Scientific and Technological Research Trend Report in the Field of Disaster Risk Reduction

——Bibliometric analysis of global disaster risk reduction literature and the influence of Chinese research in 2021

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IKCEST Disaster Risk Reduction Knowledge Service System

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Abstract

In 2021, a total of 9,941 SCI journal papers were published in the disaster risk reduction field. A total of 172 countries or regions have carried out relevant research in this field according to various experts. Among them, the top 12 countries or regions with more than 250 papers were China, the US, India, the UK, Italy, Germany, Australia, Japan, Canada, Iran, France, and Spain, respectively. China had the highest number of publications worldwide, whereas, the Helmholtz Association of German Research Centres had the highest citation rate, followed by the University of California and United States Geological Survey (USGS). The Indian Institute of Technology and National Institute of Geophysics and Volcanology of Italy had the highest proportion of highly cited papers.

The papers were mainly distributed across 13 disciplines (each with 300 papers): environmental science, geoscience synthesis, water resources science news, meteorology and atmospheric science, public environment and occupational health, environmental research, green and sustainable technology, geochemistry and geophysics, remote sensing science, environment engineering, geology engineering, imaging science and photography technology, and physical geography. Research on disaster prevention in China are mainly in the following 14 disciplines, with more than 100 papers: environmental science, geoscience synthesis, water resources science, meteorology and atmospheric science, remote sensing science, imaging science and photography technology, environment engineering, geology engineering, geochemistry and geophysics, green and sustainable technology, public environment and occupational health, environmental research, physical geography, and civil engineering. In the field of disaster prevention in China, few studies have been conducted on public environment and occupational health environment.

The five most researched topics are health risks caused by heavy metals, the application of remote sensing technology in earthquake disaster monitoring, disaster management and resilient cities from the perspective of vulnerability, disaster big data under climate change and epidemic situation, and temporal and spatial dynamic change in land use based on geographic information system data.

The appendix presents 90 abstracts from papers with a high citation index, similar to the research direction followed by the Disaster Risk Reduction Knowledge Service sub-platform of the International Knowledge Centre for Engineering Sciences and Technology.

United Nations Educational, Scientific and Cultural Organization
联合国教育、科学及文化组织
International Knowledge Centre for Engineering Sciences and Technology under the Auspices of UNESCO
国际工程科技知识中心 由教科文组织支持

Disaster Risk Reduction Knowledge Service
防灾减灾知识服务

Contents

Bibliometrics, developed in recent years, is a branch of library and information science that uses mathematical and statistical methods to describe, evaluate, and predict the status and development trends in science and technology using various statistical indicators. The Web of Science (WOS) core collection database of the Institute for Scientific Information in the US includes the best scientific and technological journals, globally, in various disciplines. To a certain extent, the papers included in it can reflect the development trend of the scientific frontier and capture the status and publication position of countries and institutions in time, and further demonstrate the dominant position of each country and institution in a certain discipline. Based on data from the WOS core collection database InCites, which integrates the Analytical Integrated Indicator System[1], as well as key indicators from the Essential Science Indicators (ESI) and Journal Citation Reports (JCR), the academic competitiveness of countries and institutions in various subject areas can be fully revealed.

Through bibliometric analysis, we identified the publication output and influence of leading countries and research institutions in the field of disaster risk reduction (DRR) science, as well as the most salient research directions in various subject areas. We also analyzed the advantages and disadvantages of research in China to elucidate the development trend of scientific research on DRR at the macro scale.

1. Distribution of research capability

1.1 Output and influence of papers from major countries

Combined with expert interpretation, as of retrieval day[2], the researchers retrieved 9,914 SCI journal papers in the field of DRR published in 2021, with relevant research carried out in 172 countries. The top 12 countries with more than 300 published papers are China, the US, India, the UK, Italy, Germany, Australia, Japan, Canada, Iran, France, and Spain, respectively. China has the largest number of publications, with a total of 2,768 papers with Chinese participation, accounting for approximately 27.9% of the total papers and

[1] http://help.incites.clarivate.com/inCites2Live/8980TRS/version/default/part/AttachmentData/data/InCites-Indicators-Handbook%20-%20June%202018.pdf
[2] February 13, 2021

occupying a leading position in the DRR field. The US is second in the list (Table 1), accounting for 17.7% of the total papers.

Among the top 12 countries, Chinese and American papers are cited most frequently[3], but the citation rate of American papers is slightly higher. British and Italian papers have a higher citation rate, with more than 50% of the papers being cited. The average citation frequency of papers from India, Australia, and Iran is relatively high, and the proportions of highly cited papers from these countries are high[4], reaching 2.34%, 2.09%, and 2.05%, respectively, which are much higher than those of other top 12 countries. These figures indicate that these three countries have considerable research strength. In addition, Australia has the highest percentage of "hot papers[5]," indicating that Australia has produced a considerable number of high-level achievements in 2021 and has attracted the attention of scientists worldwide (Table 1). South Korea and Pakistan, with less than 300 papers published per year, had produced eight highly cited papers by the end of 2021, indicating high scientific research efficiency. In general, although Italy, the UK, Australia, and Iran do not have the largest number of papers in the field, their papers are highly cited, with a high citation rate and higher standard scientific research efficiency. In contrast, China and the US produce a large number of scientific research publications, but the average citation frequency is relatively low, the cited rate of the papers is low, and the scientific research frequency needs improvement (Figure 1).

Table 1: Main countries conducting disaster prevention research in the SCIE database and their influence

Ranking	Country	WOS publication quantity	Times cited	Documents cited (%)	Citation frequency	Highly cited papers (%)	Hot cited papers (%)
1	China	2,768	3,456	42.45	1.25	1.63	0.22
2	US	1,759	1,924	43.49	1.09	0.74	0.11
3	India	726	1,287	45.87	1.77	2.34	0.41
4	UK	688	1,059	50.29	1.54	1.74	0.15

[3] Web of Science, Core Collection Citations
[4] http://help.incites.clarivate.com/inCites2Live/8980TRS/version/default/part/AttachmentData/data/InCites-Indicators-Handbook%20-%20June%202018.pdf
[5] http://help.incites.clarivate.com/inCites2Live/8980TRS/version/default/part/AttachmentData/data/InCites-Indicators-Handbook%20-%20June%202018.pdf

5	Italy	659	972	51.44	1.47	1.52	0.00
6	Germany	483	642	49.69	1.33	0.83	0.00
7	Australia	478	863	47.70	1.81	2.09	1.05
8	Japan	420	398	41.19	0.95	0.24	0.00
9	Canada	352	430	46.88	1.22	1.42	0.28
10	Iran	342	480	46.20	1.40	2.05	0.00
11	France	338	479	49.11	1.42	1.18	0.30
12	Spain	331	482	48.64	1.46	1.21	0.00

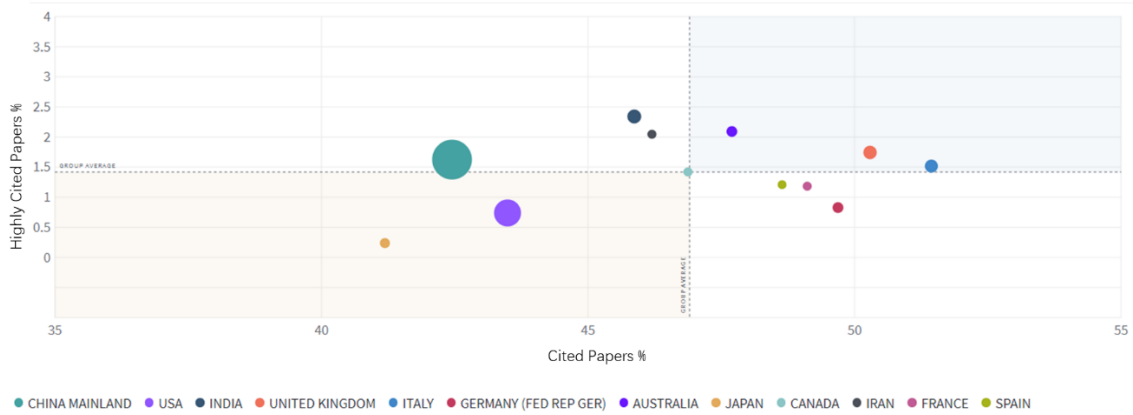

Figure 1: Total number of papers, cited frequency of papers, and proportion of cited papers in each country

1.2. Output and influence of papers from main research institutions

Among the top 10 institutions with more than 110 publications, American institutions are the greatest in number. Three of the top 10 institutions are in the US, indicating the intensity of research in this field in the US. However, among these institutions, the Helmholtz Association of German Research Centres recorded 54.74% of its papers being cited. Indeed, its papers have the highest citation rate. It is followed by the University of California and USGS. The most cited papers from Chinese institutions are from the China University of Geosciences. In addition, the citation frequency of papers from the Indian Institute of Technology System and Helmholtz Association of German Research Centres is significantly higher than the average of other institutions, indicating that their average output quality is high (Table 2). Although the total number of articles published by Ist Nazl Geofis & Vulcanol is low, the proportion of highly cited papers is only lower than that of the Indian Institute of Technology System, and the scientific research efficiency of Ist Nazl Geofis & Vulcanol was greater

than that of the latter (Figure 2).

Table 2: Top 10 institutions in number of papers on disaster prevention in the SCIE database and their influence

Ranking	Institutions	Country	WOS publication quantity	Times cited	Docs cited (%)	Citation frequency of each paper	Highly cited papers (%)	Hot papers (%)
1	Chinese Academy of Sciences	China	581	794	46.99	1.37	1.55	0.17
2	Centre National de la Recherche Scientifique	France	201	207	44.28	1.03	0.50	0
3	University of California	USA	175	241	51.43	1.38	0.57	0
4	Indian Institute of Technology System	India	159	315	43.40	1.98	1.89	0.63
5	Helmholtz Association of German Research Centres	Germany	137	208	54.74	1.52	0.73	0
6	China University of Mining and Technology	China	131	186	36.64	1.42	2.29	0
7	US Department of the Interior	USA	126	165	50.79	1.31	0.79	0
8	United States Geological Survey	USA	123	163	51.22	1.33	0.81	0
9	China University of Geosciences	China	118	176	50	1.49	1.69	0.85
10	Ist Nazl Geofis & Vulcanol	Italy	114	164	48.25	1.44	1.75	0

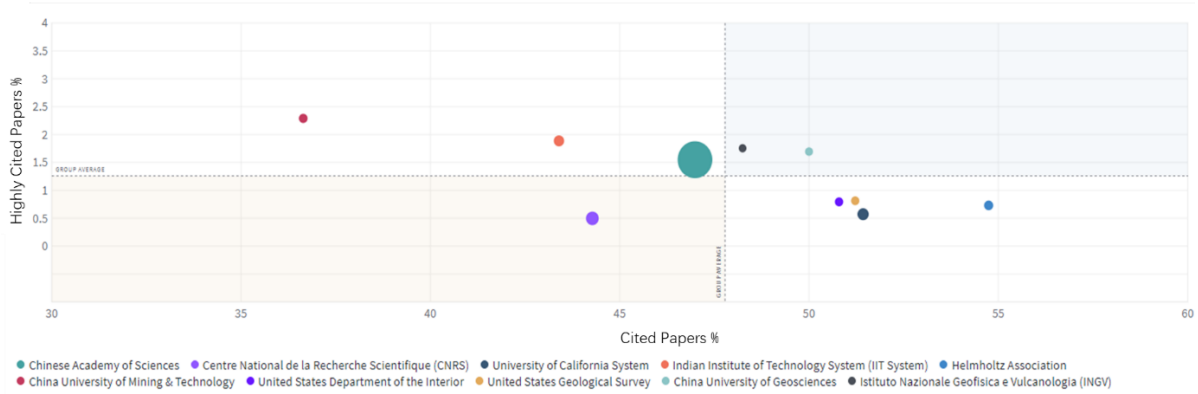

Figure 2: Total number of papers, cited frequency of papers, and proportion of cited papers in each institution

2. Research trends

2.1 Major subject areas

According to the WOS platform, disaster prevention research involves a total of 96 subject areas[6], but it is mainly distributed in the following 13 disciplines (those with more than 300 papers): environmental science, geoscience synthesis, water resources science, meteorology and atmospheric science, public environment and occupational health, environmental research, green and sustainable technology, geochemistry and geophysics, remote sensing science, environment engineering, geology engineering, imaging science and photography technology, and physical geography. The research on disaster prevention in China covers 68 subject areas, but mainly falling under 14 disciplines (more than 100 papers): environmental science, geoscience synthesis, water resources science, meteorology and atmospheric science, remote sensing science, imaging science and photography technology, environment engineering, geology engineering, geochemistry and geophysics, green and sustainable technology, public environment and occupational health, environmental research, physical geography, and civil engineering. In the field of disaster prevention in China, studies on public environment and occupational health environment have been scarce. Figure 3 shows that the research disciplines in China in the field of DRR are consistent with global trends.

[6] Web of Sciences, Disciplinary classification system is a multiple classification system, that is, a paper that may belong to multiple disciplines.

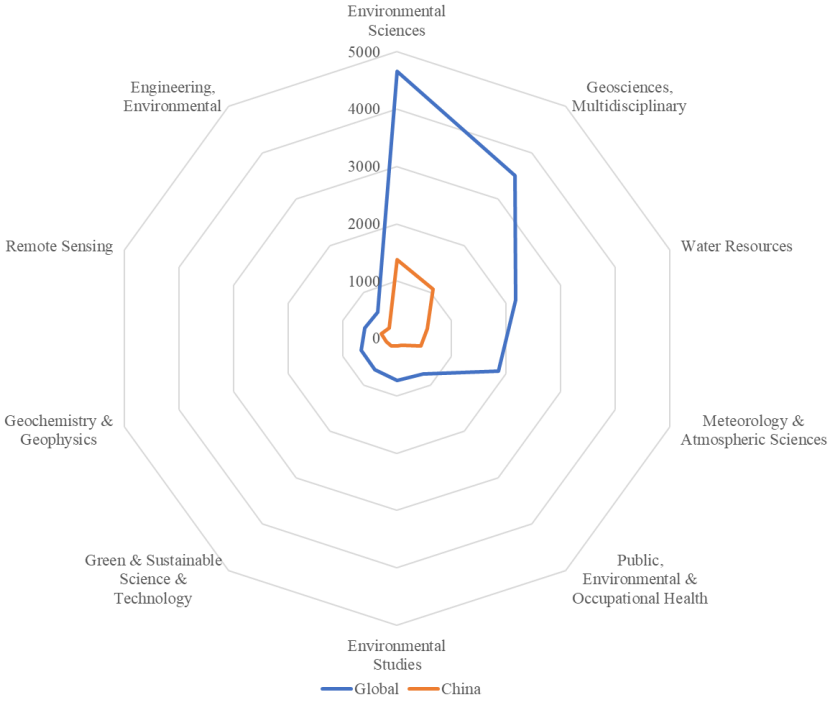

Figure 3. Percentage analysis of papers in major subject areas on DRR research in China and the world

2.2 Major journals

Published journals reflect the direction of research. According to statistics on journals in the field of disaster prevention, 14 journals have published more than 50 papers by Chinese authors, accounting for 44.2% of total published papers. Moreover, 14 journals have published more than 100 papers by international authors (non-Chinese), accounting for 38.6% of total published papers.

Table 3. Major disaster prevention journals in the SCIE database

Serial number	Journals with Chinese authors	Number of published papers	Impact factor	Journals with global authors	Number of published papers	Impact factor
1	*Remote Sensing*	148	4.848	*International Journal of Disaster Risk Reduction*	524	4.32
2	*Natural Hazards*	129	3.102	*Sustainability*	485	3.251
3	*Arabian Journal of Geosciences*	123	1.827	*International Journal of Environmental*	469	

				Research and Public Health		4.39
4	*Sustainability*	102	3.251	*Natural Hazards*	372	3.102
5	*Science of the Total Environment*	93	7.963	*Remote Sensing*	293	4.848
6	*International Journal of Environmental Research and Public Health*	92	3.39	*Environmental Science and Pollution Research*	274	4.223
7	*Environmental Science and Pollution Research*	88	4.223	*Science of the Total Environment*	255	7.963
8	*Frontiers in Earth Science*	79	3.498	*Arabian Journal of Geosciences*	254	1.827
9	*Geofluids*	71	2.176	*Water*	208	3.103
10	*Journal of Hazardous Materials*	69	10.588	*Frontiers in Earth Science*	201	3.498
11	*Water*	62	3.103	*Journal of Hazardous Materials*	127	10.588
12	*Ecotoxicology and Environmental Safety*	57	6.291	*Chemosphere*	123	7.086
13	*Environmental Pollution*	55	8.071	*Natural Hazards and Earth System Sciences*	122	4.345
14	*International Journal of Disaster Risk Reduction*	55	4.32	*Environmental Earth Sciences*	117	2.784

3. “Hot research” topics

The research content in this section is based on the keyword co-occurrence method. We used the Thomson Data Analyser software to search both automatically and manually the keywords and the field of each paper. Next, the present research used VOS viewer software to cluster the core topic words of the

papers based on the high-frequency topic word data on the topic. We set a certain co-occurrence frequency and co-occurrence intensity of cluster keywords according to the data set size of the papers. Combined with expert interpretation, we named and interpreted each cluster, and then identified and analyzed the topics of the journals.

The average cited frequency of the core topic words in the analysis results represents the average cited frequency of papers containing this topic words since they were published. The average correlation strength represents the closeness between the core topic words contained in the theme concept. The stronger the topic relevance, the greater the co-occurrence strength between the core topic words, and the more concentrated the research. Otherwise, it means that the co-occurrence strength is relatively low, and the research is more scattered.

We used Keywords Plus as the analysis method. After machine and manual cleaning, the method selected 986 keywords, with a frequency of more than 13 occurrences, from 39,327 possible keywords. In addition, 355 keywords were used as analysis objects for cluster calculation. As shown in Figure 4, by clustering the core topic words with the greatest co-occurrence intensity in these papers, we obtained five clusters, with each having at least 40 keywords. The five “hot topics” of research are as follows: health risks caused by heavy metals, application of remote sensing technology in earthquake disaster monitoring, disaster management and resilient cities from the perspective of vulnerability, disaster big data in the context of climate change and epidemic situation, and temporal and spatial dynamic change in land use based on geographic information system data.

