

TRANSPORT OF WATER, CHEMICALS AND ENERGY IN THE SOIL – PLANT – ATMOSPHERE SYSTEM IN CONDITIONS OF THE CLIMATE VARIABILITY

Book of Abstracts

2023

Edited by
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TRANSPORT OF WATER, CHEMICALS AND ENERGY IN THE SOIL – PLANT – ATMOSPHERE SYSTEM IN CONDITIONS OF THE CLIMATE VARIABILITY

**Book of Abstracts
from the 30TH POSTER DAY 2023**

8 November, 2023



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Vážení kolegovia, milí priatelia

S vdakou a nostalgiou sa vraciame do roku 1993, do čias, kedy sa zrodila jedna myšlienka, ktorá nakoniec premenila tvár vedeckej komunikácie v stredoeurópskom regióne. Prvý Posterový deň, vytvorený zásluhou Dr. Juraja Majerčáka, priviedol do našich laboratórií a chodieb výskumníkov zo Slovenska, Čiech, Poľska a Maďarska. Bola to jedinečná príležitosť prezentovať výsledky v podobe vedeckých posterov, ktoré umožnili hlbšiu diskusiu a priamu interakciu medzi autorom a zvedavými kolegami, pracujúcimi v rovnakom vednom odbore. Z týchto skromných začiatkov vyrástol silný odkaz: Posterové dni, ktoré oslavujeme práve teraz, po tridsiatich rokoch ich existencie.

Za uplynulé desaťročia sme boli svedkami rastu, premien a neustáleho pokroku v našej vednej oblasti, ale aj v prostriedkoch komunikácie a prezentovania našich výsledkov. Z posterov vo formáte A4, nalepených na kartónovom papieri sme prešli k digitálnym technológiám, ktoré umožňujú pestrosť, kreativitu a komplexnosť výskumných prezentácií. Spájali sme sily s Geofyzikálnym ústavom SAV a spoločne sme formovali Posterový deň do podoby, akú poznáme dnes - platformu, ktorá spojuje výskumníkov, umožňuje rýchlu výmenu názorov a podporuje kreovanie nových výskumných a projektových spoluprác. V histórii PD sme privítali významných rečníkov ako Dr. M. Th. Van Genuchten, Dr. Ryszard Walczak alebo prof. M. Kutilek, ktorí nám svojimi poznatkami obohatili poznanie a inšpirovali nás na ďalšie úvahy. Dnes, keď oslavujeme 30. výročie Posterových dní, si uvedomujeme, aký obrovský kus práce a oddanosti je za touto udalosťou. Spojili sme výskumníkov z rôznych krajín, vytvorili sme priestor pre otvorenú diskusiu a podporili sme rozvoj poznania. V každom postri, v každej odbornej diskusii sme nachádzali kúsky nového poznania, ktoré posúvali našu spoločnú vedeckú oblasť vpred. Posterový deň, ktorý sa zrodil v roku 1993, ma stále ambíciu byť tým mostom, po ktorom sa uberáme k novým objavom a poznatkom. Sme hrdí na to, čo sme dosiahli a sme plní nadšenia do budúcnosti, ktorá nás ešte len čaká.

Ústav hydrológie SAV, v.v.i. ďalej ďakuje touto cestou organizáciám, ktoré podporili PD 2023: 30. Posterový deň s podporou Slovenského národného komitétu IHP UNESCO.



Ing. Viliam Novák, DrSc.

Dear colleagues, dear friends

Let us take a trip down memory lane to 1993 with a heart full of gratitude and nostalgia. This was the year when a great idea was born, one that would eventually revolutionize scientific communication in Central Europe. Dr. Juraj Majerčák created the first Poster Day, which brought together researchers from Slovakia, the Czech Republic, Poland, and Hungary. They shared their research findings in the form of scientific posters, allowing for deeper discussions and direct interactions between authors and curious colleagues from the same field. From these humble beginnings, Poster Day has become a treasured legacy that we are celebrating today after thirty years of their existence.

In the past few decades, there has been significant growth and transformation in the scientific field, as well as in the means of communicating and presenting research results. We have come a long way from using A4 posters printed on cardboard paper to digital technologies that allow for more variety, creativity, and complexity in research presentations. We collaborated with the Institute of Geophysics of the Slovak Academy of Sciences to create Poster Day, which is now a platform that connects researchers, facilitates rapid exchange of ideas, and supports the formation of new research and project collaborations. Over the years, we have had the privilege of hosting distinguished speakers such as Dr. M. Th. Van Genuchten, Dr. Ryszard Walczak, and Prof. M. Kutilek have enriched our knowledge with their insights and inspired us to continue reflecting on our work.

As we celebrate the 30th anniversary of Poster Day, we wanted to take a moment to express our gratitude for the tremendous amount of work and dedication that has gone into making this event possible. We are so thrilled to have brought together researchers from different countries, creating a space for open discussions and promoting the advancement of knowledge. Every poster and expert discussion has been a joyous opportunity to discover new knowledge and make new friends. Since its inception in 1993, Poster Day has been all about creating a warm and friendly community that inspires us to strive for excellence and reach new heights. We are so proud of what we have accomplished so far and are excited to continue this journey with all of you.

The Institute of Hydrology, SAS would also like to thank the organization that supported PD 2023: 30th Poster day with support of the Slovak National Committee of IHP UNESCO.



Ing. Viliam Novák, DrSc.

POSTEROVÉ DNI V SKRATKE (HISTORY OF POSTER DAY CONFERENCE)

III. Posterový deň "Prenos vody, látok a energie v systéme SVAT", sa konal 16. novembra 1995 v Ústave Hydrológie SAV na Račianskej ul. v Bratislave. Zorganizovali ho T. Hurtalová (GfÚ SAV) a J. Majerčák (ÚH SAV). Zúčastnilo sa ho 60 účastníkov z domova a zo zahraničia, ktorí prezentovali 42 posterov. Vystúpili dr. M. Th. van Genuchten z USA, Prof. Dr. R. Walczak z Poľska a Prof. Dr. M. Kutílek z ČR.

IV. Posterový deň "Prenos vody, látok a energie v systéme SVAT", sa konal 25. novembra 1996. Prezentovaných bolo 42 posterov z Poľska, ČR, Francúzska, Rakúska a Slovenska. Organizátori: T. Hurtalová (GfÚ SAV) a J. Majerčák (ÚH SAV)

V. Posterový deň "Prenos vody, látok a energie v systéme SVAT", sa konal 13. novembra 1997 za účasti 73 účastníkov z domova a zo zahraničia, ktorí prezentovali 62 posterov. Zúčastnilo sa 12 zahraničných vedcov z Poľska, a ČR.

VI. Posterový deň "Prenos vody, látok a energie v systéme SVAT", sa konal 25. novembra 1998 za účasti 103 účastníkov z domova a zo zahraničia, ktorí prezentovali 67 posterov. Zúčastnilo sa 26 zahraničných vedcov z Poľska, a ČR. Okrem posterov, boli prednesené 3 prednášky špičkových vedeckých pracovníkov zo Švajčiarska a Maďarskej republiky.

VII. Posterový deň "Prenos vody, látok a energie v systéme SVAT", sa konal 11. novembra 1999 za účasti 105 účastníkov z domova a zo zahraničia, ktorí prezentovali 79 posterov. Zúčastnilo sa 28 zahraničných vedcov z Poľska, Maďarska a ČR. Okrem posterov, boli prednesené 3 prednášky špičkových vedeckých pracovníkov z Českej a Slovenskej republiky.

VIII Posterový deň sa konal 16. 11. 2000. Podujatie bolo organizované ako medzinárodné, zahraniční účastníci boli z Českej republiky, Poľska, Maďarska, Rakúska, Ruskej federácie, USA. Zborník referátov bol vydaný formou CD-ROM média, bolo v ňom publikovaných 87 referátov. Posterový deň sa konal pod záštitou ÚH SAV a GfÚ SAV ako aj SVH NK MHP UNESCO pri ÚH SAV a pobočky Slovenskej banskej spoločnosti pri GfÚ SAV. Organizátormi posterového dňa a editormi zborníka boli RNDr. J. Majerčák a RNDr. Tatjana Hurtalová, CSc.



VIII. Posterový deň, 2000, Ústav hydrológie SAV, Račianska 75, Bratislava

IX. Posterový deň, 29.11.2001.

Organizátori: RNDr. Juraj Majerčák, PhD. a RNDr. Tatjana Hurtalová, CSc.

Deviaty posterový deň sa konal za účasti 108 pracovníkov zo Slovenska, Českej republiky, Maďarskej republiky, Rakúskej republiky a USA. Bolo predstavených 49 posterov. V úvode

posterového dňa boli prednesené tri vyžiadané prednášky s tematikou klimatických zmien a ich dopadov na systém vegetačný kryt-pôdny profil. Vystúpil doc. J. Škvarenina z Lesníckej fakulty TU Zvolen, Dr. J. Eitzinger z BOKU Viedeň a Dr. M. Dubrovský z Ústavu fyziky atmosféry AV ČR z Hradca Králové.

X. Posterový deň Transport vody, chemikálií a energie v systéme pôda-rastlina-atmosféra (Transport of water, chemicals and energy in the system soil-crop canopy-atmosphere),
ÚH SAV, Bratislava, 28.11.2002

Organizátori: Mgr. T. Orfánus, Mgr. P. Bača, Ing. V. Mikulec, Ing. Ľ. Hornáček

Desiaty posterový deň sa konal za účasti 123 pracovníkov zo Slovenska, Poľska, Českej republiky, Maďarskej republiky, Rakúskej republiky, Nemecka, Veľkej Británie a USA. Bolo predstavených 60 posterov. V úvode posterového dňa boli prednesené dve vyžiadané prednášky s tematikou hydrológia nenasýtenej zóny. Vystúpil Prof. Svatopluk Matula, CSc. z oddelenia pedológie a geológie Českej poľnohospodárskej univerzity v Prahe a Ing. František Doležal, CSc. z Výskumného ústavu meliorácií a ochrany pôdy v Prahe. Z podujatia bol vydaný zborník vo forme CD-ROM, ktorý obsahuje 63 príspevkov s celkovým objemom 506 strán textu, tabuliek, obrázkov a máp.

XI. Posterový deň

Miesto: ÚH SAV, Bratislava, 20.11.2003

Organizátori: Mgr. T. Orfánus, Mgr. P. Bača, Ing. V. Mikulec, Ing. Ľ. Hornáček

Jedenásty posterový deň sa konal za účasti 114 pracovníkov zo Slovenska, Poľska, Českej republiky, Maďarskej republiky, Rakúskej republiky, Nemecka, Veľkej Británie a USA. Bolo predstavených 58 posterov. V úvode posterového dňa boli prednesené dve vyžiadané prednášky s tematikou hydrológia nenasýtenej zóny. Vystúpil Prof. Dr. hab. R. Walczak z Ústavu agrofyziky PAN v Lubline a Dr. J. Gusev, Institute of Water problems RAS. Z podujatia bol vydaný zborník vo forme CD-ROM, ktorý obsahuje 54 príspevkov s celkovým objemom 440 strán textu, tabuliek, obrázkov a máp.



