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Scientific Notebooks No. 067: Stochastic  
Project: BIGFLO Modification and Simulations  
(03/15/1993 through 12/16/1996)

S149

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Stochastic Project  
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All work hypotheses  
described in the  
Project Plan.

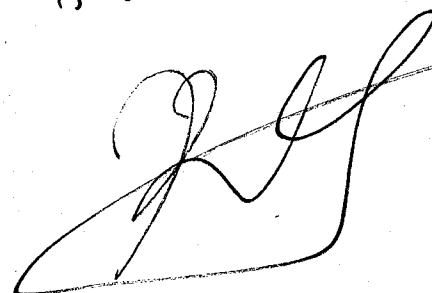


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In all references to  
BIGFLOW it is implied  
that version 2.0 is used.  
Similarly version 2.41 of PORTFLOW  
is used.

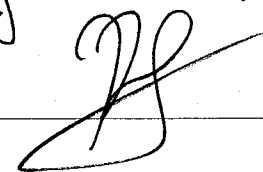


12/8/94

All dates are during 1993 except otherwise stated.

1

3/15

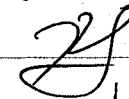


Work on Prochures set visualization continued.  
Problems with line intersections etc. currently  
investigated.



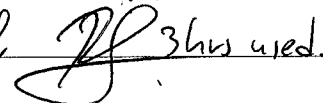
3/16 Revision of "caution paper".

BIGFLOW manual: NRC comments are incorporated.



3/17 Comparison between BIGFLOW and PORTFLOW  
for Van Esenbeken case underway.

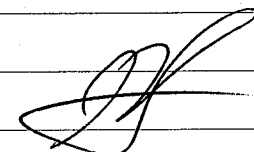
Runs made on INEL computer. The "obstacle"  
data set was used. Numbers can be found in the  
BIGFLOW manual (TEST-5). Time of 3 hrs used.



3/18 Results have some problem. Investigation  
underway. More work on 1D shows that code is  
working OK. 3D problems mean that array addressing  
may cause the problem.



3/19 Problem with visualization of Prochures is identi-  
fied. Work continues to remedy the problem.  
Work on parallel computing (Markov generator) has  
re-started. It will be presented to the SIAM confer-  
ence.



3/22 ID problem for BIGFLOW/PORTFLOW comparison fully verified. 3D results are debugged and problem of array addressing is resolved. Visualization work continues. Line connections are introduced as a potential measure of connectivity. Parallel work continued on GSLIB routines. MDM (matrix decomposition method) and TBM (Turning Bands Method) are being explored.

*[Signature]*

3/23 BIGFLOW is now verified for 3D. Contour plot of pressure head for PORTFLOW/BIGFLOW reveals very good agreement. This is still qualitative. No "absolute" measure of performance has been used.

A plot of the temporal evolution of the pressure head will be drawn to provide a better comparison. This will be done for point A (see BIGFLOW manual). LUSIM (routine of GSLIB) has been tried, but can handle only very small problems. Most probably will be dropped from the analysis.

*[Signature]*

3/24 CDS development work is going on. The "saturated zone" CDS has gone out, kindly. Talked w/ Bill Ford (NRC) regarding the "unsaturated zone" CDS. He said that he will not (cannot) do it this quarter. Most probably will be moved to the next. NRC is still officially the lead. Work on the "evapotranspiration (EAC)" CDS is going on with Mike Miller. Revised version by Neil Coleman is received. Review underway. MDM works up to  $15^3$  problems on the INEL CRAY. Problems for higher number of nodes. TBM is doing OK up to  $106^3$  problems.

*[Signature]*

3/25 "ET" CDS reviewed. New version is expected from NRC today or tomorrow.

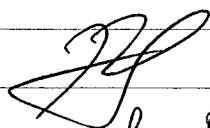
MDM attempts for conditional simulations. No extra time requirements for conditioning. Work on analyzing NNM (Nearest Neighbor Method) is going. Verification code is being transformed from 2D to 3D to handle this. Sitakanta Mohanty's code is used for that. NNM code (CMNNM) is changed in terms of format so that the two codes are compatible. Setting a meeting with Mike Miller to brief the visualization activity.

*[Signature]*

3/26 Latest version of "ET" CDS received, late Friday. Will review on Monday.

Meeting w/ M. Muller went well. Very interesting results. GLFRAC3D is indeed a useful tool for visualizing complex 3D fracture sets. Outcrops are nicely demonstrated, plane intersections, and line connections. CPU time requirements are rather extensive, especially for the full set (205 fractures).

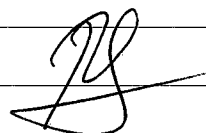
Discussion and extensive probing revealed potential small problem with the size of the domain. This leads to having much more line connections and plane intersections, thus more time. Mike Muller will look into this.



3/29 final version of BIGFLOW manual is getting close to being done. Working on figures and flowcharts.

Visualization "bug" is being eliminated. "ET" CDS being reviewed. Comments were forwarded to Mike Muller.

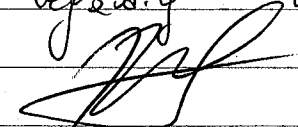
Variogram 3D code is fully coupled with NNM code. Analysis revealed a preliminary "correct" structure in terms of  $\gamma$  (correlation length). Some questions regarding  $\sigma_y$  are to be resolved.



3/30 Visualization code is almost complete in its revised form. Dry-run is to be conducted and decision on which figures to present during the mid-year review is needed.

Work on the IRFO project (fuzzy set phase) is re-started. Running of CMVSFS (connection Machine) code for verification purposes. The problem is 2D with an obstacle (of conductivity). Description of the problem is presented in the Progress Report #1 (1/20/93) to the ACK Committee.

Further analysis with CMNNM continues. Repeated unconditional realizations are being analyzed to get a better insight regarding Geostatistics.



3/31 Worked with Mike Muller on the visualization of fracture results. Decided on which figures to present in slide mode. Will take pictures tomorrow. Had a discussion with Mike Muller re: the "ET" CDS. Our review of Neil Coleman's work is consistent. Will talk with Neil tomorrow.

