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Site effects determination using two different methods - the case of the city of Mulhouse (NE France)

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The lack of scientific knowledge and techniques to allow precise prediction of seismic hazard has been dramatically illustrated these last months. However, minimizing the damages caused by such a catastrophe is obviously necessary. Several tools are available: mainly regarding prevention (building codes, urban planning constrains...) and mitigation (information campaign toward the population in order to react properly). But geophysical studies need to be ongoing in order to define this peculiar hazard. Besides seismic components (instrumental and historical seismicities, localisation of the active faults), ground characteristics need to be taken into consideration and site effects are of first interest if we want to describe precisely the situation. Today, site effects characteristics might be processed through various methods: recording earthquakes or seismic ambient noise associated to several signals processing methods, or deriving them from the characteristics of the local geology (Bauer et al, 2001; Borcherdt, 1970; Riepl, 1997; Le Brun et al., 2001; Akyol et al., 2002). But these methods are not relevant everywhere. For example, in a region with moderate seismicity or without bedrock sites or geological data, the HVNR (for horizontal over vertical noise ratio) seems still to be the best way to determine the fundamental frequency. Moreover the HVNR method is not time consuming and rather cheap to set up compared to other methods. But it has not the capability to provide properly the amplification factor, which is an important component of the site effects. The results presented in this paper have been obtained from two complementary methods, i.e. the HVNR and the receiver function that were employed in order to determine the sites effects at a local scale. The region of Mulhouse (NE France) was chosen as the case study site because of the conjunction of multiple hazards in this area (flood and seismic hazards), intricated with a high level of vulnerability (concentration of population,

power plant, chemical plants...) (Beck et al., 2003). After the case study presentation, methods will be described. The first method (HVNR) was used in order to have an accurate value of the fundamental frequency over the whole area: the seismic noise was recorded on 565 sites (Beck et al, 2005). This provides an accurate spatial distribution of the fundamental frequencies. The second method (receiver function) has been set up during 8 weeks on 15 sites where earthquakes were continuously recorded. This last field campaign allows the validation of the fundamental frequencies values obtained with the HVNR method, and also supplies complementary values of the amplification factors. Some results will illustrate the third part of the paper. Finally, some methodological discussions will conclude the paper.

References:

Akyol N., Aybige A., Eyidogan H., 2002 : Site amplification of S-waves in Bursa City and its vicinity, Northwestern Turkey : comparison of different approaches. Soil Dynamics and Earthquake Engineering, 22 : 579-587

Bauer R. A., Kiefer J., Hester N., 2001: Soil amplification maps for estimating earthquake ground motions in the Central US. Engineering Geology, 62: 7-17

Beck E., Granet M., Weber C., 2003: Risque sismique et risques technologiques: application à l'agglomération de Mulhouse. Actes des 6e Rencontres de Théoquant. 20-21 février 2003, Besançon, France. 8 p.

Beck E., Granet M., Weber C., 2005: Spatial variation of the site effects in an urban area - The case study of the city of Mulhouse (NE France). BSGF, submitted

Borcherdt R.D., 1970 : Effects of local geology on ground motion near San Francisco Bay. Bull. Seism. Soc. Am., 60 (1): 29-61

Le Brun B., Hartzfeld D., Bard P.-U., 2001: Site effect study in urban area: experimental results in Grenoble (France). Pure Appl. Geophys., 158 : 2543-2557.