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Microseismic Characteristics: Seasonal Variations, Periodic Changes, and Oceanic Influences in the Korean Peninsula

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The understanding of microseism-source characteristics has become increasingly important, particularly in the context of retrieving Green's functions, which play a crucial role in various fields of seismology. This study aims to elucidate the characteristics of microseismic sources, encompassing seasonal variations in the activity of primary and secondary microseisms, along with periodic changes observed in microseismic peaks. The analysis involved data from seven stations carefully selected from the Korean Meteorological Administration seismic network, each with over 10 years of continuous data. Employing cross-correlation techniques, we calculated Empirical Green's Functions (EGFs) between 17 station pairs. The averaged spectra of the calculated EGFs revealed two primary peaks, concentrating energy distribution around 18 seconds and in the period range of 2-5 seconds, aligning with the peaks associated with Primary and Secondary microseism. We then categorized spectral energy distribution data into less than and more than 10 seconds, aiming to discern distinct characteristics associated with the two microseismic peaks. Subsequently, we examined average temporal energy variations for each microseism, generating, we say, *spectral-time series* data by summing and averaging separated energy in the period direction, and calculating energy variations for each period using a multi-filtering technique (MFT). Observing prominent dominant changes with a 1-year period in both Primary and Secondary microseisms, we noted additional periodic variations with 6 months, 3 months, and 2 months in Secondary microseism. Specifically focusing on 1-year period changes, Primary microseism displayed dominance during the summer, with lower energy levels in the winter across the entire area. For Secondary microseism, 1-year period changes often showed the lowest values in the summer and the highest values in the winter. Additionally, in Secondary microseism, maximum or minimum values were observed in the spring and autumn, resembling patterns observed in Primary microseism. Simultaneously, we reconstructed the dominant period of ocean gravity waves from Wave Watch III to explore the effect on microseisms around the stations used in this study. Comparing this data with calculated the *spectral time series* data of Primary and Secondary microseisms revealed not only a match in the 1-year period but also in detailed phases below 1 year. This implies a close relationship between microseisms around the Korean Peninsula and ocean activities, prompting future research to delve into detailed periodic changes, correlate them with ocean activities, and identify their underlying causes.