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Research Hotspots and Frontiers of Mountain Flood Disaster: Bibliometric and Visual Analysis

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Abstract: In the context of climate change, enhanced human activities and ecological changes, the danger level for mountain floods has increased significantly, posing direct or potential hazards to local residents. To determine the current status, focus and trends in mountain flood research, in this study, we visualize the number of publications and citations, the countries and institutions engaged in research, co-citations and key literature, keyword categories and research areas, using keyword timeline analysis and burst detection based on the bibliometric software CiteSpace and VOSviewer and the Web of Sciences core collection database. The results show that the total number of publications and citations in the mountain flood field has experienced rapid growth to date. The United States, China, Germany, the United Kingdom, and Switzerland are the main countries driving the development of the field. The field is of great interest within multiple disciplinary categories and is characterized by multiple research hotspots, multiple research objectives, and cross-fertilization of multiple disciplinary categories. Analysis of the keyword timeline network and highlighted words show that disaster risk evaluation based on remote-sensing technology, the alpine region of the Himalayas, the response mechanisms of heavy rainfall to mountain floods, and the construction of hydrological models, will be research hotspots in the future.

Keywords: mountain flood; research hotspots; research trend; bibliometric analysis; visualization

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1. Introduction

Mountain floods are natural disasters caused by surge floods in mountain streams and gorges, involving high destructive power, suddenness, sand-carrying and obvious spatial and temporal characteristics. Over the past few decades, the frequency and intensity of extreme weather events (e.g., heavy rainfall) caused by climate change have continued to increase and mountain floods have occurred frequently, resulting in serious human casualties and economic losses. In June 2013, a mountain flood in North Tarakand killed nearly 5700 people, trapped 110,000, and caused power outages in the region, delaying relief efforts in remote areas [1]. Statistics show that, as one of the major global natural disasters, mountain floods have caused 5293 deaths or disappearances globally each year since the beginning of the 21st century, affecting more than 80 million people, and economic losses have reached $385.2 billion. In China, the proportion of deaths directly caused by mountain floods accounted for 84%, 71%, 75%, 80%, 80%, and 90% of all deaths due to floods from 2005 to 2010, respectively, with a total of 3887 people killed or missing in 2010 [2]. In addition to extreme precipitation due to climate change [3], the increase in human engineering and construction activities in mountainous areas [4] and the destruction of ecological environments [5] are important reasons for the apparent increase in the frequency and threat level for mountain floods. With the proliferation of literature in the mountain flood field (e.g., formation mechanisms, disaster management, etc.), it is necessary to review and summarize the current status of research in this field, to understand the development history of mountain flooding and to identify current hotspots and future trends.

Analyzing the current research status and technology is essential to clarify the development of a discipline, grasp the direction of the discipline, and understand future 'hot' research directions. Bibliometrics based on mathematical and statistical literature analysis and information-mining methods were introduced into science and technology evaluation beginning in the 1960s, with the rapid development of computer technology and diversification of literature research methods [6]. There are more than 10 kinds of knowledge map creation software available internationally, such as CiteSpace, Pajek, UCINET and VOSviewer, etc. Among them, CiteSpace is one of the software packages most used by domestic researchers, with features of supporting diversified data formats, comprehensive functions and good visualization effects, and has been applied in several disciplines [7,8]. Bibliometrics provides a reliable way to visualize and analyze the overall research activity, development dynamics and development trends of a discipline, making up for the shortcomings of traditional literature review research, such as low reference volume, use only of qualitative induction and analysis, conclusions and recommendations that are highly influenced by researchers' knowledge, and weak objectivity.

Bibliometrics has been repeatedly applied to summarize and analyze the development history, current status of research, and frontier hotspots in some fields of natural disaster research. Scholars have built knowledge maps of water resources and environment using CiteSpace based on the literature related to the water environment and water resources in the Web of Science core collection database (WOSCCD) to understand macroscopic research trends, collaborative relationships among research institutions, and research hotspots and trends in the field, as well as to point out the need to pay special attention to climate change and its complex coupling with water environment processes [9]. Some scholars analyzed the current status and hotspots of research on urban resilience based on the literature from 2013 to 2016 using methods of connection point strength, the burst and cluster of hotspot words in CiteSpace. The results show that disaster prevention and mitigation capacity was critical to the future sustainable development of cities; the findings could help governments develop management policies to enhance urban resilience and reduce disaster risk [10,11]. In recent years, bibliometric methods have also been applied to the field of natural hazards, disaster risk perception, disaster management and post-disaster medical care [12–15]. The results reflect some key issues of concern in the natural disaster field and, to a certain extent, provide a reference for government decision-makers. However, detailed analysis of the current status, hotspots, highlights and future trends in research on specific hazard types is still scarce, such as a concrete and comprehensive review of mountain flooding.