Worked with Sitakanta on the NNM code. Verified that the generator is working OK in terms of variograms. The correlation length is a Unit sl.  $\gamma = 5.7$  specified, vs.  $\gamma \approx 7$  fitted but the variogram is a beautiful exponential. Remember, also, that the variogram analyzed is the mean of 10 realizations, i.e.  $\langle \gamma(h) \rangle$ . The potential "bug" regarding the Std is still there.

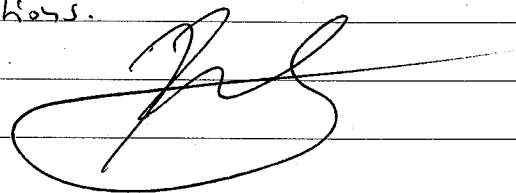


I have started narrowing down the problem. It, most probably, is a  $\nabla$  multiplier which (byte way) does not show in Van Marcke's book. The observed discrepancy is  $\sim 10$  times. More specifically,  $\sigma_y^{\text{desired}} = 2$ ,  $\sigma_y^{\text{observed}} \approx 0.21$ . Could it be a  $n^2$  factor.

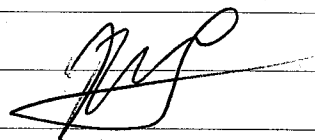
Worked on the fuzzy logic problem with Ashok. Run the CMUSTS code for the obstacle problem.

The fuzzy code FLO'SIM has a problem "dissipating" the head downstream of the obstacle.

Work is going on to remedy the situation. Potential culprits: small domain / size of obstacle, and bad initial conditions.



4/1 GWTT meeting (tele-conf.) did not take place. We waited for almost 45 min. Worked with Mike Muller to finalize the lectures slides. Worked on the CMNNM code. Trying to establish the relationship between Van Marcke's equation and my formulation. Worked on preparing vignettes for the MDA yr review.



4/2 Worked on BIGFLOW (van Genuchten) version verification is completed. Accidental deletion of a 2-page section of the new version took almost half day to bring back to normal. Couple of test cases have been run to make sure that there is no corrupted part of the code.

The problem run was the one dimensional, homogeneous, infiltration problem (presented in the BIGFLOW manual).

A study of the number of the nonlinear iterations was conducted. It was found that it takes  $\approx 26131$  iter. for VG

vs

22604 iter. for Gardner

Also, time-wise the Gardner version took 2031.4 secs vs 3350 secs for the VG version.

When one calculates the work (secs) per iteration the new version of the code has a production rate of:

$$\frac{3350}{26131} = 0.1282 \text{ sec/it.}$$

vs.

$$\frac{2031.4}{22604} = 0.0898 \text{ sec/it}$$

$\Rightarrow$

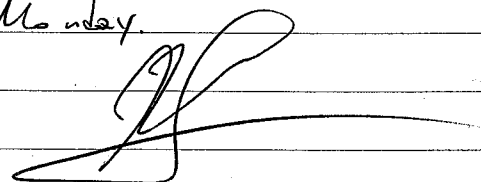
$\Rightarrow$  a decrease in efficiency of  $\approx 42\%$

which is considered satisfactory, keeping in mind the complexity of

The VG. model compared to the "linearizable" Gardner model.

I worked also on "dipping" in for the CMNMM code. Question mark regarding the  $\sigma_y$  (observed) is still to be tackled.

Worked also on the IRFD. Run a transient problem to see if there is any similarity (in the transient mode) between the direct simulation and the fuzzy logic results. Plots will be obtained on Monday. Mike Miller gave me the fracture slides. Will classify and discuss them on Monday.



4/5 Worked on Mid-yr review slides. Worked with Ashok Nedunvedi on the IRFD. Re-formulated the "obstacle" problem, so that both the fuzzy and the direct numerical code have the same interfacial conductivities. Runs made on the CM with an obstacle of  $\frac{K'_3}{K_3^2} = \frac{5}{0.5}$

Re-defined the universe of discourse for the fuzzy problem as: gradient  $\in (0, 15)$ , velocity  $\in (0, 65)$ ,  $K \in (0, 5)$

Also identified the "correct" dimensions for TECPlot visualization of BIGFLOW/POFLOW results. They are:

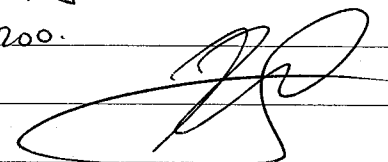
BIGFLOW  $\rightarrow$  60.5 / 121.5

x                      y

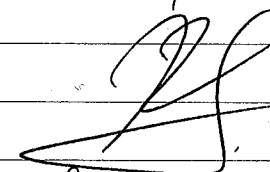
POFLOW  $\rightarrow$  55.5 / 122.5 (cutoff 55.5/x-ycoord(-0.5, 0.5))

Worked with fractures slides. Requested printouts (hardcopy) of  $\approx$  half of them. The GLFRAC3D can indeed help us visualize "connectivity" issues. Work on  $\sigma_y$  (CMNMM) discrepancy continued.

CMNMM run was prepared and submitted with a potential correction for the  $\sigma_y$  problem. Factor  $2\sqrt{3}$  eliminated from the random sampling of the RHS vector  $b = 2\sqrt{3} \cdot V_3 [z - 0.5]$  where  $z \in [0, 1]$ . Job is waiting in queue at the LALN CM-200.



4/6 Worked and finalized mid-yr review slides. Worked with Ashok on the IRFD. Identified potential problem for the non-dissipation behavior past the obstacle. Started getting color printouts of the fracture network slides. Some small problems with the "distorted" scale are being tackled. The CMNMM run with the  $2\sqrt{3}$  correction did not materialize. The problem persists.



4/7 More corrections for the mid-yr review slides. The problem with the fuzzy FLO<sup>2</sup>SIM solver is corrected. It appears that when the flow is predominantly horizontal the vertical "sweep" of the ADI, destroys the symmetry. Problems with the "distorted" color printouts are now

vested. Correct scaling method is calculated and  
prints are being produced. More work on the CMM  
code with no success. Was requested and gave an  
overview of the Stochastic ~~Process~~ Dr. B. Scully from B.E.G.

9/8 Met with Corey from publications to discuss the editorial review of the BIGFLOW NURFG. Still awaiting the 2 technical and 1 programmatic reviews. More work on the CMNMRK with no success. Met with Ashok and gave him an overview of the PSEF activity, he is going to be involved.

