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Transport of waste heat from a nuclear power plant into coastal water

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Abstract

A numerical and experimental modeling is presented for studying the transport of waste heat from a nuclear power plant into coastal water by using a full-field physical model with scale distortion, a local physical model with normal scale and a depth-averaged k–ε turbulence model with a modified second-order upwind scheme. Field investigations are also used to provide the calibration and validation of the modeling. A case study simulating the turbulent tidal flow and waste heat transport in the coastal water near Daya Bay Nuclear Power Plant in Southern China was conducted. The experimental result of the case study shows that the water temperature in coastal water was a little oversimulated near the surface and was a little undersimulated near the bottom of heated-water layer by the full-field physical model. The numerical study shows that the depth-averaged k–ε turbulence model presented a satisfied prediction of turbulent tidal flow and far-field temperature distribution in coastal water, although the near-field stratification due to the heated water effluent was not accounted for. The result of the effect of scale distortion on physical model shows that a full-field physical model with a scale distortion of 10 produced a satisfied result of temperature distribution in the present case study.

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Keywords

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