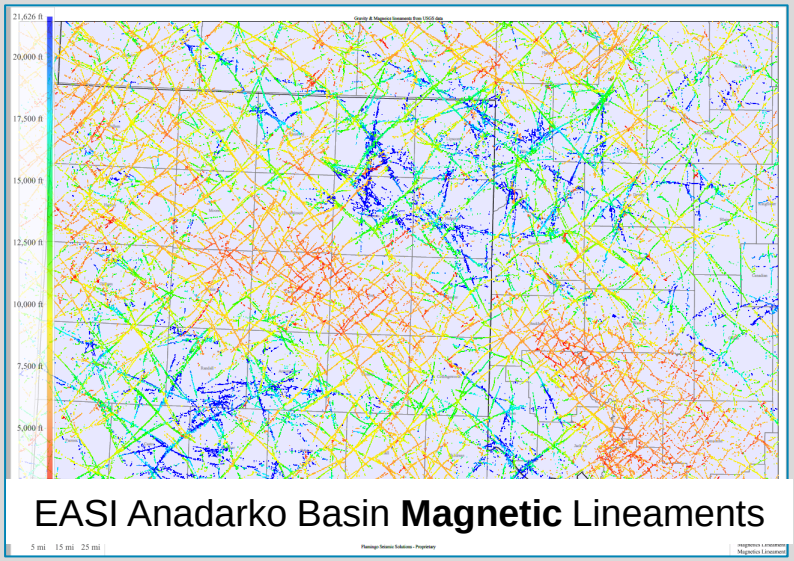




EASI Anadarko Basin **Gravity** Lineaments

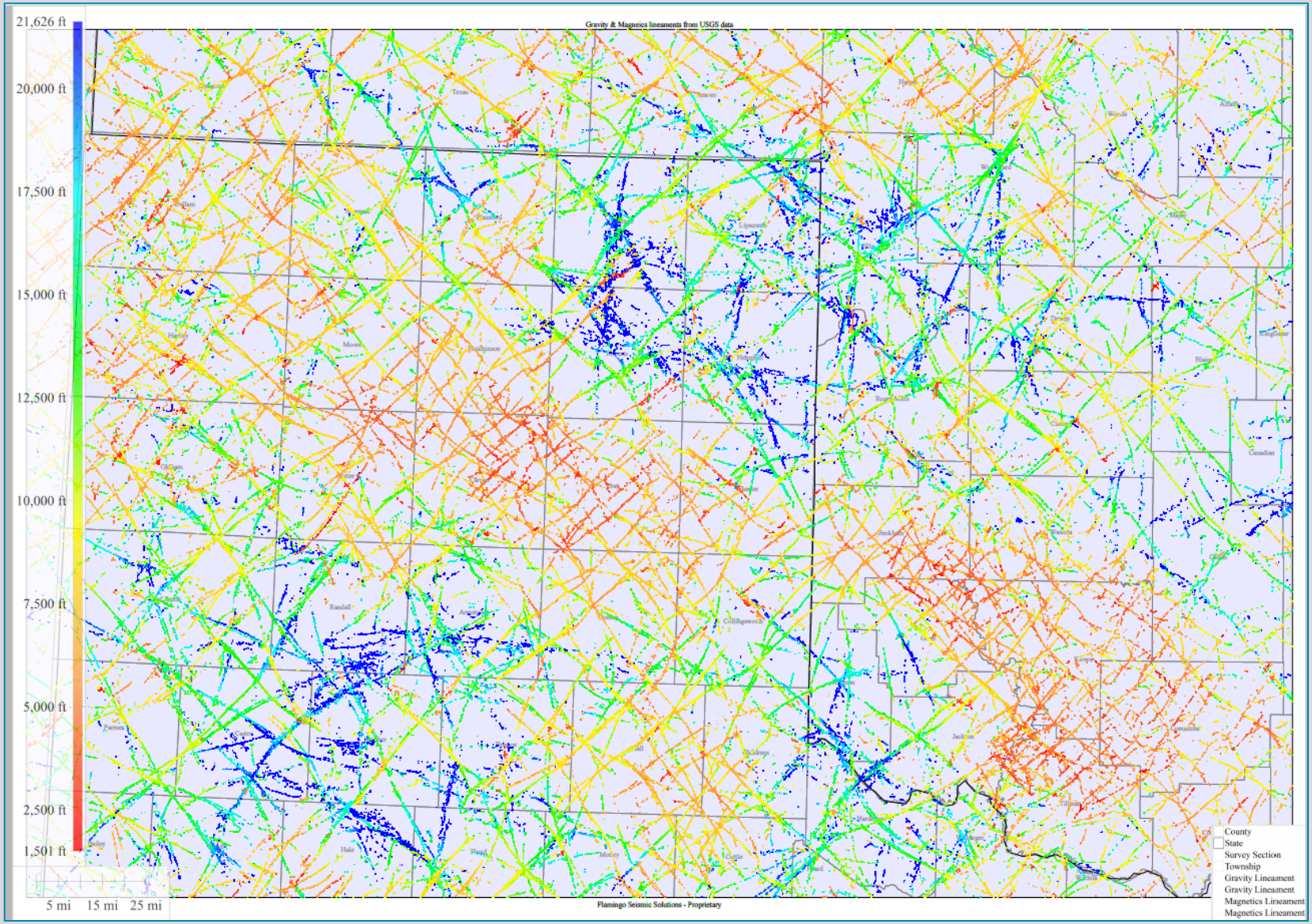
The gravity and magnetic fields often reveal very different aspects of the geology, as can be seen in this example from the Anadarko Basin.