Knowledge visualization refers to the pictorial description of knowledge for better acquisition, storage, evaluation and management of knowledge data, of which knowledge mapping is one of the main methods. It can present the structure and dynamics of disciplinary networks in academic research in a dynamic, clear and intuitive way, with a view to grasping the current research hotspots and future development directions. WOSCCD is a cross-database platform providing high-quality and trustworthy academic information retrieval in the natural sciences, engineering and technology, the social sciences, etc. Considering the language, duplication and quality of publications, it was selected as the analysis target in this study. Based on literature research, knowledge-mapping and bibliometric analysis methods, in this study, we comprehensively reviewed the research focus and hotspots as well as the future research trends for authoritative literature data in the mountain flood field using cluster analysis, co-occurrence matrices, burst detection analysis and other technologies using the literature management software CiteSpace, Pajek and VOSviewer. First, we performed a meta-analysis and visual analysis of documents retrieved from the WOSCCD using document analysis and data-mining tools, including Citespace, VoSviewer and Origin. Secondly, bibliometrics, data mining and knowledge mapping were integrated to summarize and analyze the research process and hot issues in the past 31 years. Five main analyses were undertaken including identification of: (1) trends in the number of publications and cited literature; (2) the volume of articles published by countries and institutions and their relationship networks; (3) co-cited literature and highly cited literature; (4) keyword subject categories and research areas in the literature; and (5) research keyword timelines and bursts. Finally, we considered the main issues in current research in several subfields, examined the knowledge structure and pulse picture of mountain flood research in China, analyzed the current status and hotspots of disciplinary research and proposed relevant suggestions. This study can provide a historical context and developmental insights for mountain flood research.

2. Methods and Data

2.1. Methods

Multiple professional software resources can be used for literature knowledge mapping, such as the widely used VOSviewer, Global Maps of Science, and CiteSpace [16]. VOSviewer, developed by van Eck and Ludo Waltman at the Centre for Science and Technology Studies (CWTS) at Leiden University (Netherlands), has all the basic functions of visualization and an efficient graphical user interface, with powerful features in quantitative statistics, word cloud co-occurrence, network clustering, density analysis and interaction relations. In this study, it was used to construct and visualize keyword cluster analysis, country posting relationships, and domain co-occurrence analysis for mountain floods [17]. CiteSpace, jointly developed by Drexel University (the USA) and Dalian University of Technology (China), can complete a systematic review of a field of knowledge by generating an interactive visualization of the structure and temporal patterns and trends in a research field, thereby tracking the development of a field more closely and broadly, dissecting obvious knowledge turning points and topics of interest. It has strong compatibility and can handle citation data from popular sources, such as Dimensions, CNKI, Lens, Web of Science, and Scopus [16]. In this study, the visual analysis software VOSviewer and CiteSpace, as well as the data-processing tools Pajek and Sigmaplot, were jointly used to analyze the collected literature and map scientific knowledge, focusing on the research progress and hotspot directions in various periods and countries, country cooperation clustering, keyword timelines, keyword co-occurrence clustering, and keyword burst mapping.

2.2. Data Acquisition and Pre-Processing

The literature data in this study were obtained from WOSCCD by Clarivate. This database is the earliest citation index database in the world, containing more than 150 million comprehensive and highly recognized and authoritative social science and science citations, which is fully functional for literature search, citation analysis, and data export to facilitate data processing [18,19]. In this study, keywords related to mountain flood were selected with the search formula: TS = (Mountain torrents) OR TS = (Mountain flood) OR TS = (Flash flood) AND TS = (Mountain). The search date was 5 October 2022, yielding a total of 6393 source documents. We retained 5922 articles and reviews and the data were exported in text format and de-duplicated using the culling and merging function of CiteSpace software. Finally, 5771 publications on the topic of mountain floods were obtained.

3. Results

3.1. Temporal Trend in Publications and Citations

The number of global annual publications can reflect the general trend, hotness and development rate of a research field, as well as the attention from scientific communities [20,21].

