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ADDENDUM 2 TO ANALYSIS REPORT
TASK 2 OF AP-088
ESTIMATING BASE TRANSMISSIVITY FIELDS

(AP-088: Analysis Plan for Evaluation of the Effects of Head Changes on Calibration of Culebra Transmissivity Fields)

Task Number 1.3.5.3.1.2

Report Date: May 11, 2003

Authors: R. Beauheim For Robert Holt Date: 5/14/03
Robert M. Holt
Consulting Hydrogeologist

Mario Chavez for Date: 5/14/03
Lande Yarbrough
GIS Specialist

Technical Review: R. Beauheim For Robert Holt Date: 5/14/03
Joel Kuszmaul
Consulting Geological Engineer

QA Review: Mario Chavez Date: 5/14/03
Mario J. Chavez, 6820
Carlsbad Programs Group

Management Review David Kessel Date: 5/14/03
Dave Kessel, 6821
Manager, Performance Assessment and Decision Analysis

WIPP:1.3.5.3.1.2:TD:QA-L; 522085

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Discussion

This addendum applies to activities from Task 2 of AP-088, "Analysis Plan for Evaluation of the Effects of Head Changes on Calibration of Culebra Transmissivity Fields." The purpose of this task is to develop a geologically-based predictor of mean Culebra transmissivity using a standard linear-regression approach and use this predictor to generate 100 equally probable realizations of the Culebra mean transmissivity field. This task is subdivided into six subtasks:

1) Conceptual Model Development – Formalize a conceptual model for geologic controls on Culebra Transmissivity.
2) Linear Regression Analysis – Regress geologic controls against Culebra transmissivity data to determine regression coefficients for geological controls on transmissivity.
3) Reduction of Geological Map Data – Import geological map data from Task 1 into a GIS environment and create data files of geological and "soft" data for the Culebra model domain.
4) Indicator Variography – Analyze variograms of an indicator function of high Culebra transmissivity to define a variogram model and variogram model parameters.
5) Conditional Indicator Simulation – Use variogram-model parameters for the high-transmissivity indicator to generate 100 conditional realizations of the spatial locations of high-transmissivity zones in the Culebra.
6) Construction of Transmissivity Fields – Use the regression coefficients, the 100 realizations of high-transmissivity indicators, and the other geologic data to generate 100 realizations of the mean transmissivity in the Culebra model domain.

The activities associated with each of these subtasks are described in Holt and Yarbrough (2002; 2003). This addendum is necessary because Task 2 has been revised to reflect a change in the grid spacing of the mean transmissivity fields from 50 m to 100 m and the total number of realizations was increased from 100 to 500. Subtasks 1 (Conceptual Model Development), 2 (Linear Regression Analysis), and 4 (Indicator Variography) are unaffected by this change. Subtasks 3 (Reduction of Geological Map Data), 5

(Conditional Indicator Simulation), and 6 (Construction of Transmissivity Fields), however, were repeated.

Because the new grid spacing required minor changes in Subtasks 3, 5, and 6, this addendum contains supplements for Sections 4.0, 6.0, and 7.0 of Holt and Yarbrough (2002). In addition, supplements have been prepared for some of the appendices contained within Holt and Yarbrough (2002; 2003) that require modification. Appendix supplements include:

- Appendix C Supplement - Routine Calculation: Creation of 100-m grid for AP-088,
- Appendix D Supplement - Routine Calculation: Creation of Culebra Structure Surface for AP-088,
- Appendix E Supplement - Routine Calculation: Creating Surface Elevation Data for AP-088,
- Appendix F Supplement - Routine Calculation: Creating an Isopach of Culebra Overburden for AP-088,
- Appendix G Supplement - Routine Calculation: Creation of Soft Data Files for AP-088,
- Appendix H Supplement - Routine Calculation: Creation of the Indicator Grids for AP-088,
- Appendix L Supplement - Routine Calculation: Conditional Indicator Simulations for AP-088,
- Appendix M Supplement - Routine Calculation: Adding Coordinates to Conditional Indicator Simulations for AP-088,
- Appendix N Supplement - Routine Calculation: Calculation of Mean Transmissivity Fields for AP-088,
- Appendix O Supplement - Routine Calculation: Procedure for Calculating Mean Transmissivity Fields for AP-088,
- Appendix P Supplement – CD-ROM contents.

References Cited

Holt, R. M., and L. Yarbrough, 2002, Analysis Report Task 2 of AP-088 – Estimating base transmissivity fields, ERMS#523889.

Holt, R. M., and L. Yarbrough, 2003, Addendum to Analysis Report Task 2 of AP-088 – Estimating base transmissivity fields, ERMS#523889.

Report Section Supplements

Supplement for Section 4.0 – Subtask 3 - Reduction of Geological Map Data

The purpose of this subtask is to reduce geologic map data to useable forms for conditional simulation of high-transmissivity zones and prediction of Culebra transmissivity using equation (3) of Holt and Yarbrough (2002). Geologic maps from Powers (2002) are used to determine the values of geologic controls (e.g., Culebra depth, the interconnectivity indicator, dissolution indicator, and halite indicator) for a Culebra model domain defined by Rick Beauheim (Appendix C Supplement). To create useable data sets, we imported the geological maps into a GIS environment and digitized the maps (Appendix B of Holt and Yarbrough, 2003). We then created a 100-m grid for over the Culebra model domain (Appendix C Supplement). Using the Culebra Structure Contour map data (Appendix D Supplement) and surface elevation data (Appendix E Supplement), we created an isopach map of the Culebra overburden on the 100-m model grid (Appendix F Supplement).

