

YUCCA
MOUNTAIN
PROJECT



Studies

Climate, Infiltration, and UZ Flow for TSPA-VA

Presented to
NWTRB
Panel on Performance Assessment: TSPA-VA
Albuquerque, New Mexico

Presented by:
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Albuquerque, New Mexico

April 23-24, 1998

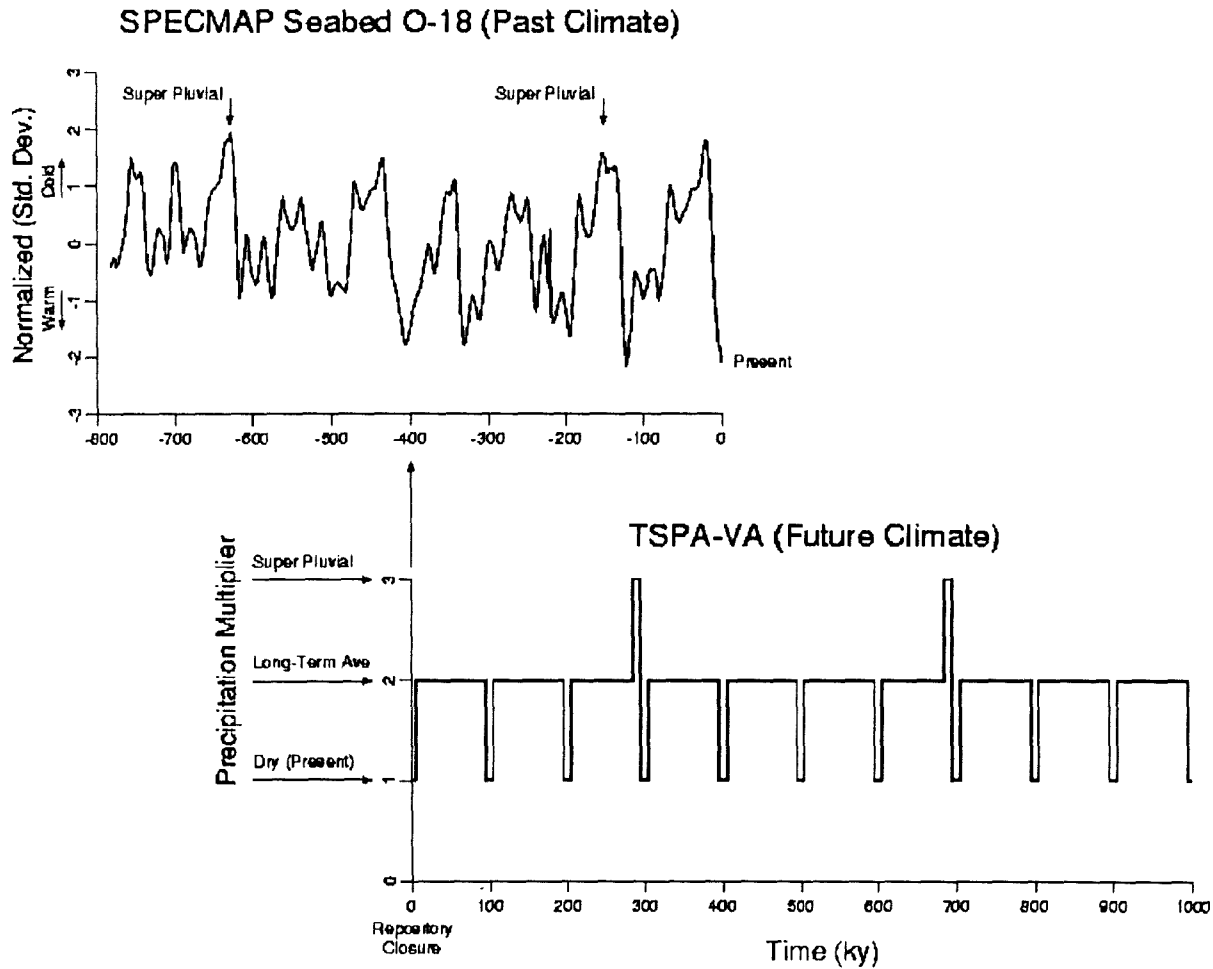
Climate

- Affects infiltration, UZ flow (w-t rise), SZ flow (flux), and biosphere components
- Three climate states are represented
 - DRY (similar to present)
 - LTA (long-term average; similar to Santa Fe)
 - SP (super-pluvial; similar to Los Alamos)
- Transition from one state to another is instantaneous
- Over 80% of the sampled time is LTA

Climate (contd.)

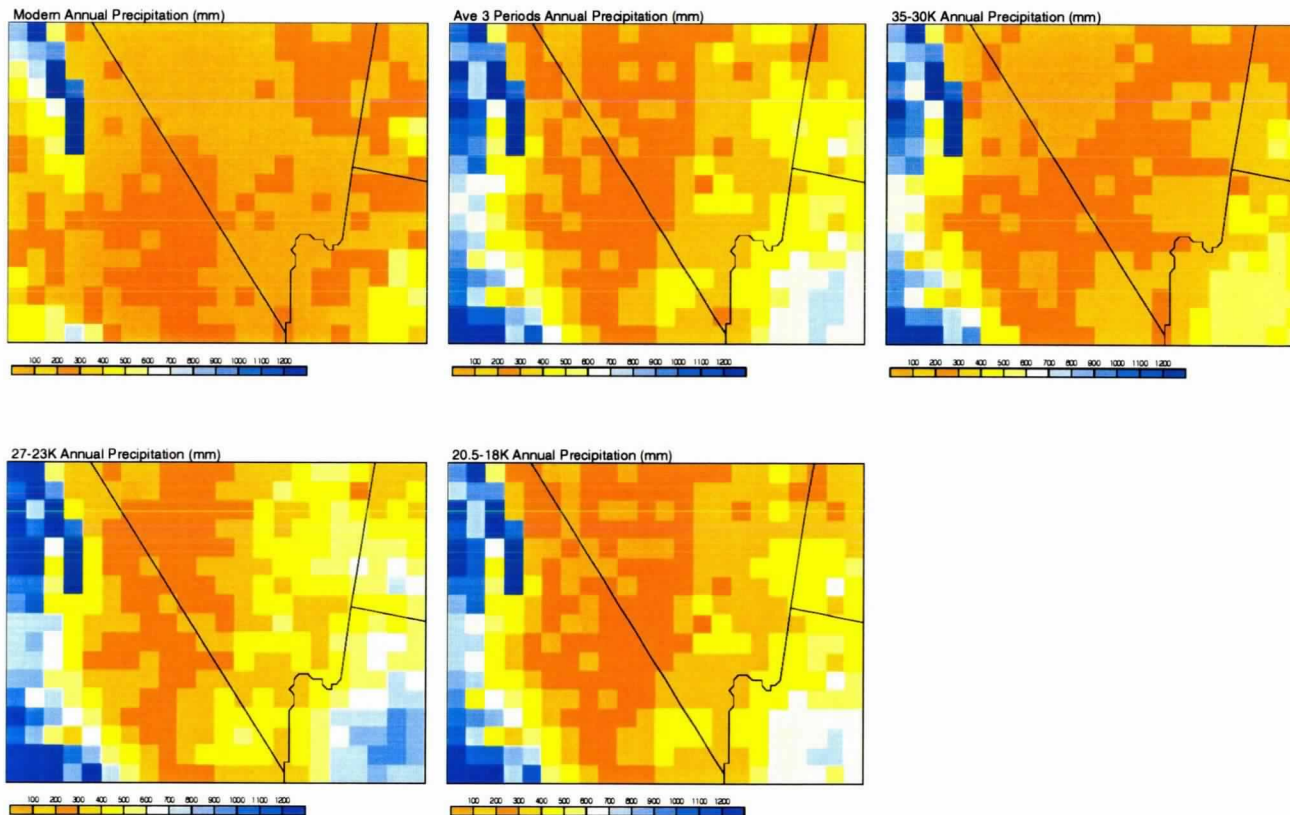
- Climate-change timing based on global paleoclimate record
- Climate magnitude based on local paleoclimate record

