

Ocean Temperature Profile Interpolation with Neural Network

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Data-driven models have been widely used in water resources related field especially in hydrology where it plays an important role in flood forecasting, rainfall-runoff prediction, water quality simulation, etc. However, the applications of data-driven model are relatively still less explored in oceanography field which heavily relies on physically-based mathematical models. This paper demonstrates how a data-driven model (neural network) interpolates temperature profiles, one of the important variables in the ocean models, in the domain of interest.

Spatial resolution of available temperature profiles are generally quite coarse, e.g. 1 degree (or 108 km). Much smaller resolutions, such as 1/6 or 1/12 degree, are, however, commonly applied in ocean modeling to better represent the bathymetry of the domain of interest. Thus, the need arises to provide temperature profiles at the model's required boundary grid points of the domain of interest. The commonly approaches are linear or bi-linear interpolation methods. However, they are: (1) not very accurate; (2) difficult in interpolation when the surrounding bathymetry changes drastically. The study proposes neural network, one of data-driven models, as an interpolation tool for 3D ocean domain.

Data used in the study are from Levitus98 database; they are in the form of monthly averaged temperature at 1 x 1 degree resolution world-wide. The second set of data considered is the measured temperature taken densely at the 60km x 60km site near Kaohsiung (Taiwan) in the period of April-May 2001. Each data set is divided into 2 subsets: one set for training while the other for verification. A feed forward backpropagation neural network is first trained with the training set and then cross validated with the verification set. The Nash-index, an indicator of simulation accuracy, is as high as 0.97 for both training and verification. The trained neural network is finally applied to yield the temperature profiles at required locations within the domain.