Using maps of the occurrence of halite in the units above and below the Culebra and well locations, we created soft data files (Appendix G Supplement) for conditional indicator simulations. We assume that transmissivity within 120 m of each well is from the same population (e.g., high or low transmissivity reflecting well-interconnected or poorly interconnected fractures, respectively) and that regions where the Culebra is overlain or underlain by halite (only m2/h2) are low-transmissivity regions.

Using maps of Salado dissolution and the occurrence of halite in the units above and below the Culebra, we created 100-m indicator grids over the model domain. These indicator grids were created for regions affected by Salado dissolution, regions where the Culebra is both overlain or underlain by halite, and a middle zone where high-transmissivity zones occur stochastically (Appendix H Supplement).

Supplement for Section 6.0 – Subtask 5 – Conditional Indicator Simulation

The purpose of this subtask is to use conditional indicator simulation to generate 500 conditional realizations of the spatial locations of high-transmissivity zones in the Culebra. 500 conditional indicator simulations are generated on the 100-m model grid using the GSLIB program sisim (Deutsch and Journel, 1998) (Appendix L Supplement) with Culebra high-transmissivity indicator data, "soft" data for regions around wells and regions where halite underlies and overlies the Culebra, and the variogram parameters. Model grid coordinates are added to sisim output using the GSLIB program addcoord (Deutsch and Journel, 1998) (Appendix M Supplement). The resulting indicator simulations are used in the construction of mean transmissivity fields (see Section 7.0).

Supplement for Section 7.0 – Subtask 6 – Construction of Mean Transmissivity Fields

The purpose of this subtask is to use the linear predictor (3) to generate 500 equally probable realizations of the mean transmissivity in the Culebra model domain. This calculation requires the regression coefficients determined in Subtask 2, Culebra depth data (Subtask 3), a Salado dissolution indicator function (Subtask 3), an indicator for where halite occurs in m2/h2 (Subtask 3), and 500 realizations of high-transmissivity indicators (Subtask 5). Realizations were assembled using a simple Fortran code, "meantsim.for" (Appendix N Supplement).

The 500 simulations were created in 5 sets. Each set consists of 10 groups of 10 realizations. All calculations were performed on a single 1.8-GHz Pentium 4, Windows 2000 computer at The University of Mississippi. A DOS batch file was used to launch and control the processing of simulations (Appendix O Supplement). These calculations resulted in 500 ASCII files containing UTM coordinates, an estimate of Culebra log-transmissivity, and a prediction of the mean Culebra transmissivity for each grid point in the Culebra model domain.

Section Supplement References:

Deutsch, C. V., and A. G. Journel, 1992, GSLIB: *Geostatistical Software Library and User's Guide*, 2nd ed., Oxford University Press, New York, NY, 369 p.

Holt, R. M., and L. Yarbrough, 2002, Analysis Report Task 2 of AP-088 – Estimating base transmissivity fields, ERMS#523889.

Holt, R. M., and L. Yarbrough, 2003, Addendum to Analysis Report Task 2 of AP-088 – Estimating base transmissivity fields, ERMS#523889.

Powers, D. W., 2002, Analysis Report for Task 1 of Ap-088 – Construction of geologic contour maps, ERMS#522086.

Appendix Supplements

Appendix C Supplement - Routine Calculation: Creation of 100-m grid for AP-088

Software Used:

ArcView

Description:

A newly revised 100-m block-centered grid was created in ArcView. Again, to be sure that grid-block centers lie along the model boundary, the created grid extends 50 m past the model domain. The following are the specifications of the domain grid:

- # of Columns 224
- # of Rows 307
- Lower Left UTMX 601650 edge, 601700 grid-block center
- Lower Left UTMY 3566450 edge, 3566500 grid-block center
- Cell Size 100 m × 100 m

The GRIDPOINT function in Arc/Info was used to generate a point spatial data set. The centers of each 100-m grid block increase in 100-m increments from 601700 in the X direction and 3566500 in the Y direction. This new 100-m grid provided the basis for all revised spatial calculations and other data set creation.

After the point spatial data set was created, the ADDXY command was used in Arc/Info to assign the xy coordinates to the 68,768 data points. This resulting data file was exported into a TAB delimited text format.

Input:

N/A

Output:

- ArcView shapefile "100m_points.shp"
- TAB delimitated file "100m_points.txt"

Platform:

1.8-GHz Pentium 4 - Windows 2000

Appendix D Supplement - Routine Calculation: Creation of Culebra Structure Surface for AP-088

Software Used:

Arc/Info

Description:

Instead of resampling the previously created 50-m surfaces, the new 100-m grids would be created from the original vector data. Using the same contour data produced from Appendix B of Holt and Yarbrough (2003), a newly derived Culebra structure surface was created on the 100-m grid pattern. Again, a hydrologically correct surface was calculated using the TOPOGRID command in ESRI's Arc/Info software. The TOPOGRID command was executed using the new 100-m grid spacing based on the grid locations derived in Appendix C Supplement. The resulting structure surface was saved as an Arc/Info GRID format.

Input:

- Arc/Info coverage format "top_culebra.shp" from Appendix B.

Output:

- Arc/Info GRID format directory file named "culebra"

Data Sources:

Appendix B and Appendix C of Holt and Yarbrough (2003)

Platform:

1.8-GHz Pentium 4 - Windows 2000

References:

Holt, R. M., and L. Yarbrough, 2003, Addendum to Analysis Report Task 2 of AP-088 – Estimating base transmissivity fields, ERMS#523889.

