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Historical Simulation of Global Wave Climate using Anthropogenic and Natural Forcings Derived from Multimodel Ensemble of CMIP6

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Wind-waves are of paramount importance for shoreline stability, offshore and coastal activities, and renewable energy generation. There is sufficient evidence of climate-driven trends in historical wave heights. It is important to quantify the relative contributions of natural and anthropogenic forcings to historical changes in wave height in order to produce more reliable future projections and adopt appropriate adaptation strategies. Historical wave climate is simulated using numerical model WAVEWATCH-III[®] (WW3) forced by multi-model CMIP6 simulations corresponding to natural forcing only (NAT), greenhouse gas forcing only (GHG), aerosol forcing only (AA), combined all forcings (ALL), and preindustrial control conditions (CTL). Surface wind at 3-hourly temporal resolution, and sea-ice area fraction at monthly frequency, from each CMIP6 model is derived to force spectral wave model WW3 over the global ocean at 1° grid resolution for 1950-2020. Other specification such as spectral discretization and parameterizations is same as the recent WW3 hindcast implemented at Ifremer. The ALL simulations generally ended in 2014, but simulations are extended to 2020 with the SSP (Shared Economic Pathway) 2-4.5 scenario. The preindustrial control (CTL) simulations is used to estimate internal climate variability. Model validation is done using altimeter data set produced by European Space Agency Climate Change Initiative (ESA-CCI), and recent ERA-5 reanalysis. Numerically simulated wave parameters time-series for different external forcing is not available yet. This study produces a novel database particularly useful for investigating the link between wave and climate variability.