# Lab 9: Spatial Analysis 1

EASC 305: Spring 2021

In this lab, you will explore a dataset using various gridded interpolation and trend analysis techniques. This lab will give you a better sense of how powerful programming languages (like `python`) can be for visualizing multiple dimensional data.

## Problem Description

In this exercise you are tasked with identifying the location of an Unexploded Ordnance (UXO) buried underground. To learn a little bit about UXOs, see here:

https://www.canada.ca/en/department-national-defence/services/uxo/what-is-uxo.html.

Based on the magnetic field (measured in nT) orientation in the study area and the orientation of the ordinance, you expect the UXO to produce a magnetic anomaly with a dipole structure (e.g., Butler et al., 2012). Use the tools provided in lecture (and lab demo) to remove any regional trend from the regional magnetic field and identify any local magnetic anomalies that might indicate the presence of a UXO.

## Deliverables

For this lab, write up your results in short report. Write your report and conduct your analysis in a Jupyter Notebook. All code should be tidy and well commented. Your report should include:

- ***Introduction*** – A very brief overview of the problem, the data and the methodology.
- ***Methodology*** – Provide a brief overview of what you did and how. There is no need to supply step-by-step instructions in this case. Justify each decision you make in the parameter selection, interpretation and trend fitting. Be sure to statistically evaluate the quality of fit of the regional trend to the data. You will be graded on your explanation of the methods used and the rationale for choosing them.
- ***Results*** – Include figures that show the steps you took to determine where the UXO is located. Your results should be logically organized and carefully interpreted.
- ***Discussion*** - Address how your results might look different if you had selected a different methodology and discuss possible sources of error in your analysis.
- ***Figures*** - All figures using a colorbar need to have a colorbar label indicating the units of what is plotted. Figures can be dispersed throughout the notebook.
- ***Figure Captions*** All figures need an appropriate figure caption. Figure captions should give a brief overview of what the figure contains and how to read it. If you have a figure caption, you DO NOT need a figure title. Figures should be referenced appropriately in the text and are included in the report AFTER they are referenced.

Your code should be inter-leaved throughout the report in logical places. Do not include all the code at the top or bottom of the report.

## References

Butler, D.K., Simms, J.E., Furey, J.S. and Bennett, H.H., 2012. Review of magnetic modeling for UXO and applications to small items and close distances. *Journal of Environmental and Engineering Geophysics*, 17(2), pp.53-73. https://library.seg.org/doi/abs/10.2113/JEEG17.2.53