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Ocean Surface Wave Climate Response to the North Atlantic Storm-Track Interannual Variability in Winter

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We analyze the responses of ocean surface waves to the large-scale atmospheric forcing in the North Atlantic boreal winter during the period 1980-2016. We analyze a set of numerical simulations from a spectral wave model (Wave-watch III) forced by the decomposed wind forcing from the ERA-Interim reanalysis (0.7° horizontal resolution). Decomposition allowed to look separately onto wind wave responses to the forcing associated with atmospheric eddies (cyclones) and to the mean large-scale circulation patterns. The transient eddy component (U‘), predominantly comprised of extratropical cyclone activity, dominates the general spatial distribution of ocean surface waves across the North Atlantic. The storm-track generates large (significant wave height > 4m), primarily zonally propagating wind waves in the mid-latitudes which deflect equatorward in the eastern Atlantic. The seasonal mean winds (U) are found to dominate the wave distribution in the subtropics and tropics (consistently with high directional steadiness of trade winds) with significant wave heights being up to 2 m in the western North Atlantic. Midlatitude storm track variability is found to have a direct relationship with significant wave height variability in the western and eastern North Atlantic. Further we quantified North Atlantic storm track variability using cyclone trajectories derived from numerical cyclone tracking in the North Atlantic using ERA-Interim. Dynamics of the cyclone counts and parameters of the cyclone life cycle (cyclone intensity, deepening rate, propagation velocity) in conjunction with wave model output allowed for a better interpretation of the responses revealed by model experiments.This work was supported by the Russian Science Foundation grant 14-50-00095.