

## 附錄 RETC 程式說明及使用

RETC是一套用來分析非飽和土壤中，土壤水保持曲線和水力傳導係數方程式的電腦程式。在水流經非飽和區域或土壤時，這些水力傳導性質是很重要的定量化參數。這套程式利用了Brooks-Corey和Van Genuchten的參數模式用來代表土壤水保持曲線；利用了Mualem and Burdine的理論孔隙分佈模式從觀察到的土壤水保持曲線預測水力傳導係數方程式，參考網頁如下：

<http://www.ussl.ars.usda.gov/models/retc.HTM>

使用說明如下：

1. 開啟 RETC 程式中的資料夾：



2. 在 RETC 資料夾中，加入一個\*.in 檔，此處以 nctu.in 為例，輸入土壤中保持曲線中張力跟體積含水比資料，格式如下：(注意，張力值單值為公分，體積含水比須為小數點後 5 位數。)

nctu - 記事本				
檔案(F)	編輯(E)	格式(O)	檢視(V)	說明
1	0.54010	1		
10	0.53860	1		
20	0.53390	1		
30	0.51160	1		
40	0.48740	1		
50	0.46790	1		
60	0.33930	1		

3. 以記事本開啟 RETC.CTL 檔案，鍵入來源資料檔 nctu.IN、鍵入結果輸出檔 nctu.OUT(每次要跑新的資料時，要將 RETC 資料夾中的 nctu.OUT 先刪去一次，才可每次於 nctu.OUT 中得到結果輸出。若不刪除亦可，輸出資料會存於 RETC.OUT 檔中，存下想要的資料即可)。再輸入 RETC 程式中的檔名例如 EXAMPLE:heptane vs air local(perm)(MDC)。接著輸入殘餘體積含水比 WCR(注意小數點後要 5 位數)、飽和體積含水比 WCS(注意小數點後要 5 位數)、CONDS 飽和時的滲透係數值(cm/s)、最後面的 20 代表模擬的點數：

retc - 記事本									
檔案(F)	編輯(E)	格式(O)	檢視(V)	說明(H)					
nctu.IN									
nctu.OUT									
RETPLT.OUT									
COMPLT.OUT									
EXAMPLE : heptane vs air local(perm)(MDC)									
3	2	1	1	1	8	50			
WCR	WCS	ALPHA	N	M	L	CONDS			
.33930	.54010		.01000	2.00000	.50000	.50000	1.00000		
0	0	1	1	0	0	0			
1.00000	20								

4. 開啟 RETC 資料夾中的 RETC 執行程式：

```
C:\ D:\論文資料\實驗資~2\retc\retc.exe
← [2J]***** RETC : LISTING OF CONTROL FILE *****
[1] OBSERVED DATA FILE NAME           : nctu.IN
[2] OUTPUT FILE NAME                   : nctu.OUT
[3] PLOT FILE NAME FOR RETENTION CURVE  : RETPLT.OUT
[4] PLOT FILE NAME FOR CONDUCTIVITY/DIFFUSIVITY: COMPLT.OUT
[5] TITLE OF CASE                      :
    EXAMPLE : heptane vs air local(perm)(MDC)
[6] TYPE OF RETENTION/CONDUCTIVITY MODEL : 3
    1. Retention: van Genuchten
       Conductivity: Mualem
    2. Retention: van Genuchten
       Conductivity: Burdine
    3. Retention: van Genuchten with m=1-1/n
       Conductivity: Mualem
    4. Retention: van Genuchten with m=1-2/n
       Conductivity: Burdine
    5. Retention: Brooks & Corey
       Conductivity: Mualem
    6. Retention: Brooks & Corey
       Conductivity: Burdine

ENTER ITEM NUMBER TO BE CHANGED <RETURN FOR NEXT SCREEN>:
```

按 Enter 進入下頁…等等：

```
C:\ D:\論文資料\實驗資~2\retc\retc.exe
[14] INITIAL ESTIMATE  .34 | .54 | .01 | 2.00 | .50 | .50 | 1.00
[15] FITTING?          0 | 0 | 1 | 1 | 0 | 0 | 0
      (0 = known parameter; remains constant during parameter estimation)
      (1 = unknown parameter to be fitted to data)
[16] WEIGHT OF K/D DATA WITH RESPECT TO WATER CONTENT DATA : 1.00
      (Default=1.0)
[17] NUMBER OF POINTS FOR PRINTING THE FITTED HYDRAULIC FUNCTION: 20

ENTER ITEM NUMBER TO BE CHANGED <RETURN FOR NEXT SCREEN>:
← [2J]*****
*
* LIST OF PROGRAM OPTIONS
*
*****
1: EDIT CONTROL FILE
2: RUN PROGRAM, OPTION TO PRINT OUTPUT FILE
3: UPDATE FILE AND QUIT TO DOS
4: QUIT TO DOS WITHOUT UPDATE
5: VIEW FILE ON SCREEN OR PERFORM DOS COMMAND

ENTER SELECTION <1 - 5>:
```

