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Bounding Uncertainty in Unsaturated-Zone Flow
Through Different Conceptual Models of Fracture-Matrix
Interaction

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Performance Assessment (PA) calculations used to evaluate the suitability of a geologic repository for nuclear waste storage require the consideration of uncertainties in the system. Most past PA calculations on the Yucca Mountain (YM) site in Nevada have modeled unsaturated zone (UZ) flow in one-dimensional columns, capturing the uncertainty by sampling flow parameters within the ranges of uncertainty of the parameters.

With continued data collection at YM, a three-dimensional (3D) model has been developed that can be calibrated to matrix saturations, water potentials, and the geochemistry of the system. However, there is still enough uncertainty in the system that the calibration is non-unique and several different models can be developed that equally well capture what is known about the system. One of the major uncertainties in the system is the degree of interaction between fractures and matrix.

For the current PA of YM a novel method is being used to bound the uncertainty in UZ flow. Several multi-dimensional flow fields will be developed, each using a different conceptual model that is consistent with the available data. For example, one model allows for very little interaction between the fractures and matrix, resulting in fast flow through the fractures. A second model allows for flow primarily in the matrix in certain units. It is believed that the range of resulting fields developed using this multiple conceptual model approach will bound possible flow fields that would be developed through sampling individual parameters.

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