Geophysical Research Abstracts, Vol. 7, 06475, 2005
SRef-ID: 1607-7962/gra/EGU05-A-06475

The Aki-Larner method still useful 30 years later : a linear-equivalent approach for non-linear effects in 2D valleys

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Valley effects forced the attention of earthquake engineers only after the Kobé event in 1995, although they were known and predicted for decades since the pioneering modelling works with various numerical methods in the late sixties / early seventies, amongst which the "Aki-Larner" technique. Nevertheless, despite their quantitative importance, these effects are not yet taken into account in routine engineering practice. One reason is certainly related to their complexity, which prevents from representing them with simple one or two parameter models; another one, probably more important, is the reluctancy of the engineering community to trust results derived from linear viscoelastic models. Surprisingly, only very few systematic studies have been undertaken for investigating the modifications of valley effects due to non-linear soil response, although very sophisticated models do exist that can account for 3D geometries and fully non-linear response.

This talk will thus present an attempt to fill that gap through an adaptation of the computationally efficient Aki-Larner technique to the linear-equivalent iterative approach, and its application to various examples of 2D valleys impinged by signals of increasing amplitude. Although this approximate approach cannot deal with very large deformations, it proves to be a useful and efficient tool for parametric studies, and does provide enlightening results as to the combined effects of 2D geometry and non-linear behavior.