Scaling Analysis of the China France Oceanography SATellite Along-Track Wave and Wind Data

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Résumé

Turbulence or turbulence-like phenomena are ubiquitous in nature, often showing a power law behavior of the fluctuations in either spatial or temporal domains. This power-law behavior is due to interactions among different scales of motion, and to the absence of characteristic scale. In this work, we consider the multi-scale dynamics of China France Oceanography SATellite (CFOSAT) data as atmospheric and oceanic quantities influenced by turbulence. Fourier power spectra were estimated for the data provided by the CFOSAT via the Wiener-Khinchine theorem to extract multiscale information for both wind speed (WS) and significant wave height (Hs). The WS data were collected from December 18, 2018 to August 31, 2020, and the Hs data from July 29, 2019 to August 31, 2020. Fourier power spectra for both WS and Hs exhibit power-law features in the ranges of 100 to 3000 km with a scaling exponent β varying from 5/3 to 3. The global distributions and seasonal variations of β for both WS and Hs have also been considered. The results show that due to the energetic convective activities in the low-latitude zones, the scaling exponents β in these regions are closer to the value of 5/3. Concerning the seasonal variations, for most regions, the scaling exponents in winter are larger than those in summer for WS. The seasonal variations of β in low-latitudes are stronger than those in the mid-latitudes. Our preliminary results enrich the fundamental knowledge of ocean surface processes and also provide a benchmark for either oceanic or atmospheric models.

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