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CNWRA INFORMATION PROCESSING STANDARD SOFTWARE SUMMARY

01. Summary Date (Yr. / Mo. / Day):	02. Summary prepared by (Name and phone): Rachid Ababou, (512) 522-2583	03. Summary action: New [ ] Replacement [ ] Deletion [ ] Previous Internal Software ID:
04. Software Date (Yr. / Mo. / Day):	03. Software title: BIGFLOW (provisional)	
06. Short title: BIGFLOW (provisional)		07. Internal Software ID:

08. Software type:
- [ ] Automated Data System
- [X] Computer Program
- [ ] Subroutine/Module

09. Processing Mode:
- [ ] Interactive
- [ ] Batch
- [X] Combination

10. APPLICATION AREA

General:
- [ ] Computer Systems Support/Utility
- [X] Scientific/Engineering
- [ ] Bibliographic/Textual
- [ ] Management/Business
- [ ] Process Control
- [ ] Other

Specific: Hydrogeologic Flow Simulation Model.

11. Submitting organization and address: CNWRA

12. Technical contact(s) and phone: Dr. Rachid Ababou (512) 522-2583

13. Narrative: BIGFLOW (provisional name) is an evolving Fortran 77 computer code for simulating three-dimensional Darcy-type flow in a heterogeneous porous medium. BIGFLOW is currently being modified from the 3D finite difference BIGFLO code previously developed at the Massachusetts Institute of Technology Parson's Laboratory (Author: R. Ababou; Contact at M.I.T.: Prof. L.W. Gelhar). The BIGFLO code accommodates steady as well as transient flow regimes in saturated, variably saturated, or purely unsaturated porous media with highly heterogeneous hydrodynamic properties. The evolving BIGFLOW code will contain the features of the previous BIGFLO code as a subset. A companion code (FLOPROC) will be used for data processing.

14. Keywords: Finite Differences; Three-Dimensional; Porous Media; Heterogeneous; Saturated; Unsaturated; Hydrogeology

15. Computer manufacturer and model: NA	16. Computer operating system: NA	17. Programming language(s): Fortran 77	18. Number of source program statements: Estimated: BIGFLO: 10000-15000 Estimated: FLOPROC: 5000-10000
19. Computer memory requirements: Adjustable (dynamic Memory Allocation)	20. Tape drives: NA	21. Disk/Drum units: NA	22. Terminals: NA

23. Other operational requirements:

24. Software availability: Available [ ] Limited [ ] In-house only [X]	25. Documentation availability: Available [ ] Inadequate [ ] In-house only [X]

26. FOR SUBMITTING ORGANIZATION USE:

CNWRA Form TOP-4 10/90

MAIN CONTACT

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SUMMARY

BIGFLO is a Fortran 77 computer code for simulating three-dimensional Darcy-type flow in a heterogeneous porous medium. It accommodates steady as well as transient flow regimes in saturated, variably saturated, or purely unsaturated porous media with highly heterogeneous or spatially random hydrodynamic coefficients. The code, as initially developed at the Massachusetts Institute of Technology (Ref. 1), is based on a 3-dimensional, 7-point centered finite difference approximation of the governing equations expressed in terms of hydraulic head for saturated flow, or in terms of moisture and pressure head for unsaturated flow (mixed form of Richards equation). The computational domain is a parallelepiped rectangle, whose axes may be inclined at an arbitrary angle with respect to the vertical. The boundary conditions, initial conditions, and linear as well as nonlinear hydrodynamic coefficients can be specified node-by-node, or on subdomains, using the companion data processor FLOPROC. Boundary conditions can be fixed head, fixed flux, or zero head gradient for gravitational drainage. Typical types of material heterogeneity used in recent applications of the code are: layered structures, piecewise constant blocks, and 3D random fields, the latter being generated independently (Ref. 2). Fast solution of the large sparse matrix systems is obtained by various preconditioned iterative algorithms based on a diagonal vector storage scheme, allowing for problem sizes on the order of a hundred thousands nodes on a Microvax-2, and one or several million nodes on the 1985-90 generation of supercomputers. A typical area of application of this code is the investigation of large-scale groundwater flow, unsaturated flow, and contaminant transport in naturally heterogeneous formations (Refs. 3,4,5).

REFERENCES

1. Ababou, R., McLaughlin, D. and Gelhar, L. W. March 1988. Three-dimensional flow in random porous media. *Report No. 318*. Cambridge, MA: Ralph Parsons Laboratory. Massachusetts Institute of Technology. 2 volumes. 1-833.