SPECMAP Seabed O-18 (Past Climate)



Climate Reconstructions

Yucca Mountain Project Precipitation estimates using Jaccard analog measure and applying anomaly regression to modern grid



Thompson and Anderson (August, 1997)

Climate Definition

| | DRY | LTA | SP |
|-----------------------|------|---------|----------------|
| average precip(mm/yr) | 150 | 300 | 450 |
| analog site | -- | Area 12 | South Lake. CA |
| average infil (mm/vr) | 7 | 40 | 120 |
| I/3 (mm/yr) | 2.3 | 13.3 | 40 |
| I*3 (mm/yr) | 21 | 120 | 360 |
| duration (ky) | 0-20 | 80-100 | 0-20 |
| water-table rise (m) | -- | 80 | 120 |
| SZ-flux multiplier | -- | 3.9 | 6.1 |

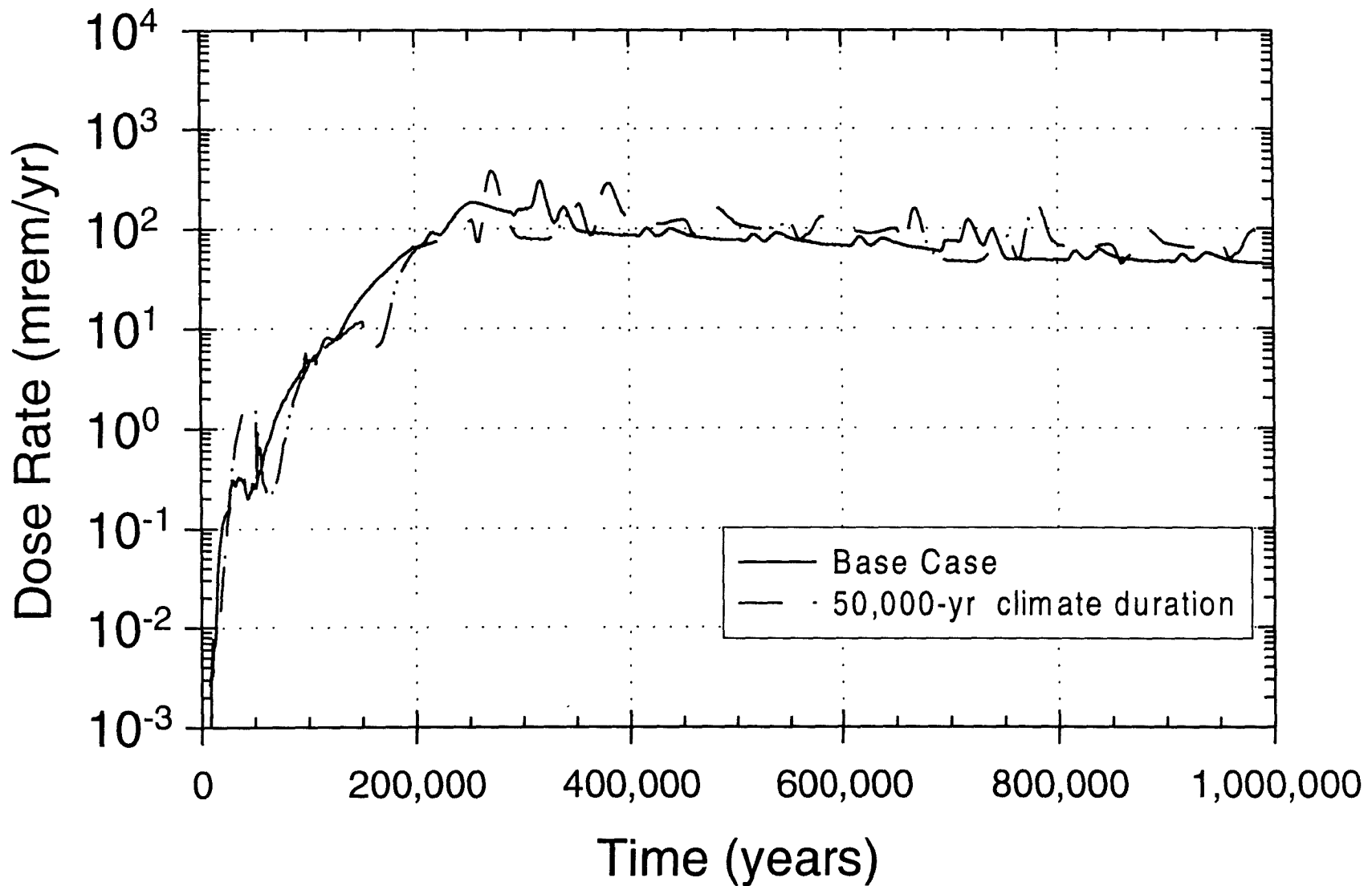
Summary

- TSPA-VA base case is primarily an LTA climate with excursions to more extreme states (DRY and SP)
 - DRY (150 mm/yr)
 - LTA (300 mm/yr – like Santa Fe)
 - SP (450 mm/yr – like Los Alamos)
- Uncertainty/variability limited to climate durations and UZ fluxes
 - no water-table-rise uncertainty
 - no SZ-flux uncertainty
 - no biosphere uncertainty