4/9 Finally, the Mid-yr review slides are being approved (text). I'll finalize what figures (and how many) to show on Monday.

The problem with the MANN case has been identified. There are 2 problems:

1)  $\Rightarrow$

	1	2	3	4
1	1	2	3	4
2	5	6	7	8
3	9	10	11	12
4	13	14	15	16

A Physical domain (2D)

$\Rightarrow$

16  $\left[ \begin{array}{ccccccc} 1 & -\alpha & -\alpha & & & & \\ & 1 & -\alpha & \dots & & & \\ & -\alpha & 1 & -\alpha & & & \\ & & -\alpha & 1 & -\alpha & & \\ & & & -\alpha & 1 & \dots & \\ & & & & \dots & \dots & 1 \\ & & & & & -\alpha & 1 \end{array} \right]$  of

coefficient matrix, which is always tridiagonal. In the CMMVM code, however, this is not the case since we are doing full 3D dimensionality as a banded-diagonal

away. When I experimented (extensively) on MATLAB  
I found that a triangular system indeed honors the statistics  
2) There is another multiplying factor, however, which  
shows from the fact that we are sampling from a finite  
sized field. Thus,  $\sigma_s = \frac{\sigma_p}{\sqrt{n}}$  is the standard  
error for the mean of the  $\sqrt{n}$  field. Obviously, the  
error in the standard deviation of the field is  $\frac{\sigma_p^2}{\sqrt{n}}$ . So,  
in order to impose the population std. we must  
multiply the field by  $\sqrt{\sigma_p^2 * n}$ .  
Have been approached by Randy Barthele (UCLA) for a  
potential collaboration for the ALT site.

4/1/12 Worked mostly on preparing my presentation to the MRC Mid-yr review. Finalized the color figures and the results slides. Worked also on the CMLNVM code and making runs for different # of contributing points etc. Held a meeting with Steven Seida regarding the ANN work in my IRFD project.

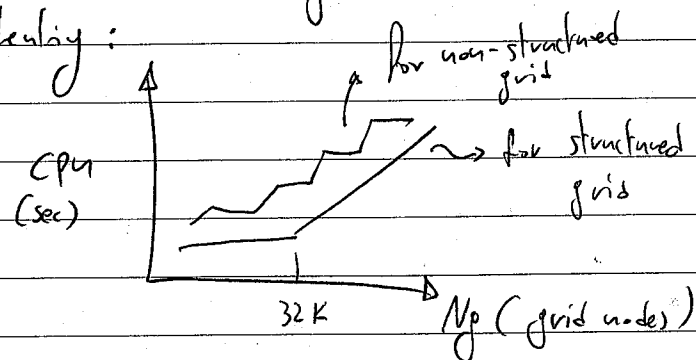
4/13 Attended some of the review proceedings. Worked mostly on preparing my presentation. Spent some time on preparing my slides for the SRAM presentation next week. Provided the write-up to the secretary for the 1D analytical solutions. She will take care of it later this week.



4/14 Gave my presentation to NRC. Went very well, in my opinion. I was asked questions mainly by Guy Arlotto and Frank Conjunzi. Discussion took place and was concluded that the major contribution of the ShadowSic Project is the development of useful tools to help NRC/CNWRPA ask the right questions of DOE. Spent very little time for the SIAM Presentation.

4/15 Worked on preparing my presentation for the SIAM conference on Mathematical Issues in the Geosciences. Prepared text slides and ID verification/benchmarking slides for the CMNNM code. Initiated some work with Ashok Nedunjadi on making the Ven Gendhen "u" a fully 3D array.

4/16 Worked mostly on preparing my presentation for SIAM. Conducted some (last minute) timings of the CMNNM code for various grid sizes. Results were interesting:



There was a distinct break in the slope of the CPU/yp curve occurring at  $\approx 32K$  nodes. Since I was making runs on a 16K processor machine, I believe it is due to the change in the VP ratio. Also, it was interesting to note the "staircase" behavior for grids that are not structured as powers of 2.

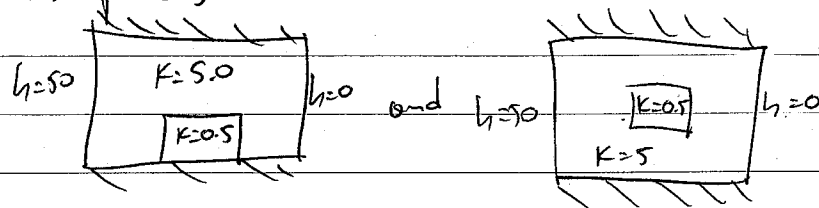
4/19 Was on travel to attend the SIAM conference at Houston. My presentation was on the 19th and went very well. Got asked many questions by the Gurtjar (UNM) group. He will be sending some codes to me in the near future.

4/22 Worked on the SUTR Program for Parallel Computing. My task was to conduct an extensive literature review of parallel computing applications for problems arising in CFD, groundwater, and ODE type of equations. My review consisted of identifying the paper, summarizing it and providing its bibliographical data.

4/23 My review continued and completed. In total, 37 papers were reviewed and summarized. Also information on 7-8 books was provided. Text from a previous report on the subject matter was also provided (spanning  $\approx 18$  references).

4/26 Corrected some typos for my literature review. Submitted my contribution to the manager of the activity Chris Freitas. Conducted some CPU comparisons for P. Johnson between the Cray (w/ INEL) and LANL. Results indicated that even though LANL's Cray is much faster than INEL's, the throughput is much slower. Approximately 2.2 times slower for execution and 3.3 times for compiling/linking.

4/27 Worked with Ashok on making runs on the Connection Machine for the verification of FLO<sup>2</sup>SIM. Two test problems were run:



The problems were run in the transient mode with  $S=0.01$  up until a time of  $T=0.2$ . Ashok will make the corresponding FLO<sup>2</sup>SIM runs. Worked on incorporating Bob Barker's BIGFLOW comments.

Also worked with Ashok on modifying BIGFLOW for the variable Van Genuchten "n" case.

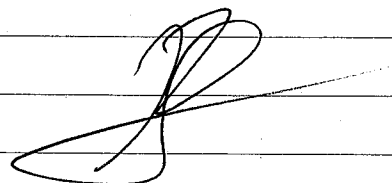
Started work on writing the progress report for the IR&D project.

