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Adjoint based data assimilation for phase field model using second order information of a posterior distribution SHIN-ICHI ITO, HIROMICHI NAGAO, The University of Tokyo, AKINORI YAMANAKA, Tokyo University of Agriculture and Technology, YUHKI TSUKADA, TOSHIYUKI KOYAMA, Nagoya University, JUNYA INOUE, The University of Tokyo — Phase field (PF) method, which phenomenologically describes dynamics of microstructure evolutions during solidification and phase transformation, has progressed in the fields of hydromechanics and materials engineering. How to determine, based on observation data, an initial state and model parameters involved in a PF model is one of important issues since previous estimation methods require too much computational cost. We propose data assimilation (DA), which enables us to estimate the parameters and states by integrating the PF model and observation data on the basis of the Bayesian statistics. The adjoint method implemented on DA not only finds an optimum solution by maximizing a posterior distribution but also evaluates the uncertainty in the estimations by utilizing the second order information of the posterior distribution. We carried out an estimation test using synthetic data generated by the two-dimensional Kobayashi's PF model. The proposed method is confirmed to reproduce the true initial state and model parameters we assume in advance, and simultaneously estimate their uncertainties due to quality and quantity of the data. This result indicates that the proposed method is capable of suggesting the experimental design to achieve the required accuracy.

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