Sensitivity Analyses

1,000,000-yr Expected-Value Total Dose-Rate History

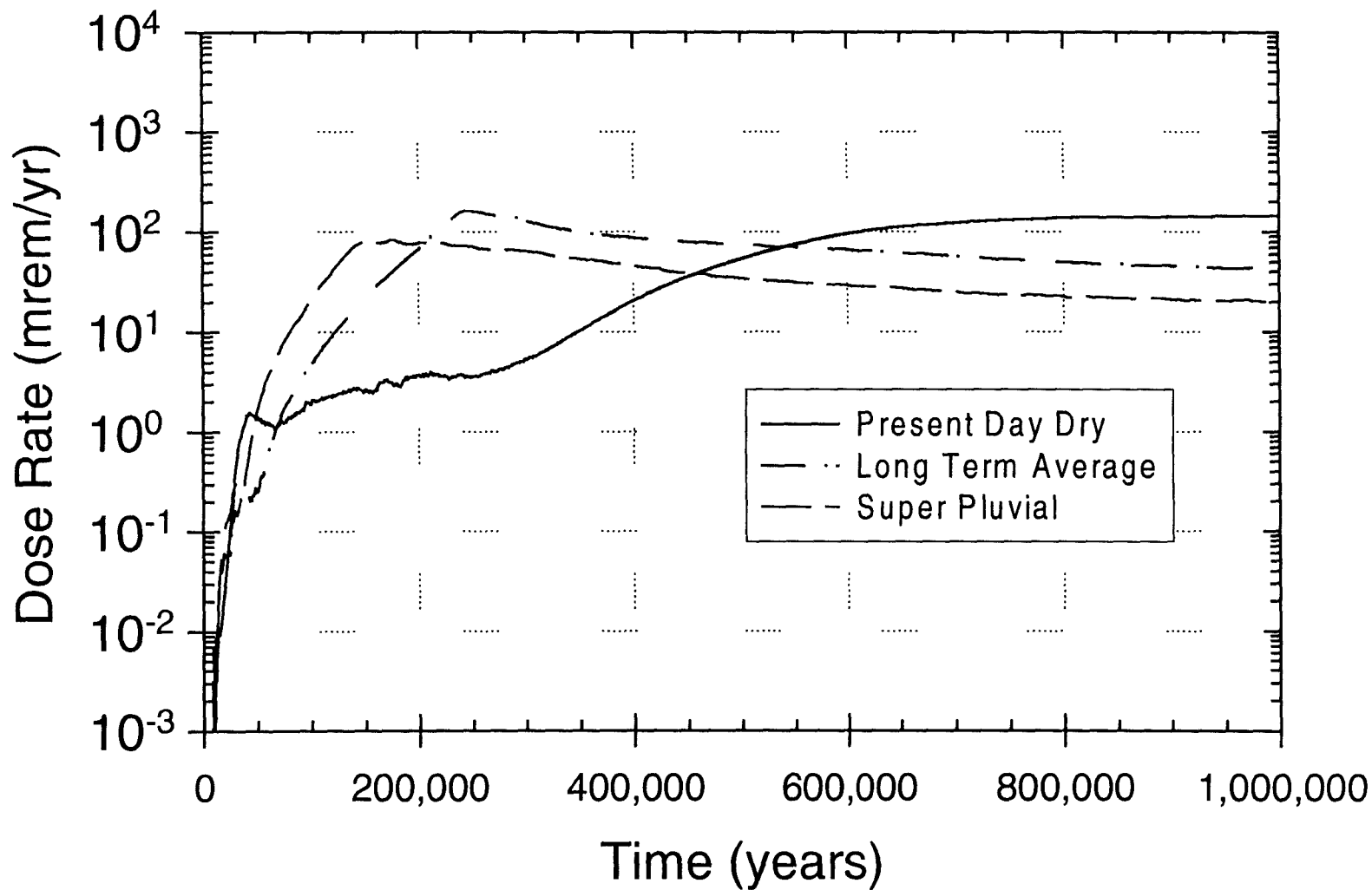
All Pathways, 20 km



Climate Sensitivity

1,000,000-yr Expected-Value Dose-Rate History

All Pathways, 20 km



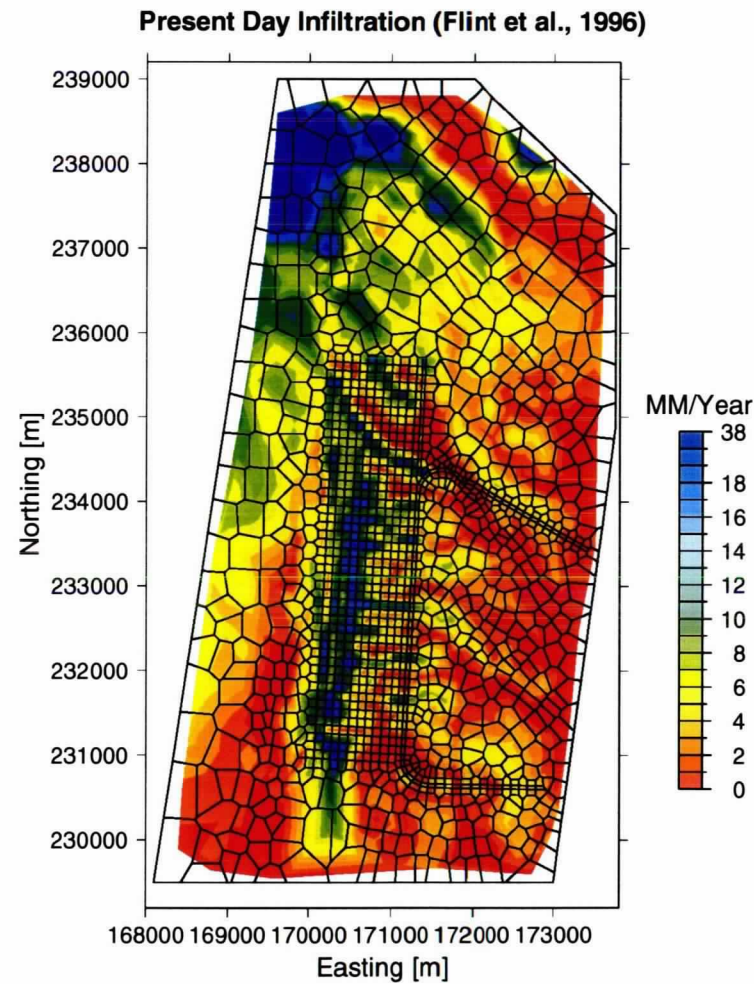
Infiltration

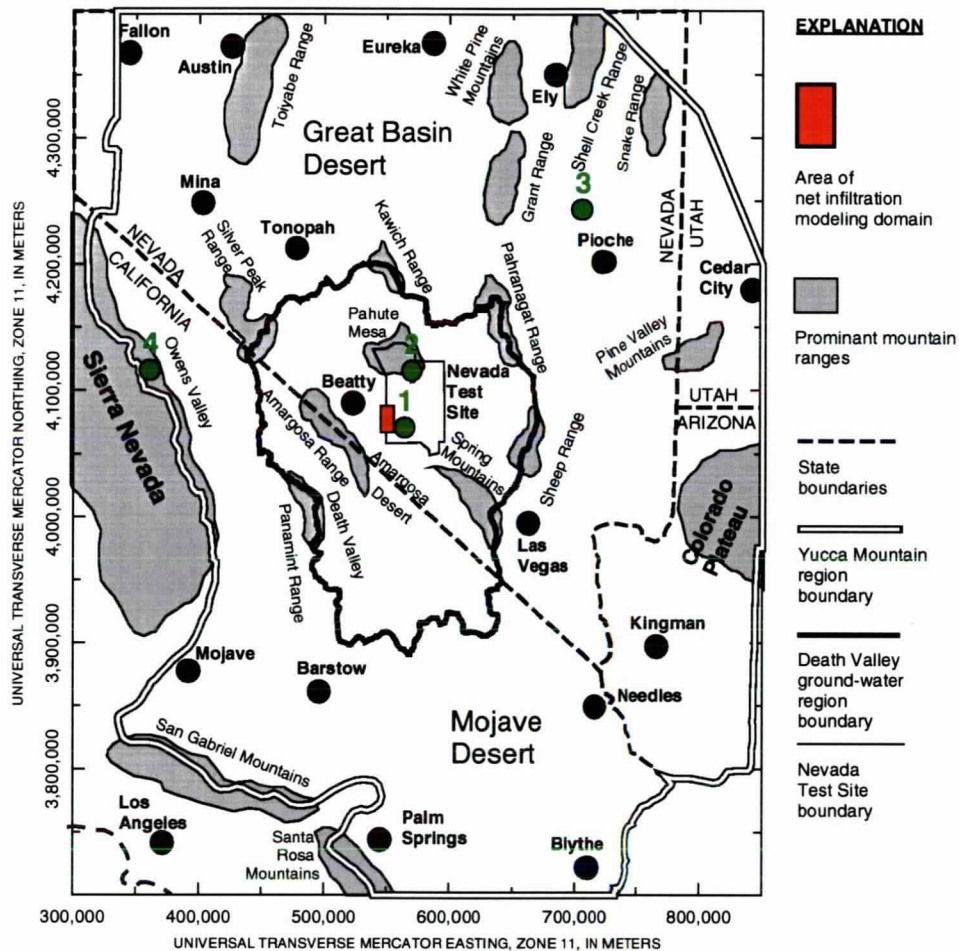
- Affects UZ flow and T-H components.
- Model calculates water balance in the soil profile based on precipitation, evapotranspiration, permeability, and storativity.
- Net infiltration (model output) is the water percolation rate at bedrock or a depth of 6 m in deep alluvium.