XI. Posterový deň, ÚH SAV, Račianska 75, Bratislava
odovzdávanie pamätných diplomov

XII. Posterový deň s medzinárodnou účasťou, 25.11.2004 v ÚH SAV Bratislava

Organizátori: Ing Viliam Novák, DrSc., Ing Anežka Čelková, RNDr. Peter Bača, PhD., Ing Vladimír Mikulec, Ing. Viliam Nagy, PhD.

Na 12. Medzinárodnom Posterovom dni sa zúčastnilo 119 účastníkov zo Slovenska, Maďarska, Poľska, Rakúska, Českej republiky a Spojených štátov amerických.

XIII. Posterový deň s medzinárodnou účasťou, 10.11.2005 v ÚH SAV Bratislava

Organizátori: RNDr. Vlasta Štekauerová, CSc., Ing Viliam Novák, DrSc., Ing Anežka Čelková, RNDr. Peter Bača, PhD., Ing. Viliam Nagy, PhD.

Táto neobvyklá forma komunikácie medzi vedeckými pracovníkmi si počas trinástich rokov získala veľkú popularitu a počet prezentácií, ako aj účastníkov sa každoročne zvyšoval. V prvom ročníku sa ho zúčastnilo 30 záujemcov- ale v tomto roku ich bolo viac ako 120, z nich 54 zo zahraničia. Prezentovaných bolo 81 príspevkov na posteroch, a tieto boli distribuované na CD ROME. Posterový deň bol venovaný jubilejúcemu RNDr. Júliusovi Šútorovi, DrSc, bývalému dlhoročnému riaditeľovi Ústavu hydrológie SAV. Trinásty Posterový deň bol už tradične spoločným produktom Ústavu hydrológie SAV a Geofyzikálneho ústavu SAV.

XIV. Posterový deň s medzinárodnou účasťou, Bratislava, ÚH SAV, 9.11.2006.

Organizátori: RNDr. Vlasta Štekauerová, CSc., Ing Viliam Novák, DrSc., Ing. Anežka Čelková, RNDr. Peter Bača, PhD., Ing. Viliam Nagy, PhD.

Podujatia sa zúčastnilo 104 účastníkov, z čoho bolo 49 zo zahraničia. Prezentovaných bolo 75 príspevkov na posteroch, a tieto boli distribuované na CD ROME. Tohoročný Posterový deň bol venovaný jubilejúcemu Ing. Karolovi Kosorinovi, DrSc, bývalému dlhoročnému pracovníkovi Ústavu hydrológie SAV. V rámci vyzvaných prednášok vystúpili pracovníci z vedeckých inštitúcií z Viedne.

XV. Posterový deň s medzinárodnou účasťou, Bratislava, ÚH SAV, 15.11.2007.

Organizátori: RNDr. Vlasta Štekauerová, CSc., Ing Viliam Novák, DrSc., Ing. Anežka Čelková, RNDr. Peter Bača, PhD., Ing. Viliam Nagy, PhD.

Podujatia sa zúčastnilo 126 účastníkov, z čoho bolo 58 zo zahraničia. Prezentovaných bolo 93 príspevkov na posteroch, a tieto boli distribuované na CD ROME. V rámci vyzvaných prednášok vystúpili pracovníci z SPU Nitra. XV Posterový deň bol už tradične spoločnou akciou Ústavu hydrológie SAV a Geofyzikálneho ústavu SAV.

XVI. Posterový deň s medzinárodnou účasťou, 13. novembra 2008 v ÚH SAV, Bratislava.

Organizátori: RNDr. Vlasta Štekauerová, CSc., Ing. Anežka Čelková, RNDr. Taťjana Hurtalová, CSc. (GFÚ SAV), RNDr. František Matejka, CSc. (GFÚ SAV), Ing. Viliam Nagy, PhD., Ing. Viliam Novák, DrSc., RNDr. Andrej Tall, PhD.

Posterového dňa sa zúčastnilo 133 výskumných pracovníkov zo 6 krajín, 56 účastníkov bolo zo zahraničia. Zborník príspevkov bol vydaný na CD-ROM a abstrakty v tlačenej forme. Popularita tohoto podujatia bola podporená aj získaním špičkových odborníkov pre úvodné prednášky (prof. Varallyay z MAV Budapešť a prof. Blum z BOKU Wien).

XVII. Posterový deň s medzinárodnou účasťou Transport vody, chemikálií a energie v systéme pôda-rastlina- atmosféra 2009, Bratislava, ÚH SAV, sa konal 12.11.2009.

Organizátori: RNDr. Vlasta Štekauerová, CSc., Ing. Anežka Čelková, RNDr. Marian Ostrožlík, CSc. (GFÚ SAV), Ing. Viliam Nagy, PhD., Ing. Viliam Novák, DrSc., RNDr. Andrej Tall, PhD. Posterového dňa sa zúčastnilo 110 účastníkov, z toho 26 zahraničných



XVIII. Posterový deň s medzinárodnou účasťou Poster Day 2010 "Transport vody, chemikálií a energie v systéme pôda-rastlina-atmosféra", spojený s Dňom otvorených dverí na ÚH SAV, ÚH SAV Bratislava, 11.11.2010.

Organizátori: RNDr. Vlasta Štekauerová, CSc., Ing. Anežka Čelková, RNDr. Marian Ostrožlík, CSc. (GFÚ SAV), Ing. Viliam Novák, DrSc., Ing. Marek Rodný, Ing. Peter Šurda, PhD.

Posterového dňa sa zúčastnilo 120 účastníkov, z toho 55 zo zahraničia,



XIX. Posterový deň s medzinárodnou účasťou "Transport vody, chemikálií a energie v systéme pôda- rastlina-atmosféra" 2011, Ústav hydrológie SAV, Račianska 75, Bratislava, 10.11.2011

Organizátori: RNDr. Vlasta Štekauerová, CSc., Ing. Anežka Čelková, Ing. Viliam Nagy, PhD., Ing. Viliam Novák, DrSc., Ing. Marek Rodný, Ing. Peter Šurda, PhD.

151 účastníkov, z toho 65 zahraničných.



XX. Posterový deň s medzinárodnou účasťou "Transport vody, chemikálií a energie v systéme pôda- rastlina-atmosféra 2012, ÚH SAV Bratislava, 15.11.2012

Organizátori: RNDr. Juraj Majerčák, PhD., Ing. Anežka Čelková, Ing. Viliam Novák, DrSc., Ing. Marek Rodný, PhD., Doc. Ing. Jana Skalová, PhD. (SvF STU), Ing. Peter Šurda, PhD., Ing. Justína Vitková, PhD.

V roku 2012 sa akcie zúčastnilo vyše 145 účastníkov, z toho 56 zo zahraničia. Po príhovore riaditeľky ÚH SAV RNDr. P. Pekárovej, DrSc. Si účastníci vypočuli prednášku doc. Šťastnej z Mendelovej univerzity v Brne. Zaujímavým spestrením úvodnej časti bol krst monografie Ing. Viliama Nováka, DrSc. „Evapotranspiration in the Soil-Plant-Atmosphere System“, ktorá vyšla tohto roku vo vydavateľstve Springer. Z Posterového dňa vyšiel zborník recenzovaných príspevkov na CD a v tlačenej forme zborník abstraktov prezentovaných posterov.



XXI. Posterový deň s medzinárodnou účasťou, Ústav hydrológie SAV, Račianska 75, Bratislava, 150 účastníkov, 13.11.2014

Organizovali: RNDr. Tomáš Orfánus, PhD., Ing. Anežka Čelková, Ing. Marek Rodný, PhD., Ing. Peter Šurda, PhD., Ing. Justína Vitková, PhD.

XXII. Posterový deň - 12.11.2015, 130 účastníkov

Akcie zorganizoval Ústav hydrológie SAV spolu s Ústavom vied o Zemi SAV s podporou Slovenského výboru pre hydrológiu a GWP. Na podujatí sa zúčastnili aj hostia z Českej republiky, Maďarska, Poľska a už tradične zaplnilo chodby a prednáškovú miestnosť Ústavu hydrológie SAV. Uskutočňuje sa pod heslom Transport vody, chemikálií a energie v systéme pôda-rastlina-atmosféra. Podujatie otvoril vedecký garant RNDr. Tomáš Orfánus, PhD. Súčasťou bolo aj predstavenie monografií vydaných v roku 2015 a odovzdávanie ocenení.

Organizovali: RNDr. Tomáš Orfánus, PhD., Ing. Anežka Čelková, Ing. Viliam Nagy, PhD., Ing. Peter Šurda, PhD., Ing. Justína Vitková, PhD.



Posterový deň 2015 a deň otvorených dverí na ÚH SAV

XXIII. Posterový deň s medzinárodnou účasťou a Deň otvorených dverí na ÚH SAV, 10.11.2016, Ústav hydrológie SAV, Dúbravská cesta č. 9, Bratislava, 150 účastníkov

23. Posterový deň s medzinárodnou účasťou a zároveň Deň otvorených dverí ÚH SAV sa konal v rámci Týždňa vedy a techniky v nových priestoroch ÚH SAV na Dúbravskej ceste 9. Ústav hydrológie organizoval toto podujatie s podporou Slovenského výboru pre hydrológiu UNESCO a Global Water Partnership.

Posterový deň otvoril vedecký garant RNDr. Tomáš Orfánus, PhD. Prítomným sa prihovarila riaditeľka Ústavu hydrológie SAV Ing. Yvetta Velísková, PhD.

Podujatia sa zúčastnilo 150 domácich odborníkov a hostia z Českej republiky, Poľska, Rakúska, Maďarska a Slovinska. S vyzvanými prednáškami vystúpili Ing. Ľubomír Lichner, DrSc. z Ústavu hydrológie a Dr. Julia Hall, PhD. z Technickej univerzity Viedeň. Ocenenie a poďakovanie za celoživotný prínos pre hydrológiu a hydrauliku si prevzal Ing. Karol Kosorin, DrSc., tohoročný jubilant (80 r.).

Zároveň sa v priestoroch ÚH SAV uskutočnila zaujímavá výstava „Historické povodňové značky na Dunaji a na slovenských riekach“ (Historic flood marks on the Danube River and on the Slovak rivers) zorganizovaná s podporou Slovenského výboru IHP UNESCO, ktorú pripravila RNDr. Pavla Pekárová, DrSc. so spolupracovníkmi.



XXIV. Posterový deň s medzinárodnou účasťou a Deň otvorených dverí na ÚH SAV, Ústav hydrológie SAV, Dúbravská cesta č. 9, Bratislava, 72 účastníkov 08.11.2017

Na konferencii boli prezentované výsledky, dosiahnuté pri riešení grantov a projektov, ktoré sa zaoberajú prenosovými javmi v systéme pôda–rastlina–atmosféra v rôznych priestorových mierkach, medzi účastníkmi prebehla výmena skúseností a vedecké diskusie pri posteroch. Z tohto podujatia bol vydaný zborník recenzovaných príspevkov v elektronickej forme (CD) a zborník abstraktov v tlačenej forme. Vedecký výbor konferencie navrhol vybrané príspevky na publikovanie v časopise *Acta Hydrologica Slovaca* č.1/2018.



XXV. Posterový deň s medzinárodnou účasťou a Deň otvorených dverí na ÚH SAV 2018, Bratislava, Dúbravská cesta, 07.11.2018, oslava 65 rokov ÚH SAV.