4/28 Continued some of the work I started with Mark Muller on Software Configuration Management for BIGFLOW. Worked on finalizing the BIGFLOW NUREG/CR document. Identified missing contour labels and incorporated them. Document is now under programmatic review. It will hopefully be sent out next week.

Worked on the ANN IR&D project. Mostly analysis and "digestion" of results obtained before. Continued writing also.

4/29 Met with Steven Feide and went over some questions I had regarding our ANN results. More specifically, we worked on Radial Basis Functions (RBFs) and Elliptic BF (EBFs). Worked with Ashok on the fuzzy part of the IR&D. Small discrepancy in FLO<sup>2</sup>SIM results is under investigation. For some (yet unknown) reason the results appear to be "shifted" one or two calls to the left. Besides that they look very nice. Both qualitative and quantitative agreement with the direct numerical simulation. A bit more "ragged" but the fact that no vertical "sweeps" were conducted (for better convergence) explains it perfectly. Continued work on finalizing the BIGFLOW document. Some more typos were found and corrected.

4/30 Worked exclusively on preparing the write up for my 12th D quarterly report. Most of this work will also be used to prepare a technical paper to be included in the PSAGK proceedings. Rex Wexcott (USMPC) has shown a great interest in the subject.




5/3

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Nothing to report regarding code runs etc.

5/7

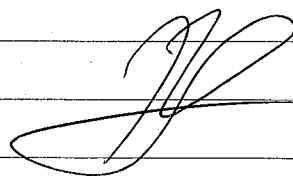


5/10

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5/14

Attended a short course on "fractured rock geohydrology" as staff development. Got to learn the numerical code FRACMAN which may be used for the Apache Leap Tuff Site.



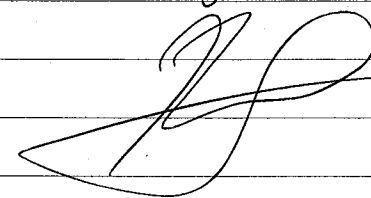
5/17 Worked on modifying the paper on the Condition Number. . . . . Addressing the reviewers' comments, I made couple of supplementary runs to evaluate the following: (i) spherical covariance model  
(ii)  $C(\xi) = \frac{\sin \xi}{\xi}$

and

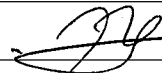
(iii) the nugget effect.

The (iii) included 2 runs for  $\sigma_0^2 = 0.1$  and  $1.0$  where  $\sigma_y^2 = 1.0$ .  $\frac{C_0(\Delta X)}{C_0(\Delta X)_{\text{no nugget}}}$  was plotted for

the two values of the nugget.



5/18 Continued work on the paper. Mainly text revisions. Worked with Ashok on figuring out why one of his result graphs was not behaving properly. The problem is that for Heterogeneous matrix, Method A and Method B do not give the same results for BIGFLOW. Found out that there is a problem in FRACMAN which does not print the same values of  $\alpha$  in the files ALFA.DAT which are in turn used by BIGFLOW. Work will continue.



5/19 Continued work on the paper. Tests on FRACVAR continued. Corrected problem of non-scaling the  $\alpha$  values.

5/20 Worked on writing the paper for PSAG14. Tests of Method A and B are satisfactory. Preliminary results seem to be favoring method A (equal pressure head).

5/21 Continued work on PSAG14 paper. Started preparing for the Study Plan review. Some more analyses with FRACVAR conducted.

5/24 Finished PSAG14 paper. It will go for review tomorrow. Started work on the Study Plan review.

5/25 Study Plan review continued. Met with Ron Green and Sitakanta Mohanty to split work.

5/26 Study Plan review continued. Assigned some of the work to Gordon. He will provide written comments on Monday. Met with Atok on the Stochastic. Detailed discussions on the assumptions and range of parameters to be used in FRACVAR took place. Some tuning on the use of the code was also conducted. Met with Rashed and worked on the TBM and variogram codes. Also worked a bit with Mike on coupling SLIM & BGSFLOW. Finished the ANN paper.

5/27 Worked on the Study Plan. Continued some work on CDS 3.9.2.4 that I started earlier this week. Worked with Rashed on the variogram code. Modified it so that a user-specified number of cells are excluded in each direction. This clears the boundary-effect problems. Some glitch with the diversification of the matrices was identified and corrected. Worked a bit on the fuzzy project. Ideas on the successive tuning of the universe of discourse are explored. Will meet with Atok next week on this issue.

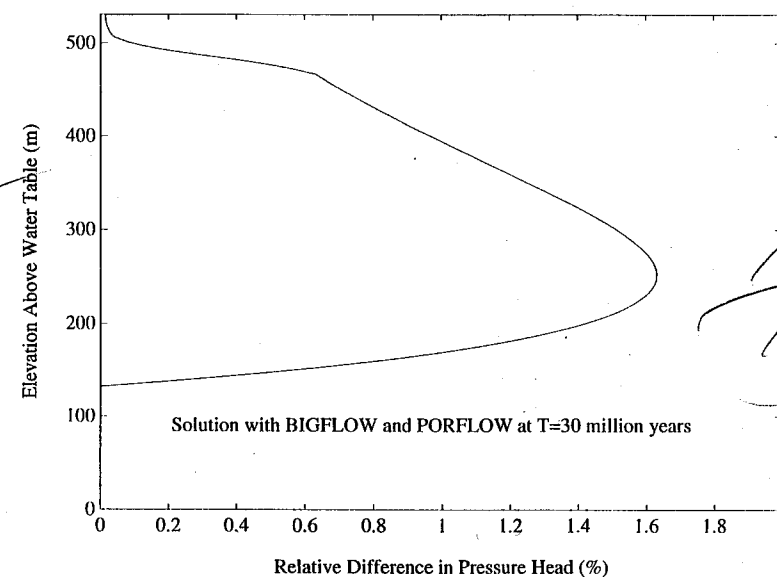
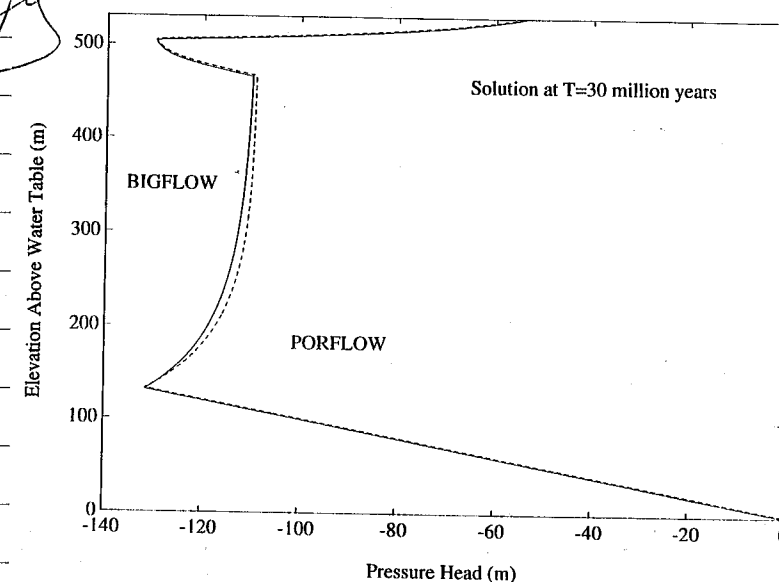
5/31 - 6/4 Worked on the Study Plan review.  
Also started work on the CDS.

