ATTENUATION RELATIONSHIPS FOR SEISMIC HAZARD ASSESSMENT

Instituto Colombiano de Geología y Minería
INGEOMINAS
REPÚBLICA DE COLOMBIA

C. Abril, M.L. Bermúdez & M.C. Dimaté
cyabrill@gmail.com, mlbermudez@ingeominas.gov.co
mcdimatec@unal.edu.co

Red Nacional de Acelerógrafos de Colombia

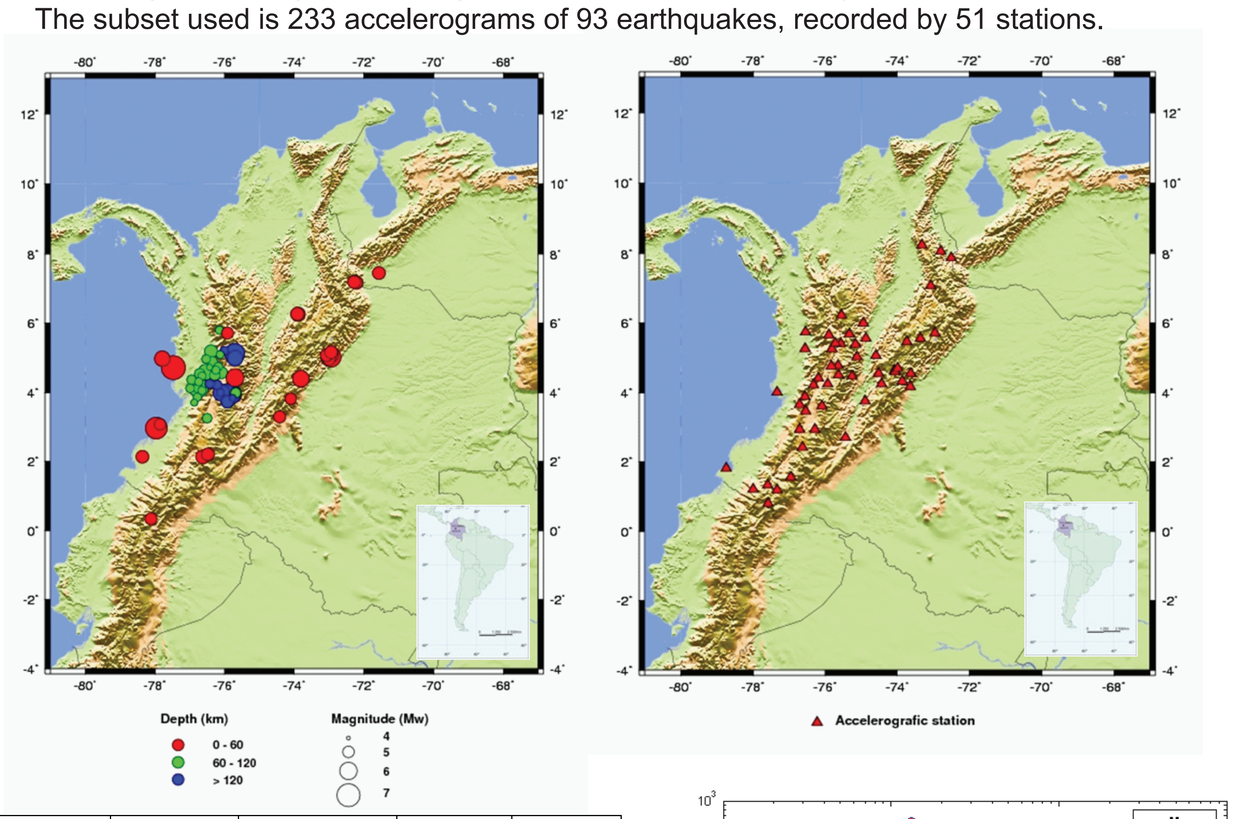
INTRODUCTION

The Colombian Geological Survey - INGEOMINAS, made the seismic hazard assessment for Colombia using a probabilistic approach. A new version of National Seismic Hazard has been obtained as an updating of the version 1996, published by AIS (Colombian Association of Earthquake Engineering), INGEOMINAS and Los Andes University. That version used Dovan (1973), Donovan (1978) and McGuire (1977) attenuation relationships, without to validate their reliability due to the Colombian Strong Motion Network - RNAC had a few data of only three years of recording [1].