Infiltration Model Parameters

- Precipitation (*site and analog records*)
- Temperature (*site-present day*)
- Cloudiness (*site-present day*)
- Vegetation (*site-present day*)
- Slope (*site*)
- Surface properties (*estimated*)
- Runoff-infiltration fraction (*estimated*)

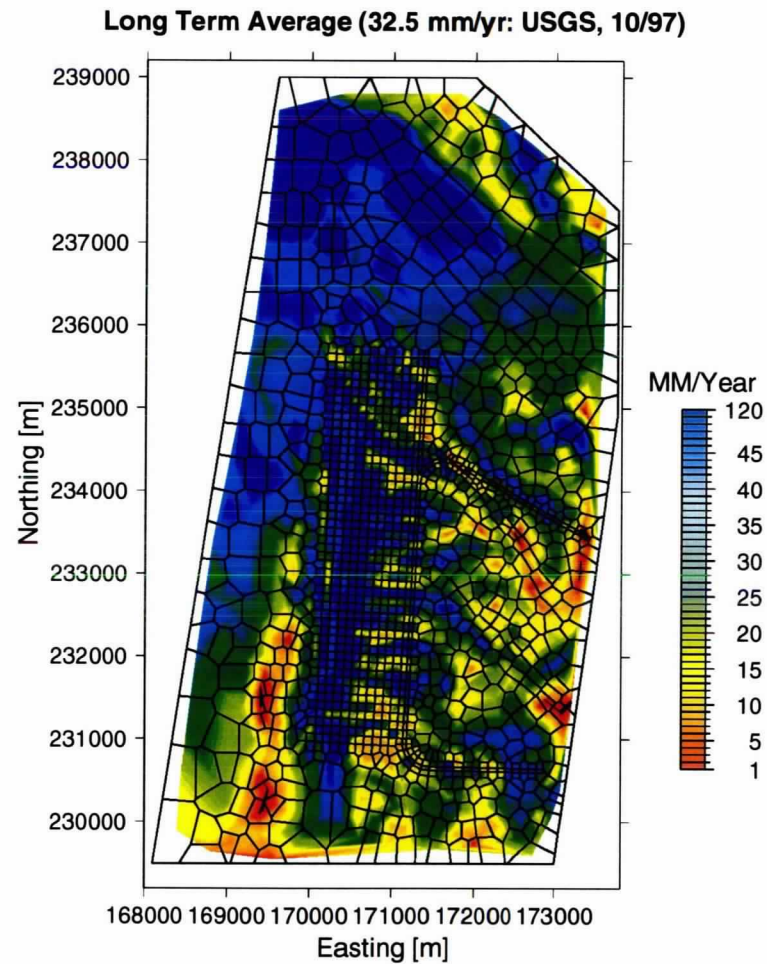
Present Day Infiltration (Flint et al., 1996)



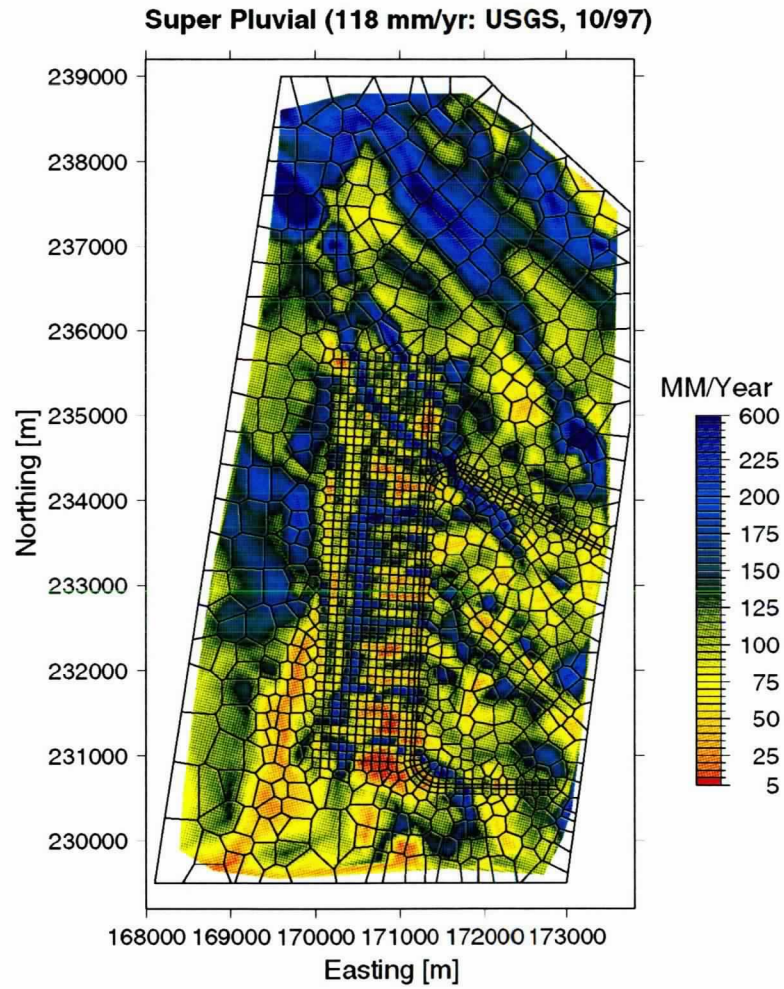


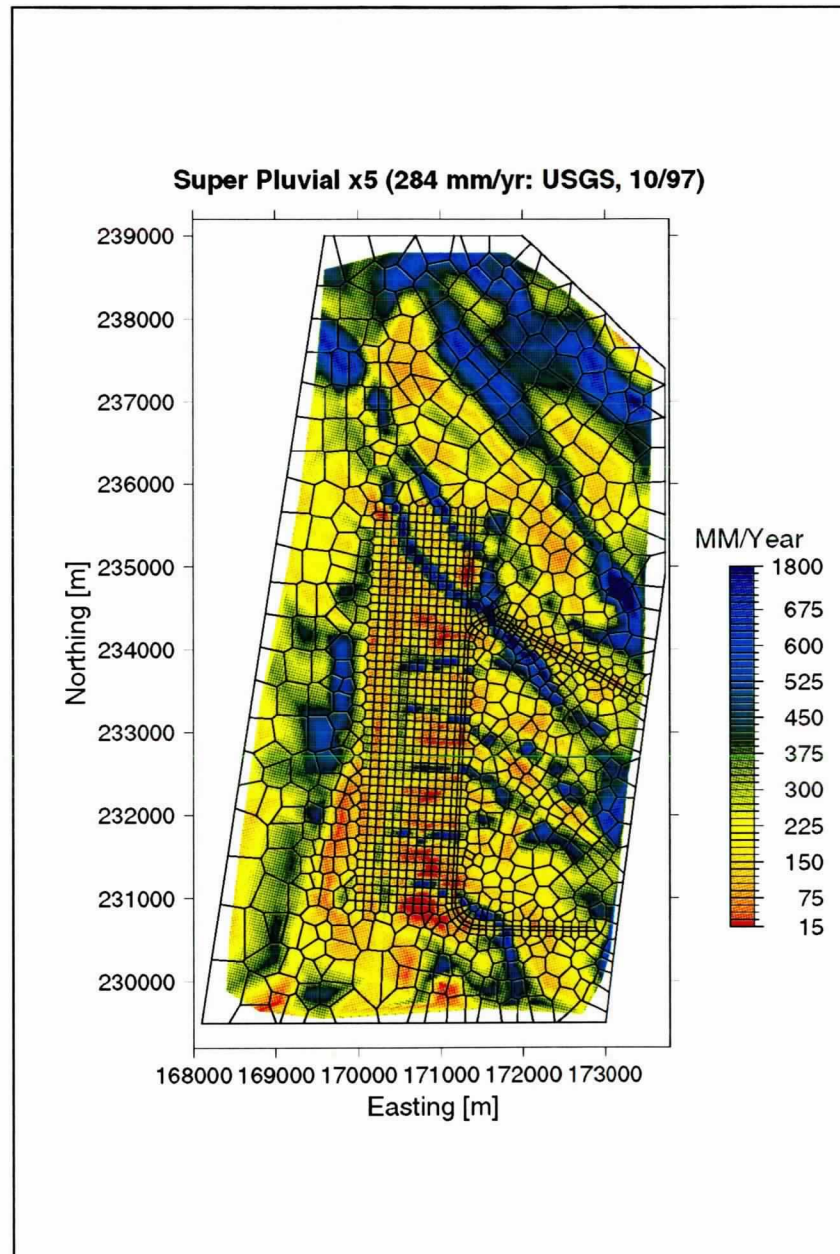
- Precipitation stations.
- 1 4JA (current climate analog)
 - 2 Area 12 Mesa (wetter future climate analog)
 - 3 Lake Valley - Steward (wetter future climate analog)
 - 4 South Lake (wetter future climate analog)