6/7 - 6/11 Finalized Study Plan review.

Started work with Ashok and Rashid on modifying BIGFLOW. Changes were made to optimize the code (loop unrolling) for all possible cases of flow conditions. Rashid identified some extraneous material which led to some efficiency loss. It did not, however, affect the solution. Simulations were conducted on the COVE-2A test case (SAND89-2558) for benchmarking the new version of BIGFLOW for a realistic case. Data representative of Yucca Mountain were used. It was found that close to steady-state solution is obtained after about 31 million years. This confirmed also the verification of BIGFLOW (version with fully heterogeneous Van Genuchten "n").

Comparisons with PORFLOW are shown on the next page. The maximum relative error observed is at a depth of  $\approx 300$  m and is  $\approx 1.5\%$ . This is assuming that the PORFLOW solution is correct.

Worked also on CDS 3.2.2.4. Had telecon meeting on Friday with Bill Ford, Neil Coleman, and Dave Brooks. Finally, worked with Steven Seitz on the ANN project.  
(Cont'd)





6/7-6/11 (cont'd). Results from the WIPP site seem promising. No quantitative comparison has been made with the SANDIA people's Krige field. It will be done in the next phase.

Started work also with Ashok/Peslid on extending BIGFLOW to fully 3D heterogeneous  $\bar{\sigma}_r$  fields. This enhancement will coincide BIGFLOW 2.0 in which all input files can, in principle, be 3D heterogeneous. This activity will be finished next week.

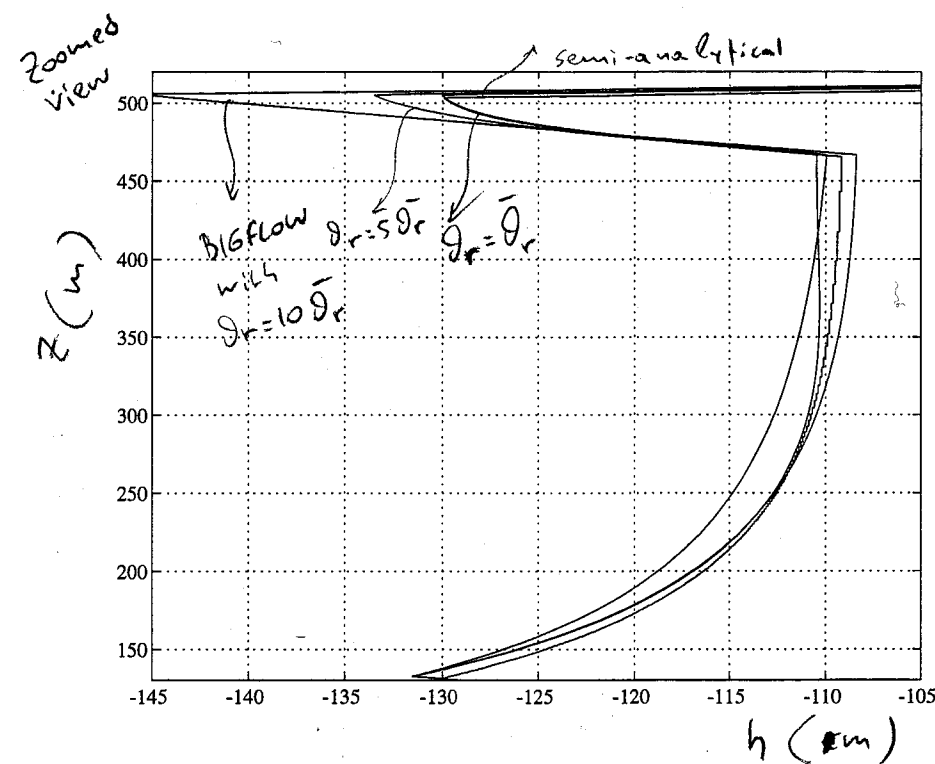
Worked also with Mike Miller on the Master code. A slight modification of the structure of the code, so that memory space is saved, will be necessary. It may be also necessary to include the TBM code as a module here. Work will continue next week.

*[Signature]*

6/14-6/18 Started work with Jim Yeh (U of A) on the independent verification of our semi-analytical results. Forwarded the files to him.

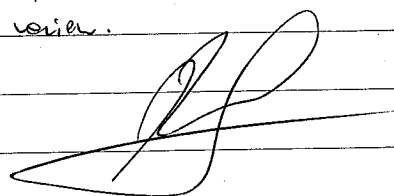
*[Signature]*

6/28-7/3 Worked on a problem with BIGFLOW. It was discovered while running comparisons between BIGFLOW, PORFLOW and the semi-analytical solution by Wittkever. The glitch is that  $\bar{\sigma}_r$  was not passed in MLCOR as a three dimensional array and only the value of  $\bar{\sigma}_r$  was used. This, obviously, was not been activated for the case of homogeneous  $\bar{\sigma}_r$ . The discrepancy was shown in the following figure:



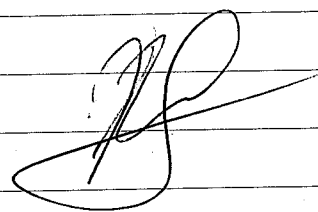
This led me to understand that there is a problem, since theoretically, at steady-state it should not matter what the (base)

Dr is. The glitch was found and corrected. Results matched nicely with both POPFLOW and the semi-analytical. These results were reported in the SEMI-ANNUAL report (SI/93). It is currently under editorial review.



