PERIODICITY AND PATTERNS OF GLOBAL WIND AND WAVE CLIMATE

ABSTRACT

Wind-generated waves propagate across the oceans transporting energy that shapes the shorelines, influences maritime commerce, and defines coastal land-use around the world. Understanding the role of the ocean wind and wave climate is imperative for ocean engineering practices with both societal impacts and scientific contributions. The focus of this dissertation is the description of the patterns and cycles of the wind and wave climate through the use of reanalysis datasets that cover 1979 to 2009. The dissertation consists of three major parts, which examine the validity of reanalysis datasets for climate research, verify climate signals in the datasets with published indices, and explore the dominant modes of variability. The data shows the relationship with published indices of known atmospheric cycles of the Arctic Oscillation (AO), Antarctic Oscillation (AAO), and El Nino Southern Oscillation (ENSO) in both the wind and wave fields. The analysis reveals that the Atlantic is saturated by signals from the Northern Hemisphere including a broad range of intra-seasonal components similar to those of the AO. The Indian and Pacific are strongly influenced by inter-annual cycles from the ENSO and AAO. In addition, these two oceans have strong components with periods of 50-90 days that have similar spatial structure to those with 2-5 year periods suggesting linkage between the two frequency components.