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Forecasting model for $Mw \geq 5.0$ earthquakes in the Algeria-Morocco region

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The studied region, in the northern border of the African Plate, has suffered moderate to strong earthquakes in the last decades. Among them, the September 9, 1954, and the October 10, 1980, El Asnam (formerly known as Orléansville), Algeria, earthquakes, with magnitudes M_S 6.7 and 7.3, respectively, the February 29, 1960, Agadir, Morocco, M $\sim$ 6.0 earthquake, or the most recent May 21, 2003, Zemmouri-Algiers, Algeria, M_W 6.8 earthquake. The 1954, 1980 and 2003 Algerian earthquakes caused a large loss of lives (1200, 5000 to 20000, according to different estimates, and 2300 deaths, respectively), as well as the 1960 Moroccan earthquake ($\sim$12000 deaths). Forecasting earthquakes, in this or other regions, is a crucial task, mainly for two reasons. One of them merely scientific: forecasting is one of the main goals of the scientific knowledge. The second one practical in itself: it is an important component in the seismic risk mitigation.

We study the correlation between locations of $Mw \geq 5.0$ earthquakes and locations of

$5.0 > Mw \geq 4.0$ events for Northern Algeria and Morocco. A preliminary study shows that it can be observed a relatively good agreement between locations for these two data sets, that is, minor earthquake locations could be used to forecast future places where will happen moderate to strong earthquakes.

Then, a time-independent forecasting model based on the spatially smoothed seismicity rate of $Mw \geq 4.0$ earthquakes is proposed. Initially, the area under study was divided into square cells. The number of earthquakes with magnitude $Mw \geq 4.0$that have taken place at a given cell is counted and smoothed. The time-independent forecasting model is proposed from the computation of $Mw \geq 5.0$ earthquake probabilities for each cell for different exposure times. Probabilities are computed considering that seismicity follows both a Poisson process and the Gutenberg-Richter magnitude-frequency relationship. Among the obtained results, we highlight the delineation of potential areas, from a probabilistic point of view, to host future earthquakes with magnitudes $Mw \geq 5.0$ and $Mw \geq 6.0$, in the studied region.