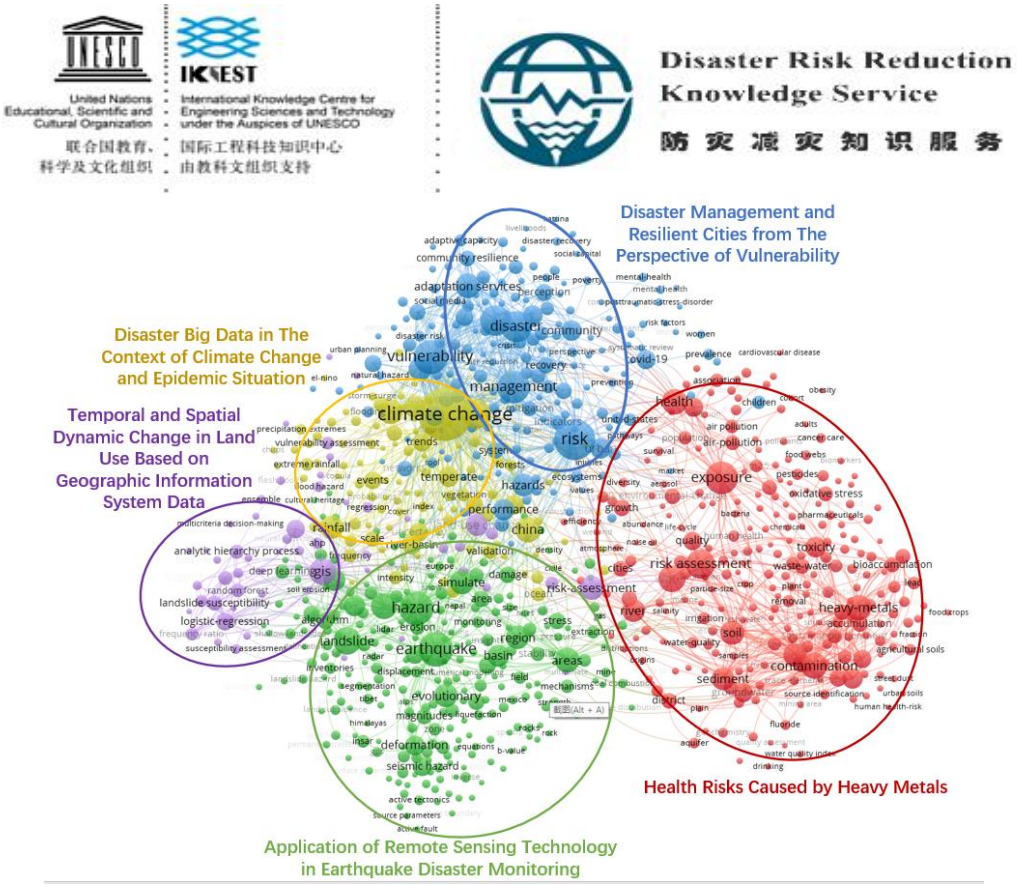

Figure 4: Analysis of research topics in the field of disaster risk reduction prevention in 2021

Appendix: abstract of highly cited literatures

1. Compound natural and human disasters: Managing drought and COVID-19 to sustain global agriculture and food sectors

Journal: Science of The Total Environment

Abstract: Individually, both droughts and pandemics cause disruptions to global food supply chains. The 21st century has seen the frequent occurrence of both natural and human disasters, including droughts and pandemics. Together their impacts can be compounded, leading to severe economic stress and malnutrition, particularly in developing countries. Understanding how droughts and pandemics interact, and identifying appropriate policies to address them together and separately, is important for maintaining a robust global food supply. Herein we assess the impacts of each of these disasters in the context of food and agriculture, and then discuss their compounded effect. We discuss the implications for policy, and suggest opportunities for future research.

2. Evaluation of deep learning algorithms for national scale landslide susceptibility mapping of Iran

Journal: GEOSCIENCE FRONTIERS

Abstract: The identification of landslide-prone areas is an essential step in landslide hazard assessment and mitigation of landslide-related losses. In this study, we applied two novel deep learning algorithms, the recurrent neural network (RNN) and convolutional neural network (CNN), for national-scale landslide susceptibility

mapping of Iran. We prepared a dataset comprising 4069 historical landslide locations and 11 conditioning factors (altitude, slope degree, profile curvature, distance to river, aspect, plan curvature, distance to road, distance to fault, rainfall, geology and land-sue) to construct a geospatial database and divided the data into the training and the testing dataset. We then developed RNN and CNN algorithms to generate landslide susceptibility maps of Iran using the training dataset. We calculated the receiver operating characteristic (ROC) curve and used the area under the curve (AUC) for the quantitative evaluation of the landslide susceptibility maps using the testing dataset. Better performance in both the training and testing phases was provided by the RNN algorithm (AUC = 0.88) than by the CNN algorithm (AUC = 0.85). Finally, we calculated areas of susceptibility for each province and found that 6% and 14% of the land area of Iran is very highly and highly susceptible to future landslide events, respectively, with the highest susceptibility in Chaharmahal and Bakhtiari Province (33.8%). About 31% of cities of Iran are located in areas with high and very high landslide susceptibility. The results of the present study will be useful for the development of landslide hazard mitigation strategies.

3. Do technological innovations have symmetric or asymmetric effects on environmental quality? Evidence from Pakistan

Journal: JOURNAL OF CLEANER PRODUCTION

Abstract: Technological innovation has played an important role in the socio-economic development of societies but, this development has come with some potential hazards to the environment. To do so, we use annual time series data over the period 1990-2018 to measure the symmetric and asymmetric effects of technology innovation on carbon emissions for Pakistan. In estimates of linear ARDL model, we found patent (trademark) has negative (positive) short-run symmetric effects on carbon emissions that have been changed into the long-run symmetric insignificant effects in Pakistan. However, when we employed a nonlinear ARDL model, we found the positive and negative shock of the patent has insignificant short-run asymmetric effects while the positive shock of the trademark has an insignificant and negative shock of the trademark has negative significant effects on carbon emissions in the short run. Our findings have been changed into the long-run asymmetric effects in Pakistan. Overall, the results show that asymmetric effects exist between technology innovation and carbon emissions in the long run. Therefore, this empirical research is applicable to policymakers in Pakistan as well as developing economies.

4. Research on displacement prediction of step-type landslide under the influence of various environmental factors based on intelligent WCA-ELM in the Three Gorges Reservoir area

Journal: NATURAL HAZARDS

Abstract: Landslides are one of the most destructive geological disasters and have been caused many casualties and economic losses every year in the world. The reservoir area formed by the world's largest hydropower project, Three Gorges Hydropower project

of China, has become a natural testing ground for landslide prediction in the hope of reducing losses. In this paper, a new algorithm with strong optimization ability, the water cycle algorithm (WCA), is combined with the extreme learning machine (ELM) to improve the prediction accuracy of step-wise landslide. The gray relational grade analysis method was adopted to determine the main influencing factors of the landslide's periodic displacement. Then, the determined factors were used as the input items of the proposed WCA-ELM model, and the corresponding periodic displacement was used as the model output item. Taking the Liujiabao landslide in the Three Gorges Reservoir area as a case history, the proposed model was verified through a comparison with the measurements. The results showed that the model has a faster convergence rate and higher prediction accuracy than the traditional back-propagation neural network model and ELM-model. The water cycle algorithm is suitable for optimizing the accuracy of the extreme learning machine model in landslide prediction.

5. Interactions of microplastics and antibiotic resistance genes and their effects on the aquaculture environments

Journal: JOURNAL OF HAZARDOUS MATERIALS

Abstract: Microplastics (MPs) and antibiotic resistance genes (ARGs) have become the increasing attention and global research hotpots due to their unique ecological and environmental effects. As susceptible locations for MPs and ARGs, aquaculture environments play an important role in their enrichment and transformation. In this review, we focused on the MPs, ARGs, and the effects of their interactions on the aquaculture environments. The facts that antibiotics have been widely applied in different kinds of agricultural productions (e.g., aquaculture) and that most of antibiotics enter the water environment with rainfall and residual in the aquaculture environment have been resulting in the emergence of antibiotic resistance bacteria (ARB). Moreover, the water MPs are effective carriers of the environmental microbes and ARB, making them likely to be continuously imported into the aquaculture environments. As a result, the formation of the compound pollutions may also enter the aquatic organisms through the food chains and eventually enter the human body after a long-term enrichment. Furthermore, the compound pollutions result in the joint toxic effects on the human health and the ecological environment. In summary, this review aims to emphasize the ecological effects and the potential hazards on the aquaculture environments where interactions between MPs and ARGs results, and calls for to reduce the use of the plastic products and the antibiotics in the aquaculture environments.

6. Marine microplastics as vectors of major ocean pollutants and its hazards to the marine ecosystem and humans

Journal: PROGRESS IN EARTH AND PLANETARY SCIENCE

Abstract: Microplastic pollutes water, land, air, and groundwater environments not only visually but also ecologically for plants, animals, and humans. Microplastic has been reported to act as vectors by sorbing pollutants and contributing to the bioaccumulation

of pollutants, particularly in marine ecosystems, organisms, and subsequently food webs. The inevitable exposure of microplastic to humans emphasises the need to review the potential effects, exposure pathways, and toxicity of microplastic toward human health. Therefore, this review was aimed to reveal the risks of pollutant sorption and bioaccumulation by microplastic toward humans, as well as the dominant types of pollutants sorbed by microplastic, and the types of pollutants that are bioaccumulated by microplastic in the living organisms of the marine ecosystem. The possible factors influencing the sorption and bioaccumulation of pollutants by microplastic in marine ecosystems were also reviewed. The review also revealed the prevailing types of microplastic, abundance of microplastic, and geographical distribution of microplastic in the aquatic environment globally. The literature review revealed that microplastic characteristics, chemical interactions, and water properties played a role in the sorption of pollutants by microplastic. The evidence of microplastic posing a direct medical threat to humans is still lacking albeit substantial literature has reported the health hazards of microplastic-associated monomers, additives, and pollutants. This review recommends future research on the existing knowledge gaps in microplastic research, which include the toxicity of microplastic, particularly to humans, as well as the factors influencing the sorption and bioaccumulation of pollutants by microplastic.

7. Engineering MXene surface with POSS for reducing fire hazards of polystyrene with enhanced thermal stability

Journal: JOURNAL OF HAZARDOUS MATERIALS

Abstract:

8. Selective Capacitive Removal of Pb2+ from Wastewater over Redox-Active Electrodes

Journal: ENVIRONMENTAL SCIENCE & TECHNOLOGY

Abstract: Water pollution has become an environmental hazard. Diverse metal cations exist in wastewater; lead is the most common heavy metal pollutant among them. Selective removal of highly toxic and ultradiluted lead ions from wastewater is a major challenge for water purification. Here, selective capacitive removal (SCR) of lead ions from wastewater over redox-active molybdenum dioxide/carbon (MoO2/C) electrodes was developed by an environment-friendly asymmetric capacitive deionization (CDI) method. The MoO2/C spheres act as cathodes of an asymmetric CDI device and effectively reduce the concentration of Pb2+ from 50 ppm to <0.21 ppb. Moreover, the SCR efficiency of lead ions over redox-active MoO2/C electrodes is >99% in mixtures of 100 ppm Pb(NO3)(2) and 100 ppm NaCl solutions. In addition, the electrodes exhibit high regeneration performance in mixtures of NaCl and Pb(NO3)(2) and high SCR efficiency for lead ions from mixtures of heavy metal ions. The tetrahedral structure of the [MoO4] lattice is shown to be more favorable for the intercalation of lead ions. In situ Raman spectroscopy further shows that the transition of the crystal interface between [MoO6] and [MoO4] cluster lattice could be electrochemically controlled

during SCR. Therefore, this study provides a new direction for the SCR of lead ions from wastewater.

9. Towards environmental sustainability: Exploring the nexus among ISO 14001, governance indicators and green economy in Pakistan

Journal: SUSTAINABLE PRODUCTION AND CONSUMPTION

Abstract: The green growth paradigm has gained much attention in the last decade. Green growth not only protects the environment and human beings but also serves as a substitute for scarce natural assets. Governance institutions develop laws and policies for all industries in a country and are directly responsible for natural resource exploration and environmental protection or destruction. Pakistan is the fifth most vulnerable country to environmental hazards in the world. To address this issue, this study is the first to analyze the relations among governance indicators, ISO 14001 and green growth in Pakistan by using time-series data from 2000 to 2017. The study utilized advanced mathematical Grey Relational Analysis (GRA) models, namely, absolute grey relational grade (GRG), Deng's GRG, and Second Synthetic Degree of Grey Incidence Analysis (SSGIG) models, to capture the relations among the studied variables. The main results revealed that ISO 14001, with the highest GRA values of 0.8-0.9, proved to be effective in channeling green growth. Among all governance indicators related to green growth, the rule of law with the highest maximin criterion value of 0.644 was found to play a key role for Pakistan. The study findings provide insights into how good governance can contribute to accomplishing the objectives of environmental sustainability. They can also help legislators and organizations understand the importance of ISO 14001 certification to promote sustainable practices across sectors in Pakistan.

10. Selenium transport and metabolism in plants: Phytoremediation and biofortification implications

Journal: JOURNAL OF HAZARDOUS MATERIALS

Abstract: The aim of this review is to synthesize current knowledge of selenium (Se) transport and metabolism in plants, with a focus on implications for biofortification and phytoremediation. Selenium is a necessary human micronutrient, and around a billion people worldwide may be Se deficient. This can be ameliorated by Se biofortification of staple crops. Selenium is also a potential toxin at higher concentrations, and multiple environmental disasters over the past 50 years have been caused by Se pollution from agricultural and industrial sources. Phytoremediation by plants able to take up large amounts of Se is an important tool to combat pollution issues. Both biofortification and phytoremediation applications require a thorough understanding of how Se is taken up and metabolized by plants. Selenium uptake and translocation in plants are largely accomplished via sulfur (S) transport proteins. Current understanding of these transporters is reviewed here, and transporters that may be manipulated to improve Se uptake are discussed. Plant Se metabolism also largely follows the S metabolic pathway.

This pathway is reviewed here, with special focus on genes that have been, or may be manipulated to reduce the accumulation of toxic metabolites or enhance the accumulation of nontoxic metabolites. Finally, unique aspects of Se transport and metabolism in Se hyperaccumulators are reviewed. Hyperaccumulators, which can accumulate Se at up to 1000 times higher concentrations than normal plants, present interesting specialized systems of Se transport and metabolism. Selenium hyperaccumulation mechanisms and potential applications of these mechanisms to biofortification and phytoremediation are presented.

11. Landslide Recognition by Deep Convolutional Neural Network and Change Detection

Journal: IEEE TRANSACTIONS ON GEOSCIENCE AND REMOTE SENSING

Abstract: It is a technological challenge to recognize landslides from remotely sensed (RS) images automatically and at high speeds, which is fundamentally important for preventing and controlling natural landslide hazards. Many methods have been developed, but there remains room for improvement for stable, higher accuracy, and high-speed landslide recognition for large areas with complex land cover. In this article, a novel integrated approach combining a deep convolutional neural network (CNN) and change detection is proposed for landslide recognition from RS images. Logically, it comprises the following four parts. First, a CNN for landslide recognition is built based on training data sets from RS images with historical landslides. Second, the object-oriented change detection CNN (CDCNN) with a fully connected conditional random field (CRF) is implemented based on the trained CNN. Third, the preliminary CDCNN is optimized by the proposed postprocessing methods. Finally, the results are further enhanced by a set of information extraction methods, including trail extraction, source point extraction, and attribute extraction. Furthermore, in the implementation of the proposed approach, image block processing and parallel processing strategies are adopted. As a result, the speed has been improved significantly, which is extremely important for RS images covering large areas. The effectiveness of the proposed approach has been examined using two landslide-prone sites, Lantau Island and Sharp Peak, Hong Kong, with a total area of more than 70 km(2). Besides its high speed, the proposed approach has an accuracy exceeding 80%, and the experiments demonstrate its high practicability.

12. Rain-Fed Rice Yield Fluctuation to Climatic Anomalies in Bangladesh

Journal: INTERNATIONAL JOURNAL OF PLANT PRODUCTION

Abstract: To examine the rain-fed Aman rice yield fluctuation due to climatic anomalies overtimes in Bangladesh, we used climate-induced yield index (CIYI), ensemble empirical mode decomposition (EEMD), step-wise multiple regression, isotopic signature, wavelet transform coherence (WTC) and random forest (RF) model. In this work, daily multiple source climatic data which were collected between 1980 and 2017, from 18 weather stations and five atmospheric circulation indices were used for this

purpose. The key findings were as follows; by employing principal component analysis (PCA), six temporal variability modes were identified as six corresponding sub-regions with various Aman rice CIYI fluctuations. The Aman rice CIYI in different sub-regions represented a noteworthy 3-4-year quasi-oscillation using the EEMD. The key climate variables (KCVs) including the potential evapotranspiration and cloud cover in September, the minimum temperature in August, and precipitation in July, August, and October were the best rice yield prediction signals in these sub-regions. The results suggest that Aman rice yield could likely decline by 33.59%, and 3.37% in the southwestern and southeastern regions, respectively, if KCV increased by 1 degrees C or 1%. The RF model suggests that the Indian Ocean Dipole (IOD) significantly influenced the rice yield. Isotopic signatures were employed to confirm the fluctuation and anti-amount effect during the Aman rice-growing period in Bangladesh. The results obtained in this study could be used as a guideline for sustainable mitigation and adaptation measures in managing agro-meteorological hazards in Bangladesh.

13. Unravelling the teleconnections between ENSO and dry/wet conditions over India using nonlinear Granger causality

Journal: ATMOSPHERIC RESEARCH

Abstract: The large scale climatic circulation processes such as El Nino Southern Oscillation (ENSO) affect the climatic anomalies throughout the world. Therefore, understanding the teleconnections of ENSO with the hydrometeorological phenomenon, such as floods and droughts, has been a key research direction for hydro-climatologists in the recent few decades. Droughts over most parts of the world have been previously reported to be influenced by the ENSO. Since India is one of the most drought-prone countries, therefore, a better understanding of these teleconnections would help immensely in better management of drought disasters. For the quantification of causal teleconnection between climatic indices and drought indices, the impact of nonlinearities on causalities has not been addressed well in the literature. Therefore, in this study, we present a nonlinear neural network-based Granger causality (NGCT) approach for the quantification of causal teleconnections between ENSO and droughts. The analysis of teleconnections between ENSO and dry/wet conditions over India has been presented using four climatic indices and two drought indices (Standardized Precipitation Index (SPI) and Standardized Precipitation-Evapotranspiration Index (SPEI)) at four time-scales. The results of the NGCT were also compared with the traditional Granger causality test (LGCT) to elucidate the potential of nonlinear approaches in teleconnection analysis. Results suggest great potential of NGCT for the examination of the teleconnection of ENSO and Indian dry/wet conditions. The area under significant causality was found significantly higher for a nonlinear approach as compared to the traditional LGCT. Further, the impact of ENSO on evapotranspiration-based (i.e., computed using SPEI) drought was found more than precipitation-based drought (i.e., computed using SPI).

14. Landslide susceptibility modeling based on ANFIS with teaching-learning-based

optimization and Satin bowerbird optimizer
Journal：GEOSCIENCE FRONTIERS
Abstract: The large scale climatic circulation processes such as El Nino Southern Oscillation (ENSO) affect the climatic anomalies throughout the world. Therefore, understanding the teleconnections of ENSO with the hydrometeorological phenomenon, such as floods and droughts, has been a key research direction for hydro-climatologists in the recent few decades. Droughts over most parts of the world have been previously reported to be influenced by the ENSO. Since India is one of the most drought-prone countries, therefore, a better understanding of these teleconnections would help immensely in better management of drought disasters. For the quantification of causal teleconnection between climatic indices and drought indices, the impact of nonlinearities on causalities has not been addressed well in the literature. Therefore, in this study, we present a nonlinear neural network-based Granger causality (NGCT) approach for the quantification of causal teleconnections between ENSO and droughts. The analysis of teleconnections between ENSO and dry/wet conditions over India has been presented using four climatic indices and two drought indices (Standardized Precipitation Index (SPI) and Standardized Precipitation-Evapotranspiration Index (SPEI)) at four time-scales. The results of the NGCT were also compared with the traditional Granger causality test (LGCT) to elucidate the potential of nonlinear approaches in teleconnection analysis. Results suggest great potential of NGCT for the examination of the teleconnection of ENSO and Indian dry/wet conditions. The area under significant causality was found significantly higher for a nonlinear approach as compared to the traditional LGCT. Further, the impact of ENSO on evapotranspiration-based (i.e., computed using SPEI) drought was found more than precipitation-based drought (i.e., computed using SPI).