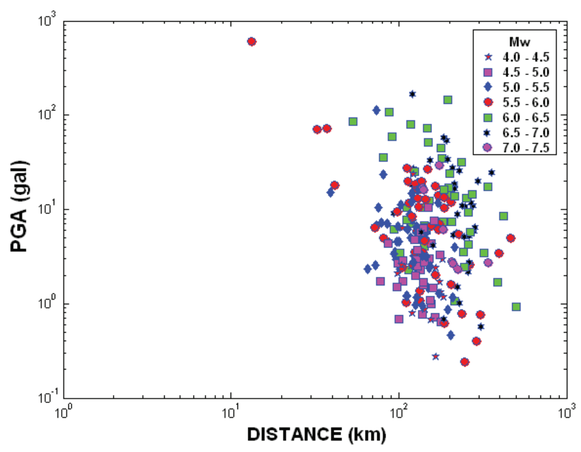
At current work, a statistical comparison between response spectra of earthquakes recorded by strong motion stations of RNAC and the spectra predicted by some worldwide empirical attenuation relationships for estimating horizontal response and Peak Ground Acceleration (PGA). The results were used by INGEOMINAS in order to decide the attenuation relationships for seismic hazard assessment.

DATABASE

A subset of RNAC database recorded throughout 15 years from 1994 to 2008, was selected according to the magnitude of registered earthquake and the hypocentral distance to station. The subset used is 233 accelerograms of 93 earthquakes, recorded by 51 stations.



Tectonic Setting	Number of Earthquakes	Number of Accelerograms	Magnitude	Depth (km)
Crustal	18	60	> 5.0	< 60
Interface Subduction	5	22	> 5.0	< 60
Benioff	35	151	> 4.0	> 60

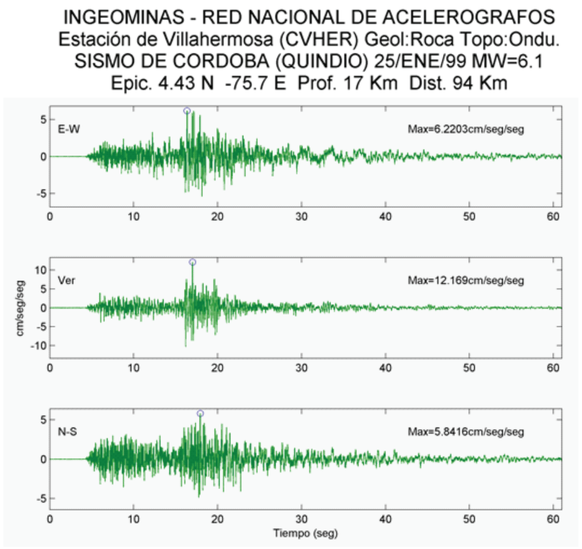


The Figure shows the PGA versus the focal distance of each record selected. The mostly data are in distances over 100 km and PGA bellow 100 Gal. To define an attenuation relationship for Colombia is necessary a more complete database in both, magnitude and distance.

