

Introduction to Modeling

- What is modeling?
 - hydrologic system synthesis
- Objectives -- why model?
 - problems to be solved
 - research -- new understandings
 - design of structural components of water-resource systems and management schemes for operation
 - planning and policy decisions
 - answer questions, e.g. What effects do agricultural land management practices have on runoff quantity and quality?

Nature and Structure of Models

- Nature of models
 - hydrology -- simulate hydrologic cycle (land and channel phases)
 - transport -- sediment, nutrients and pesticides carried in water
- Structure of models
 - requires simplification or abstraction
 - use principles of conservation of mass, energy and momentum

Modeling History

- History of models and computers as tools
 - models as implementations of old manual chart techniques vs. more rigorous solutions now possible with computers
 - hardware and software changes, effects on capabilities

Modeling History

- Approaches are influenced by:
 - techniques previously used, e.g.
 - nomographs, simple eq., statistical (regression)
 - available data -- type, length of record
 - agency requirements -- EPA, NRCS, USGS, state (when and where needed)
 - specific researchers with early efforts
 - Linsley, Holtan, others

Modeling History

- manual techniques vs. computerized solutions
 - computerizing improves efficiency, but still restricted by assumptions necessary to simplify for manual analysis, e.g. SCS CN
 - new approaches need to be sought
 - calculate on shorter time intervals and with greater spatial detail
 - more precise mathematical functions for process simulation

Computing Development

- Hardware and software changes -- effects on capabilities and, therefore, modeling approach
 - hardware
 - first available in mid-50s; ultimate potential far from realized
 - initially I/O was inconvenient, memory limited, speed slow
 - today's micros, much more power than mainframes of early 70s

Computing Development

- Hardware and software changes (cont.)
 - software
 - programming languages easier to use
 - structured programming
 - programs segmented for ease of changes
 - object-oriented programming languages
 - enhanced I/O processors -- interactive, graphics, databases, etc.