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TESTING A DRONE-BASED MAGNETIC FIELD SURVEYING SYSTEM

Erik Jacobson*, Irina Filina, Department of Earth and Atmospheric Sciences

Introduction

Aeromagnetic surveys are conducted by geoscientists to study subsurface geologic structures, such as faults. This type of survey uses a magnetometer mounted upon an airborne vehicle to collect magnetic field data. Magnetic anomalies are caused by variations in subsurface geology, namely in magnetic properties of subsurface rocks.

Jacobson and Filina (2019) reported on the development of a new low cost drone-based magnetic field surveying system by the UNL Geophysics Team. This drone-based magnetic system is capable of collecting high resolution data at low speeds and low altitudes. The current study focuses on testing this system by conducting two flights over a known subsurface fault near Venice, NE in fall 2019.

The UNL Geophysics Team's airborne magnetic system consisting of the Scintrex *ENVI-MAG* magnetometer mounted upon DJI Matrice 600 Pro Drone.

Objectives

1) Pass the FAA part 107 exam to obtain a drone pilot's license
2) Design and conduct a survey to test drone based magnetic system
3) Process acquired magnetic data to determine the surveying accuracy
4) Compare recorded magnetic anomaly with published United States Geological Survey (USGS) data (Sweeney and Hill, 2005)

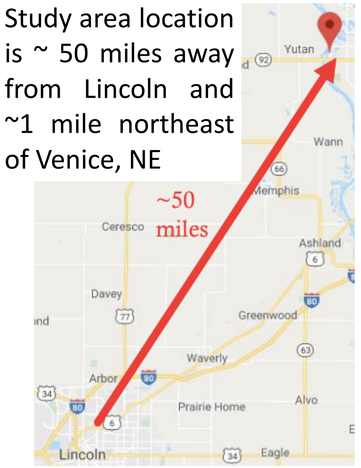
Magnetic Survey Preparation

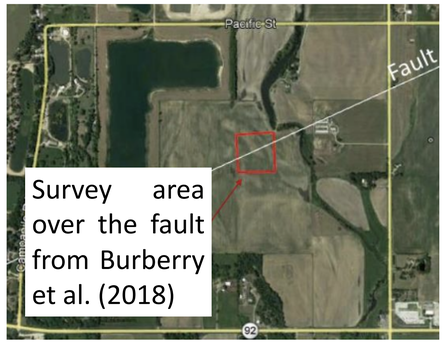
1). Obtaining a drone pilot license

A large part of passing the FAA part 107 exam involved studying sectional charts such as the one above.

2). Designing a survey

Study area location is ~ 50 miles away from Lincoln and ~1 mile northeast of Venice, NE





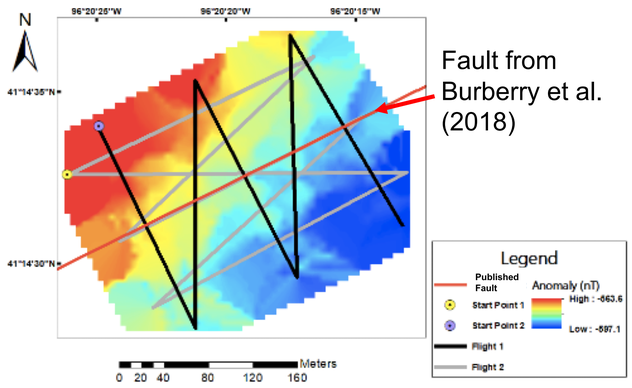
A survey consisting of two 15 min flights was designed: one parallel to the fault (blue) and one perpendicular (red)

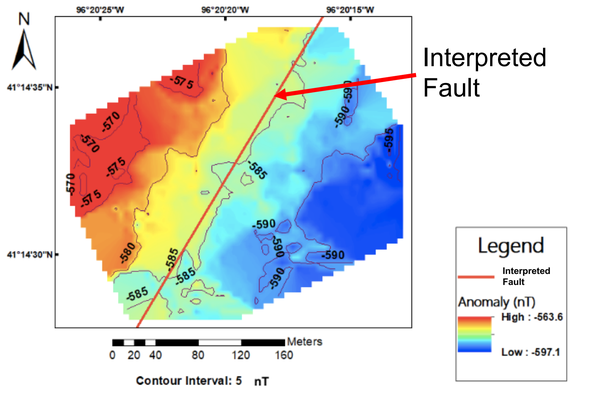
Flight and Data Processing

3). Drone-based magnetic survey was conducted on 11/9/2019. Drone is flown at a speed of 2 m/s and at a height of 7 m.

Bottom left: Magnetic anomaly map showing flight paths and published fault location (Burberry et al., 2018)

Bottom right: Magnetic anomaly map with interpreted fault





Results

1) FAA part 107 small unmanned aircraft license obtained to operate the drone.
2) The fault is visible from the processed data, but has a different trend with respect to previously published one.
3) Statistical analysis of the magnetic data in 20 crossing points shows an average difference of 2.1 nT.
4) Collected magnetic data generally agreed with the USGS's published data. There is an average offset of 30 nT.

Future work

1) Expand the survey to map adjacent fault system's segments
2) Test drone's capabilities on locating abandoned exploration wells
3) Utilize drone to map seismically active faults located near Stapleton, NE

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UNL Dept. of Earth & Atmospheric Sciences

Lyman-Richey Co. for access to survey property

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