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## 地震背景噪声互相关函数的面波理论表达形式

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An expression of the cross-correlation of ambient Seismic Noise: a derivation based on the surface-wave theory

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摘要

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**摘要** 基于弹性动力学面波激发公式推导出地震背景噪声互相关函数(简称为NCF)的理论表达形式. 证明了NCF等价于面波的震源激发公式, 其中一个台站为等价震源的位置, 另一个台站为接收点. 本文提出的最重要的概念是等价震源相位, 它直接影响群速度与相速度的测量误差. 在噪声源均匀分布的条件下, 等价震源相位等于 $-\pi/4$ . 一般情况下, 等价震源相位与噪声源分布有关, 而不是简单的常数. 在大信噪比的条件下, 等价震源相位的最大可能取值等于信噪比的倒数. 本文详细讨论了利用三台法测量相速度的可能性, 并且给出了估算等价震源相位以及相速度测量误差的公式.

**关键词:** 地震背景噪声互相关函数(NCF) 面波激发 等价震源相位函数 相速度测量

**Abstract:** The present study derives the surface-wave theoretical expression of the noise cross-correlation function(NCF). We demonstrate that the NCF is equivalent to the surface-wave excitation, in which the equivalent source is at one of the two stations. The most important concept of this paper is the equivalent source's phase function, which directly influences the accuracy of group and phase velocity measurements. Under a homogenous source distribution assumption the equivalent source's phase is  $-\pi/4$ . In general, it is dependent on the distribution of noise sources, instead of being a constant. Under the condition of large signal to noise ratios (SNR), the possible maximal value of the equivalent source' phase is equal to SNR's reciprocal. This paper also tries to study the possibility of using three stations to measure phase velocities and to estimate the equivalent source's phase function and then gives the measurement errors.

**Keywords:** Noise cross-correlation function(NCF) Surface-wave excitation Equivalent source's phase function Phase velocity measurement

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