2. Tompson, A.F., Ababou, R. and Gelhar, L.W. 1989. Implementation of the three-dimensional turning bands random field generator, *Water Resources Research*. 25(10):2227-2243.

3. Ababou, R. and Gelhar, L.W. 1988. A high-resolution finite difference simulator for 3D unsaturated flow in heterogeneous media, in *Computational Methods in Water Resources*. Elsevier and Computational Mechanics Publications. 1:173-178.

4. Ababou, R., McLaughlin, D., Gelhar, L.W. and Tompson, A.F. 1989. Numerical simulation of three-dimensional saturated flow in randomly heterogeneous porous media. *Transport in Porous Media*. 4:549-565.

5. Tompson, A.F. and Gelhar, L.W. 1990. Numerical simulation of solute transport in three-dimensional randomly heterogeneous porous media. *Water Resources Research*. 26(10):2541-2562.

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-rwxr--r--   1 abagtzog user     320797 Jan 23 10:59 yucca/y5/q50t/floproc-temp
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-rw-r--r--   1 abagtzog user      19774 Jan 27 09:51 yucca/y5/q50t/HEAD_T50_50.
-rw-r--r--   1 abagtzog user      26567 Jan 27 09:51 yucca/y5/q50t/HEAD_T6.Z
-rw-r--r--   1 abagtzog user      26649 Jan 27 09:51 yucca/y5/q50t/HEAD_T7.Z
-rw-r--r--   1 abagtzog user      26696 Jan 27 09:51 yucca/y5/q50t/HEAD_T8.Z
-rw-r--r--   1 abagtzog user       6718 Jan 30 11:20 yucca/y5/q50t/H_2.Z
-rw-r--r--   1 abagtzog user       6716 Jan 30 11:19 yucca/y5/q50t/H_1.Z
-rw-r--r--   1 abagtzog user       6859 Jan 27 00:42 yucca/y5/q50t/H_10.Z
-rw-r--r--   1 abagtzog user       6824 Jan 27 00:07 yucca/y5/q50t/H_110.Z
-rw-r--r--   1 abagtzog user       6840 Jan 27 00:05 yucca/y5/q50t/H_120.Z
-rw-r--r--   1 abagtzog user       6866 Jan 27 00:41 yucca/y5/q50t/H_20.Z
-rw-r--r--   1 abagtzog user       6840 Jan 27 00:39 yucca/y5/q50t/H_50.Z
-rw-r--r--   1 abagtzog user       6861 Jan 26 16:46 yucca/y5/q50t/H_B_10.Z
-rw-r--r--   1 abagtzog user       6841 Jan 27 00:36 yucca/y5/q50t/H_90.Z
-rw-r--r--   1 abagtzog user       6856 Jan 30 11:21 yucca/y5/q50t/H_8.Z
-rw-r--r--   1 abagtzog user       6843 Jan 27 00:38 yucca/y5/q50t/H_60.Z
-rw-r--r--   1 abagtzog user       6728 Jan 30 11:21 yucca/y5/q50t/H_4.Z
-rw-r--r--   1 abagtzog user       6806 Jan 27 00:41 yucca/y5/q50t/H_30.Z
-rw-r--r--   1 abagtzog user       6815 Jan 27 00:08 yucca/y5/q50t/H_100.Z
-rwx------   1 abagtzog user     327025 Jan 23 10:59 yucca/y5/q50t/floproc-new.
-rw-r--r--   1 abagtzog user       6820 Jan 27 00:40 yucca/y5/q50t/H_40.Z
-rw-r--r--   1 abagtzog user       6843 Jan 27 00:37 yucca/y5/q50t/H_80.Z
-rw-r--r--   1 abagtzog user      19774 Jan 23 09:45 yucca/y5/q50t/HEAD_IC.Z
-rw-r--r--   1 abagtzog user       2168 Jan 23 09:45 yucca/y5/q50t/IN1-YM4.Z
-rw-r--r--   1 abagtzog user      26630 Jan 27 09:51 yucca/y5/q50t/HEAD_T9.Z
-rw-r--r--   1 abagtzog user       6820 Jan 27 00:38 yucca/y5/q50t/H_70.Z
-rw-r--r--   1 abagtzog user       5108 Jan 23 09:45 yucca/y5/q50t/AL6-YM4.Z