Appendix E Supplement - Routine Calculation: Creating Surface Elevation Data for AP-088

Software Used:

ArcView

Description:

Following Holt and Yarbrough (2003), the new 100-m grid would be resampled from the original 30-m data provided by the USGS and not from the 50-m output grid of the initial Appendix E of Holt and Yarbrough (2002). The reported elevation value for each of the 100-m node points represents an average of elevation for the surface area contained within the grid block.

Input:

- Arc/Info GRID format file of the USGS National Elevation Dataset (NED)

Output:

- Arc/Info GRID format directory file named "dem_nad27"

Data Sources:

USGS National Elevation Dataset (NED) (http://edcnts12.cr.usgs.gov/ned/)

Platform:

1.8-GHz Pentium 4 - Windows 2000

References:

Holt, R. M., and L. Yarbrough, 2002, Analysis Report Task 2 of AP-088 – Estimating base transmissivity fields, ERMS#523889.

Holt, R. M., and L. Yarbrough, 2003, Addendum to Analysis Report Task 2 of AP-088 – Estimating base transmissivity fields, ERMS#523889.

Appendix F Supplement - Routine Calculation: Creating an Isopach of Culebra Overburden for AP-088

Software Used:

ArcView

Description:

Using the digital elevation data from the NED and the Culebra structure surface, an isopach grid was created. The isopach was created in ArcView using the map calculator function. The Culebra structure data were subtracted from the elevation data. The resulting grid is an isopach of Culebra overburden on 100-m spacing.

The GRIDPOINT function in Arc/Info was used to generate a point spatial data set. Each point was the center of a 100-m grid block. This resulting isopach data file was exported into a TAB delimited text format. Following Holt and Yarbrough (2002; 2003), a quality assurance check was created comparing overburden values at the sampled wells to the values derived from the spatial data. Due to the new 100-m grid occupying the same nodes of the previous 50-m grid, the interpolations for the values at the well locations were identical. The new 100-m isopach again underestimated the depth to the top of the Culebra by an average of 0.97 m compared to actual data. While the average error to the center of the Culebra was calculated to 0.05 m ($\sigma = 2.27$ m) for the 44 wells in the data set.

Input:

- Arc/Info GRID format directory file named "culebra" from Appendix D Supplement
- Arc/Info GRID format directory file named "dem_nad27" from Appendix E Supplement

Output:

- Arc/Info GRID format directory file named "isopach"

- EXCEL format file "qa_isopach_supplement_may2003.xls"
- TAB delimitated file "depths.dat"

Data Sources:

Geologic maps prepared by Dennis Powers for Task 1 of AP-088. ERMS# 522086. (see Input listed in Appendix B Supplement of Holt and Yarbrough, 2003)

USGS National Elevation Dataset (NED) (http://edcnts12.cr.usgs.gov/ned/)

Platform:

1.8-GHz Pentium 4 - Windows 2000

References:

Holt, R. M., and L. Yarbrough, 2002, Analysis Report Task 2 of AP-088 – Estimating base transmissivity fields, ERMS#523889.

Holt, R. M., and L. Yarbrough, 2003, Addendum to Analysis Report Task 2 of AP-088 – Estimating base transmissivity fields, ERMS#523889.

Appendix G Supplement - Routine Calculation: Creation of Soft Data Files for AP-088

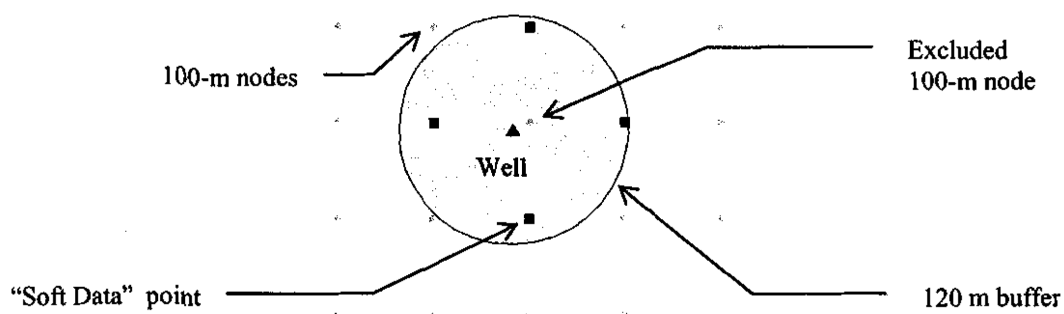
Software Used:

ArcView

Description:

Following Holt and Yarbrough (2002), soft indicator data were created for the indicator simulations. To insure that no high transmissivity regions develop in areas where halite occurs in m2/h2 or m3/h3, we increased the density of our soft data points east of the m2/h2 and m3/h3 salt margins. Soft data points, indicating low transmissivity, were placed on a 200 m grid east of the m2/h2 and m3/h3 salt margins. This 200-m grid used the original 100-m grid excluding every other node to assure the 200-m "soft data" grid spatially overlay the 100-m grid. As before, "soft data" was selected along the combined lines of m2/h2 and m3/h3 salt margins. However, for this data set every 100-m node along the eastern side of the combined line was selected.

Additional "soft data" were created near well locations using a 120-m buffer (see figure below). All 100-m grid nodes (Appendix C Supplement) lying within the 120-m buffer were selected and assigned the transmissivity attribute of the closest well.



Because all the nodes within 120 m of the well and node corresponding to the block containing the well were selected as "soft data", there was duplication in the input files.

Only one data point can occupy a 100-m grid space during a realization. Therefore the node closest to the well was eliminated from the "soft data" file.