DATA PROCESSING

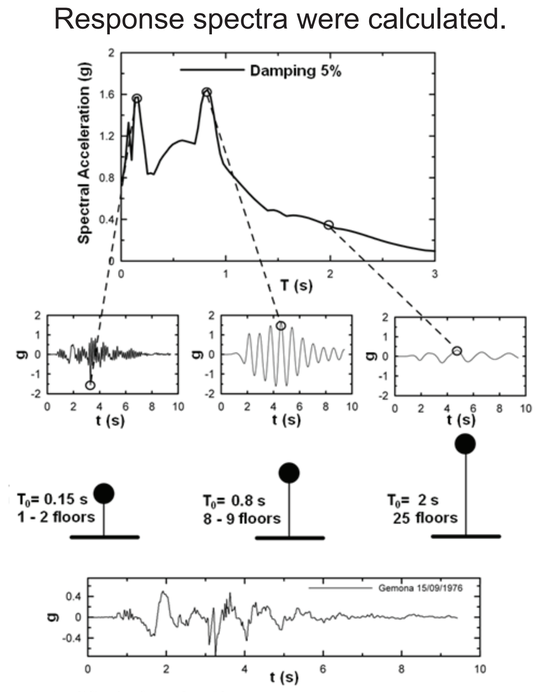
1

Each record used was baseline corrected and band-pass filtered between 0.2 and 50 Hz.



2

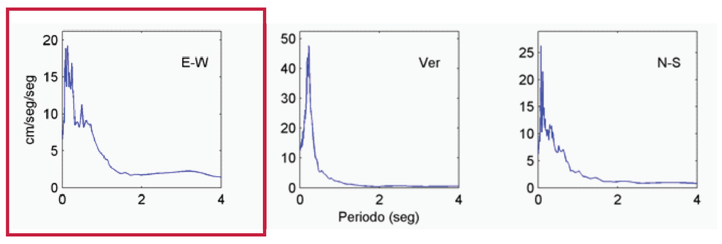
Response spectra were calculated.



*Modified of ITACA Glossary

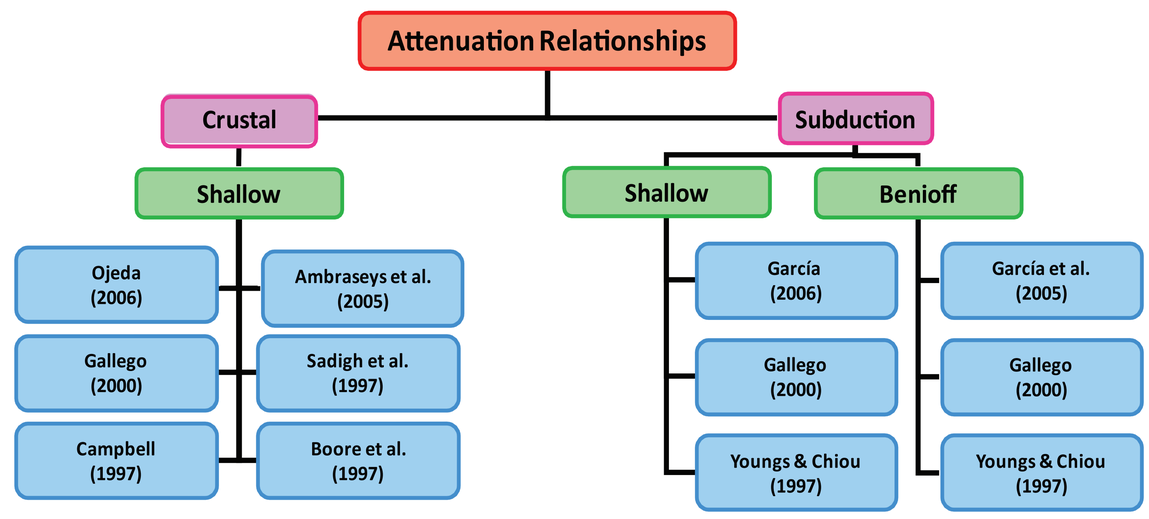
3

The response spectrum with greatest PGA from a horizontal component was selected for comparison.



