My research focuses on developing efficient stochastic approach for quantifying uncertainty in the subsurface fluid flow. Geological heterogeneities are considered by using random variables or random fields with different types of probability distributions. A large number of simulations are usually required in common routines of uncertainty quantification, which is however computationally prohibitive in practice. The probabilistic collocation method is proposed to efficiently propagate uncertainty through a relatively small number of flow simulations. Reservoir properties may behave as non-Gaussian distributions other than the typical log-normal distribution. Characterization of the non-Gaussian random fields is another focus of my research.