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Methodology of the new PSHA for the NPP Jaslovské Bohunice (Slovakia) site

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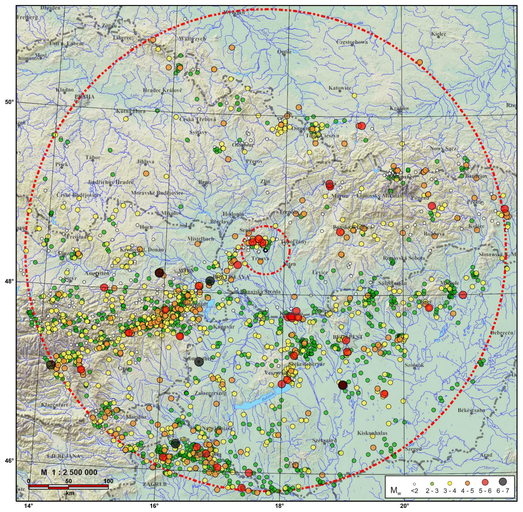
Abstract

The previous seismic hazard analysis for the Jaslovské Bohunice NPP site (EBO) was performed in 1996-1998 by the Geophysical Institute of the Slovak Academy of Sciences at the request of NPP. We present methodology of the new PSHA performed in 2011-2013 at the request of Jadrová energetická spoločnosť Slovenska (JESS) in relation to consideration on a new NPP near the existing one. The importance of PSHA is also due to the proximity of NPP sites to the active Dobrá Voda source zone.

We compiled a new seismological database for the EBO Region. We homogenized the database for the moment magnitude, declustered it, and analyzed it for the magnitude completeness in time and space. We developed a new seismotectonic model of the EBO Region and EBO Near Region. Subsequently we determined seismic-source zones in the EBO Region and in the EBO Near Region. We characterized each zone by a truncated magnitude-frequency distribution and alternative values of the maximum potential magnitude. We selected GMPEs from the set considered by the SHARE Project (Delavaud et al. 2012). For including epistemic uncertainties we constructed a logic tree with 2 304 branches.

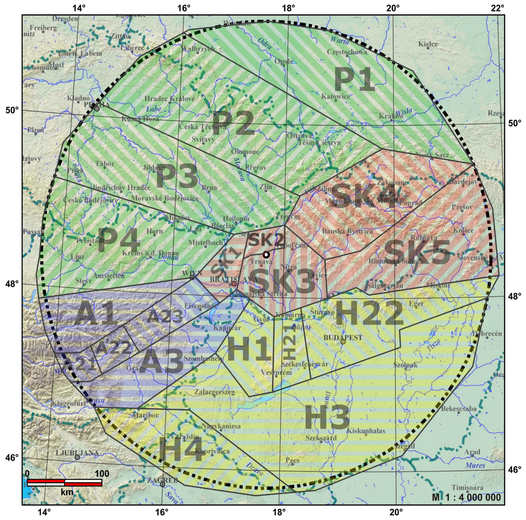
We calculated the 16th, 50th and 84th percentiles and mean Uniform Hazard Spectrum (UHS) for return periods of 475 years and 10 000 years. The calculations were performed for the free-field rock conditions (Vs30 of 800 m/s). We determined magnitude and distance of the controlling earthquake, and the horizontal and vertical hazard spectra for the Revision Level Earthquake (RLE) by the deaggregation procedure. Local conditions were accounted for by calculations of the 1D amplification factors.

Seismological database



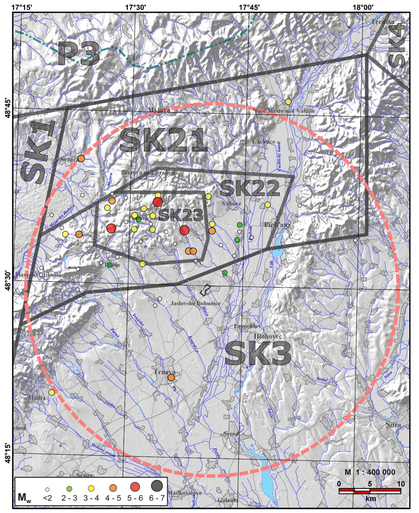
- we compiled the seismological database for the Region (305 km radius) and Near Region (30 km radius)
- we used earthquake catalogues for Slovakia, Austria, Hungary, Czech Republic and Poland, and regional earthquake catalogues ACORN and CENEC
- the homogenized database consists of 2 652 earthquakes with Mw ≥ 1.5
- we declustered the database by
  - window method (Burkhard & Grünthal 2009)
  - cluster method (Reasenberg 1985)
- we investigated the magnitude completeness by the visual cummulative method

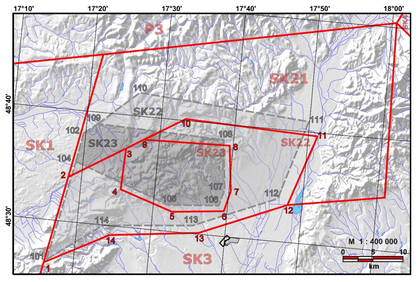
Seismic source zones



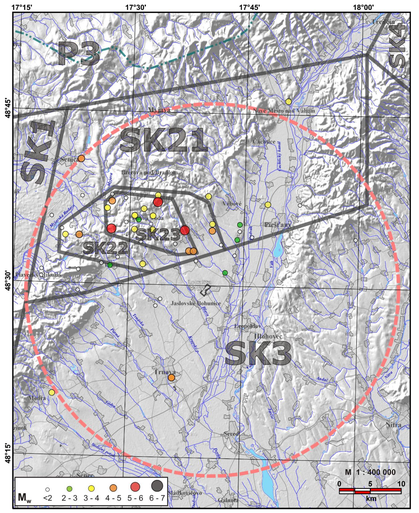
- we characterized each of 16 areal source zone by
  - magnitude-frequency parameters (Weichert 1980)
  - 4 alternative values of maximum potential magnitude
- we determined the boundaries between source zones SK2 (Dobrá Voda) and SK3 in two alternatives
  - more conservative - zonation A
  - less conservative - zonation B
- we designed SK2 with
  - vertical boundaries
  - oblique boundaries
  - alternative grouping of subzones SK21, SK22 and SK23

