Abstract—When conducting marine operations that rely on wave conditions, such as maritime trade, the fishing industry, and ocean energy, accurate wave downscaling is important, especially in coastal locations with complicated geometries. Traditional approaches for wave downscaling are usually obtained by performing nested simulations on a high-resolution local grid from global grid information. However, this approach requires high computation resources. In this paper, to downscale global wave height data into a high-resolution local wave height with less computation resources, we propose a machine learning-based approach to downscaling using the Temporal Convolutional Network (TCN) model. To train the model, we obtain the wave dataset using the SWAN model in a local domain. The global datasets are taken from the ECMWF Reanalysis (ERA-5) and used to train the model. We choose the coastal area of Bengkulu, Indonesia, as a case study. The results of TCN are also compared with other models such as LSTM and Transformers. It showed that TCN demonstrated superior performance with a CC of 0.984, RMSE of 0.077, and MAPE of 4.638, outperforming the other models in terms of accuracy and computational efficiency. It proves that our TCN model can be alternative model to downscale in Bengkulu's coastal area.

Keywords: Downscaling, Wave Downscaling, Machine Learning, TCN, Coastal Area