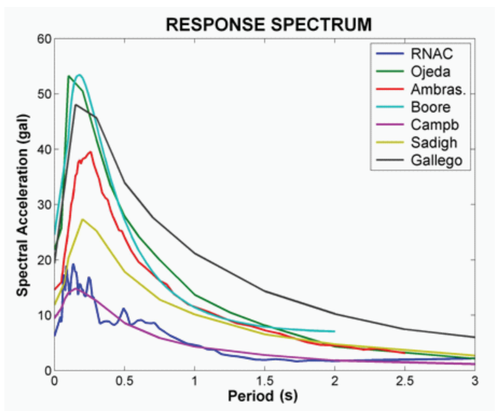
METHODOLOGY

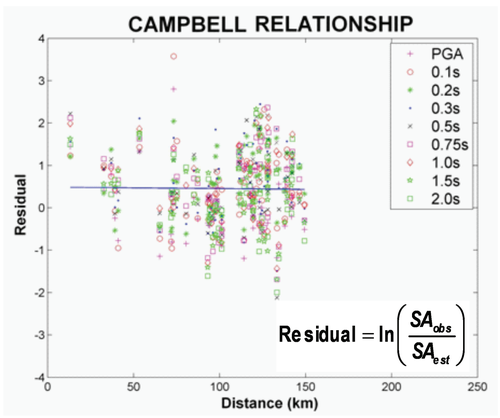
The diagram shows the authors of relationships used in this research, sorting by tectonic setting where can be used [2-9]. Three different tectonic settings are associated to Colombian seismicity.

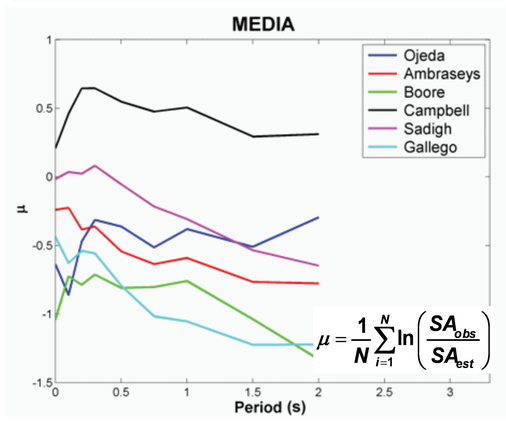


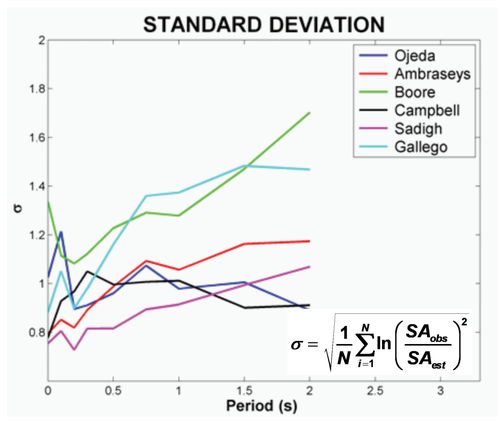
RESULTS AND CONCLUSIONS

The attenuation relationships calculate the spectral acceleration depending on the focal distance and event magnitude. The spectra predicted and calculated from record were compared one by one. Also, for statistical comparison, have been calculated the residuals, media and standard deviation between RNAC data and the predicted values. The figures below show the results obtained for crustal seismicity comparison.









Tectonic Setting	Selected Relationship
Crustal	Campbell (1997)
Interface Subduction	Youngs (1997)
Benioff	García (2005)

As a result, one relationship for every tectonic setting was suggested for seismic hazard assessment. Regards to Benioff seismicity, spectral acceleration predicted by Garcia (2005) relationship is in agreement with RNAC data. However, about crustal and interface subduction seismicity, Campbell (1997) and Youngs (1997) have a better fix to date, but the results are not absolutely conclusive.
The comparison including three different tectonic settings was useful in order to introduce source characteristic. However, regards crustal seismicity was not enough and it is necessary to apply another methodology.
The reduced database, mainly in interfaced subduction records, was a difficult to achieve a conclusive result.

ACKNOWLEDGMENTS

We are grateful to Mario Ordaz (Instituto de Ingeniería - UNAM) and Ph.D. Anibal Ojeda (KMA Ltda.), who were the research's advisors and proposed the methodology used. Also, we appreciate the suggestions of Eng. Fernando Gil, chief of Colombian Seismological Network from 2007 to 2009.

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