

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet:	Interdisciplinarne raziskave v potresni geologiji
Course title:	Interdisciplinary Research in Earthquake Geology

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Okoljske in regionalne študije, doktorski študij 3. stopnje	4D Zemlja	/	/
Environmental and Regional Studies, doctoral study 3 rd cycle	4D Earth	/	/

Vrsta predmeta / Course type Izbirni/Elective

Univerzitetna koda predmeta / University course code: DIZ07

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
15	5	10			150	6

Nosilec predmeta / Lecturer: doc. dr. Petra Jamšek Rupnik
(ostali izvajalci: dr. Jure Atanackov)

Jeziki / Languages: **Predavanja / Lectures:** slovenščina, angleščina / Slovene, English
Vaje / Tutorial: slovenščina, angleščina / Slovene, English

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:

Končana druga bolonjska stopnja ustrezne smeri ali univerzitetni študij VII stopnje

Prerequisites:

Second-cycle Bologna degree in the relevant track or a university (level VII) degree.

Vsebina:

Potresna geologija zajema vrsto metod za preučevanje aktivnih prelomov in potresnih virov tako na površju kot tudi pod njim. V okviru predmeta bodo predstavljeni osnovni pojmi in sodobni načini preučevanja aktivne tektonike, potresov in njihovih virov ter potresne nevarnosti s poudarkom na interdisciplinarnosti raziskav. Podrobneje:

- Osnovni pojmi:
 - Osnove tektonike plošč
 - Načini deformacije, prelomi in gube
 - Rast prelomov
 - Struktura pri površju

Content (Syllabus outline):

Earthquake geology encompasses a variety of methods for studying active faults and seismic sources both at the surface and below it. The course will present basic concepts and modern methods of studying active tectonics, earthquakes and their sources, and seismic hazards with an emphasis on the interdisciplinary nature of the research. In detail:

- Basic concepts:
 - Basics of plate tectonics
 - Deformation types, faults, and folds
 - Fault growth
 - Surface and near-surface structure
 - Deeper structure

<ul style="list-style-type: none"> ▪ Globlja struktura ▪ Neotektonika ▪ Aktivni prelomi in zmožni prelomi ▪ Potresni viri ▪ Potresi in potresni cikel ▪ Aseizmično lezenje ▪ Posledice in učinki potresov v naravnem okolju • Metode preučevanja v potresni geologiji: <ul style="list-style-type: none"> ▪ Strukturno-geološko kartiranje ▪ Tektonska geomorfologija ▪ Preučevanje kvartarja ▪ Geofizika ▪ Paleoseizmologija ▪ Arheoseizmologija ▪ Tektonska geodezija ▪ Seizmologija • Postopki definiranja aktivnih struktur • Aktivni prelomi in potresni viri v Sloveniji, Evropi in globalno • Potresna nevarnost • Primeri iz prakse 	<ul style="list-style-type: none"> ▪ Neotectonics ▪ Active faults and capable faults ▪ Seismic sources ▪ Earthquakes and the seismic cycle ▪ Aseismic creep ▪ Consequences and effects of earthquakes in the natural environment • Methods in earthquake geology: <ul style="list-style-type: none"> ▪ Structural-geological mapping ▪ Tectonic geomorphology ▪ Quaternary studies ▪ Geophysics ▪ Paleoseismology ▪ Archeoseismology ▪ Tectonic geodesy ▪ Seismology • Procedures for defining active structures • Active faults and seismic sources in Slovenia, Europe, and globally • Seismic hazard • Case studies
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Temeljni literatura in viri / Readings:

Izbrana poglavja iz knjig ter članki/Selected chapters from books and papers:

- Fossen, H. 2020. Structural geology. 2nd ed. - Cambridge [etc.]: Cambridge University Press, 510 str.
- Keller, E.A. in Pinter, N. 2002. Active tectonics: earthquakes, uplift, and landscape. 2nd ed. Upper Saddle River: Prentice Hall, 362 str.
- Machette, M. N. 2000. Active, Capable, and Potentially Active Faults—A Paleoseismic Perspective, *Journal of Geodynamics*, 29(3), 387-392.
- Burbank, D. W. & Anderson, R. S. 2011. Tectonic geomorphology. - Malden (MA)[etc.] : Blackwell Science, 274 str.
- Bull, W. B. 2007. Tectonic geomorphology of mountains : a new approach to paleoseismology. - Malden, MA ; Oxford : Blackwell Pub., 316 str.
- Zhou, H.-W. 2014. Practical seismic data analysis. Cambridge Universtiy Press. ISBN 978-0-521-19910.0.
- McCalpin, J. 2009. Paleoseismology. 2nd ed. Burlington, MA: Academic Press; Elsevier, 613 str.
- Atanackov J, Jamšek Rupnik P, Jež J, Celarc B, Novak M, Milanič B, Markelj A, Bavec M, Kastelic V. 2021. Database of Active Faults in Slovenia: Compiling a New Active Fault Database at the Junction Between the Alps, the Dinarides and the Pannonian Basin Tectonic Domains. *Front. Earth Sci.* 9. 604388. 10.3389/feart.2021.604388
- Šket Motnikar, B., Zupančič, P., Živčič, M., Atanackov, J., Jamšek Rupnik, P., Čarman, M., Danciu, L., Gosar, A. 2022. The 2021 seismic hazard model for Slovenia (SHMS21) : overview and

results. Bulletin of earthquake engineering, 20 (10), 4865–4894. DOI: 10.1007/s10518-022-01399-8.

