



Contribution ID: 690

Type: Oral Presentation

## An Efficient Approach to Probabilistic Groundwater Flow Modeling for Emergency Well Design

*Monday, 19 May 2025 11:40 (15 minutes)*

Global climate change has intensified extreme meteorological conditions, increasing reliance on groundwater resources, which are less vulnerable to surface water variability, in many regions. Accurately quantifying the uncertainty in hydraulic head due to the heterogeneous hydraulic conductivity of aquifers is crucial for optimizing emergency well placement and determining drilling depth, thereby supporting sustainable environmental water supply management and reliable policymaking. However, the practical implementation of uncertainty quantification is often limited by computational cost. In this study, we employ the Cumulative Distribution Function method, which deterministically solves a system of moment equations along with the equation governing the CDF of hydraulic head, eliminating the high computational burden of Monte Carlo simulations. To further enhance computational efficiency, we use the meshless Generalized Finite Difference method to solve these equations, allowing flexible placement and adaptive distribution of nodes. We apply this framework to the Taichung Basin in Taiwan to demonstrate its effectiveness in generating probabilistic groundwater level distributions for emergency wells. The methodology developed in this work is broadly applicable to real-world groundwater management and other environmental hydrological challenges, providing a robust tool for optimizing well site selection and depth determination in regions facing the risks of surface water scarcity.

### Country

USA

### Acceptance of the Terms & Conditions

[Click here to agree](#)

### Student Awards

### Water & Porous Media Focused Abstracts

This abstract is related to Water

### References

**Primary author:** Dr CHEN, Shang-Ying (Stanford University / National Cheng Kung University)

**Co-authors:** Prof. TARTAKOVSKY, Daniel (Stanford University); Prof. HSU, Kuo-Chin (National Cheng Kung University); Mr CHOU, Zi-Yan (National Taiwan University); Dr KE, Chien-Chung (Sinotech Engineering Consultants, Inc.); Dr WEI, Lun-Wei (Sinotech Engineering Consultants, Inc.); Dr CHEN, Nai-Chin (Sinotech Engineering Consultants, Inc.)

**Presenter:** Dr CHEN, Shang-Ying (Stanford University / National Cheng Kung University)

**Session Classification:** MS14

**Track Classification:** (MS14) Uncertainty Quantification in Porous Media