The 80-m buffer used by Holt and Yarbrough (2002) proved insufficient with the new 100-m node spacing. After application of an 80-m buffer, there were four wells that only had one 100-m node within 80 m of the well. Unfortunately, that 100-m node duplicated the node of the well and required elimination leaving no "soft data" around those four wells. Therefore a 120-m buffer was selected to assure additional "soft data" nodes around the wells.

The "soft data" points were then exported into a TAB delimited text format.

Input:

- ArcView shapefile "100m_points.shp" from Appendix C Supplement
- ArcView shapefile "salt_margin_m2_h2.shp" from Appendix B of Holt and Yarbrough (2003)
- ArcView shapefile "salt_margin_m3_h3.shp" from Appendix B of Holt and Yarbrough (2003)

Output:

- TAB delimited file "halitej.dat"

Data Sources:

Spatial data digitized from geologic maps prepared by Dennis Powers for Task 1 of AP-088. ERMS# 522086. (see Input listed in Appendix B of Holt and Yarbrough, 2003)

Platform:

1.8-GHz Pentium 4 - Windows 2000

References:

Holt, R. M., and L. Yarbrough, 2002, Analysis Report Task 2 of AP-088 – Estimating base transmissivity fields, ERMS#523889.

Holt, R. M., and L. Yarbrough, 2003, Addendum to Analysis Report Task 2 of AP-088 – Estimating base transmissivity fields, ERMS#523889.

Appendix H Supplement - Routine Calculation: Creation of the Indicator Grids for AP-088

Software Used:

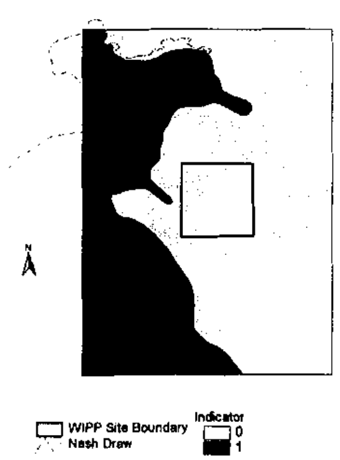
Arc/Info

Description:

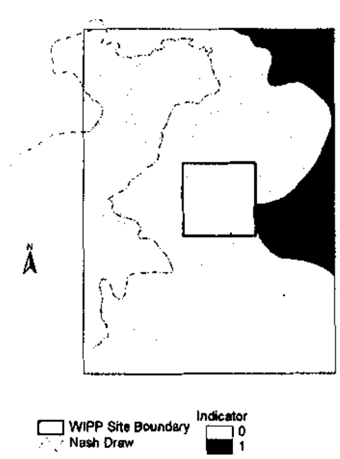
Using the same indicator polygons produced in the Appendix H of Holt and Yarbrough (2002) and Appendix H supplement of Holt and Yarbrough (2003), grids consisting of 0's or 1's were created using the Salado dissolution line, halite margin m2/h2, and halite margin m3/h3 spatial data.

The figures below show the indicator polygons within the model domain.

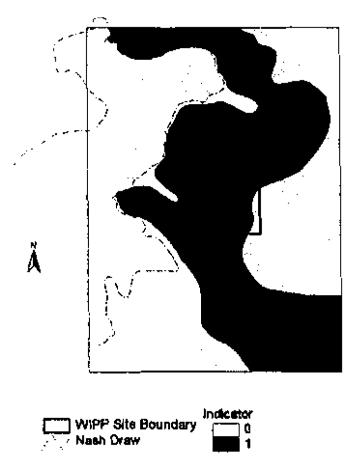
Dissolution Indicator



M2/H2 Indicator



Middlezone Indicator



Next the 100-m points created in a previous subtask (Appendix C Supplement) were overlain on each of the indicator polygons. The attributes of the polygons were then spatially joined to the points, thereby creating a new attribute in the point data representing the associated indicator value. Three indicator point data files were created using this technique:

- Halite Indicator Grid
- Middle Zone Indicator Grid
- Salado Dissolution Indicator Grid

Input:

- Shapefile "100m_points.shp" from Appendix C Supplement
- Shapefile "salado_dissolution_new.shp" from Appendix B of Holt and Yarbrough (2003)
- Shapefile "salt_margin_m2_h2.shp" from Appendix B of Holt and Yarbrough (2003)
- Shapefile "salt_margin_m3_h3.shp" from Appendix B of Holt and Yarbrough (2003)

Output:

- TAB delimited file: h2inds.dat
- TAB delimited file: middlezones.dat
- TAB delimited file: dinds.dat

Data Sources:

Spatial data digitized from geologic maps prepared by Dennis Powers for Task 1 of AP-088. ERMS# 522086. (see Input listed in Appendix B of Holt and Yarbrough, 2003)

Platform:

1.8-GHz Pentium 4 - Windows 2000

References:

Holt, R. M., and L. Yarbrough, 2002, Analysis Report Task 2 of AP-088 – Estimating base transmissivity fields, ERMS#523889.

Holt, R. M., and L. Yarbrough, 2003, Addendum to Analysis Report Task 2 of AP-088 – Estimating base transmissivity fields, ERMS#523889.

Appendix L - Routine Calculation: Conditional Indicator Simulations for AP-088

Software Used:

GSLIB program, subroutines, and include files as described in Holt and Yarbrough (2002).