Cilji in kompetence:

Študenti in študentke pridobijo sposobnosti in znanja za celovito razumevanje in analizo aktivnih tektonskih procesov in z njimi povezanih deformacij ter potresov. Pridobijo znanje o sodobnih metodah za prepoznavanje aktivnih prelomov in potresnih virov, ter njihovo karakterizacijo. Naučijo se pridobiti geološke in druge podatke za ocene potresne nevarnosti. Razumejo pomen interdisciplinarnosti in povezovanja rezultatov iz različnih področij, kar lahko uporabljajo tako pri raziskavah v potresni geologiji kot tudi v prenosu v prakso na sorodnih področjih povezanih z analizo geoloških pogojev za upravljanje s prostorom. Seznanijo se s primeri iz prakse in pridobijo praktične izkušnje za učinkovitejši prenos pridobljenega znanja v svoje poklicno okolje.

Objectives and competences:

Students will acquire the skills and knowledge necessary for a comprehensive understanding and analysis of active tectonic processes and related deformations and earthquakes. They will gain knowledge of modern methods for identifying and characterizing active faults and seismic sources. They will learn to obtain geological and other data for seismic hazard assessments. Students will understand the importance of interdisciplinarity and integrating results from various fields, which can be applied both in earthquake geology research and in practical applications related to analysis of geological conditions for spatial management. They will become familiar with practical case studies and gain hands-on experience to more effectively transfer the acquired knowledge to their professional environment.

Predvideni študijski rezultati:

- Osvojena strokovna terminologija
- Razumevanje različnih metod in njihove uporabe v raziskavah potresne geologije
- Sposobnost prepoznavanja aktivnih prelomov in potresnih virov
- Razumevanje potresne aktivnosti z geološkega vidika
- Analiza izbranega območja
- Aplikacija ene ali več izbranih metod na študijskem primeru
- Seminarska naloga

Intended learning outcomes:

- Mastery of professional terminology
- Understanding of various methods and their application in earthquake geology research
- Ability to identify active faults and seismic sources
- Understanding of seismic activity from a geological perspective
- Analysis of a selected area
- Application of one or more selected methods to a case study
- Seminar paper

Metode poučevanja in učenja:

- Predavanja
- Laboratorijske vaje
- Terensko delo
- Seminar
- Individualne naloge
- Konzultacije
- e-izobraževanje

Learning and teaching methods:

- Lectures
- Lab work/tutorials
- Field work
- Seminar
- Independent work assignments
- Consultations
- e-Learning

Načini ocenjevanja:

Seminarska naloga z zagovorom

Delež (v %) /
Weight (in %)

100

Assessment:

Written seminar paper and defence

Reference nosilca / Lecturer's references:

1. **Jamšek Rupnik, Petra**, Žebre, Manja, Jež, Jernej, Zajc, Marjana, Preusser, Frank, Monegato, Giovanni. 2022. Deciphering the deformation mechanism in Quaternary deposits along the Idrija Fault in the formerly glaciated Soča Valley, southeast European Alps. *Engineering geology*, vol. 297, 25 str. DOI: 10.1016/j.enggeo.2021.106515.
2. Grützner, Christoph, Aschenbrenner, Simone, **Jamšek Rupnik, Petra**, Reicherter, Klaus, Saifelislam, Nour, Vičič, Blaž, Vrabec, Marko, Welte, Julian, Ustaszewski, Kamil. 2021. Holocene surface-rupturing earthquakes on the Dinaric Fault System, western Slovenia. *Solid earth*, vol. 12, no. 10, str. 2211-2234. DOI: 10.5194/se-12-2211-2021.
3. Zupančič, Polona, Šket Motnikar, Barbara, Carafa, Michele M. C., **Jamšek Rupnik, Petra**, Živčič, Mladen, Kastelic, Vanja, Rajh, Gregor, Čarman, Martina, **Atanackov, Jure**, Gosar, Andrej. 2024. Seismogenic depth and seismic coupling estimation in the transition zone between Alps, Dinarides and Pannonian Basin for the new Slovenian seismic hazard model. *Natural hazards and earth system sciences : An Open Access Journal of the European Geosciences Union*, vol. 24, issue 2, str. 651-672. DOI: 10.5194/nhess-24-651-2024.
4. Kázmér, Miklós, **Jamšek Rupnik, Petra**, Gaidzik, Krzysztof. 2023. Seismic activity in the Celje Basin (Slovenia) in Roman times - archaeoseismological evidence from Celeia. *Quaternary*, vol. 6, no. 1, 13 str. DOI: 10.3390/quat6010010.
5. **Atanackov, Jure**, **Jamšek Rupnik, Petra**, Jež, Jernej, Celarc, Bogomir, Novak, Matevž, Milanič, Blaž, Markelj, Anže, Bavec, Miloš, Kastelic, Vanja. 2021. Database of active faults in Slovenia: compiling a new active fault database at the junction between the Alps, the Dinarides and the Pannonian Basin tectonic domains. *Frontiers in earth science*, vol. 9. DOI: 10.3389/feart.2021.604388.
6. Šket Motnikar, Barbara, Zupančič, Polona, Živčič, Mladen, **Atanackov, Jure**, **Jamšek Rupnik, Petra**, Čarman, Martina, Danciu, Laurentiu, Gosar, Andrej. 2022. The 2021 seismic hazard model for Slovenia (SHMS21) : overview and results. *Bulletin of earthquake engineering*, vol. 20, iss. 10, str. 4865–4894. DOI: 10.1007/s10518-022-01399-8.