按 2 Run program 後，依指示即可得到結果。

5. 開啟 nctu.OUT 或 RETC.OUT 即可得到結果，以下是輸出結果的頁面圖：

```

RETC - 記事本
檔案(F) 編輯(E) 格式(O) 檢視(V) 說明(H)
*****
*
* ANALYSIS OF SOIL HYDRAULIC PROPERTIES
*
* EXAMPLE : heptane vs air local(perm)(MDC)
*
* MUALEM-BASED RESTRICTION, M=1-1/N
* ANALYSIS OF RETENTION DATA ONLY
* MTYPE= 3 METHOD= 2
*
*****

INITIAL VALUES OF THE COEFFICIENTS
=====
NO      NAME      INITIAL VALUE  INDEX
1       WCR        .3393          0
2       WCS        .5401          0
3       ALPHA      .0100          1
4       N          2.0000         1
5       M          .5000          0
6       L          .5000          0
7       CONDS      1.0000         0

OBSERVED DATA
=====
OBS. NO.  PRESSURE HEAD  WATER CONTENT  WEIGHTING COEFFICIENT
1          10.000        .5386          1.0000
2          20.000        .5339          1.0000
3          30.000        .5116          1.0000
4          40.000        .4874          1.0000
5          50.000        .4679          1.0000
6          60.000        .3393          1.0000

```

6. 最左邊的 WC 為體積含水比(於 2 步驟中輸入的)，中間的 COND(用線條圈選處)即是預測出的滲透係數值：

```

RETC - 記事本
檔案(F) 編輯(E) 格式(O) 檢視(V) 說明(H)

SUM OF SQUARES OF OBSERVED VERSUS FITTED VALUES
=====
                UNWEIGHTED   WEIGHTED
RETENTION DATA   .00354       .00354
COND/DIFF DATA   .00000       .00000
      ALL DATA   .00354       .00354

SOIL HYDRAULIC PROPERTIES (MTYPE = 3)
=====
      WC          P          LOGP          COND          LOGK          DIF          LOGD
.3421   .8315E+02   1.920   .6153E-05   -5.211   .2317E-01   -1.635
.3449   .7615E+02   1.882   .4145E-04   -4.382   .7219E-01   -1.141
.3505   .6965E+02   1.843   .2797E-03   -3.553   .2276E+00   -.643
.3616   .6351E+02   1.803   .1892E-02   -2.723   .7370E+00   -.133
.3728   .6000E+02   1.778   .5806E-02   -2.236   .1504E+01   .177
.3839   .5749E+02   1.760   .1289E-01   -1.890   .2550E+01   .407
.3951   .5549E+02   1.744   .2398E-01   -1.620   .3915E+01   .593
.4062   .5379E+02   1.731   .3988E-01   -1.399   .5661E+01   .753
.4174   .5229E+02   1.718   .6143E-01   -1.212   .7875E+01   .896
.4285   .5092E+02   1.707   .8945E-01   -1.048   .1068E+02   1.029
.4397   .4961E+02   1.696   .1248E+00   -.904   .1427E+02   1.154
.4509   .4835E+02   1.684   .1684E+00   -.774   .1890E+02   1.277
.4620   .4710E+02   1.673   .2213E+00   -.655   .2502E+02   1.398
.4732   .4582E+02   1.661   .2845E+00   -.546   .3331E+02   1.523
.4843   .4447E+02   1.648   .3593E+00   -.445   .4502E+02   1.653
.4955   .4300E+02   1.633   .4472E+00   -.350   .6263E+02   1.797
.5066   .4130E+02   1.616   .5500E+00   -.260   .9171E+02   1.962
.5178   .3918E+02   1.593   .6707E+00   -.174   .1486E+03   2.172
.5289   .3601E+02   1.556   .8139E+00   -.089   .3108E+03   2.493
.5345   .3322E+02   1.521   .8976E+00   -.047   .6133E+03   2.788
.5401   .0000E+00

END OF PROBLEM
=====

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