Forty years of global wave hindcasts using the observation-based source terms: validation and geophysical applications

Qingxiang Liu¹, Alexander Babanin¹, Erick Rogers², and Stefan Zieger³

¹The University of Melbourne, Melbourne, Australia (qingxiang.liu@unimelb.edu.au)
²Naval Research Laboratory, Stennis Space Center, Mississippi, USA (erick.rogers@nrlssc.navy.mil)
³Bureau of Meteorology, Melbourne, Australia (stefan.zieger@bom.gov.au)

Forty years (1979-2019) of global wave hindcasts are developed with the third generation spectral wave model WAVEWATCH III® using the state-of-the-art observation-based source term parameterizations (i.e., ST6) and the advanced irregular-regular-irregular (IRI) 1/4 grid system. The wave model has been forced with two distinct wind databases sourced from the latest NCEP Climate Forecast System (CFS) and the fifth generation of the ECMWF climate reanalyses (ERA5), together with the ice concentration available from the EUMETSAT OSI SAF (version 2). The hindcasts not only include traditional integral wave parameters (e.g., wave height, period) but also provide various novel parameters such as the dominant wave breaking probability, wave-induced mixed layer depth and whitecap coverage that are derived from wave spectrum based on previous theoretical and empirical studies. Wave parameters are extensively validated against observations from in-situ buoys and satellite altimeters on a global scale. Possible applications of these hindcasts in the fields of freak waves, sea spray and air-sea gas transfer will also be discussed.