7/6-7/9 Worked with Mike Muller and Radid Islam on the code SUFLAT (Stochastic Analysis of Unsaturated

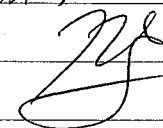
flow And Transport). This work has been on and off the past 2 wks. It seems that we are approaching the final state. But it has a small problem of SXSAS and observed some problems with BIGFLOW (in NLCOND) when the degree of heterogeneity in property fields was too high. Mike is conducting a sensitivity study to see the feasible range of properties.



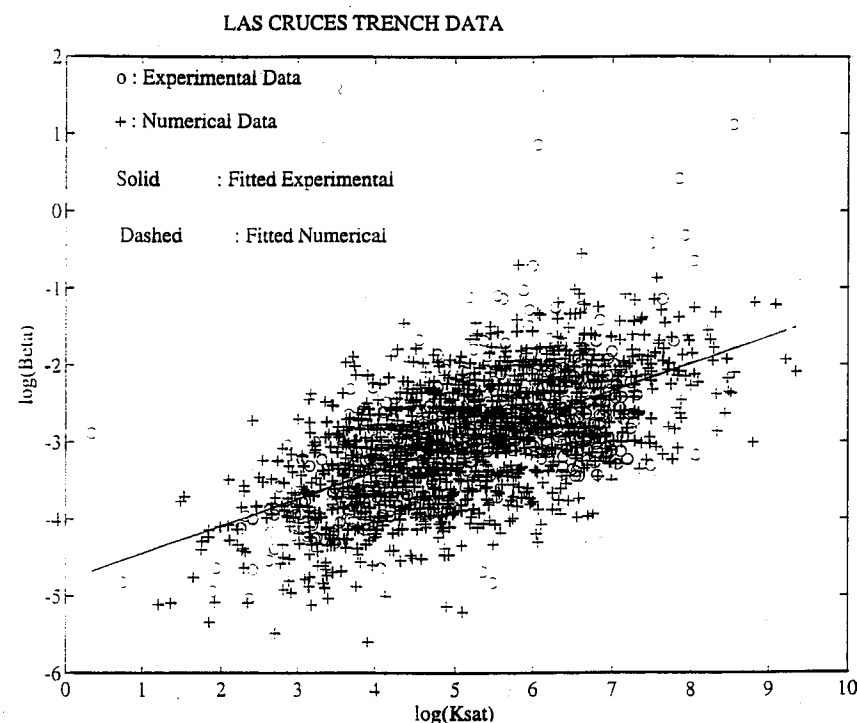
7/12-7/16 worked with Mike Muller of R. Islam on making modifications to SUFLAT, smarter parameter choice, efficiency etc. Decided on format of outputs:

- in2-head (is the pressure head?)
- out-Kunsat (unsaturated hydr. conductivity)
- out-tunsat (unsaturated moisture content)
- out-Hhead (total head)

worked on "layering" option.



7/19-7-23 Finalized SUFLAT, checks and everything. Small verification example from Las Cruces Trench completed.



Used "regression" data obtained from the data file from NUREG/CR-5841 to generate synthetic data. Then "best" fits were obtained with both experimental & synthetic data. Lives were identical. This served as a verification of the MKPROP module of SURCAT.

JF

7/26-7/30 Worked w/ David on implementing layering information to SURCAT. Problems w/ conflicts of properties.

JF

8/2-8/6 Worked on "digesting" some of the results that Ashok Nedunyzhi has produced last week. He generated and subsequently analyzed 4 cases. Heterogeneous vs. Homogeneous matrix. Long vs. short fractures.

Both cases of fracture correspond to the same volume fraction of the fractures. These results will be attempted by consultant Jim Yd.

JF

8/9-8/13 Various activities continuing in collaboration with Ashok, David, and Mike. Mostly meetings, brainstorming, etc. No completion.

JF

8/16-8/20. Made Rush Run on INEL core with BIGLOW using properties generated by SURCAT/MKPROP. Convergence is extremely slow.

JF

8/23-8/27 Making major to report this week, except that runs continued.

JF

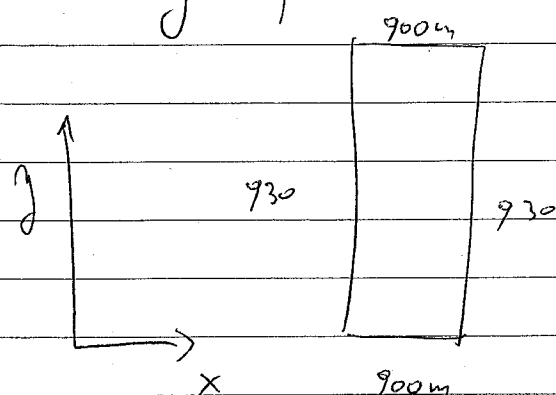
8/30-9/3 Started some new activities w/ Mike Miller. We are trying to use WPP data (questioned if as obtained by ANNs) to solve the flow problem of the transport.

Made BIGLOW to run on "goliah" Div. 20's space. Experienced problems w/ BIGLOW for this problem. Getting negative heads. Debugging of simpler properties.

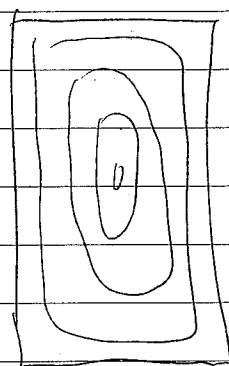
JF

Vocals J

9/6-9/13 Debugging continued. We tried many different things. Finally, identified the problem by running the following problem:



BIGFlow w/ 3 nodes in the z-direction gives this head distribution



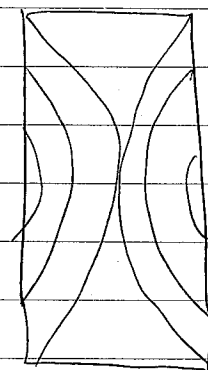
which is not physically correct.