-rw-r--r--   1 abagtzog user      11283 Jan 23 09:45 yucca/y5/q50t/BC_T50_50.Z
-rw-r--r--   1 abagtzog user       6091 Jan 23 09:45 yucca/y5/q50t/KS5-YM5.Z
-rwxr--r--   1 abagtzog user       5119 Dec 31  1991 yucca/y5/HB9-YM4.Z
-rwxr--r--   1 abagtzog user       5108 Dec 31  1991 yucca/y5/AL6-YM4.Z
-rwx------   1 abagtzog user     105647 Jan  9 14:52 yucca/floproc.f.Z
drwx------   4 abagtzog user          0 May 21 04:24 yucca/y6
drwxr-xr-x   2 abagtzog user          0 Jul 20 08:47 yucca/y6/q0
-rw-r--r--   1 abagtzog user      27444 Jan 28 17:08 yucca/y6/q0/HEAD_T1.Z
-rw-r--r--   1 abagtzog user      19774 Jan 28 17:10 yucca/y6/q0/HEAD_T50_50.Z
-rw-r--r--   1 abagtzog user      43423 Jan 28 17:05 yucca/y6/q0/OUT13.Z
-rw-r--r--   1 abagtzog user      27506 Jan 28 17:08 yucca/y6/q0/HEAD_T11.Z
-rw-r--r--   1 abagtzog user      27510 Jan 28 17:08 yucca/y6/q0/HEAD_T12.Z
-rw-r--r--   1 abagtzog user      27500 Jan 28 17:08 yucca/y6/q0/HEAD_T13.Z
-rw-r--r--   1 abagtzog user      27472 Jan 28 17:10 yucca/y6/q0/HEAD_T6.Z
-rw-r--r--   1 abagtzog user      27444 Jan 28 17:08 yucca/y6/q0/HEAD_T14.Z
-rw-r--r--   1 abagtzog user      27470 Jan 28 17:08 yucca/y6/q0/HEAD_T15.Z
-rw-r--r--   1 abagtzog user      27459 Jan 28 17:08 yucca/y6/q0/HEAD_T16.Z
-rw-r--r--   1 abagtzog user      27474 Jan 28 17:09 yucca/y6/q0/HEAD_T18.Z
-rw-r--r--   1 abagtzog user      27491 Jan 28 17:09 yucca/y6/q0/HEAD_T19.Z
-rw-r--r--   1 abagtzog user      27414 Jan 28 17:09 yucca/y6/q0/HEAD_T2.Z
-rw-r--r--   1 abagtzog user      27497 Jan 28 17:09 yucca/y6/q0/HEAD_T20.Z
-rw-r--r--   1 abagtzog user      27435 Jan 28 17:09 yucca/y6/q0/HEAD_T21.Z
-rw-r--r--   1 abagtzog user      27427 Jan 28 17:09 yucca/y6/q0/HEAD_T22.Z
-rw-r--r--   1 abagtzog user      27422 Jan 28 17:09 yucca/y6/q0/HEAD_T23.Z
-rw-r--r--   1 abagtzog user      27461 Jan 28 17:09 yucca/y6/q0/HEAD_T25.Z
-rw-r--r--   1 abagtzog user      27412 Jan 28 17:09 yucca/y6/q0/HEAD_T3.Z
-rw-r--r--   1 abagtzog user      27420 Jan 28 17:10 yucca/y6/q0/HEAD_T4.Z
-rw-r--r--   1 abagtzog user      27442 Jan 28 17:10 yucca/y6/q0/HEAD_T5.Z
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-rw-r--r--   1 abagtzog user      21080 Jan 28 17:10 yucca/y6/q0/HEAD_T50_0.Z
-rw-r--r--   1 abagtzog user      27463 Jan 28 17:10 yucca/y6/q0/HEAD_T7.Z
-rw-r--r--   1 abagtzog user      27455 Jan 28 17:10 yucca/y6/q0/HEAD_T9.Z
-rw-r--r--   1 abagtzog user       7272 Jan 30 12:56 yucca/y6/q0/H_10.Z
-rw-r--r--   1 abagtzog user       7249 Jan 30 12:58 yucca/y6/q0/H_100.Z
-rw-r--r--   1 abagtzog user       7272 Jan 30 12:57 yucca/y6/q0/H_30.Z
-rw-r--r--   1 abagtzog user       7280 Jan 28 17:19 yucca/y6/q0/H_500.Z
-rw-r--r--   1 abagtzog user       7301 Jan 30 12:56 yucca/y6/q0/H_20.Z
-rw-r--r--   1 abagtzog user      11235 Jan 28 07:15 yucca/y6/q0/BC_T50_0.Z
-rw-r--r--   1 abagtzog user      27536 Jan 28 17:08 yucca/y6/q0/HEAD_T10.Z