In both datasets one can see evidence of the Wichita mountains coming in from the southeast, indicated by the shallower depths of the magnetic data, and outlined by lineaments in the gravity.



EASI Anadarko Basin **Magnetic** Lineaments

EASI Anadarko Basin **Magnetic** Lineaments

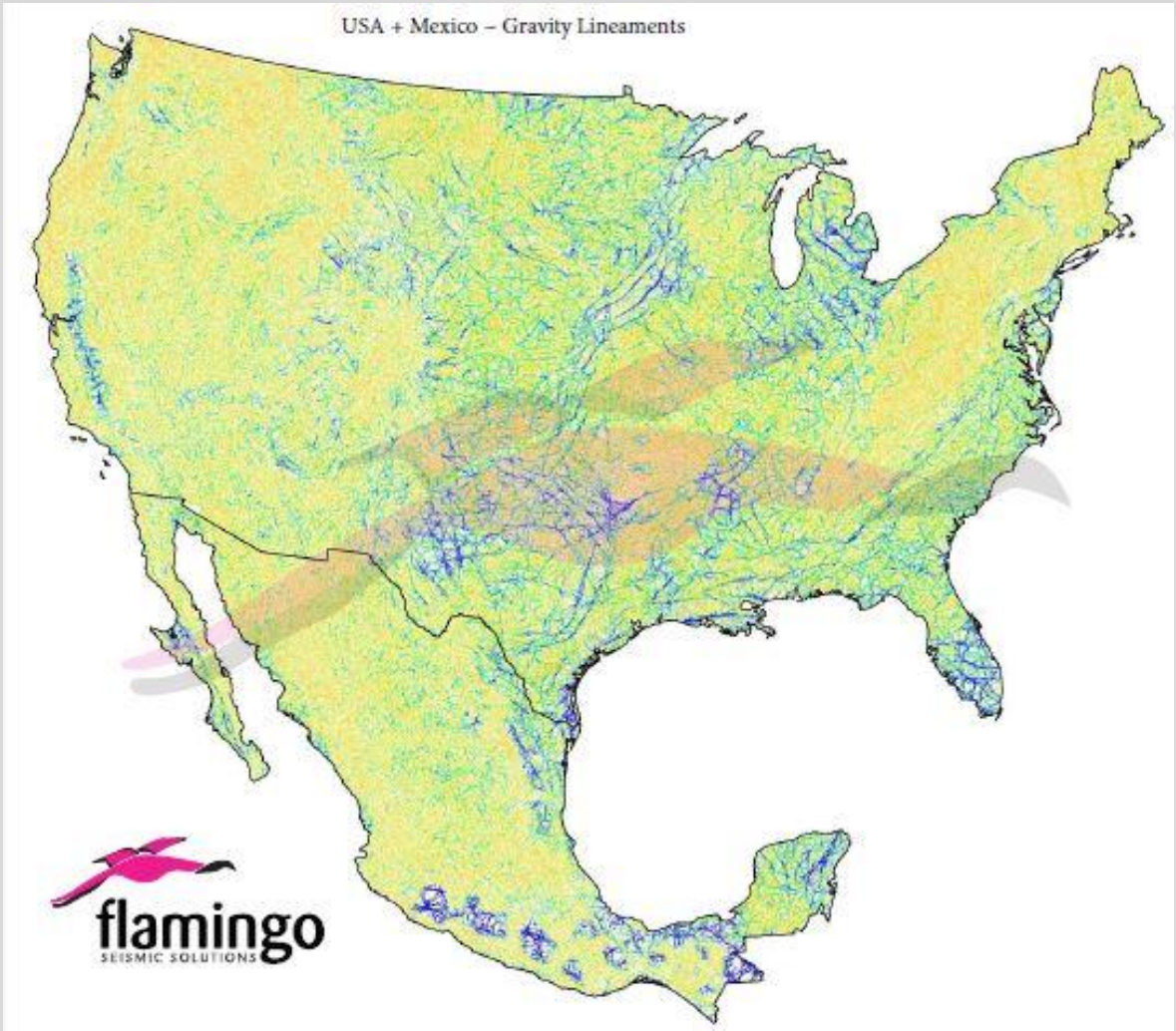


Data sources

Gridded Bouguer or Total Magnetic Intensity field are used as input

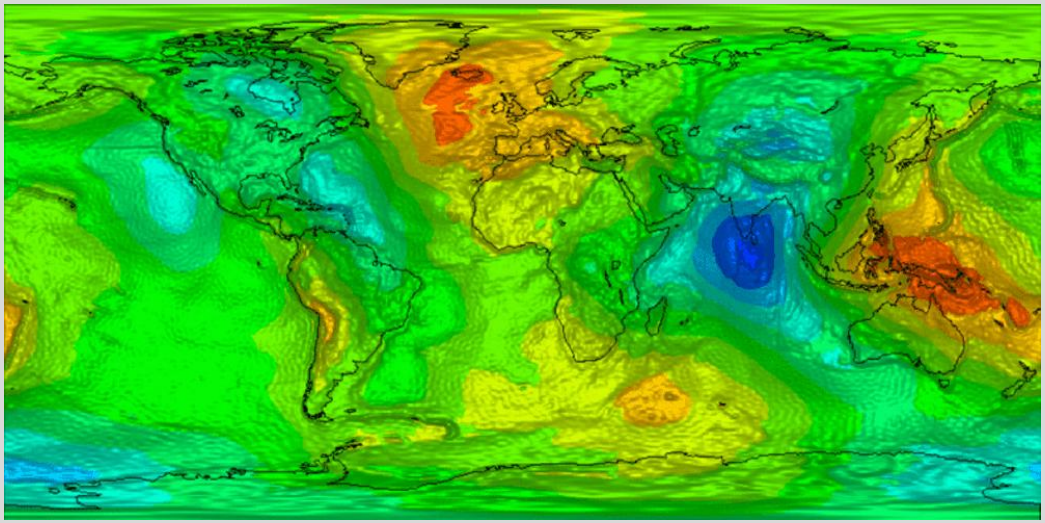
- Public Domain:
  - North America Gravity (NOAA/NGDC)
  - North America Magnetics (USGS)
  - Individual countries on selective basis
  - Worldwide (International Gravimetric Bureau, NOAA/NGDC)
- Proprietary:
  - Where clients have higher resolution, it can be used
  - Sometimes benefits from padding with public domain data

Public Domain Data



Flamingo has EASI lineaments computed on 3.8 million square miles of Gravity & Magnetic data over the US & Mexico.

Public Domain Data



Flamingo has successfully used worldwide Gravity & Magnetic data to compute EASI lineaments in several countries around the world.

Argentina	1,050,000 mi^2
Colombia	442,000 mi^2
Gulf of Mexico	600,000 mi^2
Peru	503,000 mi^2

For More Information

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SEISMIC SOLUTIONS

”Serendipity: A search for lineaments finds impact craters?.”
The Leading Edge, May 2017, 36(5), 431–436.
Ted Lautzenhiser and Ray Earley (2017).

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