Long Term Average (32.5 mm/yr:USGS, 10/97)



Super Pluvial (118 mm/yr:USGS, 10/97)



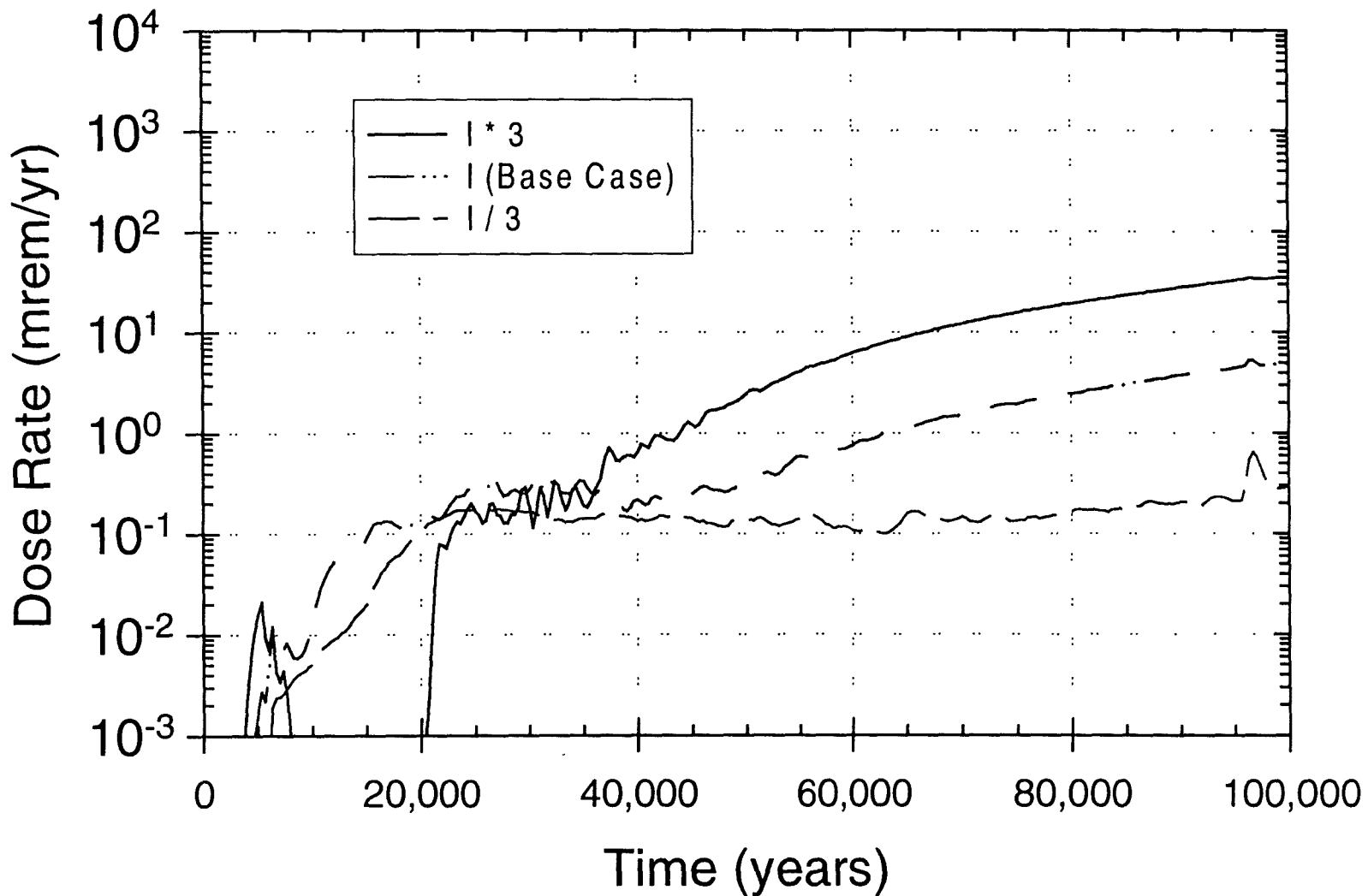


Sensitivity Analyses

DKM- X_{fm} Infiltration Sensitivity

100,000-yr Expected-Value Dose-Rate History

All Pathways, 20 km

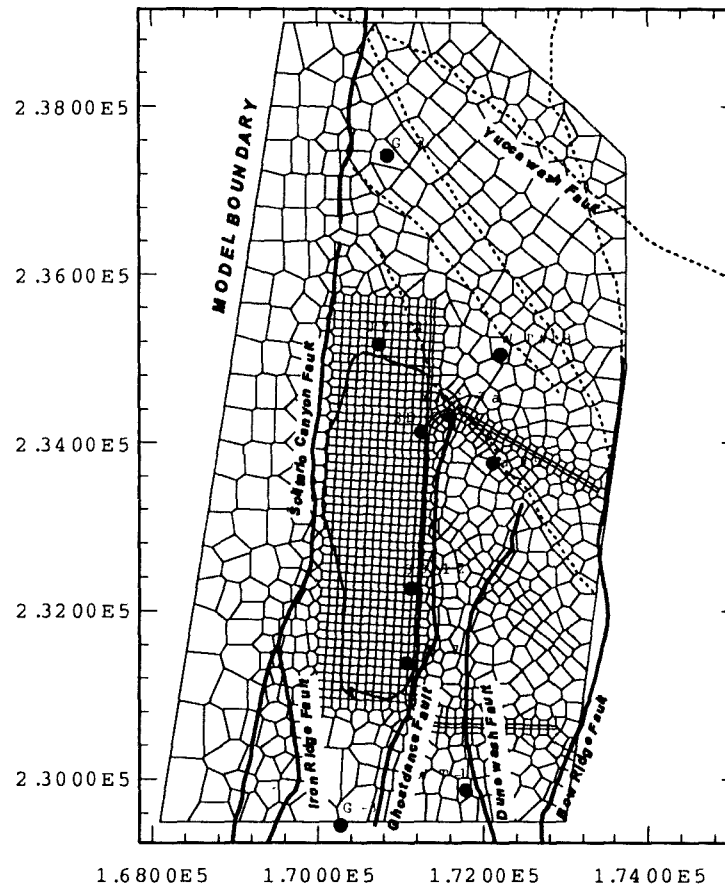


UZ Flow

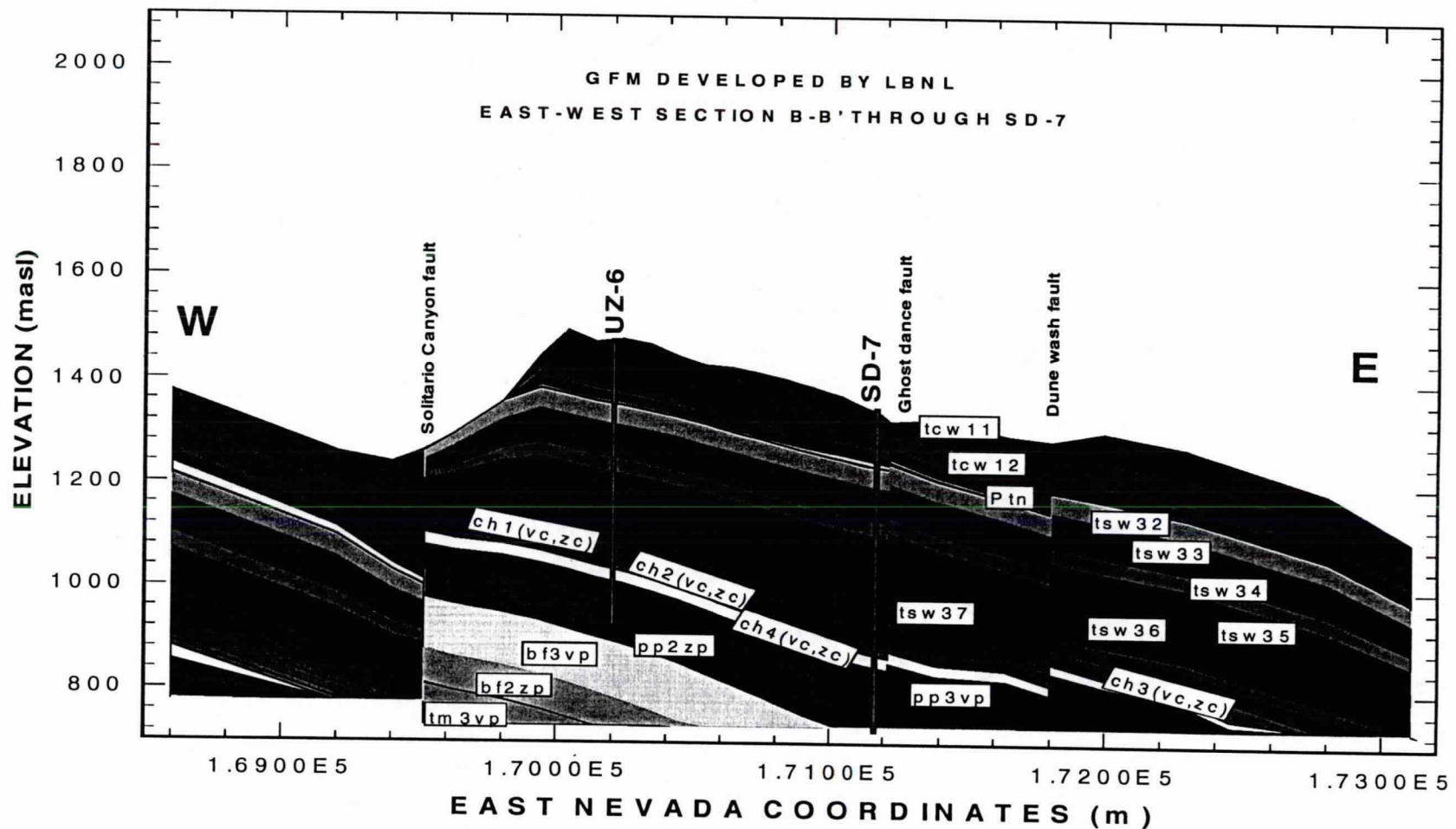
- Affects seepage and UZ transport components (also, UZ properties are used by the T-H component)
