PACKAGE ID - 000537D860000 UNSAT-HV2.0

KWIC TITLE - Water and Heat Balance Model for Predicting Drainage Below the Plant Root Zone

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LIMITATION CODE -UNL **AUDIENCE CODE -** UNL

COMPLETION DATE - 11/01/1989 **PUBLICATION DATE -** 11/01/1989

DESCRIPTION - UNSAT-H Version 2.0 is a one-dimensional model that simulates the dynamic processes of infiltration, drainage, redistribution, surface evaporation, and the uptake of water from soil by plants. The model was developed for assessing the water dynamics of arid sites used or proposed for near-surface waste disposal. In particular, the model is used for simulating the water balance of cover systems over buried waste and for estimating the recharge rate (i.e., the drainage rate beneath the plant root zone when a sizable vadose zone is present). The mathematical base of the model are Richards' equation for water flow, Ficks' law for vapor diffusion, and Fouriers law for heat flow. The simulated profile can be homogeneous or layered. The boundary conditions can be controlled as either constant (potential or temperature) or flux conditions to reflect actual conditions at a given site.

PACKAGE CONTENTS - Media Directory; Software Abstract; PNL-6779; Media Includes Source Code, Sample Problem Input Data, Sample Problem Output Data, Read Me File With Brief Code Description, File List and Errata;

SOURCE CODE INCLUDED? - Yes

MEDIA QUANTITY - 1 3.5 Diskette

METHOD OF SOLUTION - UNSAT-H uses a fully implicit, finite difference method for solving the water and heat flow equations in sequential fashion. Plant water uptake is introduced as a sink term at each node and is calculated as a function of root density, water content, and potential evapotranspiration.

COMPUTER - DEC VAX8600

OPERATING SYSTEMS - VAX/VMS Version 5.3

PROGRAMMING LANGUAGES - VAX FORTRAN 4.7

SOFTWARE LIMITATIONS - The code is currently dimensioned for 250 mesh points.

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SOFTWARE LIMITATIONS -(CONT)
SOURCE CODE AVAILABLE (Y/N) - Y

UNIQUE FEATURES - The code runs in either the isothermal or thermal mode, it has many options for representating hydraulic properties and internodal conductances, it simulates vapor diffusion in response to potential or temperature gradients, and the user can have the time steps vary according to needs. Results can easily be routed to text files with columns of data that can easily be imported to any plotting package, obviating the need to program a graphics utility. Many applications have been performed, including verification and validation tests.

RELATED SOFTWARE - This software is an extension of UNSAT-H Version 1.0. The extension allows UNSAT-H to calculate soil heat flow, nonisothermal vapor flow, actual evaporation fluxes, to represent soil hydraulic properties with the van Genuchten water retention function and the Mualem conductive function, and to process output to provide data as a function of depth. Although not required by UNSAT-H, the FAOPET program (Doorenbos and Pruit) is a useful tool for calculating potential evapotranspiration values to serve as input to UNSAT-H.

OTHER PROG/OPER SYS INFO - Each input file must have the file extension (filename).INP. this file is processed with DATAINH.EXE to produce a binary input file with the extension (filename).BIN. The main program, UNSATH.EXE, reads the file .BIN, operates, and then produces an output file with the file extension .RES. The DATAOUT.EXE program reads the file .RES and gives the user a choice of viewing the results on screen or generating text files that can easily be imported to any commercially available plotting package (e.g., Excel; 1-2-3).

TIME REQUIREMENTS - There are no timing requirements. Machine time depends on the problem description (e.g., number of nodes) and machine type. The Micro VAX II machine times required to run the example problems can be found in the user manual.

REFERENCES - M.J. Fayer, and T.L. Jones, UNSAT-H Version 2.0, Unsaturated Soil Water and Heat Flow Model, PNL-6779, April 1990\ J. Doorenbos, and W.O. Pruitt, Guidelines for Predicting Crop Water Requirements, FAO Irrigation Paper No. 24, 2nd ED, Rome Italy, pp 1-107, 1977; M.J. Fayer, M.L. Rockhold, and M.D. Campbell, Hydrologic Modeling of Protective Barriers, Comparison of Field Dat and Simulation Results, Soil Sci., Soc. Am. J, 56:690-700, 1992; D. Hillel, Computer Simulation of Soil Water Dynamics, International Development Research Center, Ottawa, Canada, 1977.

ABSTRACT STATUS - Submitted November 1992. ESTSC sucessfully screened and released package June 1993.

SUBJECT CLASS CODE - R

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KEYWORDS -
COMPUTER PROGRAM DOCUMENTATION
U CODES
PLANTS
DRAINAGE
HEAT FLOW
FLUID FLOW
WASTE DISPOSAL
DIFFUSION
ROOT ABSORPTION
SOILS
LOW-LEVEL RADIOACTIVE WASTES
ROOTS

EDB SUBJECT CATEGORIES -
990200 540230

SPONSOR - DOE/RW

PACKAGE TYPE - SCREENED