

**U.S. DEPARTMENT OF ENERGY
OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT**

**NUCLEAR WASTE TECHNICAL REVIEW BOARD
FULL BOARD MEETING**

**SUBJECT: INTEGRATION AND USE OF
CLIMATIC AND HYDROLOGIC
DATA AND MODELS**

PRESENTER: DR. DWIGHT T. HOXIE

**PRESENTER'S TITLE
AND ORGANIZATION: HYDROLOGIST
U.S. GEOLOGICAL SURVEY
LAS VEGAS, NEVADA**

**PRESENTER'S
TELEPHONE NUMBER: (702) 794-7286**

**RENO, NEVADA
APRIL 21-22, 1993**

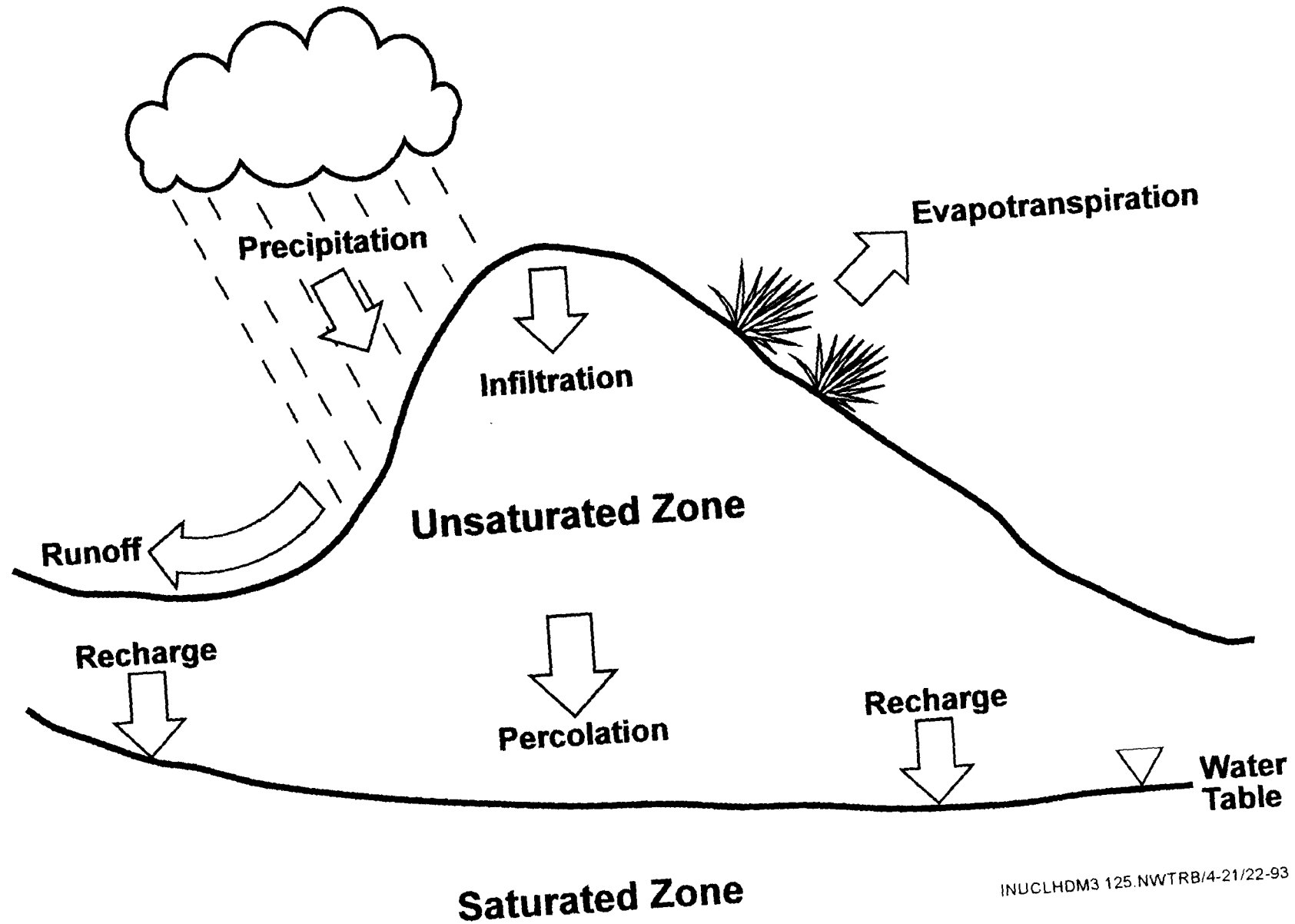
Presentation Objectives

- **What is the technical issue to be resolved?**
- **Why is it important?**
- **How will it be resolved?**