15. Flash flood susceptibility assessment using the parameters of drainage basin morphometry in SE Bangladesh
Journal: QUATERNARY INTERNATIONAL
Abstract: Predicting the occurrence and spatial patterns of rainfall induced flash floods is still a challenge. Instant genesis and typically smaller areal coverage of the flash floods are the major impediments to their forecasting. Analysis of the morphometric parameters provides useful insight on hydrological response of the drainage basins to high intensity rainfall events. This information is valuable for understanding the flash flood potential of the drainage basins and for evading the destructions caused by the hazard. Here, we use eighteen morphometric parameters that influence the runoff volume, flow velocity, and inundation depth scenario of a flash flood. The analysis has been carried out for simulating the relative flash flood susceptibility of thirteen watersheds (B1 to B13) of variable sizes in southeastern Bangladesh. The morphometric parameters were derived from Digital Elevation Model (DEM) using Geographic Information System (GIS). The evaluated basin parameters include: area (A), perimeter (P), length (Lb), stream order (Su), stream number (Nu), stream length

(Lu), stream frequency (Fs), drainage density (Dd), texture ratio (Rt), bifurcation ratio (Rb), basin relief (Hr), relief ratio (Rr), ruggedness number (Rn), time of concentration (Tc), infiltration number (If), and form factor (F). Two relative flash flood susceptibility scenarios were generated: (i) general watershed level, and (ii) more precise pixel level status. The watershed level comparison reveals that B4 and B6 watersheds constituting 72.61% of the total area are ?very high? susceptible, whereas the susceptibility of the other watersheds has been found as ?high? [B5 (6.95%)], ?moderate? [B8 and B13 (8.63%)], ?low? [B2, B10, B11 (4.64%)], and ?very low? [B1, B3, B7, B9, and B12 (7.18%)]. The derived watershed susceptibility map was subsequently integrated with two spatial analysis algorithms i.e., topographic wetness index (TWI) and topographic position index (TPI) through overlay analysis. The integration helped to understand the combined role of the general watershed morphometry and the in situ topography for determining the flash flood susceptibility of each spot (30 m ? 30 m) within all the selected watersheds. The quantitative analysis and characterization of the watersheds from the perspective of flash flood hazard in this investigation is expected to be useful for implementing the site-specific mitigation measures and alleviating the effects of the hydrological hazard in the study area.

16. Evaluating the meteorological drought characteristics over Pakistan using in situ observations and reanalysis products

Journal: INTERNATIONAL JOURNAL OF CLIMATOLOGY

Abstract: Drought is one of the most frequent natural disasters occurring in Pakistan and has a great influence on livelihood, agriculture, and economy. The availability of long-term high-quality reanalysis products over Pakistan has been of great concern in recent decades. Here, we conduct drought assessment in Pakistan based on the standardized precipitation index (SPI) and the standardized precipitation evapotranspiration index (SPEI) at 3, 6, and 12 months timescales during 1983-2018. We use long-term in situ observations to evaluate the accuracy of reanalysis products, including Climatic Research Unit (CRU TS), National Centers for Environmental Prediction version II (NCEP-2), European Centre for Medium-Range Weather Forecasts Version-5 (ERA-5), and Modern-Era Retrospective analysis for Research and Applications version II (MERRA-2). The main results are summarized as follows: (a) drought indices and drought areas assessed from reanalysis products are relatively more representative of historical droughts that had occurred in southern Pakistan and overestimation is evident for drought severity in western than eastern Pakistan; (b) statistically significant increasing trends (1984-1998 and 2000-2010) in monthly drought areas and occurrence are evident by CRU TS and MERRA-2 in dominant arid and semiarid regions; (c) climate variables and drought features of southern Pakistan are best represented by CRU TS and MERRA-2, while that of southwestern and western parts are best represented by ERA-5; (d) the Nash-Sutcliffe efficiency (NSE) results range from -2 to 1, where the NSE of SPEI values (-1.0) show relatively weaker than SPI values (0.5) in most parts of the regions, specifically in the southern Pakistan; (e)

a strong positive linear relationship on a monthly scale is evident in CRU TS, MERRA-2, and ERA-5 exhibiting relatively high correlation coefficient (0.84), except for NCEP-2. Furthermore, the SPEI results are found to be better than SPI; thus, this study suggests SPEI may be more suitable than SPI in monitoring droughts under climate change.

17. Rapid mapping of landslides in the Western Ghats (India) triggered by 2018 extreme monsoon rainfall using a deep learning approach

Journal: LANDSLIDES

Abstract: Rainfall-induced landslide inventories can be compiled using remote sensing and topographical data, gathered using either traditional or semi-automatic supervised methods. In this study, we used the PlanetScope imagery and deep learning convolution neural networks (CNNs) to map the 2018 rainfall-induced landslides in the Kodagu district of Karnataka state in the Western Ghats of India. We used a fourfold cross-validation (CV) to select the training and testing data to remove any random results of the model. Topographic slope data was used as auxiliary information to increase the performance of the model. The resulting landslide inventory map, created using the slope data with the spectral information, reduces the false positives, which helps to distinguish the landslide areas from other similar features such as barren lands and riverbeds. However, while including the slope data did not increase the true positives, the overall accuracy was higher compared to using only spectral information to train the model. The mean accuracies of correctly classified landslide values were 65.5% when using only optical data, which increased to 78% with the use of slope data. The methodology presented in this research can be applied in other landslide-prone regions, and the results can be used to support hazard mitigation in landslide-prone regions.

18. Bio-remediation approaches for alleviation of cadmium contamination in natural resources

Journal: CHEMOSPHERE

Abstract: Cadmium (Cd) is a harmful heavy metal that can cause potent environmental and health hazards at different trophic levels through food chain. Cd is relatively non-biodegradable and persists for a long time in the environment. Considering the potential toxicity and non-biodegradability of Cd in the environment as well as its health hazards, this is an urgent issue of international concern that needs to be addressed by implicating suitable remedial approaches. The current article specifically attempts to review the different biological approaches for remediation of Cd contamination in natural resources. Further, bioremediation mechanisms of Cd by microbes such as bacteria, fungi, algae are comprehensively discussed. Studies indicate that heavy metal resistant microbes can be used as suitable biosorbents for the removal of Cd (up to 90%) in the natural resources. Soil-to-plant transfer coefficient (TC) of Cd ranges from 3.9 to 3340 depending on the availability of metal to plants and also on the type of plant species. The potential phytoremediation strategies for Cd removal and the key factors influencing bioremediation process are also emphasized. Studies on molecular

mechanisms of transgenic plants for Cd bioremediation show immense potential for enhancing Cd phytoremediation efficiency. Thus, it is suggested that nano-technological based integrated bioremediation approaches could be a potential futuristic path for Cd decontamination in natural resources. This review would be highly useful for the biologists, chemists, biotechnologists and environmentalists to understand the long-term impacts of Cd on ecology and human health so that potential remedial measures could be taken in advance.

19. Rapidly Evolving Controls of Landslides After a Strong Earthquake and Implications for Hazard Assessments

Journal: GEOPHYSICAL RESEARCH LETTERS

Abstract: Strong earthquakes, especially on mountain slopes, can generate large amounts of unconsolidated deposits, prone to remobilization by aftershocks and rainstorms. Assessing the hazard they pose and what drives their movement in the years following the mainshock has not yet been attempted, primarily because multitemporal landslide inventories are lacking. By exploiting a multitemporal inventory (2005-2018) covering the epicentral region of the 2008 Wenchuan Earthquake and a set of conditioning factors (seismic, topographic, and hydrological), we perform statistical tests to understand the temporal evolution of these factors affecting debris remobilizations. Our analyses, supported by a random-forest susceptibility assessment model, reveal a prediction capability of seismic-related variables declining with time, as opposed to hydro-topographic parameters gaining importance and becoming predominant within a decade. These results may have important implications on the way conventional susceptibility/hazard assessment models should be employed in areas where coseismic landslides are the main sediment production mechanism on slopes. Plain Language Summary Strong earthquakes in mountain regions can trigger thousands of landslides, forming deposits of rock and soil debris along steep slopes. Months to years later, rainstorms may generate debris flows-destructive water-debris mixtures that rush downslope and flood valleys. Scientists use models to estimate the hazard of landslides and debris flows, which are based on accurate maps of the slopes, the type of rock or soil, inventories of known landslides, rainfall trends, and more. Susceptibility and hazard maps are the main product of these models. They are used to predict the probability of a hazardous event occurring at a given location in a given time span. These maps are usually static, in the sense that they are thought to remain valid for a long time because the data they are based upon (such as the shape of slopes) do not vary much. However, postearthquake landscapes are very dynamic: debris moves downslope, carried by rain or shaken by aftershocks; meanwhile, new landslides occur on some slopes, while others revegetate and stabilize. The overall picture is complex as many variables are involved. We use machine learning to demonstrate that static hazard maps become unable to predict landslides after just a few years, and advocate for the use of frequently updated maps linked to fresh inputs, tracking the location and activity of debris deposits, and old and new.

20. Wildfire Damage Assessment over Australia Using Sentinel-2 Imagery and MODIS Land Cover Product within the Google Earth Engine Cloud Platform
Journal: REMOTE SENSING
Abstract: Wildfires are major natural disasters negatively affecting human safety, natural ecosystems, and wildlife. Timely and accurate estimation of wildfire burn areas is particularly important for post-fire management and decision making. In this regard, Remote Sensing (RS) images are great resources due to their wide coverage, high spatial and temporal resolution, and low cost. In this study, Australian areas affected by wildfire were estimated using Sentinel-2 imagery and Moderate Resolution Imaging Spectroradiometer (MODIS) products within the Google Earth Engine (GEE) cloud computing platform. To this end, a framework based on change analysis was implemented in two main phases: (1) producing the binary map of burned areas (i.e., burned vs. unburned); (2) estimating burned areas of different Land Use/Land Cover (LULC) types. The first phase was implemented in five main steps: (i) preprocessing, (ii) spectral and spatial feature extraction for pre-fire and post-fire analyses; (iii) prediction of burned areas based on a change detection by differencing the pre-fire and post-fire datasets; (iv) feature selection; and (v) binary mapping of burned areas based on the selected features by the classifiers. The second phase was defining the types of LULC classes over the burned areas using the global MODIS land cover product (MCD12Q1). Based on the test datasets, the proposed framework showed high potential in detecting burned areas with an overall accuracy (OA) and kappa coefficient (KC) of 91.02% and 0.82, respectively. It was also observed that the greatest burned area among different LULC classes was related to evergreen needle leaf forests with burning rate of over 25 (%). Finally, the results of this study were in good agreement with the Landsat burned products.

21. Livelihood resilience and strategies of rural residents of earthquake-threatened areas in Sichuan Province, China
Journal: NATURAL HAZARDS
Abstract: Natural disasters are increasing in frequency in China. Enhancing residents' livelihood resilience and adjusting their livelihood strategies have gradually become effective means of dealing with disaster risk. Therefore, it is of great significance to explore the livelihood strategies and livelihood resilience of rural residents in earthquake-stricken areas to help them cope with disaster risks. However, few studies have explored the correlation between residents' livelihood resilience and livelihood strategies from the perspective of residents' livelihood resilience. Based on a survey of 327 households in four districts and counties of Sichuan Province, China that were affected by the Wenchuan and Lushan earthquakes, we construct a framework for analyzing livelihood resilience and livelihood strategy selection. We comprehensively analyze the characteristics of livelihood resilience and livelihood strategy and explore their correlation using an ordinal multi-classification logistic regression model. The results show that: (1) Among 327 sample households, 90.21% were non-farming, 3.67%

were part-time households and 6.12% were farming households. Residents' livelihood resilience is mainly based on their disaster prevention and mitigation capacity. (2) As far as the correlation between livelihood resilience and livelihood strategies is concerned, the stronger the buffer capacity in livelihood resilience, the more rural residents tend to engage in non-farming activities to obtain income. When other conditions remain unchanged, the logarithmic probability of choosing an agricultural livelihood strategy decreases by 21.814 for each unit of buffer capacity. From the perspective of residents' livelihood resilience, this study deepens our understanding of the relationship between livelihood resilience and livelihood strategy in earthquake-stricken areas. It also provides useful information for the formulation of policies to improve residents' resilience in disaster-threatened areas.

22. The Making of the NEAM Tsunami Hazard Model 2018 (NEAMTHM18)
Journal: FRONTIERS IN EARTH SCIENCE
Abstract: The NEAM Tsunami Hazard Model 2018 (NEAMTHM18) is a probabilistic hazard model for tsunamis generated by earthquakes. It covers the coastlines of the North-eastern Atlantic, the Mediterranean, and connected seas (NEAM). NEAMTHM18 was designed as a threephase project. The first two phases were dedicated to the model development and hazard calculations, following a formalized decision-making process based on a multiple-expert protocol. The third phase was dedicated to documentation and dissemination. The hazard assessment workflow was structured in Steps and Levels. There are four Steps: Step-1) probabilistic earthquake model; Step-2) tsunami generation and modeling in deep water; Step-3) shoaling and inundation; Step-4) hazard aggregation and uncertainty quantification. Each Step includes a different number of Levels. Level-0 always describes the input data; the other Levels describe the intermediate results needed to proceed from one Step to another. Alternative datasets and models were considered in the implementation. The epistemic hazard uncertainty was quantified through an ensemble modeling technique accounting for alternative models' weights and yielding a distribution of hazard curves represented by the mean and various percentiles. Hazard curves were calculated at 2,343 Points of Interest (P01) distributed at an average spacing of -20 km. Precalculated probability maps for five maximum inundation heights (MIH) and hazard intensity maps for five average return periods (ARP) were produced from hazard curves. In the entire NEAM Region, MIHs of several meters are rare but not impossible. Considering a 2% probability of exceedance in 50 years (ARP approximate to 2,475 years), the POIs with MIH >5 m are fewer than 1% and are all in the Mediterranean on Libya, Egypt, Cyprus, and Greece coasts. In the North-East Atlantic, POIs with MIH >3 m are on the coasts of Mauritania and Gulf of Cadiz. Overall, 30% of the POIs have MIH >1 m. NEAMTHM1 8 results and documentation are available through the TSUMAPS-NEAM project website (http://www.tsumaps-neam.eu/), featuring an interactive web mapper. Although the NEAMTHM1 8 cannot substitute in-depth analyses at local scales, it represents the first action to start local and more detailed hazard and risk

assessments and contributes to designing evacuation maps for tsunami early warning.

23. Comparative analysis of the fragility curves for Italian residential masonry and RC buildings

Journal: BULLETIN OF EARTHQUAKE ENGINEERING

Abstract: The Department of Civil Protection (DPC), in compliance with the EU decision 1313/2013 and at the request of the Sendai Framework for Disaster Risk Reduction 2015-2030 to update the disaster risk assessments by various countries, released the latest National Risk Assessment for Italy at the end of 2018. Specifically, as regards the seismic risk assessment, six research units belonging to two centres of competence of the DPC collaborated under its guidance to update the risk maps of the Italian residential heritage. This extensive collaboration complied with the recent Italian code for Civil Protection, which requires a broad scientific consensus for risk assessment. During this research activity, six fragility models were developed, according to some common criteria (four for masonry buildings and two for RC buildings). These models were then implemented by the DPC for the definition of the national seismic risk. Within this context, the aim of this paper is to evaluate the risk results provided by these models, compare their features, and assess and validate their prediction capabilities. In particular, this paper shows the comparison of predicted and observed damage scenarios and consequences on building stock and the population of two seismic events, i.e. L'Aquila 2009 and Amatrice 2016. Furthermore, the paper provides some interesting damage and risk predictions at a national level. Overall, the forecasts and comparisons made in this study demonstrate the validity of the approach adopted by the DPC for the assessment of national seismic risk.

24. The Tsunami Caused by the 30 October 2020 Samos (Aegean Sea) M(w)7.0 Earthquake: Hydrodynamic Features, Source Properties and Impact Assessment from Post-Event Field Survey and Video Records

Journal: JOURNAL OF MARINE SCIENCE AND ENGINEERING

Abstract: The tsunami generated by the offshore Samos Island earthquake (M-w = 7.0, 30 October 2020) is the largest in the Aegean Sea since 1956 CE. Our study was based on field surveys, video records, eyewitness accounts and far-field mareograms. Sea recession was the leading motion in most sites implying wave generation from seismic dislocation. At an epicentral distance of similar to 12 km (site K4, north Samos), sea recession, followed by extreme wave height (h similar to 3.35 m), occurred 2 ' and 4 ' after the earthquake, respectively. In K4, the main wave moved obliquely to the coast. These features may reflect coupling of the broadside tsunami with landslide generated tsunami at offshore K4. The generation of an on-shelf edge-wave might be an alternative. A few kilometers from K4, a wave height of similar to 1 m was measured in several sites, except Vathy bay (east, h = 2 m) and Karlovasi port (west, h = 1.80 m) where the wave amplified. In Vathy bay, two inundations arrived with a time difference of similar to 19 ', the second being the strongest. In Karlovasi, one inundation occurred. In both towns and in western Turkey, material damage was caused in sites with h > 1

m. In other islands, h <= 1 m was reported. The h > 0.5 m values follow power-law decay away from the source. We calculated a tsunami magnitude of M-t similar to 7.0, a tsunami source area of 1960 km(2) and a displacement amplitude of similar to 1 m in the tsunami source. A co-seismic 15-25 cm coastal uplift of Samos decreased the tsunami run-up. The early warning message perhaps contributed to decrease the tsunami impact.

25. The 2018 Mw7.5 Palu ‘supershear’ earthquake ruptures geological fault's multi-segment separated by large bends: results from integrating field measurements, LiDAR, swath bathymetry, and seismic-reflection data

Journal: GEOPHYSICAL JOURNAL INTERNATIONAL

Abstract: On 2018 September 28, 18:02:44 local time, the magnitude 7.5 earthquake accompanied by a tsunami and massive liquefaction devastated Palu region in Central Sulawesi, Indonesia. Comprehensive post-disaster surveys have been conducted, including field survey of surface ruptures, LiDAR, multibeam-bathymetry mapping and seismic-reflection survey. We used these data to map fault ruptures and measure offsets accurately. In contrast to previous remote-sensing studies, suggesting that the earthquake broke an immature, hidden-unknown fault inland, our research shows that it occurred on the mappable, mature geological fault line offshore. The quake ruptured 177-km long multifault segments, bypassing two large releasing bends (first offshore and second inland). The rupture onset occurred at a large fault discontinuity underwater in a transition zone from regional extensional to compressional tectonic regimes. Then, it propagated southward along the similar to 110-km submarine fault line before reaching the west side of Palu City. Hence, its long submarine ruptures might trigger massive underwater landslides and significantly contribute to tsunami generation in Palu Bay. The rupture continued inland for another 67 km, showing predominantly left-lateral strike-slip up to 6 m, accompanied by a 5-10 per cent dip-slip on average. The 7 km sizeable releasing bend results in a pull-apart Palu basin. Numerous normal faults occur along the eastern margin. They cut the Quaternary sediments, and some of them ruptured during the 2018 event. Our fault-rupture map on mature straight geological fault lines allows the possible occurrence of early and persistent 'supershear', but significant asperities and barriers on segment boundaries may prohibit it.

26. Livelihood risk and adaptation strategies of farmers in earthquake hazard threatened areas: Evidence from sichuan province, China

Journal: INTERNATIONAL JOURNAL OF DISASTER RISK REDUCTION

Abstract: It is the final year for China to meet its targets for the 2020 deadline in its battle against poverty. Exploring the livelihood risks faced by farmers and their livelihood adaptation strategies in areas where disaster and poverty are intertwined can provide useful insights for the formulation and implementation of government policies for alleviating poverty. Based on survey data from 327 households in the Wenchuan and Lushan counties of Sichuan, China, this study systematically analyzed the four types of livelihood risks faced by farmers and six types of livelihood adaptation

strategies they adopted. Multinomial logistic regression models were constructed to explore the correlation between the livelihood risks and the livelihood adaptation strategies. The results showed that: (1) Among the four livelihood risks faced by farmers, social risks were the largest and health risks were the smallest. (2) Among the six livelihood adaptation strategies adopted by farmers, borrowing money and loans was the most, while choosing to wait for government relief was the least. (3) When faced with health risks, farmers preferred to work outside of the home; when faced with environmental risks, farmers preferred to wait for government relief; when faced with financial risks, there were no significant differences between the six livelihood adaptation strategies chosen by farmers; when faced with social risks, farmers preferred to draw on their savings to survive.

