



Innovative techniques to improve Nakamura spectral ratio method for site effects estimation

R. Carniel (1), F. Barazza (1) and P. Malisan (1)

(1) Dipartimento di Georisorse e Territorio, Università di Udine

The well known Nakamura method for site effects estimation is based on the H/V spectral ratio of ambient noise recordings. The determined peak frequencies are interpreted as the fundamental resonance frequencies of the investigated sites, thus providing information on shallow layers characteristics and geometry. The seismic noise is usually measured along two horizontal directions and one vertical direction, so we can obtain two Nakamura spectral ratios that in some cases show noteworthy differences, that may be ascribed to the presence of noise and make the determination of the "significant" spectral peaks not so straightforward. In this work we present possible aids for highlighting the significant peaks in the spectral ratios, using both automatic and/or interactive algorithms. In particular we make use of the Singular Spectrum Analysis (SSA) and of the Wavelet Transform. Both techniques allow the time series to be decomposed into different components, some of which can be interpreted as noise and consequently be removed from the time series. Removal of these minor components of the data can lead to significant improvements in the identification of the peaks in the spectral ratio. The general idea is to apply various denoising levels, and then choose a level such that the 'matching' between the two Nakamura spectral ratios along the two horizontal directions is maximized in terms of minimum Euclidean distance and/or maximum correlation.