

MEETING OF THE **BSEC** AD HOC WORKING GROUP OF EXPERTS ON SEISMIC RISK June 9, 2021

Recent activities on the seismic risk assessment to improve emergency response



National Institute for Earth Physics

Institutul Național de Cercetare Dezvoltare pentru Fizica Pământului







Risk criteria aggregation according to National methodology for risk assessment

Risc Criteria T1- Physical Impact	weight
C1.1. deaths	11,88%
C1.2. wounded	11,39%
C1.3. evacuated	10,23%
C1.4. People with no access to the basic services	9,36%
C1.5. Civil & industrial buildings	9,70%
C1.6. Transportation infrastructure	10,10%
C1.7. Utilities	9,97%
C1.8. Equipments	8,31%
C1.9. Afected area (antropic)	9,52%
C1.10. Environment (protected areas affected)	9,53%
TOTAL T1 - Physical Impact	100,00%
	_
Risc Criteria T2- Economic Impact	weight
C.2.1.Costs related to human losses	22,66%
C.2.2. Costs related to direct material losses	20,96%
C.2.3. Costs associated to environmental losses	19,92%
C.2.4. Costs for intervention forces	18,97%
C. 2.5. Indirect costs	17,50%
TOTAL T2 - Econimical Impact	100,00%
Risc Criteria T3- Psihological & Social Impact	weigh
C.3.1. Interruption of daily life	49,40%
C.3.2. The psychological impact in society	50,60%
TOTAL T3 - psiho & social impact	100,00%



RO-RISK project results underpin policy decisions aimed at reducing disaster risk and increase the safety of citizens:

- An unified methodology for risk evaluation <u>based on scenarios</u>
- A national data base with input data
- Platform for risk communication with maps (national level)
- Emergency Reaction/Intervention capacity assessment
- Updated and increased quality of plans for prevention & emergencies response









CIRRUS-PN18150101









Development for ShakeMap purposes of GMPE for Vrancea intermediate-depth earthquakes -functional form derived by Nonlinear Mixt Effects Regression accounts for event depth, magnitude, path, location (back-, along-, forearc) of the recording station and site effects through f0 fundamental frequency computed from H/V noise records and site class according EC8 (Manea et al., 2021, in press)



7

200 250 300

Rhypo[km]

70 100 150

0.1

380

6 Magnitude, Mw

0

4

0.5 1 5 1015

Fundamental frequency







• Development for ShakeMap purposes of GMPE for Vrancea intermediate-depth earthquakes

Scenario May30,1990 VRI event Mw=6.9; h=89km



Conventional ShakeMap results

Custom ShakeMap results (azimuthal selection of best-fit GMPE between Sokolov et al.2008 and Vacareanu et al.2015)

Results of the new GMM



•

SeisDaRo 3



- Seisdaro (the system for rapid estimation of **Seis**mic **Da**mage in **Ro**mania) version 3 :
 - Custom ShakeMap module for Romanian Seismic appropriate description of ground motion due to intermediate-depth Vrancea earthquakes
 - Custom PAGER-like module (better adapted intensity computation and quantification of population exposure)
 - Module based on SELENA software (analytical approach for building loss estimation) with building and population data from the 2011 national census, at city/commune level
 - Module for professional cartographic representation of the results and GIS data generation









PAGER-RO module results, compared with results from SELENA module





4 March 1977 (Mw 7.4)



SeisDaRo 3





SeisDaRo Operational Dashboard for GIS interactive results dissemination to stakeholders

https://infp.maps.arcgis.com/apps/opsdashboard/i ndex.html#/b9f10aa87424488285e119989349dad7



SeisDaRo 3





Integration of SeisDaRo results in a methodology for the estimation of emergency intervention delay times and implications (the Network-risk toolbox for ArcGis) <u>https://infp.maps.arcgis.com/apps/opsdashboard/index.html#/595cde078f384e04bb09ecc1e6ffc143</u>





Services & Software will be open to potential users and their modular structure combined with focused dissemination activities, will ensure both adaptation to other areas as well as future expansion in order to fully cover the Black Sea Basin, ensuring sustainability and multiplication of results.



More solutions for effective seismic risk assessment, alerts and decision aid in emergency response at <u>http://www.infp.ro/</u> (services)

You are kindly invited to visit and contribute to the new site

https://wgesr.infp.ro/

Thank you for your kind attention

cioflan@ infp.ro

Refences

- Cioflan, C.O., Manea, E.F., Apostol, B. F., Insights from Neo Deterministic Seismic Hazard Analyses în Romania în "Earthquakes and Sustainable Infrastructure: neodeterministic (NDSHA) approach guarantees prevention rather than cure", Eds. Panza G.F., Kossobokov V. G., Laor E., De Vivo B., Elsevier, DOI 10.1016/B978-0-12-823503-4.00013-0
- Pavel, F., Vacareanu, R., Douglas, J., Radulian, M., Cioflan, C.O., Barbat, A. (2016). An updated probabilistic seismic hazard assessment for Romania and comparison with the approach and outcomes of the SHARE project. Pure and Applied Geophysics, 173(6), 1881-1905.
- Toma-Danilă, D., Cioflan, C. O., Ionescu, C., & Tiganescu, A. (2018). The near real-time system for estimating the seismic damage in Romania (SeisDaRo). Recent upgrades and results. In Proceedings of the 16th European Conference on Earthquake Engineering.
- Toma-Danilă, D. (2018). A GIS framework for evaluating the implications of urban road network failure due to earthquakes: Bucharest (Romania) case study. Natural Hazards, 93(1), 97-111.
- Methodology for risk assessment and integration of sectoral risks (in Romanian) at https://www.igsu.ro/documente/RO-RISK/Metodologia%20de%20evaluare%20unitara%20a%20riscurilor%20-%20versiune%20finala.pdf