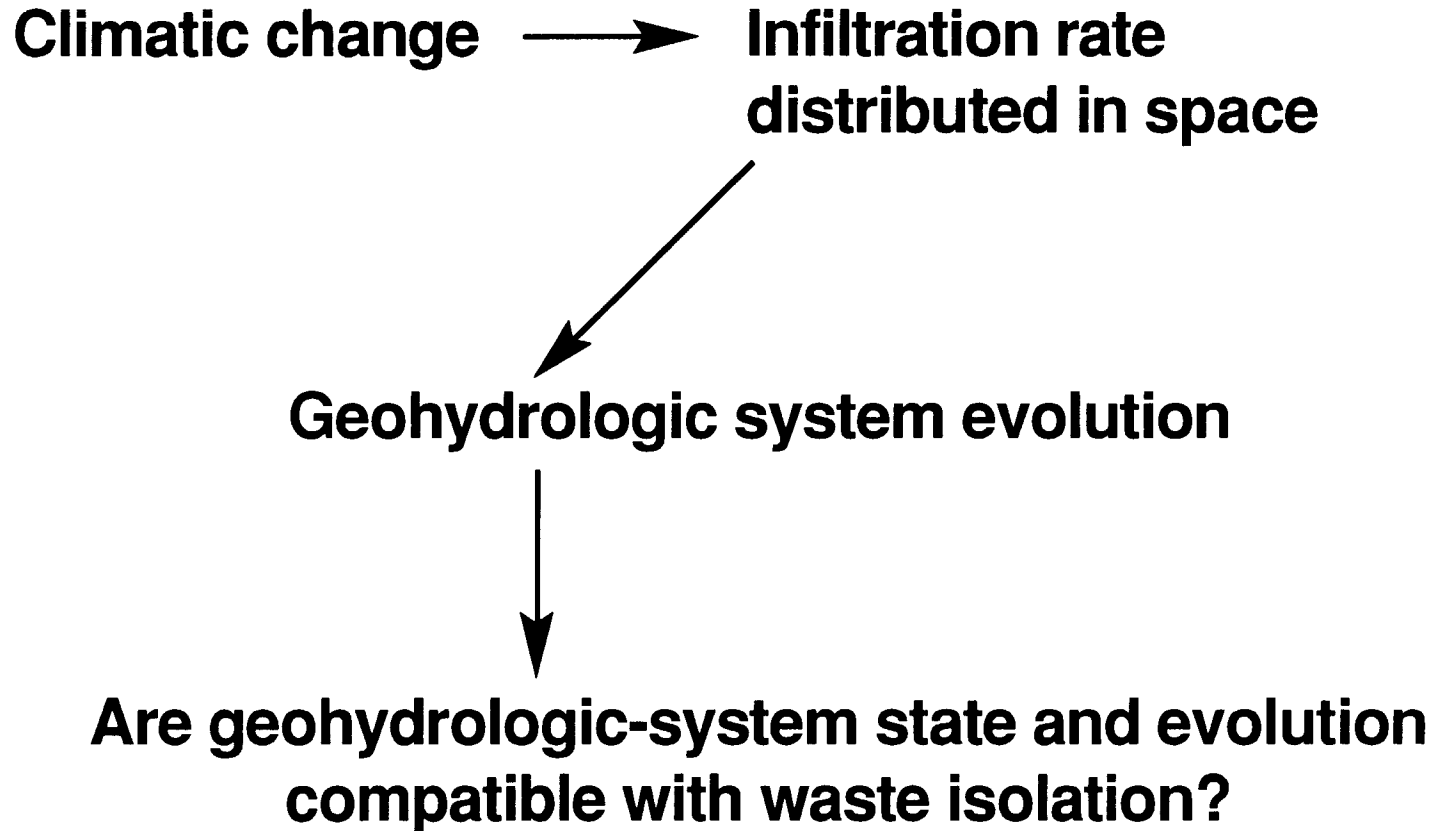
Natural Processes Controlling Overall Geohydrologic System Evolution

- **Tectonism → Geologic framework**
 - System geometry and boundaries
 - Pathways for fluid movement
 - Magmatism → Ambient thermal field
- **Climate change → Hydrologic state**
 - Moisture distribution and flux in the unsaturated zone
 - Water-table configuration and flow rates and direction in the saturated zone

Schematic Geohydrologic System Processes



Issue Definition



The Rub

Climatic conditions and change cannot be translated directly into infiltration and hydrologic-system state and evolution.

In particular, there is no simple closed-form functional relation between climate and infiltration and geo-hydrologic-system state.

The Approach

- **Given the nuts and bolts of field and laboratory data**
- **Models provide the tools essential for resolving the issue**

Model Types

Process models

- **Small-scale, focussed**
- **Heuristic**
 - **Example: Flow in unsaturated zone fractured rocks**

System models

- **Large-scale, integrated**
- **Predictive**
 - **Examples: Geologic framework, geohydrologic system, climate**

Models Needed to Resolve the Issue

Geologic framework

- **Assumed given and nonvarying with time**

Climate

- **Global and regional**
- **Present, past, and future**

Geohydrologic

- **Process and system**

System - Model Data Needs

- **Geologic** - **Stratigraphy and structure**
- **Geohydrologic** - **Hydrologic properties, existing conditions, and boundary conditions**
- **Climatic** - **Forcing functions, land-mass elevation and distribution, and present and past climatic conditions**

The Fundamental Connection Between Climatic and Geohydrologic System Models

Climate and the consequent spatial distribution and time variation of net infiltration constitute the land-surface boundary condition for the geohydrologic system models

Model Limitations

- **Idealized simplifications of real-world processes and systems**
- **Conceptual uncertainty**
- **Statistical data uncertainty**

Example Model Hierarchy