Organizátori: RNDr. Tomáš Orfánus, PhD., Ing. Anežka Čelková, Ing. Viliam Nagy, PhD., Ing. Peter Šurda, PhD., Ing. Justína Vitková, PhD., Mgr. Anton Zvala, PhD.

25. ročník medzinárodnej konferencie Posterový deň a Deň otvorených dverí navštívilo 65 domácich a zahraničných vedcov z rôznych výskumných inštitúcií. Účastníci zo Slovenska, Maďarska, Čiech, Poľska a Slovinska už tradične prezentovali svoje výsledky formou posterov, pri ktorých mohli konzultovať s odborníkmi z rôznych vedeckých oblastí, mali možnosť podeliť sa o skúsenosti v nových trendoch moderného výskumu systému pôda–rastlina–atmosféra, navzájom sa inšpirovať a nadviazať ďalšiu spoluprácu. Prednášky, ktoré tento rok prezentovali Dr. Gábor Milics zo Széchenyi István University v Győri (Maďarsko) a Ing. RNDr. Jaroslav Rožnovský, CSc., z Mendelovej univerzity v Brne (ČR), boli zamerané na meranie a monitorovanie vlhkosti pôdy a následnej aplikácie závlahových dávok potrebných pre konkrétnu plodinu, ale tiež na hodnotenie sucha, povodní a zadržanie vody v krajine.



XXVI. Posterový deň s medzinárodnou účasťou a Deň otvorených dverí na ÚH SAV 2019, Bratislava, Dúbravská cesta 9, ÚH SAV, 50 účastníkov, 06.11.2019

Organizátori: Ing. Peter Šurda, PhD., Ing. Anežka Čelková, Ing. Justína Vitková, PhD., Mgr. Anton Zvala, PhD.

26. ročník medzinárodnej konferencie Posterový deň a Deň otvorených dverí navštívilo 50 domácich a zahraničných vedcov z rôznych výskumných inštitúcií. Účastníci zo Slovenska, Maďarska, Čiech a Poľska už tradične prezentovali svoje výsledky formou posterov. Tematické prednášky tento rok odprezentovali Dr. Renáta Sándor z Agricultural Institute, Centre for Agricultural Research (Maďarsko) a Dr. Mateusz Lukowski z PAN Warsava (Poľsko).

XXVII. Posterový deň s medzinárodnou účasťou „TRANSPORT VODY, CHEMIKÁLIÍ A ENERGIE V SYSTÉME PÔDA – RASTLINA – ATMOSFÉRA v podmienkach klimatickej variability“ na webovom portáli ÚH SAV, 11. 11. – 13. 11. 2020,

Organizátori: RNDr. Pavla Pekárová, DrSc., Ing. Justína Vitková, PhD., Ing. Dana Halmová, PhD., RNDr. Pavol Miklánek, CSc., Ing. Ivan Mészáros, PhD., RNDr. Jakub Mészáros, Ing. Dana Pavelková, PhD.

Konferencia v roku 2020 bola ovplyvnená obmedzeniami z dôvodu šírenia sa infekčného ochorenia COVID-19, vyvolané koronavírusom SARS-CoV-2. Z tohoto dôvodu sa Posterový deň konal virtuálne.

V tomto roku bolo do konferenčného zborníka posterov (Book of Posters – 27th Poster day 2020) zaradených 37 posterov s abstraktami v angličtine. Príspevky uverejnené v zborníku sú dôkazom širokého spektra vedeckých disciplín, ktoré sú riešené v systéme pôda – rastlina – atmosféra. V zborníku boli zoradené podľa tém:

- I. Voda v pôde
- II. Hydrologické modelovanie
- III. Klimatická zmena a variabilita klímy
- IV. Kvalita vody

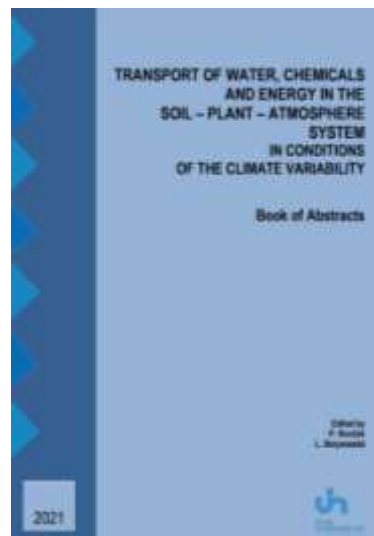
To, že riešenie uvedených problémov si dnes vyžaduje široký okruh znalostí z fyziológie rastlín, ekológie, hydrológie, meteorológie, pedológie, ale i matematiky, fyziky a chémie dokazuje 96 spoluautorov posterov z Čiech, Maďarska a Slovenska.



XXVIII. Posterový deň s medzinárodnou účasťou „TRANSPORT VODY, CHEMIKÁLIÍ A ENERGIE V SYSTÉME PÔDA – RASTLINA – ATMOSFÉRA v podmienkach klimatickej variability“ na webovom portáli ÚH SAV, 8. 11. – 14. 11. 2021

Organizátori: Mgr. Peter Rončák, PhD., Ing. Justína Vitková, PhD., Ing. Lenka Botyanszká, PhD., Ing. Peter Šurda, PhD.

XXVIII. Posterový deň sa konal opäť vo virtuálnom priestore prostredníctvom navštívenia stránky www.posterdayuhsav.sk, kde bolo možné vidieť 2 vyzvané prednášky (Dr. George Kordzakhia: "Climate change impact on Georgian glaciers" a Dr. Peter Valent: "Hora - national flood risk mapping in Austria"). Do zborníka bolo zaradených vyše 50 abstraktov z prezentovaných posterov zo Slovenska, Českej republiky, Maďarska, Poľska, Gruzínska a Slovinska.



XXIX. Posterový deň s medzinárodnou účasťou „TRANSPORT VODY, CHEMIKÁLIÍ A ENERGIE V SYSTÉME PÔDA – RASTLINA – ATMOSFÉRA“ ÚH SAV, 10. 11. 2022 65 účastníkov

Organizovali Mgr. Peter Rončák, PhD., Ing. Justína Vitková, PhD., RNDr. Pavol Miklánek, CSc., Ing. Lenka Botyanszká, PhD., Ing. Peter Šurda, PhD.

Počas Týždňa vedy a techniky 2022 sa na Ústave hydrológie SAV, v.v i. (ÚH SAV, v.v.i.) konala medzinárodná konferencia Posterový deň a Deň otvorených dverí na ÚH SAV, v. v. i. XXIX. ročník konferencie, ktorý sa po dvoch rokoch opäť konal v prezenčnej forme, sa niesol v priateľskom a odbornom duchu, tak ako pred pandémiou Covid-19. Po úvodných slovách moderátora RNDr. Pavla Mikláneka, CSc. a riaditeľky ÚH SAV, v. v. i. Ing Yvetty Velískovej, PhD. nasledovali vyzvané prednášky doc. Ing. Jaroslava Vida, PhD. z Katedry prírodného prostredia, Lesníckej fakulty, Technickej univerzity vo Zvolene a dr. Saeida Okhraviho z ÚH SAV, v.v.i. v Bratislave.



Účastníci XXIX. Posterového dňa.

RNDr. Pavla Pekárová, DrSc.

RNDr. Pavol Miklánek, CSc.

Ústav hydrológie SAV, v. v. i.

30 YEARS OF THE SLOVAK NATIONAL COMMITTEE OF THE INTERGOVERNMENTAL HYDROLOGICAL PROGRAMME OF UNESCO

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ABSTRACT

The Slovak Committee for IHP UNESCO is the body of the Slovak Commission for UNESCO. SVH is responsible for its activities to the Ministry of Foreign Affairs of the Slovak Republic, the Slovak Commission for UNESCO and the Presidium of the Slovak Academy of Sciences. In the field of foreign relations and international cooperation, SVH proceeds in full compliance with the principles of foreign policy of the Slovak Republic. Based on its own statute, the Committee also fulfils the role of the National Committee of the International Association of Hydrological Sciences (IAHS) within the International Union of Geophysics and Geodesy (IUGG) and the International Council on Science (ISC). The main running projects: Regional Collaboration of the Danubian Countries in Hydrology; Low Flow and Drought in the Danube River Basin; ERB – European Reference Basins. The main national activities: Conferences of the Young Hydrologists (35th conference in 2023); Poster Day (30th Poster day in 2023); publishing of the series of monographs Publications of the SVH (so far, 12 volumes have been); granting of the Ľudo Molnár Awards (8 prizes have been awarded so far).

Keywords: Slovak Committee for Hydrology, Intergovernmental Hydrological Programme, UNESCO

A MULTIVARIATE COPULA-BASED FRAMEWORK FOR RESERVOIR SAFETY EVALUATION: A CASE STUDY ON THE PARNÁ RIVER, SLOVAKIA

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²Institute of Hydraulic Engineering and Water Resources Management, Technische Universität Wien, Vienna, 1040, Austria.

³Department of Mathematics and Constructive Geometry, Faculty of Civil Engineering, Slovak University of Technology in Bratislava, Radlinského 11, 810 05 Bratislava, Slovakia.

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ABSTRACT

Resilient flood risk management needs reliable estimations of the design values for proposing structural mitigation measures such as sizing reservoir volumes and the spillways of dams, the height of flood levees, and planning areal zoning for residential areas at risk. Control values are also needed to test the safety of existing flood control measures and structures. In practice, the most often used quantities of interest for the safety of flood control structures evaluation and flood risks assessment. Evaluating the present safety of past designs where storage was involved requires the entire hydrograph (the flood peak-volume-duration-shape) estimates related to the present or future conditions. This study aimed to provide risk analysts with a consistent multivariate probabilistic framework for evaluating reservoir safety and assessing flood risks, which respects and describes the dependence structures among the flood peaks, volumes, and durations of the observed and synthetic flood hydrographs. Additionally, the seasonality of flood generation was respected by a separate analysis of summer and winter floods. The framework consists of five steps: identification of floods and the separation of observed hydrographs; analysis of the dependence of flood characteristics for the maximum annual floods and maximum seasonal floods in the summer and winter seasons; modelling the marginal distributions of flood characteristics; modelling the joint distribution of flood peaks, volumes, and durations; and the Construction of synthetic flood hydrographs. The dependence modelling of flood peaks, volumes and durations was carried out with various types of non-parametric and parametric copulas. The flood risk assessments were described by hydrograph analyses and the conditional joint probabilities of the exceedance of flood volumes and durations conditioned on flood peaks. The properties of the synthetic hydrographs were also based on these probabilities. The evaluation of the reservoir safety and assessment of the flood risks has been demonstrated based on data from Parná River in the western part of Slovakia on the inflow into the Horné Orešany reservoir. The concept was based on flood events assigned to the prevailing flood process types in the region with discernible flood-peak-volume-shape relationships. Rather than examining the safety based on a single control flood wave, a scheme was proposed, allowing us to arrive at a set of control flood waves with associated probabilistic parameters. These permit to study of several aspects of reservoir safety (hydrologic, hydraulic, and geotechnical). The study not only provides suggestions for developing a more comprehensive copula-based framework and offers valuable tools for risk analysts seeking a robust and accurate assessment

of flood risks and reservoir safety evaluation in Slovakia but also emphasizes the importance of moving beyond the classical univariate perspective commonly employed in practice.

