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Investigation of the effect of wind speed fluctuation on the drag coefficient

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The drag coefficient is generally expressed as functions only of the wind speed U_{10} . However, there exists considerable disagreement among the observed values of the drag coefficient. In this study, we observed the wind stress at the coastal tower of Hiratsuka Offshore Experimental Tower of the University of Tokyo in Japan. The 3-axis sonic anemometer was installed on the top of the tower, which was 20 m above mean sea level. The observation periods were from September 15, 2015 to December 31, 2019. The eddy correlation method was used to calculate the friction velocity every 10 minutes. The variation of the drag coefficient plotted against the wind speed U_{10} has very large variation using the all period data. The variation of the drag coefficient was reduced by excluding large fluctuation of wind speed in time series within one hour. Furthermore, the sudden changes of the wind speed and direction was also found to affect the variation of the drag coefficient. These results show that the wind speed fluctuation influenced the variation of the drag coefficient. We also investigate the effect of waves on the drag coefficient.

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