

20th century climate changes in ocean wind waves over the Northern Hemisphere from visual wave data

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Variability in the characteristics of the wind waves over the Northern Hemisphere is studied on the basis of the Global Climatology of Ocean Waves, derived from the Voluntary Observing Ship (VOS) data for the period from the end of 19th century to present. Wave observations in VOS are taken visually by marine officers, and to a lesser degree than winds are influenced by historical changes in observational practices. An outstanding feature of visual wave observations is the availability of separate estimates of the wind sea, associated with the local wind, and swell, integrating the wind forcing over the larger domain. Traditionally analysed from the model and satellite data significant wave height (SWH) results from these two components and does not allow for the understanding of mechanisms driven the variations on surface roughness. We studied long-term trends in wind sea, swell, and SWH for the period from 1880 to 1940s along the major ship routes and from 1950s to present over the whole North Atlantic and North Pacific. Decadal scale variations were studied for the last 50 years using EOF and SVD analysis. Special attention is given to the effects of sampling errors in variability of ocean waves. Wind sea and swell demonstrate different patterns of variability, associated with the North Atlantic Oscillation (NAO) and Pacific Oscillation. In particular, swell variability is clearly associated with the storm frequency, while wind sea reflects the local wind signal. In order to project the NAO signals onto wave variability, joint analysis of the climate variability in the characteristics of atmospheric cyclones over the Northern Hemisphere and of the wind wave parameters has been performed.