Keywords: copula-based approach, reservoir safety, flood seasonality, multivariate risk analysis, synthetic hydrographs

Acknowledgements: This work was supported by the Slovak Research and Development Agency under Contract No. APVV 19-0340, No. APVV 20-0374 and the VEGA Grant Agency No. VEGA 1/0577/23.

ANALYSIS OF THE WATER TEMPERATURE IN THE JALOVECKÝ CREEK DURING THE HYDROLOGICAL YEAR 2022

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ABSTRACT

Water temperature is one of the most basic indicators when assessing the condition of surface waters. The paper deals with the comparison and evaluation of water temperature in the Jalovecký creek at different altitudes and air temperature. The water temperature was measured at six locations from an altitude of 560 m to 1,100 m a. s. l. The air temperature was measured at three locations at an altitude of 560 m, 750 m and 1,400 m a. s. l. The water temperature in the Jalovecký creek was evaluated from hourly measurements during the hydrological year 2022 (November 1, 2021 – October 31, 2022). From the measured water temperatures, hourly, daily, and monthly mean water temperature values were calculated for each location. These measurements were also used in evaluating the dependence of water temperature on altitude and air temperature. The lowest mean water temperature (both hourly and monthly) was recorded at the site with the highest altitude (Hlboká valley), while the highest mean water temperature (both hourly and monthly) was recorded at the site with the lowest altitude (Ondrašová).

Keywords: air temperature, water temperature, hydrological year, Jalovecký creek

CLIMATIC ASSESSMENT OF THE SKALKA RECREATION AREA

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¹ Slovenský hydrometeorologický ústav, regionálne pracovisko Banská Bystrica

² Národné lesnícke centrum, Lesnícky výskumný ústav, Zvolen

³ Technická Univerzita vo Zvolene, Lesnícka fakulta, Katedra prírodného prostredia

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ABSTRACT

The Skalka recreational area is located in the Kremnica Mountains near the town of Kremnica, Slovakia. The average annual air temperature, on a long-term average, reached 4.7 °C. An average of 74 ice days and only 5 summer days occurred in this area during the evaluated period 1981–2013. The average annual humidity was 79 %. The average long-term cloud cover was 66 %. On the open mountain peaks, the average annual sunlight duration was 1765 hours, but on unfavourably oriented steep slopes, the duration was up to 35 % shorter. In the Skalka recreation area, 175 days of fog occurred on a long-term annual average, mostly in the winter term. The number of days with frost reached an annual average of 75 days, with a maximum in December and January. The average annual wind speed here reaches 3.5–4.5 m.s⁻¹ at 10 m above ground level. The long-term average of annual precipitation total is around 1,200–1,260 mm. From a climatological point of view, the assessed area is suitable for a wide range of recreational activities all year round.

Keywords: climatic assessment, air temperature, humidity, cloud cover, sunlight duration

COMPARISON OF THE REFERENCE PERIOD 1961-2000 WITH THE PERIOD 1981-2020

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ABSTRACT

Recently the World Meteorological Organization (WMO) recommended a 30-year period 1991-2020 for the purpose of the comparison of the hydrological and climatic characteristics. However, for the purposes of historical comparison and climate change monitoring, WMO still recommends the continuation of the 1961-1990 period for the computation and tracking of global climate anomalies. In the water management of Slovakia, the reference period 1961-2000 is still valid in decision-making and hydrological regime evaluation. In this work, we have analyzed the changes in the long-term mean annual flows at 113 water-gauging stations over different periods. We analyzed the 40-year-long moving averages of the long-term mean annual discharges in the period 1961-2020 in comparison with the 1961-2000 reference period. Finally, we have compared the actual 40-year-long reference period 1961-2000 with the 40-year-long period 1981-2020. The results show the changes that indicate the need for a new reference period to be used in Slovakia. The new reference period should include the period after the year 2000, where the deviations from the previous reference period are becoming more important.

Keywords: long-term discharge, reference period, N-year moving period

CREATION OF HIGH-RESOLUTION GRIDDED PRECIPITATION DATASET FOR THE AREA OF SLOVAKIA

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ABSTRACT

Long-term gridded climatological datasets are useful for climatology, hydrology and environmental science and the need for them has become more important in recent years. They can supply lacks in station network density and serve as input into further analyses. Herein we present creation of high resolution gridded precipitation dataset for the territory of Slovakia. The presented dataset was created on daily basis in period from 1981 to 2021 with spatial resolution 1x1 km. It was based on data from rain gauge station network in Slovakia and was supplemented by data from totalisators, information from expert knowledge and adjacent rain gauge stations from neighboring countries. The method consists of two steps: firstly, the background monthly precipitation fields for normal periods 1981-2010 and 1991-2020 were computed using kriging with external drift with smoothed 5 km elevation as covariate. Secondly daily precipitation anomalies were computed using inverse-distance weighting. Finally, the daily precipitation data sets were created using the multiplication of the two data layers. Results can serve for further analyses of drought, climate change or hydrological applications.

Keywords: precipitation, gridded dataset, Slovakia, spatial interpolation

DANUBE RIVER HEATWAVES

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ABSTRACT

Rising temperatures significantly impact flowing water systems and their associated ecosystems. Despite limited research on European river heatwaves, this study analyzes water temperature data from 1991 to 2022 at five Danube River gauging stations in Serbia. We aim to understand riverine heatwaves and their link to climate change. Our analysis reveals a warming trend in the Danube River basin, with increasing annual, summer, and winter water temperatures. Riverine heatwaves are more frequent during both hydrological summer and winter, featuring extended durations and high temperatures, especially in summer. Statistical analyses confirm these trends. We also note spatial temperature variations along the Danube, with downstream areas consistently warmer due to geographical and hydrological factors. Riverine heatwaves correlate with low discharge during summer, highlighting the vulnerability of aquatic ecosystems. Some heatwaves occur during above-normal discharge in winter, indicating complex temperature-discharge interactions.

Keywords: Danube, heatwave, temperature, climate change

DROUGHT AND ITS IMPACT ON AGRICULTURE AND FRUIT GROWING IN SLOVAKIA IN 2022

Jakub Ridzoň, Gabriela Ivaňáková, Ivana Krčová, Maroš Turňa

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Corresponding autor: Jakub Ridzoň, Slovak Hydrometeorological Institute, jakub.ridzon@shmu.sk

ABSTRACT

The year 2022 was exceptional for the severe drought, not only in Europe, but also in Slovakia. The drought hit significantly all natural ecosystems and key social-economic sectors, as the agriculture, the energetic industry and the river transport. The drought in 2022 is evaluated by two indices - SPEI and CMI, and also by the intensity of soil drought, relative saturation and the deficit of soil moisture. The analysis of meteorological and soil drought is supplemented by the information of drought impacts, which represents the real influence of drought on the agricultural crops and fruit trees in various regions in Slovakia. The lack of snow covers in winter 2021/2022, the higher average temperature and lack of precipitation in spring and hot waves in summer caused extreme dry conditions on more than half of area of Slovakia and the duration of this drought was locally longer than 200 days. The agriculturists and fruiterers in most regions of Slovakia reported the losses of crop yields.

Keywords: drought, SPEI, CMI, lack of precipitation, drought impacts

DROUGHT SUSCEPTIBILITY OF FIELD CROP SPECIES INFLUENCED BY THE SPATIAL LOCATION

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email – jolankai.marton@uni-mate.hu*

ABSTRACT

Plant growth and development may be influenced by various crop site parameters. An assessment study was done at the MATE University, Gödöllő to evaluate the magnitude of aridity in relation with the geographic location of the crop site. Field crop species (Sugar beet *Beta vulgaris*, winter barley *Hordeum vulgare*, winter wheat *Triticum aestivum*, maize *Zea mays*, potato *Solanum tuberosum*, and alfalfa *Medicago sativa*) were examined in the study. Long term data of twelve meteorological stations (Békéscsaba, Budapest, Debrecen, Miskolc, Mosonmagyaróvár, Nagykanizsa, Nyíregyháza, Pécs, Siófok, Szeged, Szolnok, Szombathely) representing all regions of Hungary were used as a basis of evaluation. PAI indices of each station were processed with vulnerability indices of the field crops studied. According to the results cereals proved to be the least susceptible, while potato and maize were proved to be highly influenced by aridity x vulnerability interactions. Alfalfa and sugar beet were the most endangered crops in the study. The geographic altitude of the crop site has shown negative correlation with the magnitude of drought indices.

Keywords: aridity, crop plants, crop site, vulnerability

EFFECTS OF FERTILIZATION AND CROPS ON SOIL ORGANIC MATTER IN ARABLE SOIL

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ABSTRACT

Soil organic matter (SOM) is a significant soil quality indicator controlling fertility. Studies suggest there is a loss in SOM due to intensive cultivation practice. The present work aimed to study fertilization and crop effects on soil organic carbon (SOC) concentration and SOM composition in cropland. It is part of a long-term experiment to study fertilization effects on soil quality. It was established in 1958 in Hungary, Martonvásár, and characterized by Chernozem soil. Soil samples were collected in April 2019, air-dried, and sieved (<2 mm). They were fractionated into mineral phase-associated organic matter (MPAOM) and aggregate-associated organic matter (AAOM) beside bulk soil. SOM composition and SOC concentration are not affected by fertilization or crops. Only the C:N ratio was high under the NPK+manure treatment compared to the NPK treated plots. The aliphatic carbon (C) was higher in wheat than maize soil. All SOM compositions differed in soil C pools (i.e., AAOM compared to MPAOM) and bulk soil. High SOM stability and SOC concentration were found in MPAOM pool. MPAOM pool is the primary way for C protection in arable soil.

Keywords: soil pools, SOM composition, SOC concentration, fertilization, land uses

EFFECTS OF LAND USE CHANGE ON SOIL ORGANIC MATTER

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ABSTRACT

Degraded soils by intensive cultivation need to be restored for climate change mitigation and adaptation. The research focused on three land use types (grassland, cropland, abandoned cropland) on the same Chernozem. The organic carbon (SOC) was investigated in soil fractions and the bulk soil. The components of the organic matter were also analysed by methods of spectroscopy. SOC content of the topsoil increased significantly due to cultivation stop (2.2%) compared to the cropland (1.8%) but was far below that of the grassland (3.3%). The increase was more remarkable for the mobile SOC fraction (aggregates), although the proportion of more easily oxidised organic compounds was higher in this fraction than in the mineral phase fraction. Cultivation intensity was proportional to the aromaticity of the soil organic matter, indicating increased decomposition under cropland. Cultivation significantly reduced the spatial heterogeneity of the cropland soil. Overall, the 12 years of lack of cultivation were insufficient time to refill the SOC in the mineral phase and none in the fraction of the aggregates.

Keywords: climate change, land use change, soil organic matter, grassland, cultivation

EFFECT OF ROOF SUBSTRATE DEPTH AND RAINFALL CHARACTERISTICS ON RUNOFF REDUCTION

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ABSTRACT

Studies on various substrate depths and vegetation for runoff of green roofs in the climatic conditions of Slovakia are limited. The purpose of this study was to investigate the effects of substrate depth on runoff reduction based on rainfall intensity. A total of 3 modules were implemented with three substrate depths (7, 10, and 14 cm). Three intensities of rainfall were tested using a rainfall simulator; the duration of each rainfall was 15 minutes. The runoff reduction increased significantly with increasing substrate depth. The percentage reduction of runoff between the substrate depth of 7 and 10 cm was approximately 20%. We recorded an even higher reduction (+10%) at the depth of the substrate. These differences were observed for all intensities of simulated rainfalls. These results suggest that as the rainfall intensity increases, the depth of the substrate is more important for runoff reduction.