Description:

As described in Holt and Yarbrough (2002), conditional indicator simulations of Culebra high transmissivity zones were generated using the GSLIB routine "SISIM.f" and a Fortran executable (sisim.exe). Conditioning data are read from file "ndlogTe.dat." Soft data for conditioning are read from "halitej.dat." All 10 conditional indicator simulations are output to "sisim.out" as a single vector of 1's or 0's. For these simulations the numbers of maximum original data, maximum previous nodes, and maximum soft indicator nodes for kriging were all increased to a value of 10 in the parameter file "sisim.par"

Input:

- File: sisim.par (CD#5)
- File: ndlogTe.dat (Appendix I of Holt and Yarbrough, 2002)
- File: halitej.dat (File halitej.dat of Appendix G supplement)

Output:

- File: sisim.out (CD#5)

Data Sources:

Appendix I of Holt and Yarbrough (2002) and Appendix G Supplement

Platform:

1.8-GHz Pentium 4 - Windows 2000

References:

Holt, R. M., and L. Yarbrough, 2002, Analysis Report Task 2 of AP-088 – Estimating base transmissivity fields, ERMS#523889.

Holt, R. M., and L. Yarbrough, 2003, Addendum to Analysis Report Task 2 of AP-088 – Estimating base transmissivity fields, ERMS#523889.

Appendix M - Routine Calculation: Adding Coordinates to Conditional Indicator Simulations for AP-088

Software Used:

GSLIB program: ADDCOORD.FOR

GSLIB subroutines: CHKNAM.FOR, STRLEN.FOR

Compiler: Fortran Powerstation 4.0

Description:

As in Holt and Yarbrough (2002), the GSLIB program "ADDCOORD.FOR" separates the individual simulations and adds coordinates to the indicator output. The parameter file that controls this program was modified to accommodate the new 100-m grid. An example parameter file (R01.par) is shown below. Changes are highlighted in yellow

```
sisim.out                   \file with data
r01cord.out                 \file for output
1                           \realization number
224  601700.0   50.0        \nx,xmn,xsiz
307  3566500.0   50.0       \ny,ymn,ysiz
1   1.0   1.0               \nz,zmn,zsiz
```

Input:

- File: R**.par (Shown above)
- File: sisim.out (Described in Appendix L Supplement)

Output:

- File: r**coord.prn (CD#5)

Data Sources:

See Appendix L Supplement.

Platform:

1.8-GHz Pentium 4 - Windows 2000

References:

Holt, R. M., and L. Yarbrough, 2002, Analysis Report Task 2 of AP-088 – Estimating base transmissivity fields, ERMS#523889.

Holt, R. M., and L. Yarbrough, 2003, Addendum to Analysis Report Task 2 of AP-088 – *Estimating base transmissivity fields*, ERMS#523889.

Appendix N - Routine Calculation: Calculation of Mean Transmissivity Fields for AP-088

Software Used:

program: meantsim.for (written by R. M. Holt)

Compiler: Fortran Powerstation 4.0

Description:

The program meantsim.for (Holt and Yarbrough, 2002) was modified to accommodate the new 100-m grid and recompiled.

Input:

- File: r**T.par (Holt and Yarbrough, 2002)
- File: depths.dat (Appendix F Supplement)
- File: dinds.dat (Appendix H Supplement)
- File: middlezones.dat (Appendix H Supplement)
- File: h2inds.dat (Appendix H Supplement)
- File: r**coord.dat (Appendix M Supplement)

Note: '**' corresponds to realization number

Output:

- File: r**T.out
- File: r**T.txt
- File: r**cntr.txt

Note: '**' corresponds to realization number

Data Sources:

See Appendix F Supplement, Appendix H Supplement, and Appendix M Supplement

Platform:

1.8-GHz Pentium 4 - Windows 2000

References:

Holt, R. M., and L. Yarbrough, 2002, Analysis Report Task 2 of AP-088 – Estimating base transmissivity fields, ERMS#523889.

Program Listing for "meantsim.for"

The program was modified to match the new 100-m grid. Modifications are highlighted below in yellow.

```
      program meantsim
c     This program reads in required data for regression estimation of
c     the mean of Culebra logT.

      parameter (NX = 224)
      parameter (NY = 307)
      parameter (b1 = -5.441)
      parameter (b2 = -4.636e-3)
      parameter (b3 = 1.926)
      parameter (b4 = 0.678)
      parameter (b5 = -1.0)

      real X,Y,Z,h2,mz,di,dpth,ht,logT,T
      character str*3

      read(21,'(a3)') str

  open(22,file='h2inds.dat',status='old')
  open(23,file='middlezones.dat',status='old')
  open(24,file='dinds.dat',status='old')
  open(25,file='depths.dat',status='old')
  open(26,file=str // 'cord.out',status='old')
  open(41,file=str // 'T.out',status='unknown')
  open(42,file=str // 'T.txt',status='unknown')
  open(43,file=str // 'cntr.txt',status='unknown')

      do i=1,7
       read(26,*)
      end do

      icntr=0
      do j=1,NY
       do i=1,NX
        icntr=1+icntr
        read(22,*) X,Y,h2
        read(23,*) X,Y,mz
        read(24,*) X,Y,di
        read(25,*) X,Y,dpth
        read(26,*) X,Y,Z,ht
              logT=b1+b2*dpth+b3*mz*(1.-ht)+(b3+b4)*di+b5*h2
        T=10**(logT)
c     Output for flow models
        write(41,10) int(X),int(Y),logT,T
c     Output for visuallization
        write(42,*) icntr,',',logT
        write(43,*) icntr,',',int(X),',',int(Y)
       end do
      end do

      10  format(2(1x,i14),1x,2(1x,e14.5))
      end
```

Appendix O - Routine Calculation: Procedure for Calculating Mean Transmissivity Fields for AP-088

Software Used:

DOS

Description:

The 500 simulations were created in 5 sets. Each set consists of 10 groups of 10 realizations. All calculations were performed on a single 1.8-GHz Pentium 4, Windows 2000 computer at The University of Mississippi. A DOS batch file was used to launch and control the processing of simulations.

