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Journal of Oceanography and Marine Research

Commentary

Wind and Wave height measurements in the field

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DESCRIPTION

For accurate wave-height forecasts, it's necessary to require under consideration changes in various physical phenomena associated with meteorology, because wave motion is suffering from changes in ocean wind. However, it is generally difficult to carry out continuous field measurements of such physical phenomena in an area of investigation at sea, because of the lack of facilities required for such measurements. The physical processes associated with meteorological or oceanographic phenomena are thought to possess changeable correlations in space and time. Therefore, perhaps it's possible to forecast wave-height changes effectively by developing a way that takes spatiotemporal features into consideration. The Japan Meteorological Agency has found out regional stations for ground-based meteorological monitoring of coastal areas using ultrasonic wave-height meters. The system is referred to as the Automated Meteorological Data Acquisition System (AMeDAS). An approach for wave-height forecast, based on spatiotemporal wind motions monitored at multiple ground-based AMeDAS stations, provides an alternative method for solving the above measurement problem. One of traditional approaches for analyzing wave-height changes is to take sea surface oscillations to be a probabilistic phenomenon then to think about statistical approaches for expressing the dynamics of wave heights from this standpoint. Statistical models for handling measurements of long-term variations in wave height are considered mainly from two perspectives: nonstationarity. On the opposite hand, statistical methods for modeling wave height that take under consideration changes in wind speed and wind direction have also been considered. However, adequate statistical considerations of whether the use of spatiotemporal winds motion are an effective method for expressing and forecasting changes in wave height have not yet been undertaken. Also, it's not clear that statistical spatiotemporal models can improve forecasting accuracy when traditional statistical models are used.

In this chapter, we consider the points above through the event of a statistical spatiotemporal model. We first consider a time series model for expressing the relationship between wave-height changes measured in a coastal area and wind motion (i.e., wind direction and wind speed) measured at one meteorological AMeDAS station, by extending the model considered in Hokimoto and Shimizu (2008). Then we propose a way to require spatiotemporally measured wind motion data under consideration, by extending the model structure developed above. Also, the applicability of the strategy for the analysis of actual phenomena is evaluated by a case study of wave-height forecast from a coastal area of Hokkaido, Japan. This chapter is organized as follows. We describe field measurements of wave height and wind motion, including a preliminary statistical analysis of the measured data. We develop a statistical spatiotemporal model for forecasting wave height. The effectiveness of the strategy is examined by forecasting experiments. We show the applicability of the method in the analysis of actual phenomena through a case study.

One of on the reasons why wave development phenomena are of interest is to improve understanding of how the direction of wind flow can impacts wave heights. To examine the applicability of the spatiotemporal model developed here, we estimate the wind flow above by applying the model. Displays histograms showing wind direction for the four seasons, as observed in the data measured at six meteorological stations. Note that the horizontal axis corresponds to the wind direction shown at 16 azimuths, where 1,5,9,13 corresponds to north, east, south and west, respectively.

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Received 02-Nov-2022, Manuscript No. OCN-22-11284; **Editor assigned:** 04-Nov-2022, PreQC No. OCN-22-11284 (PQ); **Reviewed:** 25-Nov-2022, QC No. OCN-22-11284; **Revised:** 03-Dec-2022, Manuscript No. OCN-22-11284 (R); **Published:** 10-Dec-2022, DOI: 10.35248/2572-3103.22.10.258

Citation: Graham B (2022) Wind and Wave height measurements in the field. J Oceanogr Mar Res. 10: 258.