Keywords: roof substrate, runoff, retention, rainfall

EFFECT OF ZEOLITE MODIFIERS OBTAINED FROM FLY ASH WASTE ON HYDROPHYSICAL PROPERTIES OF POLISH AND SLOVAK SOILS

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ABSTRACT

Some soils used in agriculture have properties that make them unsuitable for growing crops without proper management techniques. Among other things, soil additives are used to improve soil structure and water retention capacity. The main research objective was to determine the effect of zeolite modifiers combined with selected soils of Polish and Slovak origin on their hydrological properties. Poland's soil was characterized as degraded chernozem (silty clay soil), while Slovakia's soils are sandy soil and silty loam soil. As soil conditioners, there was used fly ash (waste generated by coal-fired power plants), a synthetic zeolite produced from fly ash (NaP1FA R102) and a zeolite composite (NaP1C). The results suggest that the application of fly ash increased the hydrophobicity of Polish and Slovak sandy soil and silty loam soil compared to the control 73.02 to 96.22; 8.67 to 24.88 and 29.23 to 33.94, respectively. Nevertheless, saturated hydraulic conductivity was decreased in each case after modifier application. Zeolite materials can modify hydraulic conductivity due to the existence of channels in their structure. It should be noted that zeolites have different effects on different soil textures, and in the case of sandy and silty loam type soils, the use of zeolite can effectively reduce the average particle size, causing the hydraulic conductivity to be lower compared to control soils. The increased contact angle of the modified soils was caused by the presence of silane groups located in zeolite materials.

Keywords: Saturated hydraulic conductivity, hydrological properties, zeolite modifiers

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EVALUATION OF THE WATER BALANCE OF THE SOIL IN THE EAST SLOVAKIAN LOWLAND DURING THE DROUGHT IN 2022

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ABSTRACT

The water supply in the unsaturated zone is the result of the interaction processes of the unsaturated zone with the surrounding subsystems. Water in the unsaturated zone is a source of water for the biosphere. This source supplies water to the vegetation cover during the growing season. The water in this source does not have the properties of free water. In order for plants to be able to use it, they must have a developed root system and a suction pressure that is able to overcome the binding of water with the soil. Information on the temporal and spatial distribution and dynamics of moisture in the unsaturated zone of the soil environment is crucial for agricultural production, water management in the country and the design of adaptation measures. In the past vegetation period of 2022, it was possible to see the manifestations and feel the consequences of the lack of water in the unsaturated zone of soils on the territory of Slovakia. In East Slovakian Lowland conditions, the lack of water manifested itself in the form of soil drought. In this study, the components of the water regime of the soil in the Milhostov area of the East Slovakian Lowland during the vegetation period of 2022 are quantified and analyzed. The database for the analysis was obtained by monitoring and numerical simulation on the HYDRUS mathematical model. Extremely small actual evapotranspiration was identified, only 3.2% of potential evapotranspiration. The significant influence of the groundwater level on water reserves in the root zone of the soil profile was confirmed. In the form of an isoline, the course of moisture along the vertical of the soil profile during the growing season is shown.

Keywords: soil water regime, unsaturated zone, monitoring, numerical simulation

EXTREME OF DROUGHT IN 2022 ON SLOVAK AREA AND DROUGHT IMPACT ON NATURALLY AND ARTIFICIAL RENEWABLE

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ABSTRACT

In the last decade, there were several significant dry periods (2015, 2018), but in 2022, especially during the summer months, we recorded the most significant period of drought in the Slovak area. From September 2021 to August 2022, the spatial total of precipitation was below 500 mm, which represents the lowest value in 142 years. In our work, we studied the occurrence and intensity of drought as well as its impact on young forest stands (cultures, natural regeneration) of the main economic trees (Spruce, Fir, Pine, Beech, Oak). We recorded data on the negative effects of drought on trees through weekly drought monitoring reports from foresters from all over Slovakia. The length of the dry period ranged from 160 to 204 days, depending on the locations. According to the reporters estimates, we recorded the lowest water supply in the soil from the 20th to the 32nd week. The worst estimated impacts of drought on artificial regeneration were recorded mainly from 25 to 30 weeks, within natural regeneration from 26 weeks to 35 weeks, while drought impacts on natural regeneration were 20 % lower compared to the artificial regeneration. In the framework of artificial regeneration, the worst negative impacts were recorded on fir, spruce, and beech, and of natural regeneration, especially on spruce.

Keywords: drought, natural regeneration, artificial regeneration, drought impacts, national reporting network

GAP-FILLING OF THE MISSING SOLAR RADIATION DATA USING MACHINE LEARNING MODELS

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ABSTRACT

Solar radiation is the main driver for evapotranspiration processes. Solar net radiation, commonly used to calculate reference evapotranspiration, is usually calculated from actual sunshine duration; however, these data are often unavailable in meteorological stations with demanded length of measurement. Although the actual sunshine duration is possible to estimate with the empirical model, the results of our pilot study showed very poor accuracy using that method. The research aimed to find a method for gap-filling missing solar net radiation values using remote sensing-based datasets and machine learning models. Sixty meteorological stations where the length of daily solar net radiation measurement was more than 50% between 1980-2020 were selected for this analysis. Reference solar net radiation data were calculated using FAO56 methodology. Three reanalysis datasets were used to recognize the most accurate dataset- Era5, Era5-Land and Merra-2. Merra-2 showed the best precision with a mean absolute BIAS of 35,55% and a mean Pearson correlation coefficient of 0.88. Random forest regressor model, Support Vector Machines model and Multiple linear regression model were applied for modelling the missing data using Merra-2 data, extraterrestrial radiation and maximum possible sunshine duration data. The results show the best Random Forest Regression model performance for modelling missing solar net radiation data.

Keywords: solar net radiation, machine learning, remote sensing

GROWING SEASON IN CHANGING CLIMATE

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ABSTRACT

The climate assessment is based on a comparison with the previous period at various stages of the development. For that purpose, long-time series of observations and measurements are created. At their inception, they go through a system of controls (completeness, exceeding limits, consistency, spatial control and statistical control). Agreed (data revision) data are gradually stored in the database. After a designated period, typically 30 years, a standard in climatology, long-term averages are computed utilizing data from as many stations as possible. However, completion requires a lot of effort, as many data series are often incomplete due to record breaks and relocations, albeit within related locations. The fact that the climate is changing is evident through the analysis of numerous meteorological elements and their characteristics. In this paper, we focused mainly on the air temperature during the growing season, based on the characteristic temperature thresholds (5 °C, 10 °C and 15 °C). The WMO methodology was used to prepare a 30-year time series classified as normal for the period 1991-2020. This dataset will be the basis for identifying changes. We are aware that in the case of a change in air temperature, it is only a matter of mitigating an already observing change, e.g. against the period 1981 - 2010, resp. even greater difference compared to 1961 - 1990. In the overall trend, however, we observe a continuous increase in air temperature, which is reflected in many indicators, such as the shift (occurrence) of the onset (earlier) and termination (later) of characteristic air temperatures that affect various sectors (agriculture, fruit growing, tourism etc.). At the same time, the change in circulation leads to greater variability, which causes considerable damage. Climate change causes the appearance of unexpected phenomena and values even in seasons and locations where they were not expected in the past, either positively or negatively. The submitted contribution can serve as a standard for the expected start and termination of agricultural works. At the same time, it will indicate possible (highly likely) changes in the duration of the growing season in different locations and altitudes.

Keywords: growing season, climate change, characteristic air temperatures, normal period (WMO).

HOW CLIMATE CHANGE WILL AFFECT SUB-DAILY RAINFALL INTENSITIES

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ABSTRACT

Time series of 3-hour precipitation totals obtained from several EURO-CORDEX models (RCP8.5) were processed to derive ensembles of future rainfall frequencies. The spatial domain was limited to the territory of Slovakia and its neighboring countries. Annual maxima series of 3-hour precipitation totals were identified to estimate quantiles corresponding to return periods of 2 to 100 years using the Generalized Extreme Value (GEV) distribution in a non-stationary form, allowing the shape parameter to vary over time. Additionally, station rain gauge data, including self-recording and automatic rain gauges from Slovakia, were used to derive rainfall quantiles. Historical runs from 1991 to 2005 and projections from 2006 to 2020 of the Regional Climate Models (RCMs) were combined and corrected for bias against station-based historical quantiles of 180-minute rainfall intensities from 1991 to 2020. Defining envelope curves of short-term rainfall intensities for aggregation times ranging from 5 to 180 minutes allowed us to estimate quantiles of sub-hourly rainfall frequencies for the time horizons of 2040 and 2080. The resulting raster maps were subsequently re-gridded into a regular grid with dimensions of 500 by 500 meters using non-linear triangulation. For the Slovak portion of the investigated domain, the regional climate models indicate that rainfall intensities are likely to increase by approximately 20-30% by 2080. The RCMs used in this study also suggest that the quantiles derived from RCMs without bias correction tend to underestimate 3-hour quantiles by as much as around 20% for return periods of 5 to 50 years.

Keywords: rainfall intensities, regional climate models, bias correction

HOW TO MODIFY THE STRUCTURE AND POROSITY OF SOILS? - RESEARCH BASED ON MODEL SOIL AGGREGATES CONCERNING THE USE OF DIGESTATE AS AN ORGANIC SOIL ADDITION

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ABSTRACT

Soil resources are non-renewable, and the soil itself is an extremely complex and dynamic medium. With the constantly increasing area of soil with various forms of degradation, new methods of land revitalization are being sought. For this reason, various soil enrichment techniques are being tested, including the application of different organic additives into the soil (Pranagal et al. 2023). In recent years, the use of digestate has become more and more common. This is because of its possible impact on a wide range of soil's physical, chemical and biological properties (Gryń et al. 2020). Although the spatial arrangement of organic particles and pore size distribution plays a key role in the accumulation and preservation of organic matter in soil, how digestate modifies pore structure is poorly understood. Our research aims to determine the effect of post-fermentation sludge on model soil aggregate structure and porosity. The organic sludge was taken from the agricultural biogas plant and mixed with soil at different rates. From those mixtures, model soil aggregates were prepared in special plexiglass forms. The changes in soil structure were investigated by mercury porosimetry and scanning electron microscopy observations combined with energy dispersive spectroscopy. The results revealed that organic sludge affected the pore size distribution of model aggregates. In general, the addition of digestate caused an increase in the porosity, total pore volume and average pore diameter and diminished aggregate bulk density. The intensity of observed changes depended on organic sludge concentration.

Keywords: digestate, porosity, SEM-EDS, structure, soil.