The batch file initially opens directory 1D. It then opens a subdirectory d1r and launches the program "sisim.exe" which then generates 10 equally probable indicator realizations of Culebra high-transmissivity zones (see Appendix L Supplement). It then adds coordinates to each of the indicator realizations using addcoord.exe (see Appendix M Supplement). Finally it calculates a mean Culebra transmissivity field for each realization using "meantsim.exe" (see Appendix N Supplement). The batch file then changes to subdirectory d2r and repeats all calculations. This process continues until 10 realizations are created in 10 subdirectories. After completing the first 100 realizations within directory 1D, the batch file then changes directories to directory 2D and repeats this procedure. This process cycles another 3 times until the final 100 realizations are calculated in directory 5D.

All files were identical except for the 50 separate files "sisim.par" which contained different random number seeds.

Input:

N/A

Output:

N/A

Data Sources:

N/A

Platform:

1.8-GHz Pentium 4 - Windows 2000

Example contents of Tfield_500realizations.bat

```
cd .\1D\d1r
sisim
addcoord r01.par
addcoord r02.par
addcoord r03.par
addcoord r04.par
addcoord r05.par
addcoord r06.par
addcoord r07.par
addcoord r08.par
addcoord r09.par
addcoord r10.par
meantsim r01t.par
meantsim r02t.par
meantsim r03t.par
meantsim r04t.par
meantsim r05t.par
meantsim r06t.par
meantsim r07t.par
meantsim r08t.par
meantsim r09t.par
meantsim r10t.par
cd ..\d2r
sisim
addcoord r01.par
addcoord r02.par
addcoord r03.par
....
```

Appendix P Supplement – CD-ROM Contents

All of the files created in Task 2 of AP-088 are contained within five CD-ROMs. The directory structure for these CDs is shown below.

Appendix File Structure and File Name List

AP_088 Task 2

CD #1

- Appendix A
    - Input
        - newdat4_7_02m2.prn
    - Mathcad
        - Regress Model 3.mcd
    - Output
        - residuals.dat

- Appendix B
    - Input
        - culebra_structure.pdf
        - drillhole_ID_numbers.pdf
        - rustler_halite_margins.pdf
        - salado_dissolution_and_culvt_thickness.pdf
    - Output
        - salado_dissolution_new.shp
        - salt_margin_m1_h1.shp
        - salt_margin_m2_h2.shp
        - salt_margin_m3_h3.shp
        - salt_margin_m4_h4.shp
        - top_culebra.shp
- Appendix C
    - Output
        - final_points.shx
        - final_points.txt
        - qa_final_pints.xls
- Appendix D
    - Input
        - top_culebra (Arc/Info Coverage)
    - Output
        - culebra (Arc/Info Grid)
- Appendix E
    - Input
        -
    - Output
        - dem (Arc/Info Grid)
- Appendix F
    - Input
        - culebra (Arc/Info Grid)
        - dem (Arc/Info Grid)

    - Output
        - isopach
        - isopach.txt
        - qa_isopach.xls
- Appendix G
    - Input
        - final_points.shx
        - salt_margin_m2_h2.shp
        - salt_margin_m3_h3.shp
    - Output
        - halite.txt
- Appendix H
    - Input
        - final_points.shp
        - final_points.txt
        - salado_dissolution_new.shp
        - salt_margin_m2_h2.shp
        - salt_margin_m3_h3.shp
    - Output
        - salado_dissolution_qa.pdf
        - middlezone_qa.pdf
        - halite_qa.pdf
        - p_middlezone.txt
        - p_halite.txt
        - p_dissolution.txt
- Appendix I
    - Input
        - newdat4_7_02m2.prn
    - Mathcad
        - High T indicator 2.mcd
    - Output
        - inddat.dat
        - ndlogTe.dat
- Appendix J
    - Executable
        - gamv.exe
    - Input
        - GAMV.PAR
        - ndlogTe.dat
    - Output
        - gamv450.prn
    - Source_Code
        - CHKNAM.F
        - CHKNAM.FOR
        - GAMV.FOR
        - GAMV.INC
- Appendix K
    - Input
        - gamv450.prn
    - Mathcad
        - varioview450.mcd
- Appendix L
    - Input
        - haliteg.dat
        - ndlogTe.dat

        - SISIM.PAR
    - Source_code
        - ACORNI.FOR
        - BEYOND.FOR
        - CHKNAM.FOR
        - COVA3.FOR
        - GETINDX.FOR
        - KSOL.FOR
        - LOCATE.FOR
        - ORDREL.FOR
        - PICKSUPR.FOR
        - POWINT.FOR
        - SETROT.FOR
        - SETSUPR.FOR
        - SISIM.F
        - SISIM.INC
        - SORTEM.FOR
        - SQDIST.FOR
        - SRCHSUPR.FOR
- Appendix M
    - Input
        - R01.PAR
    - Source_code
        - ADDCOORD.FOR
        - CHKNAM.FOR
        - STRLEN.FOR
- Appendix N
    - Input
        - R01t.PAR
    - Source_code
        - meantsim.for

CD #2 – *Note that all realization directories are essentially the same. File names vary* as described in Appendix N.

