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The seismic alert system of Mexico (SASMEX): Progress and its current applications

J.M. Espinosa-Aranda *, A. Cuéllar, F.H. Rodríguez, B. Frontana, G. Ibarrola, R. Islas, A. García

Centro de Instrumentación y Registro Sísmico, A. C. (CIRES), Anaxágoras 814, Narvarte, Benito Juárez, 03020 México D.F., Mexico

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ABSTRACT

The Seismic Alert System of Mexico (SASMEX) is being conformed by the Seismic Alert System of Mexico City (SAS), pioneer in public earthquake early warning services and the Seismic Alert System of Oaxaca City (SASO), with a set 12 and 36 sensing field stations, respectively. Today, the alerting functions of these systems are currently in the process of integration. SAS started in 1991 and SASO in 2003, have emitted 78 early warnings of more than 2350 earthquakes detected by their sensing field stations. Authorities of Mexico Federal District (GDF) and the State of Oaxaca, since 2003 agreed with Mexico's Ministry of the Interior (SEGOB), coordinate necessary to improve their seismic alert systems and join their roles to make must efficient possible disaster mitigation activities that might cause strong Mexican earthquakes. This paper describes the main current applications of SAS and SASO: schools, radio and TV commercial broadcast, and the Alternate Emitters of Seismic Alert System (EASAS) operating in Acapulco and Chilpancingo both of Guerrero state. To reach better efficiency in the seismic warning delivery, since 2009 we are applying NWR-SAME receivers in Mexico City Valley, and testing their codes enhancement to obtain the expedite earthquake warning issuing. Also the GDF is promoting to increase the observation capacity of the seismic danger around Mexico City, to detect it and warn any strong effect, reducing a new possible seismic disaster, and recently the SEGOB, hereby their General Coordination of Civil Protection, agreed to extend an SASMEX sensor coverage between Chiapas and Jalisco states to issuing earthquake warning signal to reduce their population vulnerability.

1. Introduction

After experiencing the serious seismic disaster generated by the "Caleta de Campos" M8.1 Michoacán earthquake in 1985, Mexico City Authorities have been promoting since 1989 the design and evolution of *Sistema de Alerta Sísmica* (*SAS*), with the aim to mitigate possible future earthquake damage produced by such as the latent "Guerrero Gap" seismic danger [1].

Thanks to the financial support from the Ministry of Works and Services (SOS) of the GDF, the original *SAS* idea was developed by *Centro de Instrumentación y Registro Sísmico* (CIRES) Civil Association. This technological resource started its experimental operation in August 1991 and has been available and evaluated as a public service since 1993. To date, it is applied and evaluated in more than 80 elementary schools, both private and public, located in urban regions prone to seismic risk and where early warning of seismic alert signals from an *SAS* has been useful, as well as in the Mexico City subway rail transport (METRO).

SAS disseminates public seismic alert in the valleys of Mexico and Toluca, this one located about 50 km NW of Mexico City. In addition, it also alerts on a contract basis to more than 280 miscellaneous institutions comprising schools, public buildings and emergency organizations.

The implementation of an *SAS* in the Mexico Valley has made possible to anticipate the arrival of the effects of S-waves with an average of 60 s, time enough to allow an execution of safety of automatic system procedures for the protection of equipment or systems susceptible to undergo damage, such as power plants, computer systems and telecommunication networks [2].

On May 14, 1993, after an *SAS* identified an earthquake M6.0 and anticipated with 65 s the imminent arrival of its effect in Mexico City, the local authorities decided to disclose early warning notices publicly. The alert signal broadcast was a possible thanks to the support from most of the commercial radio and television networks grouped in the *Asociación de Radiodifusores del Valle de Mexico* (ARVM), Civil Association, which agreed to contribute as a social service for their audience since August 1993.

An *SAS*, has evolved aiming the best on availability and reliability of their four basic sub-systems: Seismic Detection, Communication, Warning Dissemination and Central Control and Recording, to guarantee the effective earthquake alert public service [3].

On September 14, 1995 at 8:04 a.m. in Mexico City, having elapsed almost 10 years after the tragic earthquake of 1985 [3], an

* Corresponding author.
E-mail address: espinosajm@cires.org.mx (J.M. Espinosa-Aranda).

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