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HYDROLOGICAL REGIME AND OCCURRENCE OF DROUGHT IN GROUNDWATER FOR THE PERIOD OF YEARS 2011 - 2022

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ABSTRACT

Drought in groundwater is increasingly occurring even in the temperate climate zone. At SHMÚ, drought has been assessed since 2011. The SANDRE method was used for this assessment. 62 springs and 141 boreholes were processed. Significantly dry years were the years 2012, 2019 and 2022. The years 2013 and 2021 were evaluated as above average. The hydrological regime of groundwater and its changes evaluated as part of the drought for the period of 2011 -2022 in monthly step compared with the reference period 1981 – 2010 show decreases, either in the level of groundwater or the yield of springs. The most sensitive areas in Slovakia for impact of drought (2011 – 2022) were north, partly middle part and east part of Slovakia.

Keywords: groundwater drought, SANDRE method, hydrological regime

CHANGES IN HUMIDITY CHARACTERISTICS IN SLOVAKIA SINCE 1961

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ABSTRACT

The main aim of the work was to investigate how the humidity characteristics have changed and to what extent the country/regions have a drying tendency. We used data of the Penman and the Budyko – Zubenokova's potential evapotranspiration, Tomlain's irrigation indicator and the SPEI to investigate changes in the moisture characteristics. The SPEI is used in operational way for meteorological drought monitoring in Slovakia. The PET considered in the SPEI is estimated according to the Penman-Montheit method, which is also recommended by WMO. To obtain the regions with negative atmospheric evaporative demand, we used the relative SPEI using the coefficients of the theoretical distribution estimated for the spatial averaged data of the PET and precipitation. These coefficients were applied to calculate the SPEI using the station data. Three reference periods were compared: 1961-1990, 1981-2010 and 1991-2020. The comparison of the different reference periods has shown that the annual precipitation sums increased slightly, but their increase does not cover the increase of the PET resulting in the drying tendency. The highest negative change was observed in the south-western and south-eastern part of Slovakia hitting the lowland regions with intensive agricultural land use.

Keywords: potential evapotranspiration, SPEI, Tomlain's irrigation indicator, drying tendency

CHANGES IN SORPTION OF NITRATE AND PHOSPHATE IONS IN SOIL WITH BIOCHAR AMENDMENT

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ABSTRACT

Biochar is one of the tools used in agricultural practice to improve soil properties. Several studies have shown an increase in soil retention capacity and also a longer retention of water soluble nutrients in soil with the addition of biochar. In this paper, we focused on whether and how biochar can affect the sorption of nitrate and phosphate ions in soil. Sorption measurements were made in the laboratory on samples of pure soil, soil amended with biochar at 20 t. ha⁻¹ rate and reapplied biochar at the same rate. The results showed that the sorption of nitrate ions increased by half at plot with biochar and twice at plot with biochar reapplication, in comparison to control. The sorption of phosphate ions increased by 13% at plot with biochar and by 30% at plot with biochar reapplication compared to the control.

Keywords: biochar, silt loam soil, nitrate ions, phosphate ions

CHARACTERIZATION OF PALEOSOL-LOESS LAYERS UNDERSTANDING MODIFICATION PROCESSES

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ABSTRACT

Paleosols' chemical and physical behaviour depends on different processes, such as climate, reworking, weathering, and connection with different fluid systems. For this reason, it is important to know how we can distinguish among the different processes. This study focused on three different kinds of loess-paleosol systems (from Zebegény, Nagymaros, and Bácsaapáti, Hungary). We analyzed the chemical and physical behavior to understand the processes affecting the system. For this reason, granulometry, mineralogy, organic material, and susceptibility were also studied. The results show that the three paleosol-loess systems were not reworked, however, macro morphology suggested the opposite in two cases (Nagymaros, Zebegény). Furthermore, the climate in two cases was rainy (Zebegény, Nagymaros), and one was alternating (dry and rainy periods). The main result of weathering is the clay mineral precipitation, mainly smectite in all areas.

Keywords: paleosol, weathering, reworking, granulometry, mineralogy

IDENTIFYING AND REMEDIATING RED MUD CONTAMINATION IN SOIL

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ABSTRACT

Research on the soil effects of the red sludge disaster has received considerable attention. This pollution is known to alter the soil's pH and induce changes in its processes and environmental conditions. After contamination, the conventional approach involves time-consuming sampling and extensive laboratory analyses to ascertain the extent of the pollution, often resulting in exorbitant remediation costs. In this current study, we have devised a straightforward method for conducting on-site contamination assessments by leveraging pH measurements and calibrated additives. These estimations provide a means to restore the soil's pH to its original state. To achieve this, we have employed a distillery by-product, which not only serves as a practical solution for remediation but also presents a valuable source of organic matter and phosphorus to enrich the soil.

Keywords: red mud, pH, remediating

IMPACT OF CHEMICAL MODIFICATION ON PHYSICOCHEMICAL PROPERTIES OF BIOCHAR AND ON HYDROPHYSICS PROPERTIES OF SOIL CLAY MINERAL

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ABSTRACT

The process of degradation of soils is a serious worldwide problem. The solution may be organic adsorbents, e.g. biochar (BC). However, these ecological materials are often characterized by insufficient parameters and it is necessary to modify them. The study aimed to modify BC with ammonia hydroxide and citric acid to enhance the physicochemical properties of BC and hydrophysical properties of soil clay mineral (montmorillonite – M). The BC was derived from wheat straw at 650°C. The characteristic included specific surface area, total pore volume, FTIR spectra, surface charge density, pH, and elemental composition. The hydrophysical properties (bulk density, porosity, particle density, saturated hydraulic conductivity) were measured. The M was mixed with BC, amino modified BC – BCN, and citric modified BC – BCA at 1% of the dosage. The reagents changed the nature and surface chemistry of biochars by introduce new amine and ester groups. The BCs application significantly improved hydrophysical properties of M i.e. the BCN generated the highest increasing of saturated conductivity and the BC the lowest.

Keywords: wheat straw, pyrolysis, chemically modified biochar, montmorillonite

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INVESTIGATION OF SOIL PROPERTIES INFLUENCING ADSORPTION-DESORPTION PROCESSES OF PHARMACEUTICALLY ACTIVE COMPOUNDS (PHACS) IN SOILS

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ABSTRACT

Several challenges faced by the agricultural sector, such as water scarcity due to global climate change PhACs are released into the agricultural environment through number of pathways, such as treated or untreated effluents of wastewater treatment plants (WWTPs) or improper waste disposal. The environmental risk from PhACs is mainly controlled by adsorption and desorption processes in the soil and changes in environmental parameters affecting these processes. Soils with different physical and chemical parameters were sampled to investigate the factors influencing sorption processes. Adsorption/desorption experiments were performed by conforming to the OECD 106 guidelines using a batch equilibrium method. The tested PhACs adsorbed to the higher extent on the topsoil samples with high organic matter content. The adsorbed amount decreased with depth in the soil profile. The extent of desorption increased gradually with depth, due to decreasing organic matter content. Higher clay content also decreased the desorption of PhACs. Consequently, as the organic matter content decreases, the risk of desorption and leaching of hydrophobic pharmaceuticals increases.

Keywords: PhACs, adsorption, desorption, soil organic matter

MICROCLIMATIC CHANGES OF CLIMAX MOUNTAIN SPRUCES DUE TO THEIR CALAMITOUS DISINTEGRATION IN WESTERN TATRAS - TANAP

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ABSTRACT

Microclimate of climax spruces provide us important information's about soil-air environment in forest stand e.g., about basic data about air, soil temperatures and about another micrometeorological components. Growing nature risks and catastrophes for example temperature extremes, drought, forest and land fires, rainfall, windy and spruce bark beetle calamity are doubtless signs of human conditional global climate change. These changes can change microclimatic and hydrological conditions of forest environment. We carried out measurements in three-day time interval from 18.7. until 20.7. 2022 on these areas: dead forest, forest edge, open area, living forest. The research areas are located in Western Tatras (TANAP) on the research object Červenec in 1450 m a.s.l. Micrometeorological measurements temperature of air and soil were carried out by using micrometeorological station consisting of measurements devices (Minikin i-line), which measure air temperature on the Earth surface in altitude (5 cm, 50 cm, and 200 cm). We are used device Microlog T3 with three sensors Pt1000 (-2 cm, -5 cm, and -10 cm) for measure of soil temperature. Measured values which were divided in two intervals (ten minutes interval and hour interval), for better representation of progress temperature. The aim of this study is to compare impact of calamitous stages of forest disintegration on air, soil temperature. The obtained knowledge about changes of forest microclimate of mountain spruces as the result of their calamitous disintegration provide valuable knowledge for regeneration of future forest, and for his protect from forest fires.

Keywords: microclimate, air and soil temperatures, mountain climax spruces, calamitous disintegration, TANAP

MONITORING AND DOCUMENTATION OF THE NATURA 2000 SITE “GR2310001” IN RIVER ACHELOOS DELTA, GREECE

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ABSTRACT

River Acheloos Delta is a wetland of international importance, protected by Ramsar Treaty and Natura 2000. It is a complicated hydrosystem of natural lakes and artificial dam-lakes, lagoons and parts of river Acheloos. It is characterized by very competition uses of water, which the most important of them are: a) Hydroelectric Production, b) Irrigation, c) Anti-flooding control, d) Domestic water supply and e) Ecological Preservation. The natural environment has been transformed into a fully anthropogenic one, after the construction of the dams of Kremasta in 1965, Kastraki in 1969 and Stratos I & II in 1989 from Public Power Corporation of Greece (DEH) for hydroelectric production, but also serves the uses above. According to the Legislations (129264/23-05-2007 & 205198/18-11-2011 Ministerial Agreements) the human intervention due to anthropogenic activities in Acheloos Delta, needs to be investigated, if they are compatible with the protection and preservation of Natura 2000 habitats area “GR2310001”. A monitoring program took place, for the documentation of these areas, under the cooperation of PPC (Public Power Corporation of Greece) with Laboratory of Ecohydraulics & Internal Water Management (ECO-HYDRO Lab). After the field work, the documentation of the habitats and the mapping of the study area, it appears that the current state of Acheloos Delta has not been significantly affected and the complicated hydrosystem has reached a dynamic equilibrium between the natural processes combined with the anthropogenic interventions. Finally, it is checked that the norms of the Environmental Flows Legislation have been taken into account.

Keywords: river Acheloos delta, Natura 2000, GR2310001, monitoring, documentation, human intervention

NUMERICAL SOLUTION OF UNSTEADY FLOW EQUATIONS USING GODUNOV-TYPE METHODS IN IRREGULAR CROSS-SECTION RIVERS

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ABSTRACT

The shallow-water equations have a wide range of applications in hydraulic engineering, including the simulation of tidal flows in estuaries and coastal regions, wave propagation, stationary hydraulic jumps, river dynamics, dam breaks, and open channel flows. To model real-world problems accurately, it is necessary to incorporate source terms associated with bed topography and bed shear stress into these equations. In this paper, we present a numerical solution for the shallow-water equations with source terms in irregular cross-section rivers. We utilized a Godunov-type finite volume method and the Riemann solver Roe. To achieve second-order accuracy in both space and time, we employed the MUSCL algorithm. Additionally, to ensure method stability in the presence of extreme and abrupt gradients, we incorporated slope limiters and the TVD method. The results demonstrate the high accuracy and numerical stability of the developed model, making it a suitable option for simulating flow dynamics in natural water bodies.

