Geophysical Research Abstracts
Vol. 19, EGU2017-5754, 2017
EGU General Assembly 2017


# Mechanism of air-sea momentum flux from low to high winds

Dongliang Zhao
China (dlzhao@ouc.edu.cn)

Mechanism of air-sea momentum flux from low to high winds

Dongliang Zhao

Physical Oceanography Laboratory, College of Oceanic and Atmospheric Sciences, Ocean University of China, Qingdao 266100, China.
Email: dlzhao@ouc.edu.cn

Abstract
In the condition of wind speed less than 20 m/s, many studies have shown that drag coefficient roughly increases linearly with wind speed, which is usually extrapolated to high winds in practice. Since the pioneer work of Powell et al. (2003), both field and laboratory studies have indicated that the drag coefficient begins to decrease or saturate when wind speed is greater than a critical value such as 30 m/s. All the reduction mechanisms proposed up to now are related to the effect of sea spray induced by wave breaking in high winds. This study tries to propose another mechanism that is directly related to wave breaking. Based on the wind-wave growth relations, it is found that drag coefficient increases simultaneously with wave age and wave steepness. The reduction of drag coefficient with wave age that has been shown by previous studies mainly reflect the wind effect because the phase speeds of waves vary in a very narrow range, and can be roughly regarded as constant. It is indicated that two parameters including wave age and wave steepness together control the momentum transfer through air-sea interface. The wave age and wave steepness represent the abilities of wind input and wave receiving energy, respectively. In general, the two parameters are well correlated and can be replaced one another in the condition of low and moderate winds, in which the wave steepness decreases with the increasing wave age. In the condition of high winds, the wave steepness reaches to its upper threshold due to wave breaking, in which wave steepness cannot increase with the decreasing of wave age. At the same time, wave ages become very small, thus drag coefficients begin to decrease with wind speed. It is further suggested that there are two different upper thresholds of wave steepness for laboratory and field waves, which can be applied to explain the reduction of drag coefficient either in laboratory or in field