27. Risk mitigation for rockfall hazards in steeply dipping coal seam: a case study in Xinjiang, northwestern China

Journal: GEOMATICS NATURAL HAZARDS & RISK

Abstract: Many recent examples have shown that rockfalls can occur in underground steep coal mines. The stratigraphic circumstances, block formation mechanism, and cumulative damage effects of rockfalls in the longwalls of a steeply dipping coal seam (SDCS) make them detrimental to workplace safety. Therefore, this study examined an approach for mitigating rockfall hazards in SDCSs. A passive mesh system was installed to prevent the propagation of rockfalls, which decreased the number of collisions between the falling rocks and mining equipment. The interactions of the falling rocks and passive mesh were studied using a series of full-scale numerical impact tests. The following conclusions could be drawn. The displacement of the mesh increased with the rockfall kinetic energy, showing the characteristic of strain hardening. The peak stress appeared near the contact area between the rockfall and mesh, and it spread to the mesh edge in an X-shaped pattern. Stress concentrations were likely to occur in areas that were in direct contact with the mesh and mesh edges. The displacement of the mesh increased when the incidence angle increased, and the number of mesh cells entering the plastic state increased significantly. The internal energy ratio increased with an increase in the incidence angle, indicating that a greater incidence angle led to a larger amount of kinetic energy being transferred from the block into the internal energy of the passive mesh. Finally, the method was verified by comparing the numerical test with the on-site damaged equipment. The high replacement frequency of a passive mesh system and the annual fatality rate in the longwalls of SDCS were significantly improved. This study provided the design for a drapery mesh system for rockfall disaster prevention, particularly the mitigation of rockfall hazard risks in underground SDCSs.

28. GIS-based landslide susceptibility modeling: A comparison between fuzzy multi-criteria and machine learning algorithms

Journal: GEOSCIENCE FRONTIERS

Abstract: Hazards and disasters have always negative impacts on the way of life.

Landslide is an overwhelming natural as well as man-made disaster that causes loss of natural resources and human properties throughout the world. The present study aimed to assess and compare the prediction efficiency of different models in landslide susceptibility in the Kysuca river basin, Slovakia. In this regard, the fuzzy decision-making trial and evaluation laboratory combining with the analytic network process (FDEMATEL-ANP), Naive Bayes (NB) classifier, and random forest (RF) classifier were considered. Initially, a landslide inventory map was produced with 2000 landslide and non-landslide points by randomly divided with a ratio of 70%:30% for training and testing, respectively. The geospatial database for assessing the landslide susceptibility was generated with the help of 16 landslide conditioning factors by allowing for topographical, hydrological, lithological, and land cover factors. The ReliefF method was considered for determining the significance of selected conditioning factors and inclusion in the model building. Consequently, the landslide susceptibility maps (ISMS) were generated using the FDEMATEL-ANP, Naive Bayes (NB) classifier, and random forest (RF) classifier models. Finally, the area under curve (AUC) and different arithmetic evaluation were used for validating and comparing the results and models. The results revealed that random forest (RF) classifier is a promising and optimum model for landslide susceptibility in the study area with a very high value of area under curve (AUC = 0.954), lower value of mean absolute error (MAE = 0.1238) and root mean square error (RMSE = 0.2555), and higher value of Kappa index (K = 0.8435) and overall accuracy (OAC = 922%).

29. Flood susceptibility modelling using advanced ensemble machine learning models
Journal: GEOSCIENCE FRONTIERS

Abstract: Floods are one of nature's most destructive disasters because of the immense damage to land, buildings, and human fatalities. It is difficult to forecast the areas that are vulnerable to flash flooding due to the dynamic and complex nature of the flash floods. Therefore, earlier identification of flash flood susceptible sites can be performed using advanced machine learning models for managing flood disasters. In this study, we applied and assessed two new hybrid ensemble models, namely Dagging and Random Subspace (RS) coupled with Artificial Neural Network (ANN), Random Forest (RF), and Support Vector Machine (SVM) which are the other three state of-the-art machine learning models for modelling flood susceptibility maps at the Teesta River basin, the northern region of Bangladesh. The application of thesemodels includes twelve flood influencing factorswith 413 current and former flooding points, which were transferred in a GIS environment. The information gain ratio, the multicollinearity diagnostics tests were employed to determine the association between the occurrences and flood influential factors. For the validation and the comparison of these models, for the ability to predict the statistical appraisal measures such as Freidman, Wilcoxon signed-rank, and t-paired tests and Receiver Operating Characteristic Curve (ROC) were employed. The value of the Area Under the Curve (AUC) of ROC was above 0.80 for all models. For flood susceptibility modelling, the Dagging model performs superior,

followed by RF, the ANN, the SVM, and the RS, then the several benchmark models. The approach and solution-oriented outcomes outlined in this paper will assist state and local authorities as well as policy makers in reducing flood-related threats and will also assist in the implementation of effective mitigation strategies to mitigate future damage.

30. Satellite InSAR survey of structurally-controlled land subsidence due to groundwater exploitation in the Aguascalientes Valley, Mexico

Journal: REMOTE SENSING OF ENVIRONMENT

Abstract: To address increasing water demands in expanding cities, many aquifers in Mexico are overexploited and deplete. The resulting land subsidence often combines with ground faulting/fracturing and damage to infrastructure. This study provides the longest Synthetic Aperture Radar (SAR) survey ever undertaken for the Aguascalientes Valley, aimed to constrain its structurally-controlled subsidence process and the induced risk. 275 ERS-1/2 1996-2002, ENVISAT 2003-2010 and Sentinel-1 2014-2020 C-band SAR images are processed with change detection, differential Interferometric SAR (InSAR) and Small Baseline Subset (SBAS) methods. Aguascalientes notably expanded over the last four decades, as revealed by Seasat 1978 L-band SAR, Landsat 1985-2010 and Sentinel-2 2020 optical imagery. The observed subsidence pattern involves alluvial/fluvial deposits within the N-S trending graben. Maximum settlement rates are -14 cm/year in 1996, -10 cm/year in 2000-2010 and over -12 cm/year in 2015-2020. An acceleration (-0.70 cm/year(2)) is recorded in 2015-2020 close to recently developed industrial plants and housing districts. Satellite estimates agree with in-situ observations, static GPS surveying and continuous GPS monitoring data. Rough correlation is found with piezometric level drop rates, whereas aquifer thickness plays a stronger role in the subsidence process. While these outcomes align with the existing literature, this InSAR survey: (i) unveils previously unknown E-W deformation affecting two N-S oriented bands within the valley, with up to similar to +/- 3 cm/year in 2015-2020 towards its center; (ii) identifies zones of sagging and hogging with horizontal strain (epsilon) of up to 0.05-0.1%; (iii) retrieves differential rates reaching 6-8 cm/year and angular distortions (beta) of 1/500 along the Oriente fault; and (iv) investigates the statistical distribution of, beta across field surveyed faults and fissures, and marks areas with potentially yetunmapped ground discontinuities. A new surface faulting risk matrix embedding beta and epsilon is therefore proposed to estimate subsidence impact on properties and population. Given its scale-dependency, the risk assessment provides a lower bound to the percentage of urban areas at risk within the Aguascalientes state: at least 2% of the urban areas were at high and very high risk in 2003-2010 (involving similar to 12,000 properties and similar to 39,000 inhabitants), but this increased to 6% in 2015-2020 (similar to 25,600 properties, similar to 85,200 inhabitants). The evidence of a subsidence process evolving spatially and temporally highlights the need for continuous updating of hazard information.

31. Mapping the evolution and current trends in climate change adaptation science

Journal: CLIMATE RISK MANAGEMENT

Abstract: Research on climate change adaptation has increased in number and significance since the 1970s. Yet, the volume of information on adaptation is now difficult to manage given its vast scope and spread across journals, institutions, disciplines and themes. While an increasing number of researchers have used systematic literature reviews to analyse particular themes within this rapidly growing field of research, there is still missing an overall analysis of the current state of climate change adaptation science literature and its evolution. This paper fills this gap by providing a multifaceted bibliometric review of climate change adaptation science literature that is focused on the human dimensions and how it has been constructed across time, disciplines, social relationships and geographies. Our novel review, spanning from 1978 to mid-2020, identifies the underpinning foundations of climate change adaptation literature, leading authors, countries and organisations as well as dominant research themes and priorities and explores how these have changed over time. Our results show an annual average increase of 28.5% in climate change adaptation publications, with over 26,000 authors publishing on this topic, and increasing diversity in publishing sources. Priority research topics and themes have been dynamic over time, while some core concepts (vulnerability, resilience, adaptive capacity) and sectors (water, agriculture) have remained relatively stable. The key challenge going forward is how to consolidate this vast research endeavour into a more coherent adaptation theory that in turn can better guide science of adaptation and support adaptation policy and practice (science for adaptation).

32. Changing climate risk in the UK: A multi-sectoral analysis using policy-relevant indicators

Journal: CLIMATE RISK MANAGEMENT

Abstract: This paper presents a consistent series of policy-relevant indicators of changing climate hazards and resources for the UK, spanning the health, transport, energy, agriculture, flood and water sectors and based on UKCP18 climate projections. In the absence of explicit adaptation, risks will increase across the whole of the UK, but at different rates and from different starting values in different regions. The likelihood of heat extremes affecting health, the road and rail network and crop growth will increase very markedly. Agricultural and hydrological drought risks increase across the UK, as does wildfire danger. River flood risk increases particularly in the north and west. Demand for cooling energy will increase, but demand for heating energy will decline. Crop growing degree days will increase, benefiting the production of perennial crops. In general, the risks associated with high temperature extremes will increase the most in warmer southern and eastern England, but the rate of increase from a lower base may be greater further north and west. Reducing emissions reduces risks in the long term but has little effect over the next two or three decades. The results provide evidence to support the development of national and local climate and resilience policy. Measures to enhance resilience are needed alongside policies to achieve net zero emissions by 2050. Resilience policy should recognise the variability in change in risk

across the UK, and therefore different local priorities. Explicit choices need to be made about 'worst case' emissions scenarios as they can influence strongly estimated changes in risk: the increase in risk with RCP8.5 can be considerably higher than with a pathway reaching 4 degrees C by 2100.

33. Integrating expected loss and collapse risk in performance-based seismic design of structures

Journal: BULLETIN OF EARTHQUAKE ENGINEERING

Abstract: With the introduction of performance-based earthquake engineering (PBEE), engineers have strived to relate building performance to different seismic hazard levels. Expected annual loss (EAL) and collapse safety described by mean annual frequency of collapse (MAFC) have become employed more frequently, but tend to be limited to seismic assessment rather than design. This article outlines an integrated performance-based seismic design (IPBSD) method that uses EAL and MAFC as design parameters. With these, as opposed to conventional intensity-based strength and/or drift requirements, IPBSD limits expected monetary losses and maintains a sufficient and quantifiable level of collapse safety in buildings. Through simple procedures, it directly identifies feasible structural solutions without the need for detailed calculations and numerical analysis. This article outlines its implementation alongside other contemporary risk-targeted and code-based approaches. Several case study reinforced concrete frame structures are evaluated using these approaches and the results appraised via verification analysis. The agreement and consistency of the design solutions and the intended targets are evaluated to demonstrate the suitability of each method. The proposed framework is viewed as a stepping stone for seismic design with advanced performance objectives in line with modern PBEE requirements.

34. Proposing a novel comprehensive evaluation model for the coal burst liability in underground coal mines considering uncertainty factors

Journal: INTERNATIONAL JOURNAL OF MINING SCIENCE AND TECHNOLOGY

Abstract: Coal burst is a severe hazard that can result in fatalities and damage of facilities in underground coal mines. To address this issue, a robust unascertained combination model is proposed to study the coal burst hazard based on an updated database. Four assessment indexes are used in the model, which are the dynamic failure duration (DT), elastic energy index (W-ET), impact energy index (K-E) and uniaxial compressive strength (R-C). Four membership functions, including linear (L), parabolic (P), S and Weibull (W) functions, are proposed to measure the uncertainty level of individual index. The corresponding weights are determined through information entropy (EN), analysis hierarchy process (AHP) and synthetic weights (CW). Simultaneously, the classification criteria, including unascertained cluster (UC) and credible identification principle (CIP), are analyzed. The combination algorithm, consisting of P function, CW and CIP (P-CW-CIP), is selected as the optimal classification model in function of theory analysis and to train the samples. Ultimately,

the established ensemble model is further validated through test samples with 100% accuracy. The results reveal that the hybrid model has a great potential in the coal burst hazard evaluation in underground coal mines.

35. Increased outburst flood hazard from Lake Palcacocha due to human-induced glacier retreat

Journal: NATURE GEOSCIENCE

Abstract: Human-induced warming is responsible for the retreat of Palcaraju glacier and the associated increase in glacial lake outburst flood hazard, according to an analysis of observations and numerical models. A potential glacial lake outburst flood from Lake Palcacocha (Cordillera Blanca, Peru) threatens Huaraz, a city of 120,000 people. In 1941, an outburst flood destroyed one-third of the city and caused at least 1,800 fatalities. Since pre-industrial times, Lake Palcacocha has expanded due to the retreat of Palcaraju glacier. Here we used observations and numerical models to evaluate the anthropogenic contribution to the glacier's retreat and glacial lake outburst flood hazard. We found that the magnitude of human-induced warming equals between 85 and 105% (5-95% confidence interval) of the observed 1 degrees C warming since 1880 in this region. We conclude that it is virtually certain (>99% probability) that the retreat of Palcaraju glacier to the present day cannot be explained by natural variability alone, and that the retreat by 1941 represented an early impact of anthropogenic greenhouse gas emissions. Our central estimate is that the overall retreat is entirely attributable to the observed temperature trend, and that the resulting change in the geometry of the lake and valley has substantially increased the outburst flood hazard.

36. Increasing cryospheric hazards in a warming climate

Journal: EARTH-SCIENCE REVIEWS

Abstract: The cryosphere is an important component of the global climate system. Cryospheric components are sensitive to climate warming, and changes in the cryosphere can lead to serious hazards to human society, while the comprehensive understanding of cryospheric hazards largely remains unknown. Here we summarized the hazards related to atmospheric, oceanic and land cryosphere. The different types of cryospheric hazards, including their phenomena, mechanisms and impacts were reviewed. Our results suggested that: 1) The recorded hazards from atmospheric cryosphere including frost, hail, freezing rain decreased or showed great spatial heterogeneities, while their future changes are difficult to predict, and the extreme cold events in winter may increase in the future; 2) Sea ice extent declines rapidly, and iceberg numbers will increase. The permafrost-dominated coastline erosion will be exacerbated by climate warming. Meanwhile, the sea level rise is expected to continue in the next decades; 3) The glacier collapse, glacial lake outbursts and paraglacial readjustments will increase in the future. Although the total area of snow cover will decrease, the heavy snow events, snow avalanches, and snowmelt floods will not decrease simultaneously. The permafrost-related rock and debris flow and thaw slump will also increase with permafrost degradation. Taken together, we concluded the

cryosphere is shrinking, while cryospheric hazards will likely increase in a warming climate.

37. Glacial change and hydrological implications in the Himalaya and Karakoram

Journal: NATURE REVIEWS EARTH & ENVIRONMENT

Abstract: Glaciers in the Himalaya-Karakoram mountain ranges harbour approximately half of the ice volume in High-mountain Asia and modulate the flow of freshwater to almost 869 million people within the Indus, Tarim, Ganges and Brahmaputra river basins. Since the mid-twentieth century, rising temperatures have led to unsustainably high melting rates for many glaciers, particularly in the Himalaya, temporarily increasing summer meltwater run-off but continuously reducing the ice-storage volume. In this Review, we discuss how and why glaciers and meltwater supplies have changed, how they will likely evolve in the future and how these changes impact water resources and water-related hazards. Heterogeneous glacier retreat is changing streamflow patterns, in turn, affecting the incidence of glacial-lake outburst floods and exacerbating the risk of flooding and water shortages associated with future climate change. These changes could negatively impact downstream populations and infrastructure, including the thriving hydropower sector and some of the world's largest irrigated agriculture systems, by making water flow more extreme and unpredictable. An improved in situ monitoring network for weather, hydrology and glacier change is a crucial requirement for predicting the future of this resource and associated hazards, and their impact on regional water, energy and food security. Glaciers in the Himalaya and Karakoram mountain ranges provide freshwater and hydropower to millions of people but are also melting at unsustainably high rates. This Review discusses recent and projected changes in glacier melt and resulting implications for regional water-related hazards and water resources. Key pointsHimalayan glaciers have lost mass at an accelerating rate in recent decades, in contrast with relatively stable Karakoram glaciers.Under a range of climate change scenarios, the run-off of glacier meltwater in the Himalaya and Karakoram is likely to peak in the next few decades.After glacial run-off peaks, run-off will decline as the glaciers in both mountain ranges shrink, although the magnitude and timing of the peak and the rate of subsequent decline are uncertain.Basin run-off regimes will become more rain-dominated as the modulating effect of glaciers decreases, and this is likely to increase the impact of droughts and floods.The frequency of glacial-lake outburst floods and run-off floods have increased recently and could increase further in coming decades, threatening existing and planned hydropower infrastructure downstream.A lower-emissions climate change pathway would reduce the rate of glacier loss, increasing the time available for adaptation. This pathway would have considerable socio-economic benefits.

38. Geohazards and human settlements: Lessons learned from multiple relocation events in Badong, China - Engineering geologist's perspective

Journal: ENGINEERING GEOLOGY

Abstract: Mountainous regions are inherently susceptible to geohazards, such as landslides and debris flows, with the threat of natural disasters compounded by human activities (mainly settlements). Lessons learned from past events that involved the interactions between human activities and geohazards are helpful for future site selections of human settlements in mountainous regions. To this end, the events associated with county seat relocations in Badong, a typical county in the Three Gorges Reservoir region, China, are studied from an engineering geologist's perspective. Over its history, the county seat was relocated multiple times, with the first relocation traced back to the Song dynasty (960-1279 CE) and the last two relocations linked to the Three Gorges Dam project. By studying geohazards and their interactions with human activities in these county-seat relocations, and through the reconstruction of these events, we secure insights into decision-making for these events. As part of the reconstruction of these relocation events, we analyze a giant pre-historic landslide, whose discovery ultimately prompted the third relocation. Using the case history of this landslide, we also discuss and emphasize the importance of proactive monitoring of geohazards for disaster resilience enhancement, recognizing that our knowledge of nature is vastly incomplete.

39. Flood Susceptibility Assessment Using Novel Ensemble of Hyperpipes and Support Vector Regression Algorithms

Journal: WATER

Abstract: Recurrent floods are one of the major global threats among people, particularly in developing countries like India, as this nation has a tropical monsoon type of climate. Therefore, flood susceptibility (FS) mapping is indeed necessary to overcome this type of natural hazard phenomena. With this in mind, we evaluated the prediction performance of FS mapping in the Koiya River basin, Eastern India. The present research work was done through preparation of a sophisticated flood inventory map; eight flood conditioning variables were selected based on the topography and hydro-climatological condition, and by applying the novel ensemble approach of hyperpipes (HP) and support vector regression (SVR) machine learning (ML) algorithms. The ensemble approach of HP-SVR was also compared with the stand-alone ML algorithms of HP and SVR. In relative importance of variables, distance to river was the most dominant factor for flood occurrences followed by rainfall, land use land cover (LULC), and normalized difference vegetation index (NDVI). The validation and accuracy assessment of FS maps was done through five popular statistical methods. The result of accuracy evaluation showed that the ensemble approach is the most optimal model (AUC = 0.915, sensitivity = 0.932, specificity = 0.902, accuracy = 0.928 and Kappa = 0.835) in FS assessment, followed by HP (AUC = 0.885) and SVR (AUC = 0.871).

40. Numerical simulation of rockfalls colliding with a gravel cushion with varying thicknesses and particle sizes

Journal: GEOMECHANICS AND GEOPHYSICS FOR GEO-ENERGY AND GEO-

RESOURCES

Abstract: A gravel cushion is an effective method for preventing rockfall disasters, but the thickness and particle size of cushion influence the impact response between rockfall and cushion. Based on previous indoor experiments, a numerical model of a rockfall impacting a cushion was built, and the accuracy of the model were verified by comparing with the coefficient of restitution obtained from experimental results. Then, the impact response characteristics during collision between rockfall and cushion, including the impact force on the cushion surface, the impact force on the cushion bottom, and the penetration depth, were studied. It was found that decreasing the cushion thickness can only reduce the impact force on the cushion bottom, while decreasing the particle size of the cushion can reduce both the impact forces on the cushion surface and bottom. With an increase in the falling height of rockfall, both of the impact forces on the cushion surface and bottom consistently increase, and the increase rate of the impact force on the cushion surface is higher than that of the impact force on the cushion bottom. The penetration depth is significantly affected by the particle size of cushion. With an increase in the falling height of rockfall, the penetration depth increases, but when the particle size of cushion is relatively large, the influence of the falling height of rockfall on the penetration depth decreases to some extent. These numerical results provide a widely applicable theoretical foundation for gravel cushions against rockfall disasters.