- Model is 3-D, steady-state DKM from LBNL (1997)
- Model is calibrated to S_m , ψ_m , pneumatic data, and perched water, using infiltration maps and site hydrologic-property data
- TSPA calculation samples among discrete flow fields produced by the model

Mountain-Scale UZ Flow Model

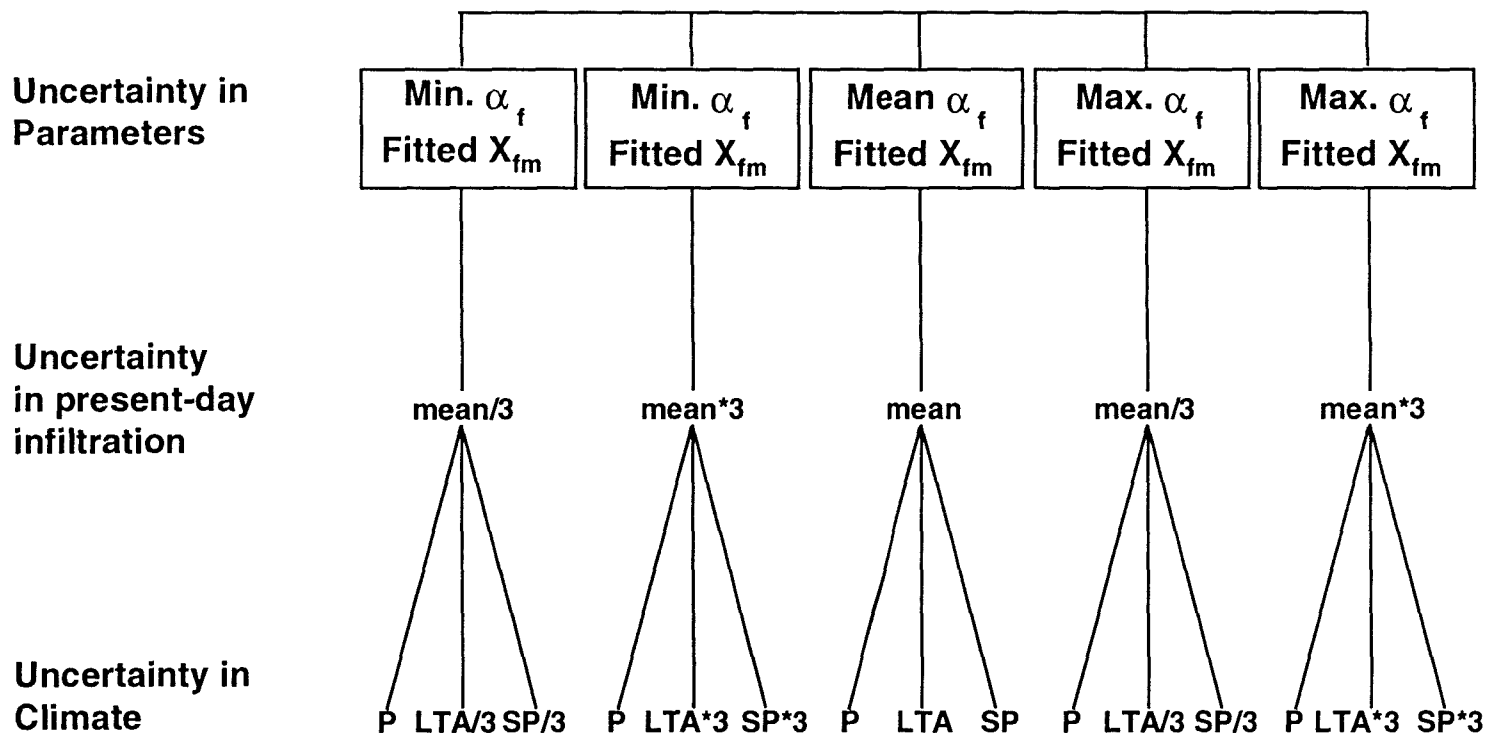
(Bodvarsson et al., 1997)



