Archaeological prospecting using drone-towed electromagnetic and magnetic systems

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SUMMARY

Drone-borne magnetic and electromagnetic sensor systems solutions have gradually expanded their use within geophysical prospecting. Magnetic and electromagnetic sensors in a drone setup allow much movability compared to a standard handhold walking survey and will also downscale the cost and risk typically associated with helicopter-borne surveys. Hence, a drone-based solution seems very attractive for magnetic and electromagnetic prospecting and could potentially replace some of the existing setups.

This abstract presents drone-towed magnetic and electromagnetic systems and datasets (Figures 1 and 2) from the same area in the southern part of Denmark (Thy), where both the magnetic and electromagnetic data show features from sub-surface structures in their raw data form. The area is known for its prehistorical flint mines, and using both magnetic and electromagnetic data will provide a better background for mapping these. To further enhance and verify any archaeological structures, we will apply levelling, micro levelling and grid the data to make interpretation possible.

The sensors and drone are off-the-shelf products, but the arrangement and construction of the survey are unique. We towed the sensors in a 6 meters wire configuration underneath the drone to avoid electromagnetic interference (Vilhelmsen and Døssing 2022) and flew with 0.7m line spacing approximately 1 meter above the surface. The vertical magnetic gradient shown in Figure 1 is measured in the same area as the quadrature response, and the legend is comparable. The quadrature response shown in Figure 2 is a stacked response from a transmission frequency of 40025Hz, 65675Hz, and 91275Hz measured with the multi-frequency broadband electromagnetic sensor GEM2-UAV from Geophex.

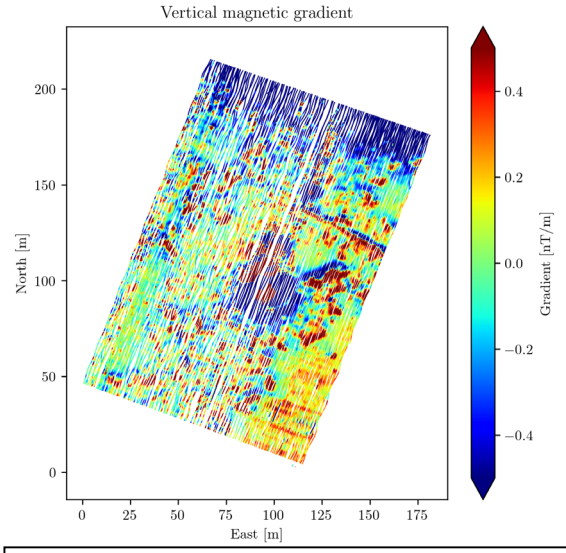

Figure 1: The raw vertical magnetic gradient from the drone-towed magnetic survey is plotted here in the limit +/- 1nT.

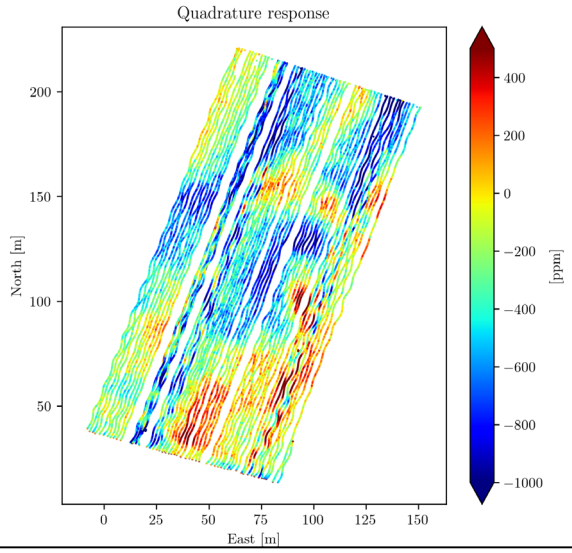

Figure 2: The stacked quadrature response from the drone-towed frequency-domain electromagnetic induction survey, with the transmission frequency of 40025Hz, 65675Hz, and 91275Hz.

Vilhelmsen, T. B. and Døssing, A.: Drone-towed CSEM system for near-surface geophysical prospecting: On instrument noise, temperature drift, transmission frequency and survey setup, EGUsphere [preprint], https://doi.org/10.5194/egusphere-2022-217, 2022.

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