After hrs of debugging we started suspecting this option.

J

9/20-9/24. We finally found out after many trials that there appears to be a problem with BIGFlow when it is run under saturated conditions. The minimum number of nodes in the z-direction, in order to run a 2D problem is 5 and not 3 as it is possible in the unsaturated conditions.

When we ran the problem with 5 nodes we got:



which is correct in terms of mass balance, etc. worked w/ Alrok and discovered a small "bug" in PARCULAR. What happened is that for the range of stochastic properties in the matrix some of the  $\alpha$  (ALFA.DAT) values (as interpolated) became negative. Even though the semi-analytical solution  $V$  does not appear to have a problem with it, these values would be very wrong for Jim Yeh's code. This did not occur w/ homogeneous matrix. Therefore, files were sent to VOA electronically for their analysis.

Working w/ Alrok to fix the problem.

J

9/27/10/1. Volky to report, except intense authority  
of abstracts for AGU, IHLW, and CMMR  
conferences.

*[Signature]*

10/4-10/8. NRC/VOA/CMMR meetings.  
Gave my presentation & participated in various  
discussions.

*[Signature]*

10/11/10/15. Worked w/ Mike to visualize Tucca Mtn  
results. Prepared style sheets for pressure  
head, Ksat, Kunsat. Developed code  
"satBip2tec.pl" to convert Ksat to  
saturation. All plots were verified and  
printed on prints of transparencies.  
Identified possible "glitch" in Mike's plotting.  
He used the previous time-stepping's pressure head  
results. The plots affected will be re-cal-  
culated & plotted next week.  
Asked him to make changes in FLUX so that  
this is transparent to the user so that it doesn't  
happen again.

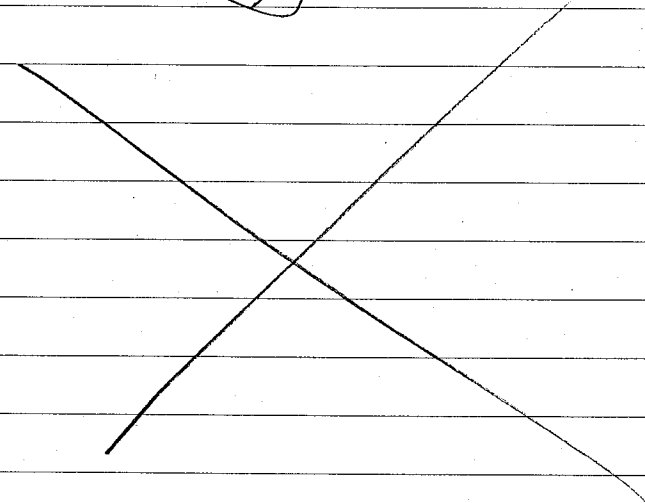
*[Signature]*

10/18-10/22/93. Worked w/ Alhok. Fixed the code and produced  
new stochastic/matrix fields in order to meet the  
constraints imposed by the  $\alpha$  interpolation.  
Applied it w/ success. Verified that no  $\alpha$  problem  
exists any more. Produced necessary files &  
shipped them to Jim Yeh for his analysis.

Run w/ Mike a faulted scenario for Tucca Mountain.  
Substantial time is required as this is a dynamic  
perturbation. Analysis of results revealed that  
the flow fields are very much influenced by the  
fault.

Met w/ Mike & Vicki Kepoor for his orientation.  
Decided on transport run of properties & layout his  
how to run SIM. Mike and Vicki are going  
to work together next week.

*[Signature]*



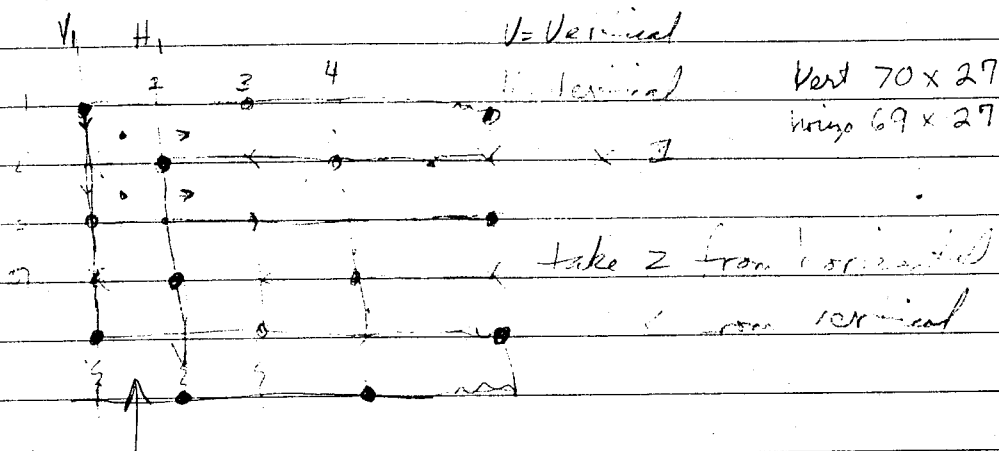


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Vel files 18 files r2114VEL#.dat