East-West Stratigraphy at SD-7



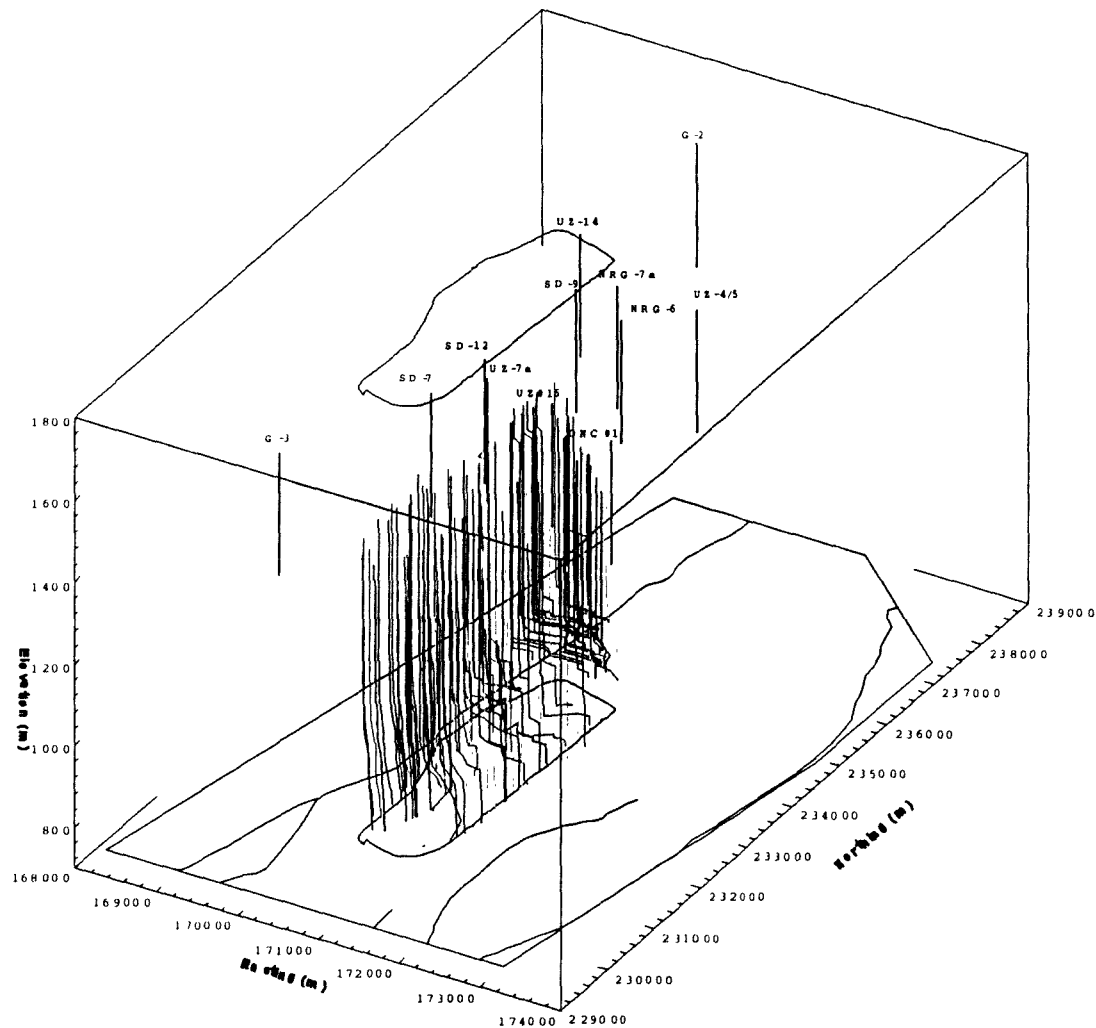
Base-Case UZ-Flow Simulations (15 Simulations)



Climate Legend

P: Present
LTA: Long-Term Average
SP: Super Pluvial

Streamlines for 3-D UZ Flow Field

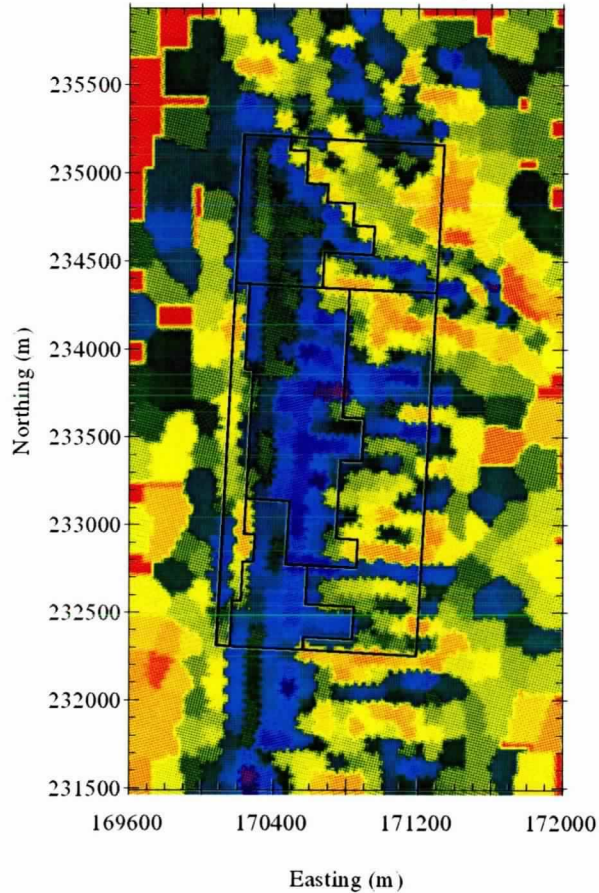


Total (fracture+matrix) Percolation Fluxes

Base-Case Long-Term Average Climate Scenario

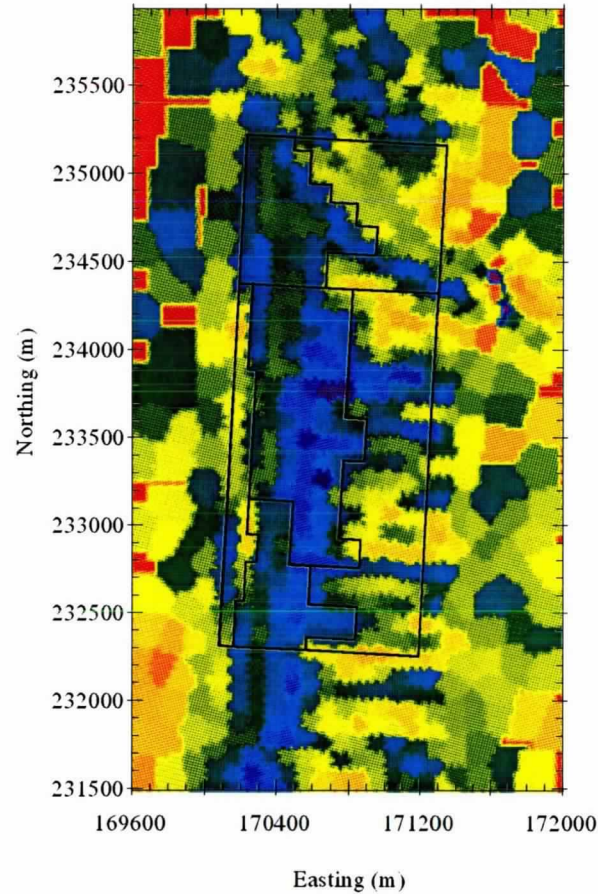
Surface (Infiltration)

mnaqbf1.infiLhdf



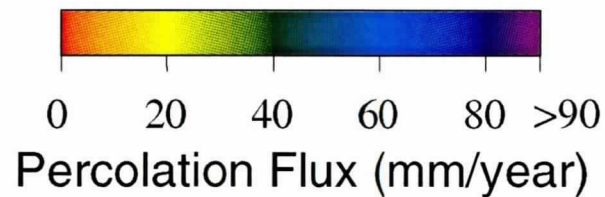
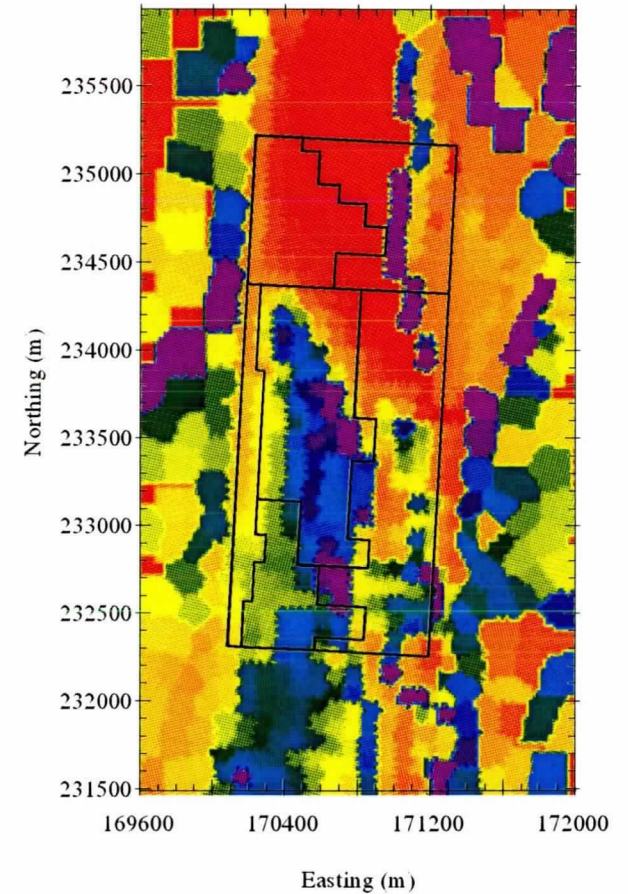
Repository Horizon

