Civ E 676
Case Studies in Groundwater Management

Assignment 2.

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Due: Monday, February 24

In April 1992, Ontario Power Generation measured concentrations of tritium in the groundwater at their Bruce Nuclear Power Development (BNPD) Radioactive Waste Operations Site 1 (RWOS-1) that exceeded their internal maximum permitted concentration. As part of a model study, a conceptual model of the site was developed; this conceptual model has been updated since as part of subsequent investigations of tritium releases at RWOS-2 and as part of OPG's pursuit of a deep geologic repository (DGR) for low and intermediate level nuclear waste. In 2010, CH2MHill undertook a field and model study on the tritium release from low level storage buildings at RWOS2. In 2012, the model was used to investigate the impact of changes in recharge that will occur with the construction of the DGR. This assignment uses Kriging and the inverse square method to estimate the structural contours of the various units at the site from the punctual data obtained from test pits and bore holes. The various data sets for this assignment can be retrieved from the web site: www.civil.uwaterloo.ca/sykesj. The descriptive manual for GEOAS and the manual can be can be found at http://www.epa.gov/ada/csmos/models/geoeas.html. The model is old school DOS rather than windows based; you will have to run it in DOSBOX which you can download from the course website. The SURFER program for plotting is available on NEXUS. It can also be downloaded from the course website. The files and data sets that are required for this assignment are as follows:

TOPLIME.DAT GEOEAS data set giving: x location, y location, top of limestone. No changes to this data set are required for use in GEOEAS. Delete first 5 lines and keep only data for use in SURFER This file contains all data for the site.

TILLTH.DAT GEOEAS data set giving among other data: identifier, x location, top of till, bottom of till, till thickness. No changes to this data set are required. This file contains data for those boreholes or testpits that intersect the top of the bedrock. The data set is used to Krige the till thickness.

GROUND.DAT GEOEAS data set for ground surface elevation. No changes to this data set are required.

Bnpd_2.DXF data for use in SURFER/MAP/LOAD BASE MAP to plot site details (shows access road, shoreline, buildings and outline of BRUCE site)

Using these data sets,

1. Using the GEOEAS software for Kriging, determine the estimates and standard deviations for the top of bedrock. (use the file TOPLIME.DAT). Plot the results using SURFER and the fn.grd

file created in GEOEAS. Compare and discuss the results obtained using a linear variogram model and a Gaussian variogram model .

2. Using GEOEAS Kriging, determine the estimates and standard deviations for the thickness of the quaternary sediments (sand and/or till) using TILLTH.DAT. Plot the results using SURFER

3. Estimate the top of the bedrock as Kriged ground surface minus the Kriged thickness of quaternary sediments using the file GROUND.DAT and the results from question 2.

4. Estimate the top of bedrock using the inverse squares method (note: you can use the routine in SURFER and the TOPLIME.DAT file that has been edited by removing all lines other than data).

5. Compare and discuss the results obtained (note you have estimated the top of the bedrock in three different ways.)

6. For the top of limestone, to the TOPLIME.DAT file add several soft data points at a location with a high variance in order to determine the reduction of the standard deviation of having additional data. Comment on the results.

7. **COMMENT ON THE HYDROGEOLOGICAL SIGNIFICANCE OF THE RESULTS, FROM BOTH A FLOW AND A CONTAMINANT PERSPECTIVE**.

In presenting your work, give variogram data. The coordinates are BNPD plant coordinates with the X direction being EAST and the Y direction being NORTH. All distances and elevations are in feet. When using the GRID routine of SURFER, make sure that the limits of the plot have a meaningful origin.

Note: be prepared to discuss this work in class.