- Appendix O
    - newb10r.zip
    - newb09r.zip
    - newb08r.zip
    - newb07r.zip
    - newb06r.zip
    - newb05r.zip
    - newb04r.zip
    - newb03r.zip
    - newb02r.zip
    - newb01r.zip

Example Listing of a Realization Directory

addcoord.exe	Application
meantsim.exe	Application
sisim.exe	Application
depths.dat	Data File
dinds.dat	Data File
h2inds.dat	Data File

haliteg.dat	Data File
middlezones.dat	Data File
ndlogTe.dat	Data File
sisim.dbg	Data File
Tfield.bat	Batch File
r01cord.out	Out File
r01T.out	Out File
r02cord.out	Out File
r02T.out	Out File
r031cord.out	Out File
r03T.out	Out File
r04cord.out	Out File
r04T.out	Out File
r05cord.out	Out File
r05T.out	Out File
r06cord.out	Out File
r06T.out	Out File
r07cord.out	Out File
r07T.out	Out File
r08cord.out	Out File
r08T.out	Out File
r09cord.out	Out File
r09T.out	Out File
r10cord.out	Out File
r10T.out	Out File
sisim.out	Out File
R01.PAR	Parameter File
R01t.PAR	Parameter File
R02.PAR	Parameter File
R02t.PAR	Parameter File
R03.PAR	Parameter File
R03t.PAR	Parameter File
R04.PAR	Parameter File
R04t.PAR	Parameter File
R05.PAR	Parameter File
R05t.PAR	Parameter File
R06.PAR	Parameter File
R06t.PAR	Parameter File
R07.PAR	Parameter File
R07t.PAR	Parameter File
R08.PAR	Parameter File
R08t.PAR	Parameter File
R09.PAR	Parameter File
R09t.PAR	Parameter File
R10.PAR	Parameter File
R10t.PAR	Parameter File
SISIM.PAR	Parameter File
r01cntr.txt	Text file of node ID and UTM coordinates
r01T.txt	Text file of node ID and transmissivity
r02cntr.txt	Text file of node ID and UTM coordinates
r02T.txt	Text file of node ID and transmissivity
r03cntr.txt	Text file of node ID and UTM coordinates
r03T.txt	Text file of node ID and transmissivity
r04cntr.txt	Text file of node ID and UTM coordinates
r04T.txt	Text file of node ID and transmissivity
r05cntr.txt	Text file of node ID and UTM coordinates

r05T.txt	Text file of node ID and transmissivity
r06cntr.txt	Text file of node ID and UTM coordinates
r06T.txt	Text file of node ID and transmissivity
r07cntr.txt	Text file of node ID and UTM coordinates
r07T.txt	Text file of node ID and transmissivity
r08cntr.txt	Text file of node ID and UTM coordinates
r08T.txt	Text file of node ID and transmissivity
r09cntr.txt	Text file of node ID and UTM coordinates
r09T.txt	Text file of node ID and transmissivity
r10cntr.txt	Text file of node ID and UTM coordinates
r10T.txt	Text file of node ID and transmissivity

CD #3 – Supplementary CD (Feburary 2003)

- Appendix B Supplement
    - Input
        - Culebra_elev_rev_1-3-03_B.pdf
        - Salado_Dissolution_Line_revised_1-3-03.pdf
    - Output
        - dissolution_line.shp
        - culebra_contours.shp
- Appendix D Supplement
    - Input
        - culebra (Arc/Info Coverage)
    - Output
        - culebra (Arc/Info Grid)
- Appendix E Supplement
    - Input
        -
    - Output
        - dem_nad27 (Arc/Info Grid)
- Appendix F Supplement
    - Input
        - culebra (Arc/Info Grid)
        - dem_nad27 (Arc/Info Grid)
    - Output
        - isopach
        - isopach.txt
        - qa_isopach_supplement.xls
- Appendix H Supplement
    - Input
        - final_points.shp
        - final_points.txt
        - dissolution_line.shp
        - salt_margin_m2_h2.shp
        - salt_margin_m3_h3.shp
    - Output
        - salado_dissolution_qa.pdf
        - middlezone_qa.pdf
        - p_middlezone.txt
        - p_dissolution.txt
- Appendix O Supplement
    - c10r.zip
    - c09r.zip

- c08r.zip
- c07r.zip
- c06r.zip
- c05r.zip
- c04r.zip
- c03r.zip
- c02r.zip
- c01r.zip
-

CD #4 – Supplementary CD (May 2003)

- Appendix C Supplement
  - Output
    - 100m_grid.shp
- Appendix D Supplement
  - Input
    - culebra (Arc/Info Coverage)
  - Output
    - culebra (Arc/Info Grid)
- Appendix E Supplement
  - Input
    -
  - Output
    - dem_nad27 (Arc/Info Grid)
- Appendix F Supplement
  - Input
    - culebra (Arc/Info Grid)
    - dem_nad27 (Arc/Info Grid)
  - Output
    - isopach (Arc/Info Grid)
    - depths.dat
    - qa_isopach_supplement_may2003.xls
- Appendix G Supplement
  - Input
    - 100m_grid.shp
    - salt_margin_m2h2
    - salt_margin_m3h3
  - Output
    - halitej.dat
- Appendix H Supplement
  - Input
    - 100m_grid.shp
    - final_points.txt
    - salado_dissolution_line_new.shp
    - salt_margin_m2_h2.shp
    - salt_margin_m3_h3.shp
  - Output
    - h2inds.dat
    - middlezones.dat
    - dinds.dat
- Appendix L Suplement
  - Input
    - halitej.dat
    - ndlogTe.dat
    - SISIM.PAR

