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Investigation on Effective Turbulence Models for Predicting Tanker Stern Flows

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Summary: This paper concerns investigation on effective turbulence models for predicting tanker stern flows. Objectives of the present work are twofold: i.e., (1) perform detailed evaluation of two equation models that are, at present, most widely accepted in numerical ship hydrodynamics; and (2) investigate feasibility in extending the models for more accurate and efficient mathematical forms. The ad-hoc approach on simple zero or one equation model is not of interest in the present work. Instead, effort will be fully focused on models that offer consistency with flow physics and possibly universal validity. The CFD code used in the present study is FLOWPACK version 2006, which was developed by the authors and its capability has been validated through detailed studies in past years. In particular, three turbulence models are investigated in the present study, i.e., the blending k-ω/k-ε model, the Shear-Stress Transport model, and the near-wall (or low-Reynolds number) modification model. In the following, an overview is given of the present numerical method, and results are presented and discussed for SR196 series tanker and KVLCC2M tanker hull forms including detailed comparisons with available experimental data. Lastly, some concluding remarks are made concerning limitations, requirements, and prognosis for improvements of the present turbulence models.