41. Present-day land subsidence rates, surface faulting hazard and risk in Mexico City with 2014-2020 Sentinel-1 IW InSAR

Journal: REMOTE SENSING OF ENVIRONMENT

Abstract: Among the fastest sinking cities globally, the metropolitan area of Mexico City is the target of an unprecedented satellite investigation based on over 300 Sentinel-1 Synthetic Aperture Radar (SAR) Interferometric Wide swath mode scenes acquired in 2014-2020. Two-pass differential Interferometric SAR (InSAR) and the parallelized Small BAseline Subset (SBAS) repeat-pass InSAR approach provide a complete account of spatial patterns, long-term trend and present-day settlement rates affecting the city. The 3D deformation field reveals that foremost is the role of the vertical velocity V-U, with peaks of -38.7 cm/year in Nezahualcoyotl, -32.0 cm/year in Gustavo A. Madero and Venustiano Carranza, and -39.1 cm/year in Iztapalapa. Settlement at the metropolitan Cathedral in Cuauhte ' moc is ongoing at up to -8.8 cm/year, consistently with the last six decades. Volcanic edifices mark ground stability islets inside the main subsidence bowls. East-west rates are limited, except for some horizontal strain (up to +/- 5 cm/year) within the subsidence bowls. Comparison with surface geology and geotechnical zoning confirms that aquitard compaction is the predominant process. The power relationship between V-U [cm/year] and the thickness of lacustrine clay deposits H-C [m] is: V-U = 1/76*H-C(1.8). The 2019-2020 deformation scenario shows that subsidence still involves most of Nezahualcoyotl, with -3.0 cm/month VU. A well-defined long-term deformation behaviour comes out from 2014-2019 InSAR time

series and comparison with 2008-2020 GPS data. RMSE of 0.9 cm is found at MMX1 station deployed within the lacustrine unit, and 0.6 cm at TNGF station onto hard volcanic rocks. The sharpest subsidence gradients and angular distortions beta in 2017-2019 (up to over 1/400, i.e. 0.14 degrees) - thus the greatest vulnerability to surface faulting and cracking as a consequence of large tensile stress in the soil caused by differential settlement - are found at the foothills of Sierra de Santa Catarina, Penon del Marques, Cerro Chimalhuachi, Penon de los Banos and Sierra de Chichinautzin, where the transition unit is narrower (or absent). Faults and cracks develop where beta > 1/3000, i.e. 0.03%, in 2017-2019. The observed width of the influence zone (i.e. damage band), where beta is still significant to induce damage, is 250 m. Differential settlement and surface faulting could compromise the serviceability of housing and utility infrastructure. It is estimated that over 457,000 properties and 1.5 million inhabitants of the Valley of Mexico Metropolitan Area (ZMVM) are in zones at high to very high surface faulting risk, mainly in Iztapalapa, Tlahuac, Chimalhuacan and Chalco. Increased flood exposure due to formation of topographic depressions involves over 751,000 properties and -2.7 million inhabitants of the ZMVM, mainly in Nezahualcoyotl, Tlahuac, Venustiano Carranza, Iztapalapa, Gustavo A. Madero and Ecatepec de Morelos. These municipalities are often hit by catastrophic floods.

42. Optimization of state-of-the-art fuzzy-metaheuristic ANFIS-based machine learning models for flood susceptibility prediction mapping in the Middle Ganga Plain, India

Journal: SCIENCE OF THE TOTAL ENVIRONMENT

Abstract: This study is an attempt to quantitatively test and compare novel advanced-machine learning algorithms in terms of their performance in achieving the goal of predicting flood susceptible areas in a low altitudinal range, sub-tropical floodplain environmental setting, like that prevailing in the Middle Ganga Plain (MGP), India. This part of the Ganga floodplain region, which under the influence of undergoing active tectonic regime related subsidence, is the hotbed of annual flood disaster. This makes the region one of the best natural laboratories to test the flood susceptibility models for establishing a universalization of such models in low relief highly flood prone areas. Based on highly sophisticated flood inventory archived for this region, and 12 flood conditioning factors viz. annual rainfall, soil type, stream density, distance from stream, distance from road, Topographic Wetness Index (TWI), altitude, slope aspect, slope, curvature, land use/land cover, and geomorphology, an advanced novel hybrid model Adaptive Neuro Fuzzy Inference System (ANFIS), and three metaheuristic models-based ensembles with ANFIS namely ANFIS-GA (Genetic Algorithm), ANFIS-DE (Differential Evolution), and ANFIS-PSO (Particle Swarm Optimization), have been applied for zonation of the flood susceptible areas. The flood inventory dataset, prepared by collected flood samples, were apportioned into 70:30 classes to prepare training and validation datasets. One independent validation method, the Area-Under Receiver Operating Characteristic (AUROC) Curve, and other 11 cut-

off-dependent model evaluation metrices have helped to conclude that the ANIFS-GA has outperformed other three models with highest success rate AUC = 0.922 and prediction rate AUC = 0.924. The accuracy was also found to be highest for ANFIS-GA during training (0.886) & validation (0.883). Better performance of ANIFS-GA than the individual models as well as some ensemble models suggests andwarrants further study in this topoclimatic environment using other classes of susceptibility models. This will further help establishing a benchmark model with capability of highest accuracy and sensitivity performance in the similar topographic and climatic setting taking assumption of the quality of input parameters as constant.

43. Annual 30m dataset for glacial lakes in High Mountain Asia from 2008 to 2017
Journal: EARTH SYSTEM SCIENCE DATA
Abstract: Atmospheric warming is intensifying glacier melting and glacial-lake development in High Mountain Asia (HMA), and this could increase glacial-lake outburst flood (GLOF) hazards and impact water resources and hydroelectric-power management. There is therefore a pressing need to obtain comprehensive knowledge of the distribution and area of glacial lakes and also to quantify the variability in their sizes and types at high resolution in HMA. In this work, we developed an HMA glacial-lake inventory (Hi-MAG) database to characterize the annual coverage of glacial lakes from 2008 to 2017 at 30m resolution using Landsat satellite imagery. Our data show that glacial lakes exhibited a total area increase of 90.14 km(2) in the period 2008-2017, a +/-:90% change relative to 2008 (1305.59 +/- 213.99 km(2)). The annual increases in the number and area of lakes were 306 and 12 km(2), respectively, and the greatest increase in the number of lakes occurred at 5400m elevation, which increased by 249. Proglacial-lake-dominated areas, such as the Nyainqentanglha and central Himalaya, where more than half of the glacial-lake area (summed over a 1 degrees x 1 degrees grid) consisted of proglacial lakes, showed obvious lake-area expansion. Conversely, some regions of eastern Tibetan mountains and Hengduan Shan, where unconnected glacial lakes occupied over half of the total lake area in each grid, exhibited stability or a slight reduction in lake area. Our results demonstrate that proglacial lakes are a main contributor to recent lake evolution in HMA, accounting for 62.87% (56.67 km(2)) of the total area increase. Proglacial lakes in the Himalaya ranges alone accounted for 36.27% (32.70 km(2)) of the total area increase. Regional geographic variability in debris cover, together with trends in warming and precipitation over the past few decades, largely explains the current distribution of supraglacial- and proglacial-lake area across HMA. The Hi-MAG database is available at https://doi.org/10.5281/zenodo.4275164 (Chen et al., 2020), and it can be used for studies of the complex interactions between glaciers, climate and glacial lakes, studies of GLOFs, and water resources.

44. E-waste management and its effects on the environment and human health
Journal: SCIENCE OF THE TOTAL ENVIRONMENT
Abstract: Challenges in managing electronic waste (E-waste) arise from a lack of

technical skills, poor infrastructure, inadequate financial support, and inactive community engagement. This study provides a systematic review of efforts to overcome these challenges in the context of inappropriate recycling protocols of Ewaste and their toxic effects on human health and the environment. An inventory of end-of-life electronic products, which can be established through the creation of an environment friendly regulatory regime for recycling, is essential for the proper control of E-waste. An approach has been articulated to help implement effective management of E-waste in both developed and developing countries. Enforcement of systematic management measures for E-waste in developing countries coupled with best practices is expected to minimize adverse impacts while helping maintain a sustainable and resilient environment.

45. The adoption of deep neural network (DNN) to the prediction of soil liquefaction based on shear wave velocity

Journal: BULLETIN OF ENGINEERING GEOLOGY AND THE ENVIRONMENT

Abstract: Soil liquefaction has been accepted as one of the factors causing natural disasters and engineering failures in the seismic. The mathematic prediction model for soil liquefaction is widely accepted, and the standard penetration (SPT) and cone penetration test (CPT) prediction model using the machine learning method is also developed. But for the V-s, the prediction model based on the machine learning method is limited. So, considering the advantage of the deep learning method, a multi-layer fully connected network (ML-FCN) was proposed to optimize the deep neural network (DNN) and adopted to train the predictionmodel based on the Vs and SPT dataset in this paper. The history dataset was divided into a training set, a validation set, and a testing set by a ratio of 6:2:2 for better evaluation. The SPT dataset was extracted to train a corresponding DNN prediction model. According to the comparison results, the model trained by ML-FCN DNN could predict the liquefaction potential with higher accuracy than the model proposed by Hanna et al. (Soil Dyn Earthq Eng 27(6):521-40, 2007), which is enough to be applied to real engineering, the parameter of V-s is essential to improve the model performance as for the three sets.

46. Evaluating heavy metals contamination in soil and vegetables in the region of North India: Levels, transfer and potential human health risk analysis

Journal: ENVIRONMENTAL TOXICOLOGY AND PHARMACOLOGY

Abstract: This study determined the heavy metals (HMs) accumulation in different vegetables in different seasons and attributed a serious health hazard to human adults due to the consumption of such vegetables in Jhansi. The total amounts of zinc (Zn), lead (Pb), nickel (Ni), manganese (Mn), copper (Cu), cobalt (Co), and cadmium (Cd) were analysed in 28 composite samples of soil and vegetables (Fenugreek, spinach, eggplant, and chilli) collected from seven agricultural fields. The transfer factor (TF) of HMs from soil to analysed vegetables was calculated, and significant non-carcinogenic health risks due to exposure to analysed heavy metals via consumption of these vegetables were computed. The statistical analysis involving Principal

Component Analysis (PCA) and Pearson's correlation matrix suggested that anthropogenic activities were a major source of HMs in the study areas. The target hazard quotient of Cd, Mn, and Pb for fenugreek (2.156, 2.143, and 2.228, respectively) and spinach (3.697, 3.509, 5.539, respectively) exceeded the unity, indicating the high possibilities of non-carcinogenic health risks if regularly consumed by human beings. This study strongly suggests the continuous monitoring of soil, irrigation water, and vegetables to prohibit excessive accumulation in the food chain.

47. Tissue distribution and bioaccumulation of organophosphate esters in wild marine fish from Laizhou Bay, North China: Implications of human exposure via fish consumption

Journal: JOURNAL OF HAZARDOUS MATERIALS

Abstract: Despite organophosphate esters (OPEs) are ubiquitous in the environment, limited information is available about their tissue-specific accumulation potential in marine fish and exposure risks. Ten fish species from the coastal area of Laizhou Bay, North China, were sampled and analyzed to investigate tissue levels, bioaccumulation, and human exposure risks of 20 OPEs. Seventeen OPEs were detected in fish tissues with total concentration ranging from 6.6-107 ng/g dry weight. The average log bioaccumulation factor (BAF) values of OPEs ranged from 2.8 to 4.4 in livers, 2.3-3.8 in muscles, 2.5-3.9 in gills, and 2.8-4.4 in kidneys. The log BAF values of OPEs significantly increased with increasing their log K-OW values ($r = 0.55$-0.63, $p < 0.001$). The estimated daily intake of OPEs ranged from 1.7-12.0 and 3.1-22.1 ng/kg bw/d for rural and urban residents, respectively. The hazard quotients of OPEs were in the range of 4 x 10(-5) to 6.7 x 10(-4) and 7 x 10(-5) to 1.2 x 10(-3) for rural and urban residents, respectively. Results showed that the human health risks of OPEs associated with fish consumption is at low level.

48. Large-scale atmospheric circulation patterns associated with extreme monsoon precipitation in Pakistan during 1981-2018

Journal: ATMOSPHERIC RESEARCH

Abstract: Deviations in South Asian Summer Monsoon (SASM) precipitation affect the regional floods and drought patterns. In the current study, in-situ observations from Pakistan Meteorological Department (PMD), remotely sensed precipitation data from Climate Hazard Infrared Precipitation with Station data (CHIRPS), reanalysis data from ERA5, and National Center for Environmental Prediction/National Center for Atmospheric Research (NCEP/NCAR) during 1981-2018 are used to explore the atmospheric circulation patterns during above and below-normal precipitation episodes. In a statistical sense, two methods, namely the Empirical Orthogonal Function (EOF) and Percent Normal (PN) indices are used to derive dominant spatial patterns and temporal evolution of extreme monsoon precipitation episodes. Results inferred 60% of the variance to the leading EOF mode depicting a similar spatial pattern of eigenvectors across the region. The leading principal component (PC) and PN index together depicted similar deviations, complementing the extreme flooding and drought

years. From the composites, an anomalous increase (decrease) in seasonal precipitation magnitude was observed. The possible mechanism suggests an active control of atmospheric and sea-surface temperature (SST) forcing by altering the wind ascent (descent). The jet streams (200 hPa) intensification of Rossby waves high (low) pressure provides favorable frontal boundaries between polar cold and tropical warm air masses. The westerlies and easterlies are intensified (suppressed) during the above (below) normal precipitation composites, affecting the moisture transport. The enhanced (reduced) convective activities in the Indian Ocean as a primary source affected precipitation in the region during each composite.

49. Heavy metals levels in raw cow milk and health risk assessment across the globe: A systematic review

Journal: SCIENCE OF THE TOTAL ENVIRONMENT

Abstract: This systematic review presents the potential toxicity of heavy metals such as lead (Pb), mercury (Hg), cadmium (Cd), iron (Fe), nickel (Ni), aluminum (Al), and copper (Cu) in raw cow milk, focusing on their contamination sources and on the assessment of the related human health risk. Multiple keywords such as raw cow milk, heavy metals, and human health were used to search in related databases. A total of 60 original articles published since 2010 reporting the levels of these metals in raw cow's milk across the world were reviewed. Data showed that the highest levels of Ni (833 mg/L), Pb (60 mg/L), Cu (36 mg/L) were noticed in raw cow milk collected in area consists of granites and granite gneisses in India, while the highest level of Cd (12 mg/L) was reported in barite mining area in India. Fe values in raw cow milk samples were above the WHO maximum limit (0.37 mg/L) with highest values (37.02 mg/L) recorded in India. The highest Al level was (22.50 mg/L) reported for raw cow's milk collected close to food producing plants region in Turkey. The Target Hazard Quotients (THQ) values of Hg were below 1 suggesting that milk consumers are not at a non-carcinogenic risk except in Faisalabad province (Pakistan) where THQ values = 7.7. For the other heavy metals, the THQ values were >1 for Pb (10 regions out of 70), for Cd (6 regions out of 59), for Ni (3 out of 29), and for Cu (3 out of 54). Exposure to heavy metals is positively associated with diseases developments. Moreover, data actualization and continuous monitoring are necessary and recommended to evaluate heavy metals effects in future studies.

50. Arsenic in leafy vegetable plants grown on mine water-contaminated soils: Uptake, human health risk and remedial effects of biochar

Journal: JOURNAL OF HAZARDOUS MATERIALS

Abstract: Field investigation and microcosm experiment were conducted to examine the uptake of arsenic by vegetable plants grown on the soils contaminated by acidic mine water and evaluate the human health risk from con-suming the vegetables. Plant uptake of arsenic was related to the ratio of phosphorus to arsenic in soil solution for the same vegetable species. Bioaccumulation coefficient (BAC) of arsenic was highly variable amongst the different vegetable species with water spinach (white stem) and

sweet potato leaf being identified as major vegetable species with high BAC. There was a reasonably good relationship between the gastric phase-bioaccessible arsenic and the gastrointestinal phase-bioaccessible arsenic. Consumption of the vegetables grown in the investigated area poses a significantly potential human health risk with a hazard quotient (HQ) of 2.7. Application of biochar significantly inhibited the uptake of arsenic by the vegetable plant due to protonation of biochar surfaces under acidic conditions, which favoured adsorption of arsenic. The bioaccessibity of arsenic in the edible part of vegetable was also reduced due to biochar application. The HQ of the test vegetable plant (Gynura cusimbua) after soil amendment by biochar was reduced to 2 from 6 for the unamended soil.

51. GIS-based landslide susceptibility assessment using optimized hybrid machine learning methods

Journal: CATENA

Abstract: Globally, but especially in China, landslides are considered to be one of the most severe and significant natural hazards. In this study, bivariate statistical-based kernel logistic regression (KLR) models with different kernel functions (Polynomial, PUK, and Radial Basis Function), named the PLKLR, PUKLR, and RBFKLR models, were proposed for landslide susceptibility evaluation in Zichang City, China. Meanwhile, the present study aims to build landslide susceptibility maps based on bivariate statistical correlation analysis, optimization of different kernel functions, comparison of three landslide susceptibility maps and systematic analysis of spatial patterns. The steps of this article are organized as follows: Firstly, a landslide inventory containing 263 historical landslide locations was constructed. For the purpose of training and validation of models, 263 landslide locations were randomly divided into two parts with a ratio of 70/30. Secondly, 14 landslide conditioning factors were extracted from the spatial database. Subsequently, correlation analysis between the conditioning factors and the occurrence of landslides was conducted using frequency ratios. Then, the conditioning factors with normalized frequency ratios values were used as inputs to build the landslide susceptibility maps using the three models. A multicollinearity analysis was performed using collinearity statistics. Finally, the area under the receiver operating characteristic curve (AUC) was used for comparison and validation of models for recognizing the prediction capability. By further quantitative comparing mapped susceptibility values on a pixel-by-pixel basis, which can acquire underestimations and overestimations of factors (distance to river and slope) and susceptibility area. The results indicated that the PUKLR model had superior performance in landslide susceptibility assessment, with the highest AUC values of 0.884 and 0.766 for training and validation datasets, respectively. This model was followed by the RBFKLR model and the PLKLR model for the training datasets (AUC values of 0.879 and 0.797, respectively), and the PLKLR model and the RBFKLR model for the validation datasets (AUC values of 0.758 and 0.752, respectively). The landslide susceptibility map could help government agencies and decision-makers

make wise decisions for future natural hazards prevention in Zichang region.

52. Equitable Exploring ridesourcing waiting time and its determinants
Journal: TRANSPORTATION RESEARCH PART D-TRANSPORT AND ENVIRONMENT
Abstract: Waiting time (WT) is an important measure that can reflect accessibility to ridesourcing service. Previous studies explored the effects of built environment factors on WT based on estimated WT but did not control for trip-level characteristics, which may lead to biased parameter estimation. Thus, we further study this topic by using the actual WT recorded by the RideAustrin platform and considering trip-level variables. The single-level and multilevel proportional hazards models are constructed, and model comparison shows that the multilevel model performs better. We find that waiting time is positively correlated with trip-level characteristics such as traffic conditions, surge multiplier, and rainy weather. Regarding built environment factors, WT is positively related to distance to CBD and negatively related to road density, transit stop density, and land-use entropy. WT is also higher in areas with a high fraction of Hispanic/Latino and Black residents but lower in areas of low income.