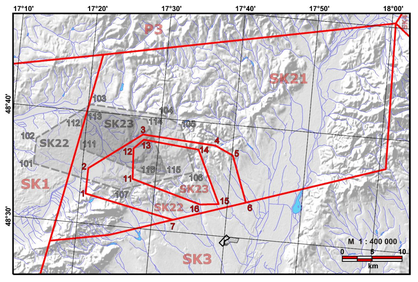
Dobrá Voda SSZ - Zonation A

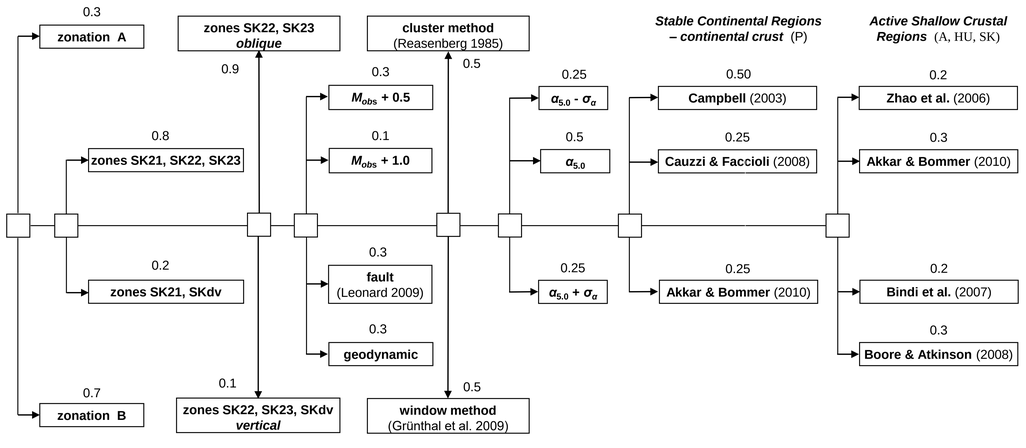




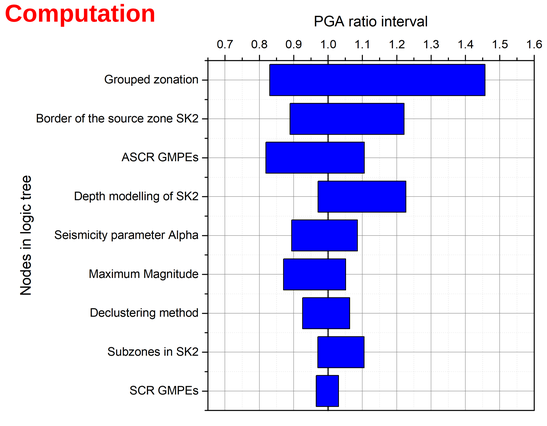
Dobrá Voda SSZ - Zonation B

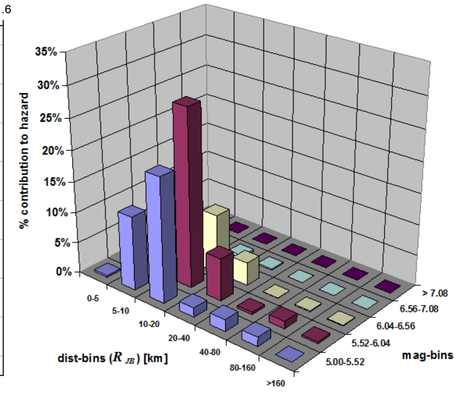




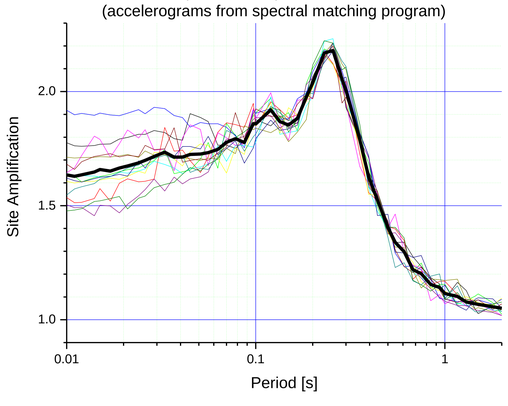


Computation





Site Amplification
from depth of 20m up to the free surface
(accelerograms from spectral matching program)



Conclusions

- we compiled a new seismological database for the Jaslovské Bohunice NPP Region
- we developed a new seismotectonic model of the Jaslovské Bohunice NPP Region and Near Region
- we constructed a logic tree with 8 nodes and 2 304 branches
- we calculated the UHS for the return periods of 475 years and 10 000 years
- based on the deaggregation, the seismic hazard is mainly sensitive to seismic source zonation in the Jaslovské Bohunice NPP Near Region
- H/V in-situ measurements indicate 1D surface structure; consequently we calculated 1D amplification factor to account for site conditions

Literature

- Burkhard & Grünthal 2009. *Swiss J. Geosci.* 102, 149-188
- Delavaud et al. 2012. *J. Seismol.* 16, 451-473
- IAEA 2010. Specific Safety Guide No. SSG-9
- Weichert 1980. *Bull. Seism. Soc. Am.* 70, 1337-1346
- for selected GMPE see report of J. Douglas http://www.gmpe.org.uk/gmpereport2014.html

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