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Spectral wave dissipation, operational wave models and observations: is there a way of improving wave forecasts?

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This work is devoted to the examination of dissipation source terms in models, and their performance in connection to wave climates and was performed using the WAVEWATCH III® (Tolman 2002, 2009) third generation wave model, which provides a flexible tool to investigate these issues. The analyses made use of model-in situ (buoy) comparisons of integral (significant wave height and zero-up-crossing period) and wave spectral observations. In order to examine novel ways of parameterizing spectral dissipation in wave models, a new formulation was implemented, tested and optimized for use within WAVEWATCH III®. The chosen dissipation scheme is a physically-based formulation resulting from the recent experimental work of Babanin et al. (2007). This is the first time that a physically consistent dissipation scheme was implemented in a global wave model like WAVEWATCH III®. The results revealed that the standard dissipation terms, already implemented in the model's official versions, produce model outputs sensitive to the local wave climate of each run. Swell dominance causes the performance of the model to deteriorate, and this is connected to the way spectral dissipation is parameterized as a "tuning knob" by the standard dissipation schemes. Model outputs obtained by using the newly implemented term, which is based on physics, were comparable and in some cases better that the outputs obtained from the "best-performing" of the standard terms. The latter, which is the most important finding of this work, sets the ground for further research on the physics of spectral dissipation and on the way these are parameterized within today's wave models.