53. Microplastic pollution and ecological risk assessment in an estuarine environment: The Dongshan Bay of China
Journal: CHEMOSPHERE
Abstract: Microplastic (MP) pollution has spurred a wide range of concerns due to its ubiquity and potential hazards to humans and ecosystems, yet studies on MP abundance, distribution, and ecological impacts on the small-scale local estuarine systems are insufficient. We conducted the first study of MP pollution in surface water of Dongshan Bay in southern China. A total of six water samples were collected using a Manta trawl (length = 3 m, width = 1 m, height = 0.6 m, and mesh size = -330 pm). The abundance, type, shape, color, and size, were measured using light microscopy and micro-Raman spectroscopy. Our results showed that MPs spanned from 0.23 to 4.01 particles m(-3) with an average of 1.66 particles m(-3). 75% of the MPs were PP, PE, and PS that may be explained by the widespread application of PE, PP, and PS foam in local fishing and aquaculture within the bay. Foam, white, and 1.0-2.5 mm were dominant shape, color, and size of MPs, respectively. Both indices of MPs-induced risk (H-estuary = 13.7) and pollution load (PLIestuary = 14.2) yielded a Hazard Level II for MPs pollution in the Dongshan Bay. The potential ecological risk from combined MPs polymers (RIestuary = 21.5) ended up at a minor risk. Our findings established the first set of baseline data on MPs pollution in Dongshan Bay and provided preliminary quantitative measures on the scale of ecological risk, which would improve the understanding of MP fate, transport, and ecological impacts in the estuarine environment.

54. Increasing glacial lake outburst flood hazard in response to surge glaciers in the Karakoram
Journal: EARTH-SCIENCE REVIEWS
Abstract: Unlike glaciers in other parts of the world, Karakoram glaciers seem to be

stable or gaining in mass in response to global climate change, a phenomenon known as 'the Karakoram anomaly'. Many of the glaciers experience irregular, frequent, and sudden advances (surges) that pose an increasing threat of ice dam lake formation and subsequent outburst flooding throughout the region. In this study, we document 179 glacial lake outburst floods (GLOFs) that occurred from 1533 to 2020 in five major valleys. Sixty-four of the events took place after 1970, and 37 of these had remote sensing imagery that covered the GLOF formation to breaching sequence. Thirty-six glaciers were associated with GLOFS due to ice-front advance building ice barriers in rivers. The Kayger and Khurdopin glaciers are the most hazardous examples, being responsible for 31.8% of major GLOFs in the entire Karakoram. Using a cross-correlation feature-tracking technique on remote sensing imagery, we analyzed ten surge glaciers and documented six surge events from 1990 to 2019. Results show periodic surge cycles for the Khurdopin, Kyager, Shishper, and Chilinji glaciers of c. 15-20 years, with a surge velocity in the mid-2010s higher than that of the late 1990s for all studied glaciers. The higher velocity of a glacier increases the risk of flooding downstream of the terminus because the transfer of a huge ice mass towards the terminus during the surge is a key factor for formation and reformation of series of ice-dammed lakes, thus determining the magnitude and frequency of outburst flood events. The response of Karakorum glaciers to global warming and climate forcing, comprising a continuum of glacier mass gain, ice thinning and ice advance, has resulted in lake formation and ice dam failures. We predict the frequency of GLOFs will increase in the future. These findings support the increasing anomalous behavior of glaciers in the Karakoram region. To synthesize the detailed observations, a conceptual model is presented of ice-dammed lake formation and GLOF initiation in response to glacier surging.

55. Landslide failures detection and mapping using Synthetic Aperture Radar: Past, present and future

Journal：EARTH-SCIENCE REVIEWS

Abstract: Landslides are geomorphological processes that shape the landscapes of all continents, dismantling mountains and contributing sediments to the river networks. Caused by geophysical and meteorological triggers, including intense or prolonged rainfall, seismic shaking, volcanic activity, and rapid snow melting, landslides pose a serious threat to people, property, and the environment in many areas. Given their abundance and relevance, investigators have long experimented with techniques and tools for landslide detection and mapping using primarily aerial and satellite optical imagery interpreted visually, or processed by semi-automatic or automatic procedures or algorithms. Optical (passive) sensors have known limitations due to their inability to capture Earth surface images through the clouds and to work in the absence of daylight. The alternatives are active, ?allweather? and ?day-and-night?, microwave radar sensors capable of seeing through the clouds and working in presence and absence of daylight. We review the literature on the use of Synthetic Aperture Radar (SAR) imagery to

detect and map landslide failures ? i.e., the single most significant movement episodes in the history of a landslide ? and of landslide failure events ? i.e., populations of landslides in areas ranging from a few to several thousand square kilometres caused by a single trigger. We examine 54 articles published in representative journals presenting 147 case studies in 32 nations, in all continents, except Antarctica. Analysis of the geographical location of 70 study areas shows that SAR imagery was used to detect and map landslides in most morphological, geological, seismic, meteorological, climate, and land cover settings. The time history of the case studies reveals the increasing interest of the investigators in the use of SAR imagery for landslide detection and mapping, with less than one article per year from 1995 to 2011, rising to about 5 articles per year between 2012 and 2020, and an average period of about 4.2 years between the launch of a satellite and the publication of an article using imagery taken by the satellite. To detect and map landslides, investigators use a common framework that exploits the phase and the amplitude of the electromagnetic return signal recorded in the SAR images, to measure terrain surface properties and their changes. To discriminate landslides from the surrounding stable terrain, a classification of the ground properties is executed by expert visual (heuristic) interpretation, or through numerical (statistical) modelling approaches. Despite undisputed progress over the last 26 years, challenges remain to be faced for the effective use of SAR imagery for landslide detection and mapping. In the article, we examine the theoretical, research, and operational frameworks for the exploitation of SAR images for landslide detection and mapping, and we provide a perspective for future applications considering the existing and the planned SAR satellite missions.

56. Energy trilemma based prioritization of waste-to-energy technologies: Implications for post-COVID-19 green economic recovery in Pakistan

Journal: JOURNAL OF CLEANER PRODUCTION

Abstract: As lockdown eases, economic activities resume in Pakistan. If the country continues to follow business as-usual (BAU) then it is anticipated that carbon output could surge past pre-COVID-19 levels that means more disasters in future. Thus, it is an unprecedented opportunity to shift from BAU and achieve carbon-neutral and nature-positive economic recovery green economic recovery (GER). To fuel the GER, access to modern, equitable, affordable and sustainable energy is paramount. This study explores waste-to-energy (WtE) as an alternative green fuel for GER. Seven WtE technologies are prioritized based on the concept of energy trilemma energy security, energy equity, and environmental sustainability. For the evaluation, an energy trilemma based decision support framework is developed using most prominent multi-criteria decision-making (MCDM) methods. The fuzzy set theory is integrated with MCDM methods to minimize uncertainty in results. Sixteen experts are engaged to score each WtE technology with respect to every energy trilemma dimension and sub-dimension. Gasification technology is found to be the most feasible option for WtE generation in Pakistan whereas Torrefaction technology is least favorable. It is concluded that the

need to shift towards sustainable energy is more than ever to limit the carbon emission and prevent future crisis.

57. Vanadium in soil-plant system: Source, fate, toxicity, and bioremediation
Journal: JOURNAL OF HAZARDOUS MATERIALS
Abstract: Vanadium(V) is an important component of industrial activities, while it may pose toxic hazards to plants, animals, and humans at high levels. Owing to its various uses in numerous industrial processes, high amount of V is released into the soil environment. Previous literature has focused on the biogeochemistry and ecotoxicity of V in soil-plant system. Consequently, this overview presents its source, fate, phyto-uptake, phyto-toxicity, detoxification, and bioremediation based on available data, especially published from 2015 to 2020. Vanadium occurs as various chemical forms (primarily as V(V) and V(IV)) in the soil environment, and its biogeochemical behaviour is easily influenced by soil conditions including redox potential, soil pH, organic matter, and microorganisms. Vanadium mainly accumulates in plant roots with very limited translocation to shoots. However, plants such as dog's tail grass and green bean are reported to accumulate high levels of V in aboveground tissues. An insight into the processes and mechanisms that allow plants to absorb and translocate V in soil-plant system is also stressed in this overview. In plants, low levels of V have beneficial effects on plant growth and development. Nevertheless, excessive V provokes numerous deleterious effects including reducing seed germination, inhibiting root and shoot growth, depressing photosynthesis, interfering with nutrients uptake, inducing overgeneration of ROS, and leading to lipid peroxidation. Mechanisms related to detoxification strategies like sequestration in root system, compartmentation in vacuoles and cell wall, and antioxidant defence systems to endure V-induced toxicity in plants are discussed as well. The detailed knowledge of bioremediation involved in the cleanup of V-contaminated soils would immensely help understand and improve the remediation process. Furthermore, this overview outlines several research gaps requiring further investigation in order to advance our understanding of the biogeochemical roles of V in soil-plant systems.

58. Prediction of Combined Terrestrial Evapotranspiration Index (CTEI) over Large River Basin Based on Machine Learning Approaches
Journal: WATER
Abstract: Drought is a fundamental physical feature of the climate pattern worldwide. Over the past few decades, a natural disaster has accelerated its occurrence, which has significantly impacted agricultural systems, economies, environments, water resources, and supplies. Therefore, it is essential to develop new techniques that enable comprehensive determination and observations of droughts over large areas with satisfactory spatial and temporal resolution. This study modeled a new drought index called the Combined Terrestrial Evapotranspiration Index (CTEI), developed in the Ganga river basin. For this, five Machine Learning (ML) techniques, derived from artificial intelligence theories, were applied: the Support Vector Machine (SVM)

algorithm, decision trees, Matern 5/2 Gaussian process regression, boosted trees, and bagged trees. These techniques were driven by twelve different models generated from input combinations of satellite data and hydrometeorological parameters. The results indicated that the eighth model performed best and was superior among all the models, with the SVM algorithm resulting in an R-2 value of 0.82 and the lowest errors in terms of the Root Mean Squared Error (RMSE) (0.33) and Mean Absolute Error (MAE) (0.20), followed by the Matern 5/2 Gaussian model with an R-2 value of 0.75 and RMSE and MAE of 0.39 and 0.21 mm/day, respectively. Moreover, among all the five methods, the SVM and Matern 5/2 Gaussian methods were the best-performing ML algorithms in our study of CTEI predictions for the Ganga basin.

59. Gathering at the top? Environmental controls of microplastic uptake and biomagnification in freshwater food webs

Journal: ENVIRONMENTAL POLLUTION

Abstract: Microplastics are ubiquitous in the environment, with high concentrations being detected now also in river corridors and sediments globally. Whilst there has been increasing field evidence of microplastics accumulation in the guts and tissues of freshwater and marine aquatic species, the uptake mechanisms of microplastics into freshwater food webs, and the physical and geological controls on pathway-specific exposures to microplastics, are not well understood. This knowledge gap is hampering the assessment of exposure risks, and potential ecotoxicological and public health impacts from microplastics. This review provides a comprehensive synthesis of key research challenges in analysing the environmental fate and transport of microplastics in freshwater ecosystems, including the identification of hydrological, sedimentological and particle property controls on microplastic accumulation in aquatic ecosystems. This mechanistic analysis outlines the dominant pathways for exposure to microplastics in freshwater ecosystems and identifies potentially critical uptake mechanisms and entry pathways for microplastics and associated contaminants into aquatic food webs as well as their risk to accumulate and biomagnify. We identify seven key research challenges that, if overcome, will permit the advancement beyond current conceptual limitations and provide the mechanistic process understanding required to assess microplastic exposure, uptake, hazard, and overall risk to aquatic systems and humans, and provide key insights into the priority impact pathways in freshwater ecosystems to support environmental management decision making. (C) 2020 Elsevier Ltd. All rights reserved.

60. Plastic in agricultural soils - A global risk for groundwater systems and drinking water supplies? - A review

Journal: CHEMOSPHERE

Abstract: The global plastic contamination is one of the major challenges facing mankind as plastic is ubiquitously present in all environmental compartments. In contrast to freshwater and marine environments, plastic contamination of agricultural soils was only recently subject to investigations although it represents a significant amount (14%) of the global plastic pollution. Of concern is the vertical migration of

plastic particles in agricultural soils and plastic-induced enhancement of pesticide transport towards underlying groundwater systems. To assess the risk of the large plastic inventory in agricultural soils for groundwater systems and drinking water supplies, this review critically synthesizes the current knowledge of the plastic mobility and plastic-pesticide interactions in agricultural soils, identifies future research directions and evaluates associated analytical challenges. The reviewed studies provide consistent evidence for vertical migration of plastic in agricultural soils towards aquifer systems, especially for sub-micrometer sized plastic particles, analogously to the well-known migration of natural particles in the sub-micrometer range (colloids). The reviewed investigations also showed that plastic changes the sorption behavior of pesticides in agricultural soils and enhances their transport towards underlying groundwater systems. Hence, the deposited plastic in agricultural soils likely poses a major risk for underlying aquifers and drinking water supplies that rely on groundwater resources below farmlands to be contaminated by plastic and pesticides. This demonstrates that improved regulatory measures are necessary regarding the general usage of plastic in the farming process to protect aquifers and drinking water supplies from plastic and pesticide contamination and to avoid a potential human health hazard. (C) 2020 The Author. Published by Elsevier Ltd.

61. Challenges and strategies for effective plastic waste management during and post COVID-19 pandemic

Journal: Science of the Total Environment

Abstract: The advent of the COVID-19 pandemic has enhanced the complexities of plastic waste management. Our improved, hyper-hygienic way of life in the fear of transmission has conveniently shifted our behavioral patterns like the use of PPE (Personal protective equipment), increased demand for plastic-packaged food and groceries, and the use of disposable utensils. The inadequacies and inefficiencies of our current waste management system to deal with the increased dependence on plastic could aggravate its mismanagement and leakage into the environment, thus triggering a new environmental crisis. Mandating scientific sterilization and the use of sealed bags for safe disposal of contaminated plastic wastes should be an immediate priority to reduce the risk of transmission to sanitation workers. Investments in circular technologies like feedstock recycling, improving the infrastructure and environmental viability of existing techniques could be the key to dealing with the plastic waste fluxes during such a crisis. Transition towards environmentally friendly materials like bioplastics and harboring new sustainable technologies would be crucial to fighting future pandemics. Although the rollbacks and relaxation of single-use plastic bans may be temporary, their likely implications on the consumer perception could hinder our long-term goals of transitioning towards a circular economy. Likewise, any delay in building international willingness and participation to curb any form of pollution through summits and agendas may also delay its implementation. Reduction in plastic pollution and at the same time promoting sustainable plastic waste management

technologies can be achieved by prioritizing our policies to instill individual behavioral as well as social, institutional changes. Incentivizing measures that encourage circularity and sustainable practices, and public-private investments in research, infrastructure and marketing would help in bringing the aforementioned changes. Individual responsibility, corporate action, and government policy are all necessary to keep us from transitioning from one disaster to another.

62. A novel coating technology for fast sealing of air leakage in underground coal mines
Journal: International Journal of Mining Science and Technology
Abstract: Air leakage in underground coal mines presents a serious hazard for coal production and the safety of miners. Coating technology is commonly used as an efficient means for preventing air leakage. To address existing problems with high dust concentrations in large operations involving complex processes and the high cost of traditional coating technology, a novel coating technology that ensures intrinsic safety by utilizing water pressure and wind pressure was developed. This new coating technology was designed to suction and spray, and the technical parameters of its spray performance was also studied. The experimental tests and evaluation indicated the optimum working range is 0.3-0.7 MPa of wind pressure, 1.2-10.2 L/min of water quantity, and 1.0-3.5 m of spraying distance. Moreover, this novel coating technology was tested in the Dashuitou Coal Mine in Gansu Province of China. Compared with conventional counterparts, the proposed new technology is safe, efficient, and convenient to operate. During spraying, dust concentrations were kept at less than 10 mg/m(3), and the average rebound ratio resilient rate of solid materials was below 13%. After spraying, the average leakage every 100 m was 4 m(3)/min, and the oxygen volume fraction in the adjacent goaf was approximately 4%, demonstrating excellent air leakage prevention. (c) 2021 Published by Elsevier B.V. on behalf of China University of Mining & Technology. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

63. Human health risk assessment for toxic elements in the extreme ambient dust conditions observed in Sistan, Iran
Journal: Chemosphere
Abstract: This study evaluates the bioaccessibility and health risks related to heavy metals (Cd, Cr, Co, Cu, Mn, Ni, Pb, Zn and metalloid As) in airborne dust samples (TSP and PM2.5) in Zabol, Iran during the summer dust period, when peak concentration levels of PM are typically observed. High bioaccessibilities of carcinogenic metals in PM2.5 (i.e. 53.3%, 48.6% and 47.6% for Ni, Cr and As, respectively) were calculated. The carcinogenic and non-carcinogenic health risks were assessed for three exposure pathways (inhalation, ingestion and dermal contact), separately for children and adults. Non-carcinogenic inhalation risks were very high (Hazard Index: HI > 1) both for children and adults, while the carcinogenic risks were above the upper acceptable threshold of 10(-4) for adults and marginally close (5.0-8.4 x 10(-5)) for children. High carcinogenic risks (>10(-4)) were found for the ingestion

pathway both for children and adults, while HI values > 1 (8.2) were estimated for children. Carcinogenic and non-carcinogenic risk estimates for dermal contact were also above the limits considered acceptable, except for the carcinogenic risk for children (7.6 x 10(-5)). Higher non-carcinogenic and carcinogenic risks (integrated for all elements) were associated with the inhalation pathway in adults and children with the exception of carcinogenic risk for children, where the ingestion route remains the most important, while As was linked with the highest risks for nearly all exposure pathways. A comparative evaluation shows that health risks related with toxic elements in airborne particles in Sistan are among the highest reported in the world.

64. Strategy for systematic review of observational studies and meta-analysis modelling of risk factors for sporadic foodborne diseases

Journal: Microbial Risk Analysis

Abstract: In order to design effective public health strategies, and, in particular, effective food safety interventions to reduce the burden of foodborne disease, the most important sources of enteric illnesses should be identified. Both case-control and cohort observational studies have for long been powerful approaches among epidemiologists to investigate the association of exposure and illness. In the literature, there are numerous case-control and cohort studies reporting results on risk factors and routes of transmission of sporadic foodborne infections. The objective of this article is to describe, in depth, the strategies implemented for systematic review and meta-analysis of the associations between multiple risk factors and eleven food and waterborne diseases, namely, non-typhoidal salmonellosis, campylobacteriosis, Shiga-toxin E. coli infection, listeriosis, yersiniosis, toxoplasmosis, norovirus infection, hepatitis A, hepatitis E, cryptosporidiosis and giardiasis. First, this article describes the procedures of systematic searches in five bibliographic engines, screening of relevance and assessment of methodological quality according to pre-set criteria. It proceeds with the explanation of a broad data categorisation scheme established to hierarchically group the risk factors into travel, host-specific factors and pathways of exposure (i. e., person-to-person, animal, environment and food routes), with views to harmonising and supporting the integration of outcomes from studies investigating a variety of potential determinants of disease. Next, the article describes the four meta-analysis models that were devised in order to calculate: (i) overall odds-ratios of acquiring the disease due to a specific risk factor by geographical region; (ii) overall odds-ratios of acquiring the disease from the different risk factors; (iii) overall risks of disease from consumption of ready-to-eat and barbecued foods; and (iv) overall effects of food handling (i.e., consuming food in raw, undercooked or unwashed state) and food preparation setting (i.e., eating food prepared outside the home) on risk of disease. The procedures for sensitivity analysis and removal of any influential and potentially-biased odds-ratio; and two methods for publication bias assessment are outlined. Finally, details are given on deviations from the standard risk categorisation scheme for specific foodborne hazards.