Keywords: Shallow-Water Equations, Godunov Method, Riemann Solver, MUSCL scheme, Dam Break

PORE-SIZE DISTRIBUTION IN SILTY LOAM SOIL WITH BIOCHAR

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ABSTRACT

Biochar appears to be a suitable material for improving the physical, chemical and biological properties of the soil. However, the improvement depends on several factors such as soil texture, biomass, pyrolysis temperature, biochar fraction size or application rate. In our study we focused on biochar application in the rate of 20 t.ha⁻¹ in to silty loam soil. Mixtures of silty loam soil and biochar were prepared in laboratory conditions. All 3 treatments (with biochar particle size: > 2 mm, 125 µm – 2 mm and < 125µm) were prepared in 3 replicates. These prepared mixtures were compared with the control treatment (without amendments), which was also prepared in 3 replicates. The results clearly indicate that a size fraction <125 µm has the best results in increasing the water content in macro (>50 µm) and meso (15–50 µm) pores compared to the reference soil and other size fractions of biochar. In the case of micro pores (<15 µm), the average values on the treatments with biochar were lower than on the reference soil, but the overall range of measured moisture values was higher on these treatments than on the reference soil.

Keywords: pore–size distribution, soil water content, biochar

PRECIPITATION AND CLIMATIC WATER BALANCE AFFECT THE ONSET OF LEAF COLOURING IN OAK (QUERCUS SP.) FORESTS IN THE WESTERN CARPATHIANS

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ABSTRACT

Climate change is accompanied by irregularly distributed precipitation throughout the year and the occurrence of drought periods. These drought periods during the vegetation growing seasons significantly affect physiological processes in plants; therefore, in many ecosystems, they are considered a limiting factor with ecological and economic consequences. In our study, we analysed the effects of climate conditions, including precipitation, climatic water balance, and temperatures, on the beginning of leaf colouring (BBCH94) of oaks (*Quercus* sp.) in individual forest vegetation zones (FVZ). Phenological stations with oak trees are located in the Western Carpathians and adjacent plains, in alluvial forests (FVZ 0) and from FVZ 1 (oak) to FVZ 4 (beech). Meteorological and phenological data from these stations cover two climatic normal periods: 1961-1990 and 1991-2020. The results of partial correlations indicated a significant effect ($p < 0.05$) of temperature and precipitation variables on the onset of BBCH94. Specifically, higher minimum and average temperatures, particularly in September, led to delayed BBCH94 in FVZs 0 to 3. Conversely, decreased precipitation and adverse climatic water balance during the summer months resulted in earlier onset of BBCH94 in FVZs 0 to 2. In addition, the differences in the climatic water balance between the two normal periods indicated an increase in summer drought over the last 30 years in FVZ 1 (oak) and 2 (beech-oak). Following these results, we concluded that the drought periods are becoming a significant limiting factor for the length of the growing season in oak forests, particularly in FVZ 1 and 2.

Keywords: climate change, precipitation, climatic water balance, phenology, oak

SCENARIOS OF AIR TEMPERATURE AND RELATIVE HUMIDITY IN HURBANOVO IN THE PERIOD UNTIL THE YEAR 2100 BASED ON OUTPUTS FROM MPI AND KNMI REGIONAL CLIMATE MODELS

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ABSTRACT

In the contribution, we evaluate the results that were achieved for the air temperature and relative air humidity in Hurbanovo based on the measurements, and we prepared a scenario for their further development until the year 2100 (in a daily step) based on the outputs of the MPI and KNMI regional climate models (with SRES A1B emission scenario). Attention is also paid to singularities in the annual course of air temperature and the duration of some typical air temperatures spells ($T \leq 0^\circ\text{C}$, $T \geq 5^\circ\text{C}$, $T \geq 10^\circ\text{C}$, $T \geq 15^\circ\text{C}$, $T \geq 20^\circ\text{C}$, $T \geq 25^\circ\text{C}$) at Hurbanovo in different periods. The obtained results show that the air temperature in Hurbanovo has been increasing from 1901 to the present, and according to the climate models, this growth will continue until the end of this century. The results of the average annual relative humidity in Hurbanovo show a gradual slight decrease in different periods between 1901 and 2020 and, according to both climate models, a further slight decrease at the end of this century.

Keywords: air temperature, relative humidity, climate scenarios, regional climate models

SNOW ACCUMULATION AND SNOW DEPTH IN SLOVAKIA IN THE 1921 – 2021 PERIOD

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ABSTRACT

Warming surface temperatures have driven a substantial reduction in the extent and duration of Northern Hemisphere snow cover. Analysis of the long-term snow cover data can provide an exact picture on the climate change induces changes. Slovak Hydrometeorological Institute maintains a network of 113 precipitation measuring stations with daily observations of the snow cover depth since 1921. This paper presents analysis of the cumulative snow cover depth in the territory of Slovakia in the period 1921 - 2021. Such an approach to processing can effectively point to changes in the seasonal development of the snow cover. The results show that, in general, we observe a decrease in the snow cover, which began to become more pronounced especially in the course of the 21st century. The magnitude and speed of the detected change is significantly influenced not only by the altitude of the precipitation gauge, but also by its geographical location.

Keywords: snow, snow cover, snow depth, climate change,

SPATIO-TEMPORAL TRENDS IN EARTHWORM COMMUNITIES IN THE GÖDÖLLŐ HILLS LANDSCAPE PROTECTION AREA IN HUNGARY

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ABSTRACT

Earthworms are known to be ecosystem engineer species. Spatio-temporal monitoring of earthworm communities looks back to several decades-long history, however, key driving factors of their assembly are still not clearly defined. In the Gödöllő Hills Landscape Protection Area, sampling was performed every month in 2023 on the top of Margita Hill and further below on the hillside. Same soil samples of 25×25×25 cm have been dug out every month and hand sorted for earthworms (5 replicates) at both sites to quantify the abundance and biomass of earthworms and test the hillside hypothesis. Altogether 6 earthworm species were found and some show different spatio-temporal distributions. Soil samples were measured using a portable near InfraRed (NIR) device. No soil parameters had a significant effect on earthworm abundance and biomass. Significantly more earthworms in some samples and big variations in sampling sites might lead to the conclusion that the aggregation of earthworm communities is driven primarily by demographic reasons. The hillside hypothesis was only accepted for biomass as it was found to be significantly bigger at the bottom of the hill than at the top.

Keywords: nature conservation, spatio-temporal monitoring, land use, earthworm communities, earthworm abundance

STUDY OF LARGE GLACIER RETREAT IN RIVERS ENGURI AND RIONI BASINS

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ABSTRACT

The retreat of large glaciers is an excellent indicator of climate change. At the same time, the study of the retreat of large glaciers is necessary to characterize the degradation of the glaciological basin. An effective solution to this problem is possible only by using high-resolution Earth satellites because these effective remote sensing tools can dynamically record the retreat of large glaciers. From the second half of the 20th century the large glaciers are retreating and this process is accelerating due to the non-linearity of modern climate change. The objective of the article is analytically describe the dependence of large glaciers retreats on time. Under certain assumptions, it allows us to determine the approximate date of the complete melting of large glaciers. The retreat dynamics of the r. Enguri Basin large glacier North Liadeshti and the r. Rioni Basins' large glacier Kirtisho (Georgia) is discussed and the analytical characteristics of their retreat are determined. Based on the Business as Usual scenario of climate change full melting dates of the glacial basins of rivers Enguri and Rioni (Georgia) are investigated. Using the results of previous studies of the other large glaciers of r. Enguri and r. Rioni glacial basins expected time of full melting of mentioned glacial basins can be determined

Keywords: glacial basins, large glaciers, retreat, climate change, satellite remote sensing

SUBSOIL ORGANIC MATTER STABILIZATION BY SOIL MINERALS

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ABSTRACT

Soil organic matter (SOM) content and composition are the focus of the current research activities as they play a crucial role in soil health and climate change mitigation. The subsoil contains half of the SOM, however, only a limited amount of studies dealt with organic matter stabilization in the subsoil. Modeling organic matter leaching into the subsoil, a fulvic acid standard was adsorbed on separate quartz, montmorillonite, mica, and goethite standards and a natural tuff. The adsorbed organic matter was characterized by HPLC from the liquid phase, the organic-mineral complexes by FTIR, and scanning electron microscopy (SEM). Preliminary results suggest the varying SOM binding capacity of the minerals in the quartz < mica < montmorillonite < goethite order. In contrast, SEM indicated a more or less homogeneous SOM coating on the tuff's various sized and mineralogical composed particles. Consequently, actual SOM attachment on the mineral surface is presumed to be the holistic result of many environmental parameters.

Keywords: organic matter stabilization, organic-mineral complex, leaching water

THE EFFECT OF LAND COVER/USE ON ANTIBIOTIC ADSORPTION IN VARIOUS SOIL ORGANIC CARBON POOLS

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ABSTRACT

As a result of climate change, irrigation with treated wastewater and the discharge of sewage sludge on agricultural land is expected to become increasingly common in continental countries. Pharmaceuticals, specially antibiotics present in high concentrations in treated wastewater will have an impact on the soil system. How each soil organic carbon (OC) pool affects the adsorption properties of bulk soils is important not only for a healthy soil ecosystem, but also for the OC decomposition time. To get a better insight into the role of soil carbon pools on adsorption, Fluoroquinolon antibiotics was tested with Batch method on 3 Luvisol samples from different land use/cover area and their fast and slow organic carbon pools. For soil with a high organic matter supply (forest), the slow pool had a remarkably high adsorption capacity. For soil under arable land, there was no significant difference between the adsorption parameters of bulk soil, and OC pools. The slow pool dominated the adsorption parameters of the whole soil in all land use/cover soils. Soil texture is the strongest factor affecting adsorption, organic matter quality mainly affects adsorption in soils with less organic matter.

Keywords: antibiotics, adsorption, organic carbon pools, principal component analysis

THE EFFECT OF VARYING PH OF THE RHIZOSPHERE ON THE SORPTION OF PHARMACEUTICALLY ACTIVE COMPOUNDS

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ABSTRACT

Continuously varying pH during the growing season can primarily affect the sorption processes of pharmaceutically active compounds (PhACs) in the soil-solution system (SSS). At the interface of the rhizoplane-rhizosphere, the generated root-assimilates (LMWOAs) are capable of modifying the sorption of PhACs. In our research owing to this, the sorption interactions of two PhACs at different pHs have been modeled. The experiments were carried out in calcaric-humic arenosol. The pH of the SSS has been modified by LMWOAs (oxalis-, citric acid) and non-organic compounds (hydrochloric acid, sodium hydroxide). The sorption mechanism of PhACs was analyzed by adsorption isotherms. The results were assessed using principled component analysis. In this study, these questions were sought: (a) Do the LMWOAs and the inorganic compounds affect the sorption interactions of these PhACs? (b) Are there differences in how LMWOAs and non-organic compounds affect intermolecular reactions between adsorbent and adsorbate? Results show that LMWOAs can provide extra adsorption sides, while non-organic compounds alter sorption processes through their pH-modifying effects.

