Geophysical Research Abstracts,
Vol. 10, EGU2008-A-04509, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-04509
EGU General Assembly 2008

Directivity of landslide response to seismic shaking: evidence from spectral analysis of microtremors

V. Del Gaudio (1), S. Coccia (1), J. Wasowski (2), M.R. Gallipoli (3) and M. Mucciarelli (4)

(1) Dipartimento di Geologia e Geofisica, Università di Bari, Italy,(2) C.N.R. - Istituto di Ricerca per la Protezione Idrogeologica, Bari, Italy,(3) I.M.A.A. - C.N.R., Tito Scalo, Italy,(4) Dipartimento di Strutture, Geotecnica, Geologia Applicata, Università della Basilicata, Potenza, Italy

Recent observations provided evidence that the response of a slope to seismic shaking can be characterized by directional variations with mean value of 2-3 of the ratio between maximum and minimum of shaking energy (Del Gaudio and Wasowski, 2007). One of the settings in which site response directivity has been observed is on slopes affected by mass movements: this is of particular interest in that the presence of a down-slope directed amplification can play an important role in landslide reactivations and should be taken into account in hazard assessment. At present the necessary conditions for the occurrence of directional amplification remain unclear and the development of reconnaissance techniques for identifying slopes affected by these phenomena would be of considerable utility. Therefore we tested a technique known as HVNR (Horizontal-to-Vertical Noise Ratio) or Nakamura's technique, commonly used for determining site resonance frequency, which measures the spectral ratio of horizontal to vertical component of ambient microtremors. In particular, we measured the azimuthal variation of HVNR values by using a light-weight portable 3-component seismometer recently developed in Italy (Tromino) for HVNR measurements. Tests were carried out in the area of Caramanico Terme (central Italy), where in the last five years a local accelerometric network has provided several data on directivity phenomena affecting slopes. The results of HVNR measurements were compared with the horizontal-to-vertical spectral ratios (HVSR) obtained for low-to-moderate mag-

nitude seismic events recorded by accelerometric stations. The peak values in the H/V spectral ratios derived from noise and seismic recordings turned out quite different: this appears to be a consequence of several factors (instrument characteristics, spectral properties of seismic events and of noise sources) that, in presence of litostratigraphically and topographically complex settings, like those of unstable slopes, seem to make H/V spectral ratios scarcely representative of actual amplification factors. However, slopes affected by site response directivity have consistently shown major H/V peaks within the same narrow (20°-30°) azimuth range both in noise and seismic event recordings and, therefore, HVNR results to be a promising technique for identifying directivity. Furthermore, a comparative test conducted on a landslide body and on neighbouring terrains demonstrated that, whereas no directivity evidence was found for the latter, the landslide sites showed spectral peaks centred around the maximum slope direction. This confirms the influence of the landslide on site response directivity, even though the collected data provide indications of variations in degree of directivity, presumably reflecting differences in local geomorphic and geologic conditions.

Reference Del Gaudio, V., and Wasowski, J.: Directivity of slope dynamic response to seismic shaking, Geophys. Res. Lett., 34, L12301, doi:10.1029/2007GL029842, 2007.