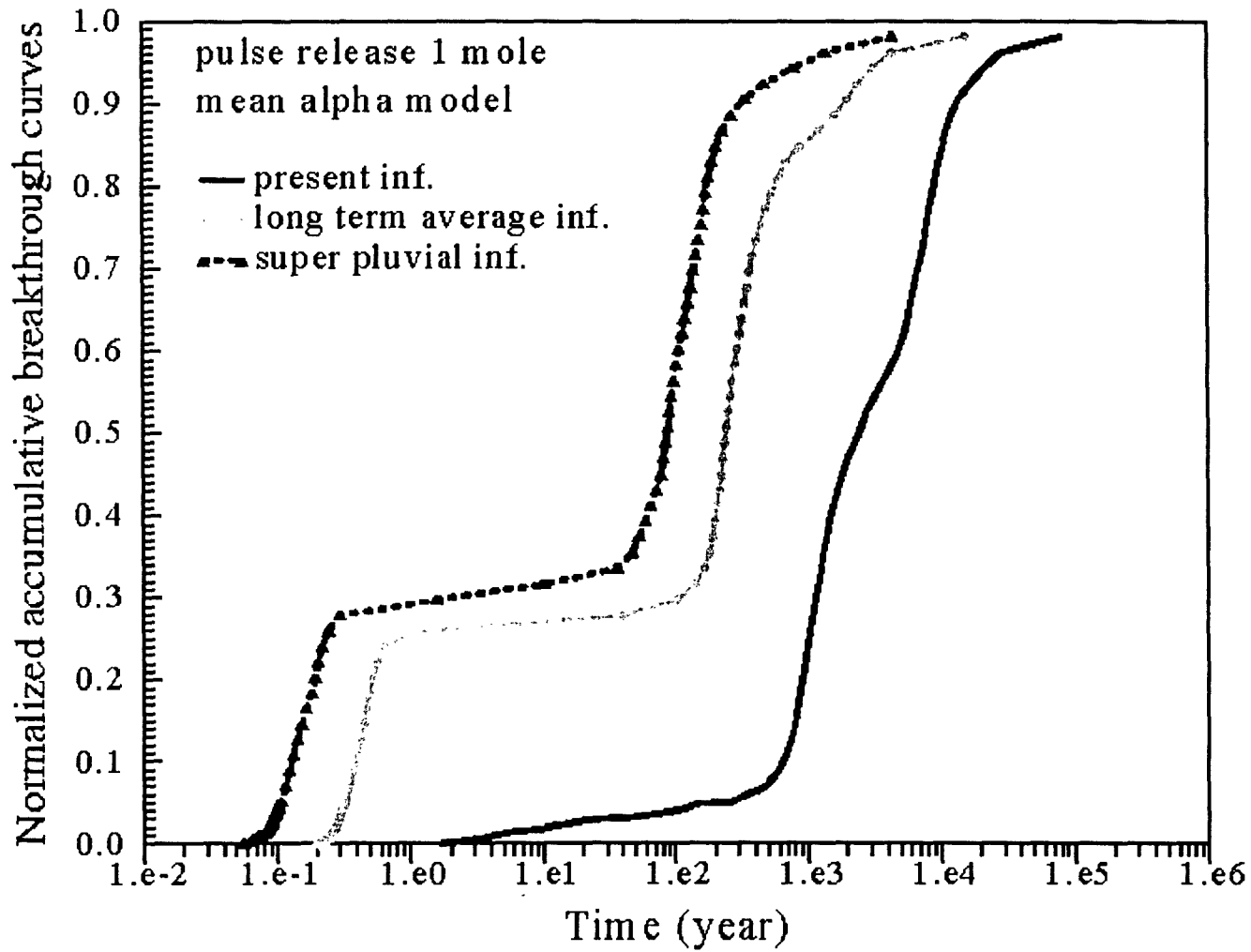
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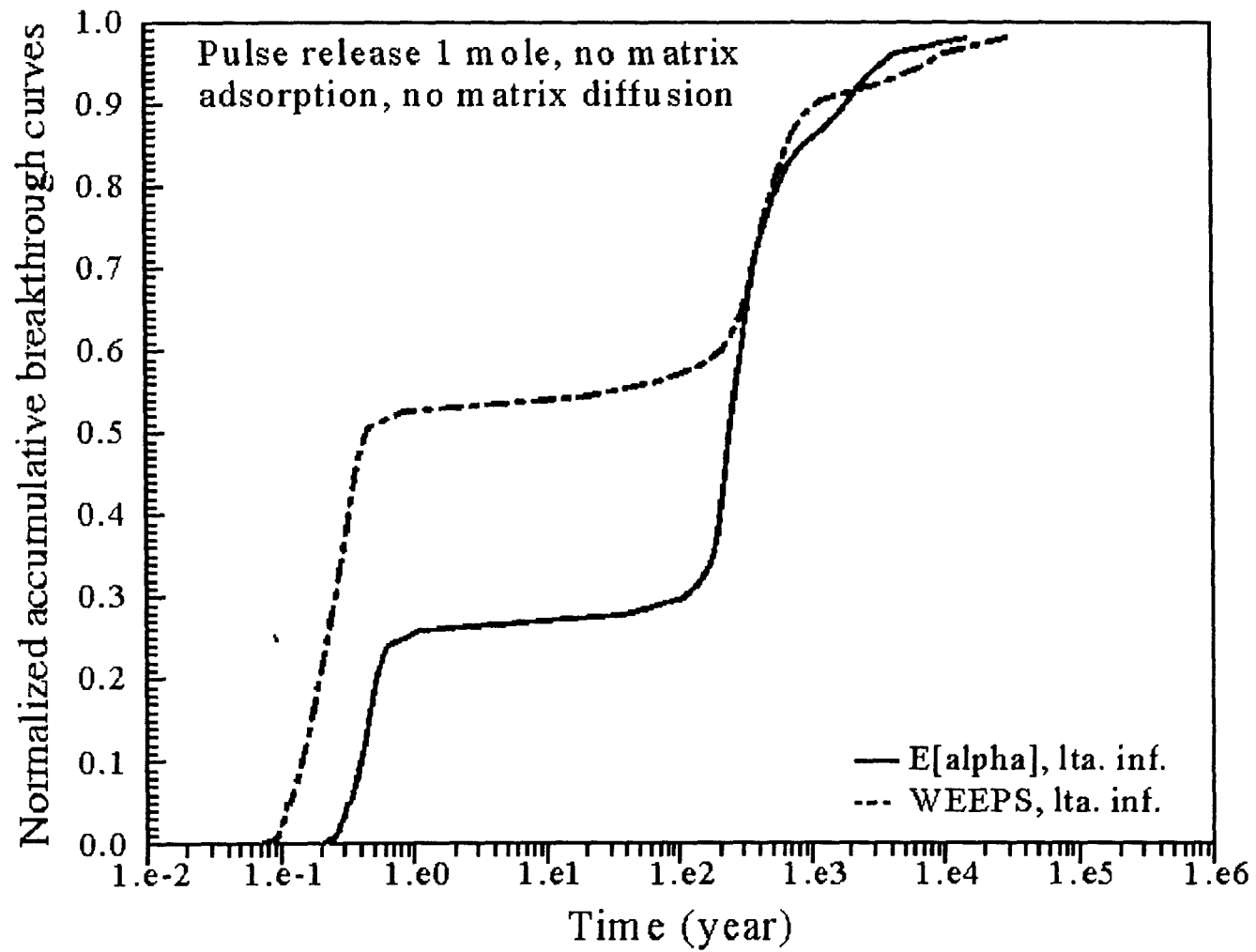
Water Table

mnaqbf1.wtLhdf





SENSITIVITY ANALYSES



DKM-weeps Infiltration Sensitivity

100,000-yr Expected-Value Dose-Rate History

All Pathways, 20 km

