Texas A & M University and U.S. Bureau of Reclamation
Hydrologic Modeling Inventory
Model Description Form

June 1999

Name of Model: Interactive River-Aquifer Simulation Program (IRAS)

Model Type: Simulation

Model Objective(s): Simulation and evaluation of stream and river flows, natural lake, reservoir and aquifer storage volumes, wetlands, pollutant concentrations and hydroelectric energy production under various water management policies over time and space. An appropriate 'simulation shell' for assessing aquatic and terrestrial ecological impacts of flow and quality regimes and for 'shared vision' exercises where multiple stakeholders who are interested in building their own simulation models to obtain a common understanding of how their watershed functions.

Agency and Office: Resources Planning Associates, Incorporated, #104, 322 Pine Tree Rd., Ithaca, NY 14850-2819 and Civil & Environmental Engineering, Hollister Hall, Cornell University, Ithaca, NY 14853-3501

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Model Structure or Mathematical Basis: Permits the simulation of water quantities and qualities, and hydropower in any river-aquifer system drawn in by the user. The operating policy is defined by reservoir release rules and allocation functions, together with multiple reservoir storage distribution targets for reservoirs operating as a group. Reach flow routing available but not recommended for flood flow simulations. Model is data-driven and thus model input data and assumptions can be easily changed.

Model Parameters: Flow routing, hydroelectric power/energy and water quality model parameters required if implemented.

Spatial Scale Employed in the Model: User-defined

Temporal Scale Employed in the Model: User-defined, but not short term flood events

Input Data Requirements: The configuration of the water resource system is specified by "drawing in" a node-link network representing reservoirs, lakes, wetlands, aquifers, inflow sites, junctions and other key monitoring locations, river reaches, canals, hydropower plants, wastewater input sites, etc.). User defines number and length of each within-year period, and number of years of simulation. In addition, the following data may be entered: Threshold values representing satisfactory, marginal, and unsatisfactory ranges for "state" variables (flows, pollutant concentrations, storage volumes and energy production levels or user-defined functions of these state variables). Surface area - elevation functions for storage reservoirs and natural lakes and elevation - discharge functions for natural lakes. Ratios of appropriate natural flows at each non gauge site to the natural flow at the appropriate gauge site(s), evaporation and other losses for all lakes and reservoirs, evaporation and other losses in all stream reaches as a function of streamflow, values of flow routing parameters in river reaches where flow time exceeds the within year time period, initial storage volumes, release rules for groups of jointly operated reservoirs and for single reservoirs operated independently (number and location of storage zones, their respective releases), reservoir storage balancing functions for reservoir groups, allocation functions of flow at diversion and water use allocation sites as a function of total flow available at the diversion site. Hydroelectric powerplant capacity, hydroelectric plant factors indicating the fraction of each within-year time period energy can be produced, energy production coefficients (including efficiency) that convert storage head and turbine flow to energy, pumped storage factors for each within year time period. Parameters for predicting width, depth, velocity and time of flow as a function of flow for each reach, pollutant constituent transformation and decay rate constants, initial concentrations of each constituent. Data read through files includes: One or more sequences of flows and other meterorological data at gauge sites in each within-year period for each year of simulation, names of quality constituents being simulated, and the mass loadings of each constituent at each node.

Computer Requirements: Windows 95/98/NT

Recommendations: Minimum of 32Mbyte RAM and 50Mbyte of available disk space.

Model Output: Time series plots of quantities, qualities and energy produced (or user-defined functions of these variables) at any node or link of the river system network, tabular and probability distribution displays of magnitude and duration of "failure" events as defined by the user, formatted files of all simulation results. Color coded map displays of satisfactory, marginal and unsatisfactory conditions, as defined by the user for any set of state variables or their user-defined functions.

Parameter Estimation / Model Calibration: Required for routing of flows and water quality model components, if implemented.

Model Testing and Verification: Continuous! Very pleased to receive comments and suggestions for improvements.

Model Sensitivity: Users can alter any data or assumption to determine sensitivity.

Model Reliability: 100%, we hope!

Model Application / Case Studies: Numerous applications in different countries of previous DOS version of IRAS. Contact developers for more information.

Documentation: User's and General Description manuals. On-line web-based help pages

Other Comments: Strengths: Flexibility and ease of use; adaptable to a wide variety of single or multiple river systems. No restrictions on networks being simulated. Based on simple mass balance assumptions, the model is intended for a first analysis of a water resource system. Links to spreadsheet and other utility programs for further analyses. One of several models for conducting watershed simulations within a 'Watershed Information and Modeling System' (WIMS). WIMS provides for the entry, organization, and display of watershed information that is supplemental and helpful to modelers and policy analysts. Weaknesses: No optimization. Additional programs may be needed to perform economic and many other non-hydrologic analyses at specific sites.