Title
Epistemic Uncertainty in Evaluation of Evapotranspiration and Net Infiltration Using Analogue Meteorological Data

Author
Faybishenko, Boris

Publication Date
2006-08-28

Epistemic Uncertainty in Evaluation of Evapotranspiration and Net Infiltration Using Analogue Meteorological Data
By Boris Faybishenko, LBNL
Submitted to 2006 American Geophysical Union Fall Meeting

Uncertainty is typically defined as a potential deficiency in the modeling of a physical process, owing to a lack of knowledge. Uncertainty can be categorized as aleatoric (inherent uncertainty caused by the intrinsic randomness of the system) or epistemic (uncertainty caused by using various model simplifications and their parameters). One of the main reasons for model simplifications is a limited amount of meteorological data. This paper is devoted to the epistemic uncertainty quantification involved in two components of the hydrologic balance-evapotranspiration and net infiltration for interglacial (present day), and future monsoon, glacial transition, and glacial climates at Yucca Mountain, using the data from analogue meteorological stations. In particular, the author analyzes semi-empirical models used for evaluating (1) reference-surface potential evapotranspiration, including temperature-based models (Hargreaves-Samani, Thornthwaite, Hamon, Jensen-Haise, and Turc) and radiation-based models (Priestly-Taylor and Penman), and (2) surface-dependent potential evapotranspiration (Penman-Monteith and Shuttleworth-Wallace models). Evapotranspiration predictions are then used as inputs for the evaluation of net infiltration using the semi-empirical models of Budyko, Fu, Milly, Turc-Pike, and Zhang. Results show that net infiltration ranges are expected to generally increase from the present-day climate to monsoon climate, to glacial transition climate, and then to the glacial climate. The propagation of uncertainties through model predictions for different climates is characterized using statistical measures. Predicted evapotranspiration ranges are reasonably corroborated against the data from Class A pan evaporometers (taking into account evaporation-pan adjustment coefficients), and ranges of net infiltration predictions are corroborated against the geochemical and temperature-based estimates of groundwater recharge and percolation rates through the unsaturated zone obtained at Yucca Mountain.

Acknowledgement: This work was supported by the U.S. Dept. of Energy under Contract No. DE-AC02-05CH11231.