-rw-r--r--   1 abagtzog user      27463 Jan 28 17:08 yucca/y6/q0/HEAD_T17.Z
-rw-r--r--   1 abagtzog user      27538 Jan 28 17:09 yucca/y6/q0/HEAD_T24.Z
-rw-r--r--   1 abagtzog user      27474 Jan 28 17:10 yucca/y6/q0/HEAD_T8.Z
-rwxr--r--   1 abagtzog user     319815 Jan 28 13:47 yucca/y6/q0/floproc.ex.Z
drwxr-xr-x   2 abagtzog user          0 May 21 04:26 yucca/y6/q50
-rwxr--r--   1 abagtzog user     320797 Jan 27 13:26 yucca/y6/q50/floproc-temp.
-rwxr--r--   1 abagtzog user     319815 Jan 27 13:26 yucca/y6/q50/floproc.ex.Z
-rwxr--r--   1 abagtzog user      27380 Jan 27 13:28 yucca/y6/q50/HEAD_T1.Z
-rwxr--r--   1 abagtzog user      27435 Jan 27 13:28 yucca/y6/q50/HEAD_T10.Z
-rwxr--r--   1 abagtzog user      27418 Jan 27 13:29 yucca/y6/q50/HEAD_T11.Z
-rwxr--r--   1 abagtzog user      27429 Jan 27 13:29 yucca/y6/q50/HEAD_T12.Z
-rw-r--r--   1 abagtzog user      24340 Feb  2 17:55 yucca/y6/q50/HEAD_T120.Z
-rwxr--r--   1 abagtzog user      27463 Jan 27 13:29 yucca/y6/q50/HEAD_T3.Z
-rw-r--r--   1 abagtzog user      27110 Feb  3 10:54 yucca/y6/q50/HEAD_T3_n.Z
-rwxr--r--   1 abagtzog user      27422 Jan 27 13:29 yucca/y6/q50/HEAD_T5.Z
-rwxr--r--   1 abagtzog user      27418 Jan 27 13:29 yucca/y6/q50/HEAD_T6.Z
-rw-r--r--   1 abagtzog user       6573 Feb  2 17:56 yucca/y6/q50/H_120_c20.Z
-rw-r--r--   1 abagtzog user      27215 Feb  3 10:54 yucca/y6/q50/HEAD_T6_n.Z
-rwxr--r--   1 abagtzog user      27515 Jan 27 13:29 yucca/y6/q50/HEAD_T8.Z
-rwxr--r--   1 abagtzog user      27461 Jan 27 13:29 yucca/y6/q50/HEAD_T9.Z
-rw-r--r--   1 abagtzog user       7110 Jan 30 00:19 yucca/y6/q50/H_10.Z
-rwx------   1 abagtzog user     327025 Jan 27 13:26 yucca/y6/q50/floproc-new.e
-rw-r--r--   1 abagtzog user       7124 Jan 27 13:36 yucca/y6/q50/H_120.Z
-rw-r--r--   1 abagtzog user       7069 Feb  5 10:24 yucca/y6/q50/H_T120_n.Z
-rw-r--r--   1 abagtzog user      24340 Feb  2 17:32 yucca/y6/q50/HEAD_T120_c20
-rw-r--r--   1 abagtzog user      27112 Feb  3 10:54 yucca/y6/q50/HEAD_T1_n.Z
-rwxr--r--   1 abagtzog user      19774 Jan 27 13:28 yucca/y6/q50/HEAD_IC.Z
-rw-r--r--   1 abagtzog user       7123 Jan 30 00:21 yucca/y6/q50/H_60.Z
-rwxr--r--   1 abagtzog user      27510 Jan 27 13:29 yucca/y6/q50/HEAD_T2.Z
-rwxr--r--   1 abagtzog user      27423 Jan 27 13:29 yucca/y6/q50/HEAD_T4.Z
-rwxr--r--   1 abagtzog user      27465 Jan 27 13:29 yucca/y6/q50/HEAD_T7.Z
-rw-r--r--   1 abagtzog user     127319 Jan 30 02:53 yucca/y6/q50/MASS.Z
-rw-r--r--   1 abagtzog user      11287 Feb  2 17:41 yucca/y6/q50/BC_T120_c20.Z
-rwxr--r--   1 abagtzog user     320797 Jan 27 13:26 yucca/y6/floproc-temp.ex.Z
-rwxr--r--   1 abagtzog user     319815 Jan 27 13:26 yucca/y6/floproc.ex.Z
-rwx------   1 abagtzog user     327025 Jan 27 13:26 yucca/y6/floproc-new.ex.Z
-rwx------   1 abagtzog user     168104 Dec 30  1991 yucca/bigflo.f.Z
-rwx------   1 abagtzog user     327025 Jan  9 15:40 yucca/floproc-new.ex.Z
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