Keywords: sorption, PhACs, LMWOAs, arenosol, rhizosphere

THE IMPACT OF CLIMATE CHANGE ON THE DIFFERENT LAND USE SECTORS IN RIVER BASINS IN GEORGIA

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ABSTRACT

Georgia has a highly diverse physical geography, comprised of mountains, plateau, lowland-plains, glaciers, wetlands, arid areas (semi-deserts), lakes, and rivers. Georgia has extensive forests, which cover approximately 39% of national territory and the country's forests display a rich biodiversity of over 800 different types of trees and bushes. Forests will be impacted by several natural hazards such as landslide, and also increases in pests and diseases are expected. Climate change is expected to impact food production via direct and indirect effects on crop growth processes. Direct effects include alterations to carbon dioxide availability, precipitation and temperatures. Indirect effects include through impacts on water resource availability and seasonality, soil organic matter transformation, soil erosion, changes in pest profiles and the arrival of invasive species, as well as declines in arable areas due to the submergence of coastal lands. The aim of this paper is to analyze the impacts of climate change on land use in Georgia. Based on available expert studies, the impact of climate change will be significant. Just as land use will change due to climate change, the more it will affect the runoff processes in the country.

Keywords: climate change, land use sector, forestry

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THE IMPACT OF HEATING ON THE WATER REPELENCE OF SANDY FOREST SOIL.

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ABSTRACT

The water repellency of forest soil caused by heating is controlled by various factors (temperature reached, amount and type of vegetation, soil properties). After wildfires, highly variable water repellency soil conditions of importance to soil hydrology have been found. Soil samples of mineral forest soil from the investigated area were taken from a layer to a depth of 25 mm and heated at temperatures from 50°C to 900°C to 100°C. We measured the infiltration time of a drop of water into the soil using the water drop penetration test method. The water repellency of sandy soil is different in coniferous and deciduous forests. In a coniferous forest, the soil is extremely water-repellent at temperatures of 20°C, 100°C, 200°C, 300°C, 400°C. The water repellency of soil in a coniferous forest disappears at 500°C. In a deciduous forest, the soil is not water repellent at 20°C and 100°C. Water repellency occurs at 200°C and at 300°C we found extreme water repellency. The water repellency of soil in a deciduous forest disappears at 400°C.

Keywords: soil water repellency, soil heating, water drop penetration test, sandy forest soil

THE IMPACT OF RODENTS ON SOIL PARAMETERS ON ARABLE FIELD

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ABSTRACT

Arable field suffer tremendous pressure from rodents in Hungary. Their digging activities can affect soil attributes, mainly due to the mixture of lower and upper part of the soil. This is the reason that changes greatly depend on the thickness and other parameters of the soil profile. Samples of soil materials removed and piled up on the surface by rodents and the nearby intact soil were analyzed to evaluate 12 soil parameters by a NIR device (e.g. SOM, N, P, K, Ca, Al, pH, etc.). Our aim was to show differences between the freshly remove soils of the lower layers, if there were any possible mixing effect that might change the soil forming processes. We found no statistical differences in the measured parameters in the chosen sample area. However, there are obvious trends, e.g. soil organic matter is usually lower in the materials removed from the lower layers. Statistically only the pH was close to the limit ($p=0.055$). More samples are needed to prove the effects that can be measured. Furthermore, there are more effects that can only be measured with other methodologies, e.g. macropores cause more infiltration and also affect heat and other aeration processes.

Keywords: bioturbation, soil formation, trend, chemical properties, NIR

THE IMPACT OF WILD BOAR ROOTING ON SOIL CHEMICAL ATTRIBUTES ALONG A SLOPE – COMBINED EFFECTS OF BIOTURBATION AND WATER EROSION

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ABSTRACT

Disturbances highly affect soil parameters, species richness and water erosion. A grid-based field experiment at Vörös-kővár hill of Budapest, Hungary was conducted on 125 cells, each 20×20m large along a 500m long grassy slope. Soil samples of wild boar rootings from the upper and lower slope sections were analyzed to evaluate organic matter content, water moisture and the concentration of essential macroelements (e.g. N and P). Our aim was to reveal how interacting effects of soil disturbances and water erosion shape nutrient composition of the topsoil. We confirmed statistical differences in nutrient content between rooted and intact soil and between upper and lower slope sections. Organic matter, nitrogen and moisture was affected only by wild boar rootings; clay content differed in function of slope only; while P had different concentrations between slope locations and when the rooted and intact soils were contrasted. However, the interaction effect between slope and rooting was not significant, indicating that wild boar impact on soil nutrient composition was uniform along the slope and water erosion affects other attributes of the soil than this bioturbation.

Keywords: *Sus scrofa*, grubbing, NIR, soil organic matter, runoff

THE INFLUENCE OF BED SEDIMENTS ON THE FLOW CONDITIONS AT GABČÍKOVO - TOPOĽNÍKY CHANNEL, ŽITNÝ OSTROV

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ABSTRACT

The aim of this paper was to find out the consequences of Gabčíkovo – Topoľníky channel silting up, the one from three main channels of Žitný ostrov channel network, to the flow conditions at this channel. This article deals with appraising of results from the field measurements at Gabčíkovo – Topoľníky channel for period from 2018 to 2023. The area of Žitný ostrov is flat land and the velocities in all channels of channel network are very slow. The occurrence of small velocities is considered for main reason of sediment's aggradation at channel bed. The flow profile of channels is reduced by increasing of thickness of bed sediments and in consequence of permanent sedimentation processes is adversely changing not only the cross-section of channel, but also its longitudinal profile. The volume of sediments is growing, too. Bed sediments, its thickness and texture have the important impact to interaction between surface water in channels of ŽO network and groundwater in its surroundings. There were performed the detailed field measurements of bed sediment thicknesses along the Gabčíkovo-Topoľníky in 2018 and 2023. Based on the calculation of the values of the average thickness of the bed sediments, there was determined the longitudinal distribution of the bed sediments along the G-T channel, the percentage of silting of the flow area in this channel and the values of the volumes of bed sediments in the G-T channel for the monitored period. The results of these measurements are summed up in all tables and figures of this paper and their comparison indicates the growing trend of longitudinal silting up of this channel and the volume quantity of bed sediments during the observed period.

Keywords: channel network, bed sediments, cross-section, longitudinal profile, volume of sediments

THE INFLUENCE OF BIOCHAR PREPARATION ON SELECTED SURFACE-CHARGE PROPERTIES OF BIOCHAR-AMENDED SILTY LOAM

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ABSTRACT

Numerous studies conducted on biochar in recent years indicate high potential of this material in modification of the chemical and physicochemical properties of soils. In particular, biochar may influence soil capacity for chemical retention of cations by providing valuable organic compounds with varying acidity. This effect, however, seems to be strictly dependent on the properties of biochar. In view of the above, the aim of this research was to analyze the influence of the pyrolysis temperature, particle size and dose of biochar on the negative surface charge and the distribution of apparent dissociation constants of functional groups of biochar-amended silty loam. Measurements were performed using the potentiometric titration method for soil mixtures with 0-5% doses of biochar produced at 300°C and 520°C and fractionated into two groups of particle sizes: <125µm and 125µm-2mm. The results allowed to illustrate quantitative changes in the negative surface charge, as well as qualitative changes in the distribution between strongly acidic, medium and weakly acidic functional groups. The dynamics of these effects may be important in predicting the retention of micro and macronutrients.

Keywords: biochar as soil conditioner; soil capacity for retention of cations; pyrolysis temperature of biochar; particle size of biochar

Acknowledgements: This research was performed within the PAS-SAS joint project for the years 2023-2024.

THE MOST SIGNIFICANT PESTICIDES CURRENTLY USED IN SLOVAKIA MONITORED IN SURFACE WATER DURING 2012-2022

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ABSTRACT

Pesticides are substances intended to eliminate or suppress the growth of unwanted organisms - animals, plants, fungi or various microbes. Contamination of the environment by pesticides can pose serious harmful effects on non-target organisms and also on human health. In order to set appropriate measures for the environmental protection, it is necessary to monitor and evaluate the occurrence of pesticide residues in individual components of the environment. Monitoring of pesticides in Slovak surface water is carried out annually, in accordance with the relevant Water monitoring program under the responsibility of the Ministry of the Environment of the Slovak Republic. The paper presents the results of the monitoring of ten important pesticides used in agricultural production (over 10 000 kg/year) in Slovakia during the period 2012-2022. So far, the monitoring has not proven a significant long-term contamination of surface water in the Slovak Republic by pesticides. There was only one substance, chlorpyrifos, which exceeded the environmental quality standard (EQS) in one monitoring site in 2020 and potentially also in two other sites in 2021 and 2022, respectively.

Keywords: pesticides, monitoring, surface water, environmental quality standards (EQS), limit of quantification (LOQ).

TO THE PROBLEM OF DETERMINING T-YEAR MINIMUM DAILY SPECIFIC FLOWS IN THE HRON RIVER BASIN

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ABSTRACT

Determination and assessment of T-year minimum flows and low water content in water measuring stations is one of the main topics of hydrology. Due to the extension of time series of hydrological data and their better availability, it is possible to work with an increasing number of complete data series. The aim of this contribution is the processing of documents and the proposal of a methodology for processing T-year minimum flows on selected streams with the longest possible series of observations in the Hron river basin (1931–2020) using one type of theoretical distribution function with the possibility of regionalization (generalization) of its parameters. The use of one type of distribution also makes the possibility to estimate the value of T-year minimum flows for parts of the stream without observations based on the long-term average of minimum annual flows and distribution function parameters from neighbouring water measuring stations.

Keywords: Hron River basin, minimum flows, T-year minimum flow, frequency distribution.

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THE INFLUENCE OF MICROPLASTICS ON THE PROPERTIES OF SANDY AND SILTY LOAM SOIL

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ABSTRACT

An ever-increasing amount of microplastics enters the environment and affects soil properties. The aim of this study was to determine the effect of adding three microplastics (high-density polyethylene, polyvinyl chloride and polystyrene) at a concentration of 5% (wt/wt) to sandy and loamy soil on some soil properties (water sorptivity, hydraulic conductivity and soil water repellency). It was found that the addition of microplastics to sandy soil led to a decrease in water sorptivity and hydraulic conductivity, and to an increase in soil water repellency (assessed by the contact angle). Furthermore, after adding microplastics to silty loam soil, there was an increase in water sorptivity and hydraulic conductivity, and the magnitude of soil water repellency remained unchanged.

Keywords: microplastics, sandy soil, silty loam soil, contact angle, hydraulic conductivity, sorptivity

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UTILIZING CHLOROPHYLL FLUORESCENCE TO EVALUATE THE CONDITION OF BARLEY VEGETATION ON SOIL THAT HAS HAD BIOCHAR APPLIED

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ABSTRACT

Biochar can efficiently produce renewable energy from agricultural resources, promising environmental and economic benefits for sustainable agriculture. Research is needed on the responses of plants in interaction with biochar. At the level of the photosynthetic apparatus, the influence of environmental factors manifests itself by changing the activity of the photosynthetic apparatus. The activity of photosystem II at the level of photochemical processes is monitored by the rapid kinetics of chlorophyll fluorescence. This study evaluates the effect of biochar application and re-application on the photosynthetic processes of barley plants. Our findings show that the application of biochar to the soil affected the rapid kinetics of barley chlorophyll fluorescence, but without statistical significance. This effect was manifested only at a lower temperature or lower soil moisture. None of the tested parameters could clearly distinguish the samples with added biochar from the control samples. The chosen method points to its potential applicability in further research on the effect of biochar in soil on plants. However, we recommend supplementing it with another measurement of the actual state of the plant growth.

Keywords: biochar, spring barley (*Hordeum vulgare* L.), Chlorophyll fluorescence