   - Source_code
     - ACORNI.FOR
     - BEYOND.FOR
     - CHKNAM.FOR
     - COVA3.FOR
     - GETINDX.FOR
     - KSOL.FOR
     - LOCATE.FOR
     - ORDREL.FOR
     - PICKSUPR.FOR
     - POWINT.FOR
     - SETROT.FOR
     - SETSUPR.FOR
     - SISIM.F
     - SISIM.INC
     - SORTEM.FOR
     - SQDIST.FOR
     - SRCHSUPR.FOR
- Appendix M Supplement
   - Input
     - R01.PAR
   - Source_code
     - ADDCOORD.FOR
     - CHKNAM.FOR
     - STRLEN.FOR
- Appendix N Supplement
   - Input
     - R01t.PAR
   - Source_code
     - meantsim.for

CD #5 – Supplementary CD (May 2003)

- Appendix O Supplement
   - 1D.zip
     - d10r
     - d09r
     - d08r
     - d07r
     - d06r
     - d05r
     - d04r
     - d03r
     - d02r
     - d01r
   - 2D.zip
     - d10r
     - d09r
     - d08r
     - d07r
     - d06r
     - d05r
     - d04r
     - d03r
     - d02r

    - d01r
- 3D.zip
    - d10r
    - d09r
    - d08r
    - d07r
    - d06r
    - d05r
    - d04r
    - d03r
    - d02r
    - d01r
- 4D.zip
    - d10r
    - d09r
    - d08r
    - d07r
    - d06r
    - d05r
    - d04r
    - d03r
    - d02r
    - d01r
- 5D.zip
    - d10r
    - d09r
    - d08r
    - d07r
    - d06r
    - d05r
    - d04r
    - d03r
    - d02r
    - d01r

Chavez, Mario Joseph Mario Chavez

From: Lance Yarbrough [Lance@Yarbrough.com]

Sent: Wednesday, May 14, 2003 12:48 PM

To: 'Chavez, Mario Joseph'

Subject: RE: CD data on FTP server

Yes, please do so.

I , Lance D. Yarbrough give Mario Chavez permission to sign on my behalf the May 2003 addenda.

Thank you,
Lance D. Yarbrough

Lance D. Yarbrough, EIT
Graduate Researcher/Instructor
Geology and Geological Engineering
118 Carrier Hall
University, MS 38677
V- (662) 915-7651
F- (662) 915-5995

-----Original Message-----
From: Chavez, Mario Joseph [mailto:mjchave@sandia.gov]
Sent: Tuesday, May 13, 2003 4:18 PM
To: 'Lance Yarbrough'
Subject: RE: CD data on FTP server

thanks Lance, I cut the CD's and need your permission to sign the latest addenda for record submittal.

Mario

-----Original Message-----
From: Lance Yarbrough [mailto:Lance@Yarbrough.com]
Sent: Tuesday, May 13, 2003 9:15 AM
To: Chavez, Mario Joseph; rmholt@olemiss.edu
Subject: CD data on FTP server

I am currently transferring the contents of the two CDs to the Sandia FTP server. All files will be in a single compressed (.zip) file named cds_4and5_may2003.zip

They are in the /Greenchile/T fields directory.

Within this file are two directories for each of the CDs and a few files that should go on each CD. These are the Appendix P files. There is a Word document and a PDF. These files list the contents of the CDs from the first to fifth.

I have also included a PDF containing the CD labels. This file is for a standard two CD label sheet.

The file is very large! About 983 MB and it should hopefully be finished by lunch.

Thank you,

INFORMATION ONLY

Lance

Lance D. Yarbrough, EIT

Graduate Researcher/Instructor

Geology and Geological Engineering

118 Carrier Hall

University, MS 38677

V- (662) 915-7651

F- (662) 915-5995

INFORMATION ONLY

Chavez, Mario Joseph Mario Chavez

From: Joel Kuszmaul [kuszmaul@olemiss.edu]
Sent: Sunday, May 11, 2003 4:39 PM
To: mjchave@sandia.gov; rlbeauh@sandia.gov
Cc: rmholt@olemiss.edu
Subject: Addendum 2 Report DRC Form Complete

drckuszholtcmplt-add2.doc (105...

I have completed my technical review of the Addendum 2 report from Holt and Yarbrough. The issues that I had identified have been resolved. I have attached a copy of the completed DRC form. I wish to authorize either Mario or Rick to sign the form on my behalf.

Thanks,

Joel Kuszmaul

****

Joel Kuszmaul
Associate Professor
Dept. of Geol. & Geol. Engineering
University of Mississippi
P.O. Box 1848
University, MS 38677

phone: (662)915-7499
fax: (662)915-5998

Chavez, Mario Joseph Mario Chavez

From: Robert M. Holt [rmholt@olemiss.edu]
Sent: Sunday, May 11, 2003 7:22 PM
To: 'mjchave@sandia.gov'; 'rlbeauh@sandia.gov'
Subject: FW: Addendum 2 Report DRC Form Complete

drckuszholtcmplt-add2.doc (105...

Mario and Rick,
I wish to authorize either Mario or Rick to sign this form on my behalf. Bob

-----Original Message-----
From: Joel Kuszmaul
Sent: Sunday, May 11, 2003 6:39 PM
To: mjchave@sandia.gov; rlbeauh@sandia.gov
Cc: rmholt@olemiss.edu
Subject: Addendum 2 Report DRC Form Complete

I have completed my technical review of the Addendum 2 report from Holt and Yarbrough. The issues that I had identified have been resolved. I have attached a copy of the completed DRC form. I wish to authorize either Mario or Rick to sign the form on my behalf.

Thanks,

Joel Kuszmaul

****

Joel Kuszmaul
Associate Professor
Dept. of Geol. & Geol. Engineering
University of Mississippi
P.O. Box 1848
University, MS 38677

phone: (662)915-7499
fax: (662)915-5998

INFORMATION ONLY