5702457

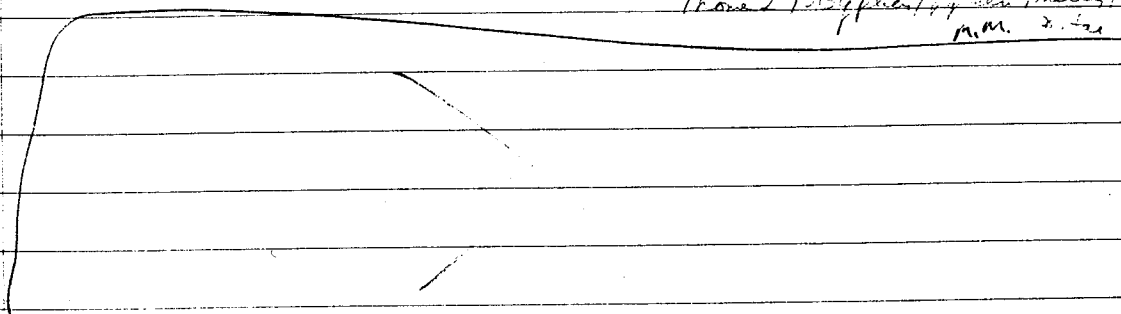


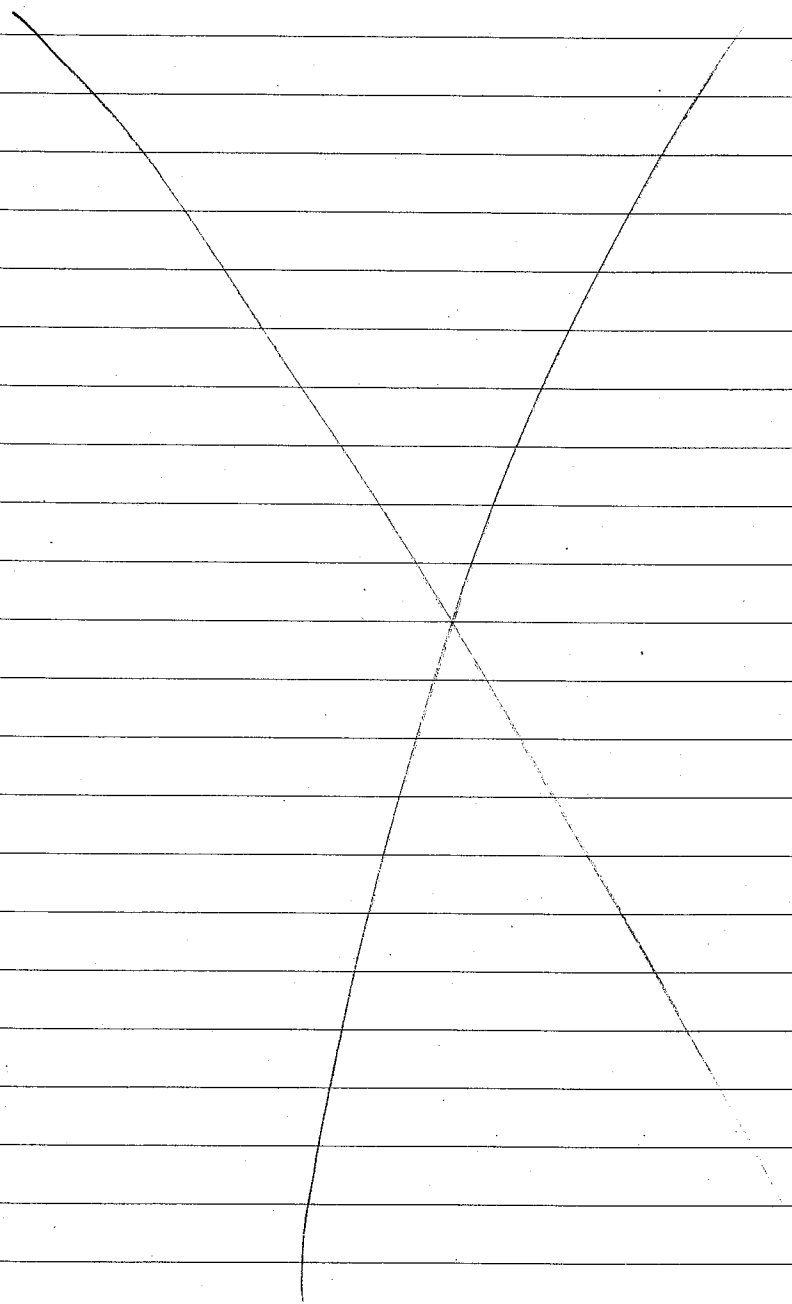
for ea. pt, take avg of horizontal  
avg of vertical  
for boundaries, just re-use closest  
data point

to get horiz. 1.5 avg. 142 (actually just use 2 since 1 horiz does exist)  
vert 1.5 avg. 182

time for ea. file counted from start of  
sim = 0 seconds, distance in meters  
to get time elapsed to each file sub. time file n-1  
from time file n

Home 2 19154 phan / green / muller /  
mm. 2.42





2 den line

1937

14X I3 1X I3  
J<sub>in</sub> I<sub>in</sub>

Dec 2 70

Dec J = J<sub>in</sub> i<sub>in</sub>

Read  $x^{den}, y^d, d_1, d_2, d_3, d_4, velx$

skip 3 lines

30

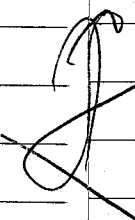
30

Read  $x^{den}, y^d, d_1, d_2, d_3, d_4, velx$

cv + avg

output

1.0 1.0



Pages 1 through 37 of this Scientific Notebook were reviewed for compliance with QAP-001 in response to Corrective Action Request 94-02. Corrections and clarifications were made as appropriate. In some cases, the date of a change will reflect the date of this review rather than the date of the original Scientific Notebook entry.

Randy Folck  
SWRI-QA

12/09/94

Project was closed December 1994 because it reached completion.

12/14/96

Ⓟ

*[Signature]*

**ADDITIONAL INFORMATION FOR SCIENTIFIC NOTEBOOK No.: 065, 067,  
068, and 069**

<b>Document Date:</b>	02/26/1993
<b>Availability:</b>	Southwest Research Institute® Center for Nuclear Waste Regulatory Analyses 6220 Culebra Road San Antonio, Texas 78228
<b>Contact:</b>	Southwest Research Institute® Center for Nuclear Waste Regulatory Analyses 6220 Culebra Road San Antonio, TX 78228-5166 Attn.: Director of Administration 210.522.5054
<b>Data Sensitivity:</b>	<input checked="" type="checkbox"/> "Non-Sensitive" <input type="checkbox"/> Sensitive <input type="checkbox"/> "Non-Sensitive - Copyright" <input type="checkbox"/> Sensitive - Copyright
<b>Date Generated:</b>	1993
<b>Operating System:</b> (including version number)	UNIX
<b>Application Used:</b> (including version number)	NA
<b>Media Type:</b> (CDs, 3 1/2, 5 1/4 disks, etc.)	1 8-mm tape
<b>File Types:</b> (.exe, .bat, .zip, etc.)	Various
<b>Remarks:</b> (computer runs, etc.)	Media contains: data and output files relative to the stochastic project.