65. Photothermal and Joule heating-assisted thermal management sponge for efficient cleanup of highly viscous crude oil

Journal: Journal of Hazardous Materials

Abstract: Fast and efficient cleanup of high-viscosity oil spills on the sea is still a global challenge today. Traditional recycling methods are either energy demanding or inefficient. Hydrophobic/oleophilic sorbents are promising candidates to handle oil spills, but they have limited ability to recover high viscosity oil. In this work, we report a superhydrophobic/oleophilic carbon nanotubes (CNT) and polypyrrole (PPy) coated melamine sponge (m-CNT/PPy@MS). The CNT/PPy coating enables the sponge to convert light and electricity to heat, ensuring that the absorbent can adapt to various working environments. The rapid heat generation on the sponge surface can significantly reduce the viscosity of crude oil and accelerate the absorption rate, thereby achieving the purpose of rapid recovery of oil spills. Under one sun illumination (1.0 kW/m(2)) and an applied voltage (8 V), the surface temperature of the m-CNT/PPy@MS can reach 118.6 degrees C. The complete penetration time of oil droplets is 93.5% less than that of an unheated sponge. In addition, under half sun irradiation intensity and 11 V, the porous sponge absorbed 6.92 kg/m(2) of crude oil in the first minute, which is about 31 times as much as that of an unheated sponge. Finally, we demonstrate a continuous absorption system, consisting of a self-heating m-CNT/PPy@MS and peristaltic pump, that can continuously recover oil spills on the sea surface. In view of its unique design, lower cost and fast oil absorption speed, this work provides a new option to tackle large-scale oil spill disasters on the sea surface.

66. Hydrogeochemical and health risk evaluation of arsenic in shallow and deep aquifers along the different floodplains of Punjab, Pakistan

Journal: Journal of Hazardous Materials

Abstract: The current study delineated the distribution, (hydro)geochemical behavior and health risk of arsenic (As) in shallow (depth 35 m; handpumps and electric pumps) and deep (depth 35 m; tube wells) aquifers in five areas along the Indus River (Bhakar, Kallur Kot), Jhelum River (Jhelum) and Chenab River (Hafizabad, Gujranwala) floodplains of Punjab, Pakistan. Relatively, greater As concentration was observed in deep wells (mean: 24.3 mu g L-1) compared to shallow wells (19.4 mu g L-1), with groundwater As spanning 0.1-121.7 mu g L-1 (n = 133) in three floodplains. Groundwater from Hafizabad (Chenab River floodplain) possessed the highest As (121.7 mu g L-1), Na+ (180 mg L-1), Ca2+ (95 mg L-1), Cl- (101 mg L-1) and SO42- (1353 mg L-1) concentrations. Arsenic health risk modeling indicated the potential carcinogenic (value > 10?4) and non-carcinogenic (hazard quotient > 1.0) risks for groundwater of all areas, with the utmost risk estimated for Chenab floodplain and deep aquifers. Positive saturation index values for Fe oxide mineral phases may suggest their potential role in As mobilization/ release in these aquifer environments. This study provides critically-important and baseline knowledge for a widespread groundwater As examination along these three floodplains, which is vital for launching suitable As

mitigation and remediation programs to reduce the potential health risk.

67. Advanced Functional Nanostructures based on Magnetic Iron Oxide Nanomaterials for Water Remediation: A Review

Journal: Water Research

Abstract: The fast growth of industrialization combined with the increasing population has led to an unparalleled demand for providing water in a safe, reliable, and cost-effective way, which has become one of the biggest challenges of the twenty-first century faced by global society. The application of nanotechnology in water treatment and pollution cleanup is a promising alternative in order to overcome the current limitations. In particular, the application of magnetic iron oxide nanoparticles (MIONs) for environmental remediation has currently received remarkable attention due to its unique combination of physicochemical and magnetic properties. Given the broadening use of these functional engineered nanomaterials, there is a growing concern about the adverse effects upon exposure of products and by-products to the environment. This makes vitally relevant the development of green chemistry in the synthesis processes combined with a trustworthy risk assessment of the nanotoxicity of MIONs as the scientific knowledge of the potential hazard of nanomaterials remains limited. This work provides comprehensive coverage of the recent progress on designing and developing iron oxide-based nanomaterials through a green synthesis strategy, including the use of benign solvents and ligands. Despite the limitations of nanotoxicity and environmental risks of iron oxide-based nanoparticles for the ecosystem, this critical review presents a contribution to the emerging knowledge concerning the theoretical and experimental studies on the toxicity of MIONs. Potential improvement of applications of advanced iron oxide-based hybrid nanostructures in water treatment and pollution control is also addressed in this review.

68. Corporate Social Responsibility and Sustainability. A Bibliometric Analysis of Their Interrelations

Journal: Sustainability

Abstract: Traditional economic system has brought important negative implications regarding environmental development, as well as an unequal distribution of wealth, which has led to ecological disasters and population imbalances. Considering the existence of unequal opportunities and access to resources in a global economy, it would be relevant to study the interrelations between the concepts of Sustainability and Corporate Social Responsibility (CSR). Global and multifactorial issues require the review of fieldworks and their connections. From this perspective, the present research aims to analyze the relationships between the concepts of Corporate Social Responsibility and Sustainability in order to understand the advances of current scientific production and future lines of research. In this way, there is a considerable increase of interest in this line of research, highlighting Garcia-Sanchez as the most productive author, Business, Management and Accounting as the most studied topic, and Sustainability Switzerland as the most productive journal. The country with the

most publications and citations is the United States, and the most productive institution is Universidad de Salamanca. Future lines of research should focus on the social dimension and its possibilities in the field of Circular Economy. Finally, a line of research is proposed that also includes the proposals from the 2030 Agenda for Sustainable Development and its 17 Sustainable Development Goals.

69. Unprecedented plastic-made personal protective equipment (PPE) debris in river outlets into Jakarta Bay during COVID-19 pandemic
Journal: Chemosphere
Abstract: Increased plastic uses during COVID-19 pandemic challenges efforts to reduce marine plastic debris. Despite recent observations of increased plastic-made personal protection equipment (PPE) waste in coastal areas, comparative data before and during the pandemic lacked. We present in situ monitoring data on riverine debris releases into Jakarta Bay, Indonesia, during COVID-19 pandemic relative to the 2016 baseline data. River debris at two river outlets - the Cilincing and Marunda Rivers, revealed a 5% increase in the abundance of debris and a 23-28% decrease in the weight of debris releases in March -April 2020 compared to March-April 2016, suggesting a compositional shift towards lighter debris. Plastics continued to dominate river debris at 46% (abundance) or 57% (weight). Unique to the pandemic, we observed an unprecedented presence of PPE (medical masks, gloves, hazard suits, face shields, raincoats) that accounted for 15-16% of the collected river debris of 780 +/- 138 items (abundance) or 0.13 +/- 0.02 tons (weight) daily. The observed increased plastic-made PPE in river outlets urges for improved medical waste management of domestic sources during the prolonged pandemic.

70. River contamination shapes the microbiome and antibiotic resistance in sharpbelly (Hemiculter leucisculus)
Journal: Environmental Pollution
Abstract: Animals living in urban river systems play critical roles in the dissemination of microbiome and antibiotic resistance that poses a strong threat to public health. This study provides a comprehensive profile of microbiota and antibiotic resistance genes (ARGs) of sharpbelly (Hemiculter leucisculus) and the surrounding water from five sites along the Ba River. Results showed Proteobacteria, Firmicutes and Fusobacteria were the dominant bacteria in gut of H. leucisculus. With the aggravation of water pollution, bacterial biomass of fish gut significantly decreased and the proportion of Proteobacteria increased to become the most dominant phylum eventually. To quantify the contributions of influential factors on patterns of gut microbiome with structural equation model (SEM), water bacteria were confirmed to be the most stressors to perturb fish gut microbiome. SourceTracker model indicated that deteriorating living surroundings facilitated the invasion of water pathogens to fish gut eco-environments. Additionally, H. leucisculus gut is an important reservoir of ARGs in Ba River with relative abundance up to 9.86 x 10(-1)/copies. Among the ARGs, tetracycline and quinolone resistance genes were detected in dominant abundance. Deterioration of

external environments elicited the accumulation of ARGs in fish gut. Intestinal class I integron, environmental heavy metal residues and gut bacteria were identified as key drivers of intestinal ARGs profiles in H. leucisculus. Analysis of SEM and co-occurrence patterns between ARGs and bacterial hosts indicated that class I integron and bacterial community played vital roles in ARGs transmission through water-fish pathway. In general, this study highlighted hazards of water contamination to microbiome and ARGs in aquatic animals and provided a new perspective to better understand the bacteria and ARGs dissemination in urban river ecosystems.

71. Environmental fate, ecotoxicity biomarkers, and potential health effects of micro- and nano-scale plastic contamination
Journal: Journal Of Hazardous Materials
Abstract: In recent decades, the quantity of plastic waste products has increased tremendously. As plastic wastes are released into the environment, they exert harmful effects on biota and human health. In this work, a comprehensive review is offered to describe the physical and chemical characteristics of microplastics and nanoplastics in relation to their fate, microbial ecology, transport, and ecotoxic behavior. Present discussion is expanded further to cover the biochemical, physiological, and molecular mechanisms controlling the environmental fate, ecotoxicity, and human health hazards of microand nanoplastics. The risks of their exposure to microbes, plants, animals, and human health are also reviewed with special emphasis. Finally, a direction for future interdisciplinary research in materials and polymer science is also discussed to help control the pollution caused by microand nanoplastics.

72. Combination of Feature Selection and CatBoost for Prediction: The First Application to the Estimation of Aboveground Biomass
Journal: Forests
Abstract: Increasing numbers of explanatory variables tend to result in information redundancy and dimensional disaster in the quantitative remote sensing of forest aboveground biomass (AGB). Feature selection of model factors is an effective method for improving the accuracy of AGB estimates. Machine learning algorithms are also widely used in AGB estimation, although little research has addressed the use of the categorical boosting algorithm (CatBoost) for AGB estimation. Both feature selection and regression for AGB estimation models are typically performed with the same machine learning algorithm, but there is no evidence to suggest that this is the best method. Therefore, the present study focuses on evaluating the performance of the CatBoost algorithm for AGB estimation and comparing the performance of different combinations of feature selection methods and machine learning algorithms. AGB estimation models of four forest types were developed based on Landsat OLI data using three feature selection methods (recursive feature elimination (RFE), variable selection using random forests (VSURF), and least absolute shrinkage and selection operator (LASSO)) and three machine learning algorithms (random forest regression (RFR), extreme gradient boosting (XGBoost), and categorical boosting (CatBoost)). Feature

selection had a significant influence on AGB estimation. RFE preserved the most informative features for AGB estimation and was superior to VSURF and LASSO. In addition, CatBoost improved the accuracy of the AGB estimation models compared with RFR and XGBoost. AGB estimation models using RFE for feature selection and CatBoost as the regression algorithm achieved the highest accuracy, with root mean square errors (RMSEs) of 26.54 Mg/ha for coniferous forest, 24.67 Mg/ha for broad-leaved forest, 22.62 Mg/ha for mixed forests, and 25.77 Mg/ha for all forests. The combination of RFE and CatBoost had better performance than the VSURF-RFR combination in which random forests were used for both feature selection and regression, indicating that feature selection and regression performed by a single machine learning algorithm may not always ensure optimal AGB estimation. It is promising to extending the application of new machine learning algorithms and feature selection methods to improve the accuracy of AGB estimates.

73. A physical modeling-based study on the control mechanisms of Negative Poisson's ratio anchor cable on the stratified toppling deformation of anti-inclined slopes

Journal: INTERNATIONAL JOURNAL OF ROCK MECHANICS AND MINING SCIENCES

Abstract: With ongoing increases in excavation depth, the large-scale toppling instability failure of stratified anti-inclined slopes is gaining wide attention. To address the problem of controlling toppling deformation failure of anti-inclined slopes with traditional small-deformation materials, this paper takes the results of existing studies on the extraordinary mechanical properties of engineering-scale Negative Poisson's ratio (NPR) anchor cable as a theoretical basis, and develops a model-scale NPR anchor cable according to similarity theory. Relying on a self-developed engineering disaster model experimental system, a physical modeling-based experiment to explore the reinforcement mechanism of stratified anti-inclined slope using model-scale NPR and ordinary anchor cables is performed. The physical model is monitored using static strain data acquisition equipment, an infrared thermal imager, tension sensors, and digital speckle correlation method (DSCM) displacement field measurement equipment. The evolution of the displacement field, strain field, temperature field, and anchor cable force are obtained during excavation on the physical model. By comparing the evolution of these parameters with images from both the anti-inclined slope model instability failure test and the deformation characteristics on the two sides of the slope, which were reinforced using different types of anchor cables, this paper determines the mechanisms governing instability failure of anti-inclined slopes reinforced with NPR anchor cable. In addition, this paper also proves that NPR anchor cable can be used to monitor the sliding force of anti-inclined slopes throughout excavation, and lays a foundation for the application of NPR anchor cable monitoring technology to the advanced anti-inclined slope failure warning.

74. Heavy metal associated health hazards: An interplay of oxidative stress and signal transduction

Journal: CHEMOSPHERE

Abstract: Heavy metal-induced cellular and organismal toxicity have become a major health concern in biomedical science. Indiscriminate use of heavy metals in different sectors, such as, industrial-, agricultural-, healthcare-, cosmetics-, and domestic-sectors has contaminated environment matrices and poses a severe health concern. Xenobiotics mediated effect is a ubiquitous cellular response. Oxidative stress is one such prime cellular response, which is the result of an imbalance in the redox system. Further, oxidative stress is associated with macromolecular damages and activation of several cell survival and cell death pathways. Epidemiological as well as laboratory data suggest that oxidative stress-induced cellular response following heavy metal exposure is linked with an increased risk of neoplasm, neurological disorders, diabetes, infertility, developmental disorders, renal failure, and cardiovascular disease. During the recent past, a relation among heavy metal exposure, oxidative stress, and signaling pathways have been explored to understand the heavy metal-induced toxicity. Heavy metal-induced oxidative stress and its connection with different signaling pathways are complicated; therefore, the systemic summary is essential. Herein, an effort has been made to decipher the interplay among heavy metals/metalloids (Arsenic, Chromium, Cadmium, and Lead) exposures, oxidative stress, and signal transduction, which are essential to mount the cellular and organismal response. The signaling pathways involved in this interplay include NF-kappa B, NRF2, JAK-STAT, JNK, FOXO, and HIF.

75. Emerging risks of toxic metal(loid)s in soil-vegetables influenced by steel-making activities and isotopic source apportionment

Journal: ENVIRONMENT INTERNATIONAL

Abstract: Industrial activities tend to deteriorate adjacent agricultural lands due to accumulation of potentially toxic elements in soils and crops. However, better understanding of their distinctive source partitions and transfer process remains insufficient in steel-making area. The paper focuses on the pollution levels, health risks, and provenance identification of Tl, As, Pb, Cu, Ni, Co, Sb, Cd, Zn, Be, Cr, Fe, Mn, Mo, Sn, and V in common vegetables from different farmlands near a steel-making plant. The results showed that the Tl, As, Pb, Cd, Cr, Cu and Mn were of high-level contamination in soils and generally above the maximum permissible level (MPL). Calculation using hazard quotients (HQ) exhibited that consumption of the studied vegetables may entail significant health risks to residents, especially for children, resulting from the elevated contents of Tl, As and associated toxic elements. Calculation by binary mixing model using Pb isotopic compositions suggested that steel-making activities contributed to 35-80% of the contamination of Pb and As in vegetables. It is necessary to adopt appropriate remediation measures to mitigate the farmland contamination and ensure the food safety of the agricultural products.

76. Mathematical modelling of cumulative erosion ratio for summon in soils

Journal: PROCEEDINGS OF THE INSTITUTION OF CIVIL ENGINEERS-GEOTECHNICAL ENGINEERING

Abstract: Internal erosion induced by suffusion is a progressive process that can have negative consequences for dams, foundations and tunnel projects. The erosion ratio (denoting the ratio of the weight of cumulative eroded soils to the total weight of soils) is an important parameter in characterising this process, reflecting variations in porosity and hydraulic conductivity during suffusion. In this study, an erosion equation expressing the variation in the erosion ratio with respect to the hydraulic gradient and time is derived under arbitrary hydraulic loading conditions. This equation is based on investigations into the influence of both the hydraulic gradient and of time on the process of soil erosion. The derived erosion equation is applied in a case study and the results are compared with existing test data. It is shown that the expression proposed in this paper is in good agreement with observations. Finally, the influences of the hydraulic loading history and an erosion rate coefficient on the soil erosion process are discussed.

77. COVID-19 lockdowns reduce the Black carbon and polycyclic aromatic hydrocarbons of the Asian atmosphere: source apportionment and health hazard evaluation

Journal: ENVIRONMENT DEVELOPMENT AND SUSTAINABILITY

Abstract: The entire world is affected by Coronavirus disease (COVID-19), which is spreading worldwide in a short time. India is one of the countries which is affected most, therefore, the Government of India has implemented several lockdowns in the entire country from April 25, 2020. We studied air pollutants (i.e., PM2.5, Black Carbon (BC), and Polycyclic Aromatic Hydrocarbons (PAHs) level, and observed significantly sudden reduced. In India, most of the anthropogenic activities completely stopped. Therefore, we studied the levels of BC, PAHs and PM2.5 concentrations, their sources apportion, and health risk assessment during normal days, lockdown (from lockdown 1.0 to lockdown 4.0) and unlock down 1.0 situation at Sakchi, Jamshedpur city. It was observed that lockdowns and unlock down situations BC, PAHs and PM2.5 concentrations were significantly lower than regular days. We applied the advanced air mass back trajectory (AMBT) model to locate airborne particulate matter dispersal from different directions to strengthen the new result. The diagnostic ratio analyses of BC shows that wood burning contribution was too high during the lockdown situations. However, during normal days, the PAHs source profile was dedicated toward biomass, coal burning, and vehicle emission as primary sources of PAHs. During the lockdown period, emission from biomass and coal burning was a significant contributor to PAHs. The summaries of health risk assessment of BC quantified an equal number of passively smoked cigarettes (PSC) for an individual situation was studied. This study focuses on the overall climate impact of pandemic situations.

78. The summer 2019 basaltic Vulcanian eruptions (paroxysms) of Stromboli

Journal: BULLETIN OF VOLCANOLOGY

Abstract: Stromboli is an active, open conduit mafic volcano, whose persistent mild Strombolian activity is occasionally punctuated by much stronger explosions, known

as paroxysms. During summer 2019, the volcano unexpectedly produced one such paroxysm on July 3, followed by intense explosive and intermittent effusive activity culminating in a second paroxysm on August 28. Visual observations and the analysis of the fall deposits associated with the two paroxysms allowed us to reconstruct ballistic exit velocities of up to 160 m s(-1). Plume heights of similar to 8.4 km and 6.4 km estimated for the two events correspond to mass eruption rates of 1.1 x 10(6) kg s(-1) and 3.6 x 10(5) kg s(-1), respectively. This is certainly an underestimate as directional pyroclastic flows into which mass was partitioned immediately formed, triggering small tsunamis at the sea entrance. The mass of ballistic spatters and blocks erupted during the July 3 event formed a continuous cover at the summit of the volcano, with a mass calculated at similar to 1.4 x 10(8) kg. The distribution of fall deposits of both the July 3 and August 28 events suggests that pyroclasts characterized by terminal fall velocities < 10-20 m s(-1) remained fully suspended within the convective region of the plume and did not fall at distances closer than ca 1700 m to the vent. Based on the impulsive, blast-like phenomenology of paroxysms as well as the deposit distribution and type, paroxysms are classified as basaltic Vulcanian in style. The evolution of the summer 2019 eruptive events was not properly captured within the framework of the alert level system which is focused on tsunamigenic processes, and this is discussed so as to provide elements for the implementation of the reference scenarios and an upgrade of the system to take into account such events. In particular we find that, although still largely unpredictable, at least at operational time scales, and not necessarily tsunamigenic, Vulcanian eruptions and the subsequent evolution of the eruptive phenomena should be considered for the alert level system. This serves as a warning to the implementation of alert systems where the unexpected needs to be taken into account, even at systems that are believed to be relatively predictable as is the case at many persistently active, open vent mafic systems.

