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Xuan Wang, Vladan Babovic, Xin Li

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Application of spatial-temporal error correction in updating hydrodynamic model

Xuan Wang^a, Vladan Babovic^a, Xin Li^{a*}

^a Department of Civil and Environmental Engineering, National University of Singapore, Singapore 117576, Singapore

* Corresponding author: Xin Li, Department of Civil and Environmental Engineering, National University of Singapore, Block E1A, #07-03, No.1 Engineering Drive 2, Singapore, 117576, email: xinli@u.nus.edu

Abstract

Data assimilation is a useful tool to correct the discrepancies of numerical model results by extracting reliable information from observed data. As one important category of data assimilation, updating output variable, also known as error correction, can be operated offline and give better performance with more computational efficiency. Spatial distribution procedure is one essential step for error correction since it can address the challenge for correcting the errors at locations without measurements. Currently, most attempts have been made to estimate spatial distribution pattern, or improve the competence by exploring spatial relationship, but consideration of temporal correlation or temporal lag is lacked. Fewer efforts can be found on assessing the influence of temporal lag on the spatial interpolation. This study proposes two spatial interpolation approaches, i.e. approximated space-time Ordinary Kriging (ASTOK) and temporally corrected Approximated Ordinary Kriging (TCAOK), both of which are inspired by approximated Ordinary Kriging (AOK) but take the temporal lag into consideration. These proposed schemes are compared with AOK and tested in a case study based on Singapore Regional model (SRM) and its coarse version (SRMC), to correct the water level outputs in the whole domain. The study compares the difference of the proposed approaches, and explores their adaptive capabilities by utilizing temporal lag in various manners. It also provides insight on the combination of both temporal lag and spatial lag and lays down a guide which can be utilized in other spatial interpolation procedure. The proposed scheme can also be applied to update any numerical model with insufficient observations.

Key words:

Data assimilation, Temporal lag, Error correction, Hydrodynamic model, Spatial interpolation

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