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Detection and attribution of trends in ocean waves induced by climate change and variability

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Recent observations and modeling studies indicate short and long-term trends in wave height. The direction and the slope of these trends show strong regional and temporal variations. However, it is still uncertain whether these trends are resulted by natural climate variability or transient climate change. We use the global wave model WAM forced by the data from an Earth system model calculated within the 5th Phase of the Coupled Model Intercomparison Project (CMIP5) to investigate the natural and forced variability in wave regimes. Based on model simulations of the historical period with low anthropogenic forcing over the 50 years from 1850 to 1900, we first determine the natural variability in wave climate. Then, we detect when and where the trends become statistically significant and exceed natural variability in the current climate and future high CO_2 climate change scenario RCP8.5. Finally, we attribute the changes in wave climate to shifts in the atmospheric circulation regimes and/or swell propagation. We show for instance that swell contribution to total wave height is significantly increasing in sub-polar and equatorial regions.