79. Polyhydroxyalkanoates: Trends and advances toward biotechnological applications
Journal: BIORESOURCE TECHNOLOGY

Abstract: Plastics are an integral part of most of the daily requirements. Indiscriminate usage and disposal have led to the accumulation of massive quantities of waste. Their non-biodegradable nature makes it increasingly difficult to manage and dispose them. To counter this impending disaster, biodegradable polymers, especially polyhydroxyalkanoates (PHAs), have been envisaged as potential alternatives. Owing to their unique physicochemical characteristics, PHAs are gaining importance for versatile applications in the agricultural and medical sectors. Applications in the medical sector are more promising because of their commercial viability and sustainability. Despite such potential, their production and commercialization are significant challenges. The major limitations are their poor mechanical strength, production in small quantities, costly feed, and lack of facilities for industrial production. This article provides an overview of the contemporary progress in the field, to attract researchers and stakeholders to further exploit these renewable resources to

produce biodegradable plastics on a commercial scale.

80. A comparative review of microplastics and nanoplastics: Toxicity hazards on digestive, reproductive and nervous system
Journal: SCIENCE OF THE TOTAL ENVIRONMENT
Abstract: Due to its excellent physical and chemical properties and low price, plastic has replaced part of the use of stone, wood and metal. The inability to degrade and improper handling have caused plastic pollution to become one of the most serious environmental problems in the world today. Plastic fragments undergo ultraviolet radiation, natural weathering, and biodegradation to form microplastics (MPs) and nanoplastics (NPs)1. The current re-search on MPs mainly focuses on transportation, bioaccumulation and toxicity. However, existing reviews treat NPs and MPs as a whole to discuss toxic damage, and ignore their differences in toxicity. In this review, we pro-vided the latest research information on the differences in toxicity between MPs and NPs in the digestive system, reproductive system and nervous system, and explored the possible reasons for differences in toxicity for the first time. Finally, it is recommended to consider the influence of microplastics components on the differences in tox-icity, as most of the researches now focuses on a few types of microplastics. And it is necessary to study the unique toxicity mechanism of MPs/NPs in bioaccumulation and pathway activation from the differences in phys-ical properties.

81. Attribution of the Australian bushfire risk to anthropogenic climate change
Journal: NATURAL HAZARDS AND EARTH SYSTEM SCIENCES
Abstract: Disastrous bushfires during the last months of 2019 and January 2020 affected Australia, raising the question to what extent the risk of these fires was exacerbated by anthropogenic climate change. To answer the question for southeastern Australia, where fires were particularly severe, affecting people and ecosystems, we use a physically based index of fire weather, the Fire Weather Index; long-term observations of heat and drought; and 11 large ensembles of state-of-the-art climate models. We find large trends in the Fire Weather Index in the fifth-generation European Centre for Medium-Range Weather Forecasts (ECMWF) Atmospheric Reanalysis (ERA5) since 1979 and a smaller but significant increase by at least 30% in the models. Therefore, we find that climate change has induced a higher weather-induced risk of such an extreme fire season. This trend is mainly driven by the increase of temperature extremes. In agreement with previous analyses we find that heat extremes have become more likely by at least a factor of 2 due to the long-term warming trend. However, current climate models overestimate variability and tend to underestimate the long-term trend in these extremes, so the true change in the like-lihood of extreme heat could be larger, suggesting that the attribution of the increased fire weather risk is a conservative estimate. We do not find an attributable trend in either extreme annual drought or the driest month of the fire season, September-February. The observations, however, show a weak drying trend in the annual mean. For the 2019/20 season more than half of the July-December drought was driven by record excursions of the Indian Ocean Dipole

and Southern Annular Mode, factors which are included in the analysis here. The study reveals the complexity of the 2019/20 bushfire event, with some but not all drivers showing an imprint of anthropogenic climate change. Finally, the study concludes with a qualitative review of various vulnerability and expo- sure factors that each play a role, along with the hazard in increasing or decreasing the overall impact of the bushfires.

82. Nanominerals: Fabrication Methods, Benefits and Hazards, and Their Applications in Ruminants with Special Reference to Selenium and Zinc Nanoparticles
Journal: ANIMALS
Abstract: Simple Summary Nanomaterials can contribute to the sustainability of the livestock sector through improving the quantitative and qualitative production of safe, healthy, and functional animal products. Given the diverse nanotechnology applications in the animal nutrition field, the administration of nanominerals can substantially enhance the bioavailability of respective minerals by increasing cellular uptake and avoiding mineral antagonism. Nanominerals are also helpful for improving reproductive performance and assisted reproductive technologies outcomes of animals. Despite the promising positive effects of nanominerals on animal performance (growth, feed utilization, nutrient bioavailability, antioxidant status, and immune response), there are various challenges related to nanominerals, including their metabolism and fate in the animal's body. Thus, the economic, legal, and ethical implications of nanomaterials must also be considered by the authority. Nanotechnology is one of the major advanced technologies applied in different fields, including agriculture, livestock, medicine, and food sectors. Nanomaterials can help maintain the sustainability of the livestock sector through improving quantitative and qualitative production of safe, healthy, and functional animal products. Given the diverse nanotechnology applications in the animal nutrition field, the use of nanomaterials opens the horizon of opportunities for enhancing feed utilization and efficiency in animal production. Nanotechnology facilitates the development of nano vehicles for nutrients (including trace minerals), allowing efficient delivery to improve digestion and absorption for better nutrient metabolism and physiology. Nanominerals are interesting alternatives for inorganic and organic minerals for animals that can substantially enhance the bioavailability and reduce pollution. Nanominerals promote antioxidant activity, and improve growth performance, reproductive performance, immune response, intestinal health, and the nutritional value of animal products. Nanominerals are also helpful for improving assisted reproductive technologies (ART) outcomes by enriching media for cryopreservation of spermatozoa, oocytes, and embryos with antioxidant nanominerals. Despite the promising positive effects of nanominerals on animal performance and health, there are various challenges related to nanominerals, including their metabolism and fate in the animal's body. Thus, the economic, legal, and ethical implications of nanomaterials must also be considered by the authority. This review highlights the benefits of including nanominerals (particularly nano-selenium and nano-zinc) in animal diets and/or cryopreservation media, focusing on modes of action, physiological

effects, and the potential toxicity of their impact on human health.

83. Ecological consequences of Stony Coral Tissue Loss Disease in the Turks and Caicos Islands

Journal: CORAL REEFS

Abstract: Coral reefs are suffering global declines due to climate change, natural disasters, pollution, and diseases. Coral disease events have increased in frequency and severity in the past several decades and have nearly wiped out populations of some Caribbean coral species. Stony coral tissue loss disease (SCTLD) is a novel white plague that infects many species, is highly contagious, and causes rapid mortality. SCTLD was first documented in the Turks and Caicos Islands in 2019. This study described the trends in coral community composition, cover, richness, and diversity from 2012 to 2020 on the South Caicos fore reef, to contextualize the impact of the ongoing disease outbreak in 2020. Monitoring sites were assessed using photo quadrats along permanent transects and CPCe for analysis. Coral cover, richness, and diversity remained consistent from 2012 to 2018. Coral cover was significantly lower in 2020 after the outbreak (1.14% +/- 0.65) than in any other year (2.97% +/- 1.12%, mean 2012-2018), a 62% loss. Richness reached its lowest point and was significantly lower in 2020 (6.33 +/- 1.37 taxa) than in all other years except for 2013 and 2016, and diversity reached its lowest point in 2020 as well. Coral community composition differed by year and particularly in 2020, with significant differences between 2013/2014 and 2020. In 2020, rare and susceptible taxa Dichocoenia spp., Eusmilia fastigiata, and Meandrina meandrites were absent from all surveys for the first time. Trends in relative cover of weedy coral taxa varied, with Agaricia spp. reaching its lowest relative cover (24.2%) in 2020 and Porites astreoides reaching its highest (18.9%). Ecological shifts associated with SCTLD in South Caicos are the first reported in the Turks and Caicos Islands and support other studies in the Caribbean which demonstrate that SCTLD significantly deteriorates reef composition.

84. Chemical kinetic behaviors at the chain initiation stage of CH4/H-2/air mixture

Journal: JOURNAL OF HAZARDOUS MATERIALS

Abstract: To intensively investigate chemical kinetic behaviors at the initial stage of CH4/H-2/air mixture thoroughly, the density functional theory (CAMB3LYP/6-31 G) and a detailed mechanism (GRI-Mech3.0) were used to obtain kinetic and thermodynamic parameters. The reaction paths during the explosion process were analyzed, and the reaction rates of elementary reactions were compared with different ratios of CH4/H-2/air mixture. The key reactions at the initiation stage of CH4/H-2/air mixture explosion were determined, and their configurations were optimized. The reaction mechanism, reaction channel and configuration parameters of key reactions were obtained, which was verified by the intrinsic reaction coordinate (IRC) theory. Results show that H-2 addition increases the laminar burning velocity, while it shortens the ignition delay time of H-2/CH4/air mixture. The addition of hydrogen greatly accelerated the explosion reaction from sample 1 to sample 4. Moreover, CH4 still plays

a key role at the chain initiation stage in H-2/CH4/air mixture system; the addition of H-2 would not compete with CH4 for triggering the explosion reaction, nor will it suppress the explosion of CH4. H-2 could not replace or take precedence over the chain branching reactant (CH2O) of CH4 explosion to react with O-2. Besides, H-2 takes precedence over CH4 in the process of chain transfer after the chain reaction beginning, although CH4 has a distinct advantage in the chain initiation stage. The present results can provide theoretical guidance for the prevention and control of gas explosion, which may effectively reduce the explosion hazards.

85. Challenges of using blooms of Microcystis spp. in animal feeds: A comprehensive review of nutritional, toxicological and microbial health evaluation
Journal: SCIENCE OF THE TOTAL ENVIRONMENT
Abstract: Microcystis spp., are Gram-negative, oxygenic, photosynthetic prokaryotes which use solar energy to convert carbon dioxide (CO2) and minerals into organic compounds and biomass. Eutrophication, rising CO2 concentrations and global warming are increasing Microcystis blooms globally. Due to its high availability and protein content, Microcystis biomass has been suggested as a protein source for animal feeds. This would reduce dependency on soybean and other agricultural crops and could make use of waste biomass when Microcystis scums and blooms are harvested. Besides proteins, Microcystis contain further nutrients induding lipids, carbohydrates, vitamins and minerals. However, Microcystis produce cyanobacterial toxins, induding microcystins (MCs) and other bioactive metabolites, which present health hazards. In this review, challenges of using Microcystis blooms in feeds are identified. First, nutritional and toxicological (nutri-toxicogical) data, including toxicity of Microcystis to mollusks, crustaceans, fish, amphibians, mammals and birds, is reviewed. Inclusion of Microcystis in diets caused greater mortality, lesser growth, cachexia, histopathological changes and oxidative stress in liver, kidney, gill, intestine and spleen of several fish species. Estimated daily intake (EDI) of MCs in musde of fish fed Microcystis might exceed the provisional tolerable daily intake (TDI) for humans. 0.04 mu g/kg body mass (bm)/day, as established by the World Health Organization (WHO), and is thus not safe. Musde of fish fed M. aeruginosa is of low nutritional value and exhibits poor palatability/taste. Microcystis also causes hepatotoxicity, reproductive toxicity, cardiotoxicity, neurotoxicity and immunotoxidty to mollusks, crustaceans, amphibians, mammals and birds. Microbial pathogens can also occur in blooms of Microcystis. Thus, cyanotoxins/xenobiotics/pathogens in Micmcystis biomass should be removed/degraded/inactivated sufficiently to assure safety for use of the biomass as a primary/main/supplemental ingredient in animal feed. As an ameliorative measure, antidotes/detoxicants can be used to avoid/reduce the toxic effects. Before using Microcystis in feed ingredients/supplements, further screening for health protection and cost control is required.

86. Adsorption of emerging contaminants from water and wastewater by modified biochar: A review

Journal: ENVIRONMENTAL POLLUTION

Abstract: Emerging contaminants (ECs), a group of relatively low-concentration but high-toxicity pollutants in the environment, have attracted widespread attention in recent years. These trace pollutants can be enriched in organisms and finally transferred to human bodies, posing a potential hazard to public health. Biochar, a low-cost and high-efficiency adsorbent, has been used to treat ECs in water. However, due to certain limitations of pristine biochar, such as poor adsorption capacity, narrow adsorption range, and other shortcomings, it is necessary to modify biochar to improve its applications in water treatment for ECs. Currently, there are a lot of reports on the removal of ECs from water by modified biochar. These studies explored different modification methods to functionalize biochar with various physicochemical properties, which resulted in distinct adsorption effects, behaviors and mechanisms of modified biochar on different ECs. There is a need to systematically review and digest the knowledge on the adsorption of ECs on modified biochar. In this review, recent biochar modification methods used in ECs removal are firstly summarized, and the adsorption performance and mechanisms of modified biochar on typical ECs are then systematically reviewed. Finally, the main research directions and trends, as well as recommendations and suggestions for future development are pointed out.

87. Arsenic contamination of groundwater: A global synopsis with focus on the Indian Peninsula

Journal: GEOSCIENCE FRONTIERS

Abstract: More than 2.5 billion people on the globe rely on groundwater for drinking and providing high-quality drinking water has become one of the major challenges of human society. Although groundwater is considered as safe, high concentrations of heavy metals like arsenic (As) can pose potential human health concerns and hazards. In this paper, we present an overviewof the current scenario of arsenic contamination of groundwater in various countries across the globe with an emphasis on the Indian Peninsula. With several newly affected regions reported during the last decade, a significant increase has been observed in the global scenario of arsenic contamination. It is estimated that nearly 108 countries are affected by arsenic contamination in groundwater (with concentration beyond maximum permissible limit of 10 ppb recommended by theWorld Health Organization. The highest among these are from Asia (32) and Europe (31), followed by regions like Africa (20), North America (11), South America (9) and Australia (4). More than 230 million people worldwide, which include 180 million from Asia, are at risk of arsenic poisoning. Southeast Asian countries, Bangladesh, India, Pakistan, China, Nepal, Vietnam, Burma, Thailand and Cambodia, are the most affected. In India, 20 states and 4 Union Territories have so far been affected by arsenic contamination in groundwater. An attempt to evaluate the correlation between arsenic poisoning and aquifer type shows that the groundwater extracted from unconsolidated sedimentary aquifers, particularly those which are located within the younger orogenic belts of the world, are theworst affected. More than

90% of arsenic pollution is inferred to be geogenic. We infer that alluvial sediments are the major source for arsenic contamination in groundwater andwe postulate a strong relation with plate tectonic processes, mountain building, erosion and sedimentation. Prolonged consumption of arsenic-contaminated groundwater results in severe health issues like skin, lung, kidney and bladder cancer; coronary heart disease; bronchiectasis; hyperkeratosis and arsenicosis. Since the major source of arsenic in groundwater is of geogenic origin, the extend of pollution is complexly linked with aquifer geometry and aquifer properties of a region. Therefore, remedialmeasures are to be designed based on the sourcemineral, climatological and hydrogeological scenario of the affected region. The corrective measures available include removing arsenic from groundwater using filters, exploring deeper or alternative aquifers, treatment of the aquifer itself, dilutionmethod by artificial recharge to groundwater, conjunctive use, and installation of nano-filter, among other procedures. The vastmajority of people affected by arsenic contamination in the Asian countries are the poor who live in rural areas and are not aware of the arsenic poisoning and treatment protocols. Therefore, creating awareness and providing proper medical care to these people remain as a great challenge. Very few policy actions have been taken at international level over the past decade to reduce arsenic contamination in drinking water, with the goal of preventing toxic impacts on human health. We recommend that that United Nations Environment Programme (UNEP) andWHO should take stock of the global arsenic poisoning situation and launch a global drive to create awareness among people/medical professionals/health workers/administrators on this global concern.

88. Advances in nanomaterial-based electrochemical biosensors for the detection of microbial toxins, pathogenic bacteria in food matrices

Journal: JOURNAL OF HAZARDOUS MATERIALS

Abstract: There is a growing demand to protect food products against the hazard of microbes and their toxins. To satisfy such goals, it is important to develop highly sensitive, reliable, sophisticated, rapid, and cost-effective sensing techniques such as electrochemical sensors/biosensors. Although diverse forms of nanomaterials (NMs)-based electrochemical sensing methods have been introduced in markets, the reliability of commercial products is yet insufficient to meet the practical goal. In this review, we focused on: 1) sources of pathogenic microbes and their toxins; 2) possible routes of their entrainment in food, and 3) current development of NM-based biosensors to realize real-time detection of the target analytes. At last, future prospects and challenges in this research field are discussed.

89. An investigation into climatic and terrestrial drivers of dust storms in the Sistan region of Iran in the early twenty-first century

Journal: SCIENCE OF THE TOTAL ENVIRONMENT

Abstract: Dust storms cause a wide range of impacts on environment, economy and human health in the Sistan region of southeastern Iran. This paper investigates long-term variability of dust activity over 23 years (1997-2019) using the Dust Storm Index

(DSI) and the frequency of dust-storm days (DSD, visibility <1000 m) and assesses the associated importance of various terrestrial and climatic drivers. A dust storm corridor was identified, based on the prevailing wind direction at Zabol, including parts of the Hamoun lakes and surrounding desert in order to study the effects of vegetation cover and lake water levels on dust activity. The results show maximum intensity of dust storms occurred at 10:30 a.m. and in the summer, consistent with the highest wind speeds - associated with the regionally important Levar wind - and highest air temperatures and lowest precipitation and relative humidity. Strong positive correlations were demonstrated between DSI and wind speed, particularly in summer. The 2000-2004 period saw severe dust-raising activity with a DSI of 530.6. Mean wind speeds were greater and precipitation, humidity, vegetation and water coverage were lower during this severe dust-activity period than in other periods. Comparing 2000-2004 with 1997-1999, DSI was five times higher and DSD eight times higher. The dust storms with the longest duration occurred in July 2001 and June 2008 (114 h and 78 h respectively). The July 2001 event, in which wind speed peaked at 25 m/s and visibility dropped to 100 m on several occasions, may be the longest continuous dust storm on record. The key role of water and vegetation cover in the Harnouns was highlighted, indicating the importance of protecting the Hamoun ecosystems and sustainably managing their water resources in efforts to mitigate dust storm hazards in the Sistan region.

90. A review of the removal of microplastics in global wastewater treatment plants: Characteristics and mechanisms

Journal: ENVIRONMENT INTERNATIONAL

Abstract: Wastewater treatment plants (WWTPs) are considered to be the main sources of microplastic contaminants in the aquatic environment, and an in-depth understanding of the behavior of microplastics among the critical treatment technologies in WWTPs is urgently needed. In this paper, the characteristics and removal of microplastics in 38 WWTPs in 11 countries worldwide were reviewed. The abundance of microplastics in the influent, effluent, and sludge was compared. Then, based on existing data, the removal efficiency of microplastics in critical treatment technologies were compared by quantitative analysis. Particularly, detailed mechanisms of critical treatment technologies including primary settling treatment with flocculation, bioreactor system, advanced oxidation and membrane filtration were discussed. Thereafter, the abundance load and ecological hazard of the microplastics discharged from WWTPs into the aquatic and soil environments were summarized. The abundance of microplastics in the influent ranged from 0.28 particles L-1 to 3.14 x 10(4) particles L-1, while that in the effluent ranged from 0.01 particles L-1 to 2.97 x 10(2) particles L-1. The microplastic abundance in the sludge within the range of 4.40 x 10(3)-2.40 x 10(5) particles kg(-1). In addition, there are still 5.00 x 10(5)-1.39 x 10(10) microplastic particles discharged into the aquatic environment each day Moreover, among the critical treatment technologies, the quantitative analysis revealed that filter-based treatment technologies

exhibited the best microplastics removal efficiency. Fibers and microplastics with large particle sizes (0.5-5 mm) were easily separated by primary settling. Polyethene and small-particle size microplastics (<0.5 mm) were easily trapped by bacteria in the activated sludge of bioreactor system. The negative impact of microplastics from wastewater treatment plant was worthy of attention. Moreover, unknown transformation products of microplastics and their corresponding toxicity need in-depth research.