We sliced the retrieved data from 1991 to 2021, year-by-year to reflect the pattern in the total number of publications and the annual publication impact over time.

The results show that the number of publications and citations worldwide experienced an overall upward trend from 1991–2021, especially after 2000, with the largest increase and number of publications after 2010 (Figure 1A). The total number of publications after 2010 was about 2.5 times higher than that before 2010, indicating that this field has gradually gained widespread attention from the academic community in recent years. Meanwhile, the number of citations for publications in this field showed an exponential increase after 2000 (Figure 1B). On the one hand, this is because new technologies provide new tools for mountain flood research [22,23]. On the other hand, topics such as environment and climate change, public safety, and water resource development have emerged more frequently in recent years—there is an urgent need to conduct in-depth and detailed research on themes of disaster warning, disaster mechanisms, type and source of erosion along the route, migration and transformation, and disaster management of mountain floods. In addition, mutual exchange and cooperation among countries is another main reason for the rapid development of research in this field (see below).

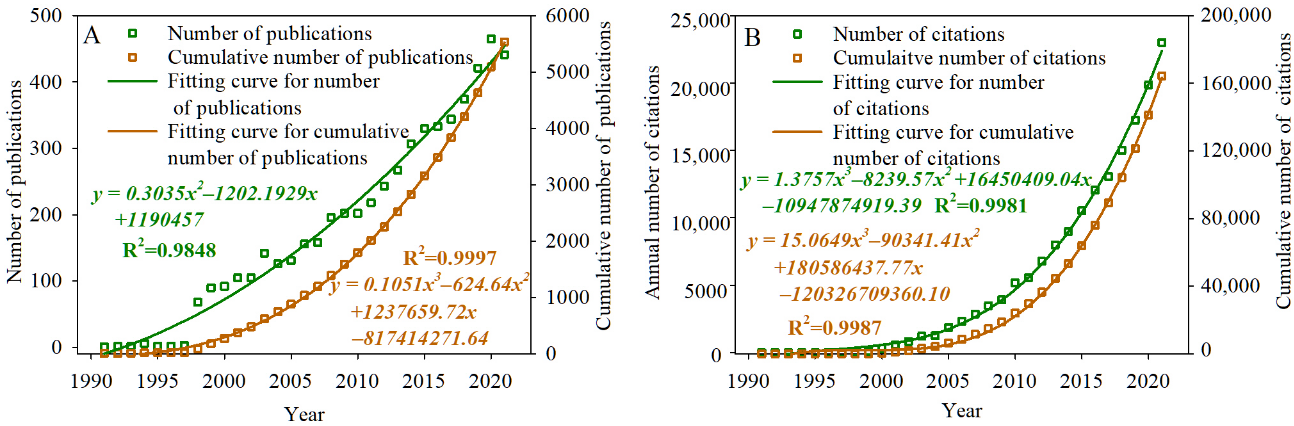

Figure 1. Annual and cumulative number of publications and citations in the mountain flood field and change trends from 1991 to 2021. (**A**) Number of publications; (**B**) Number of citations.

3.2. Countries and Institutions of the Publications

Statistics for the number of publications issued by the top 30 countries (Figure 2 and Table 1) show that the total number of publications issued by the top 10 countries is 4958, accounted for 85.91% of the total number worldwide; the percentage for the top five countries is 70.02%. The United States (USA) is the global leader in mountain flood research, with 2133 publications from 1991–2010, accounting for 36.96% of the total number of publications (5771) worldwide, followed by China (852), Germany (450), the United Kingdom (UK) (418), and Switzerland (388). The cumulative number of citations in the USA reached 80,988, with an average number of 37.97 per publication. These values for China were 16,782 and 19.70, for Germany were 15,648 and 34.77, for the UK were 18,374 and 43.96, and for Switzerland were 17,560 and 45.26. Notably, the average publication year for China was in 2016, compared to 2013 for the other countries above, indicating that research on mountain floods in China has grown rapidly in recent years and may have a consistently growing scientific impact in the future. Among the top 10 countries in terms of the number of publications, only China and India are developing countries, having relatively low citation frequencies per article. All the developed countries have PR (publication ratio) values above 500, with Switzerland reaching 4459.77. The two developing countries (China and India) are at a lower level, both below 100. This is related to their large populations and the late start of research in this field, affecting the total number of publications. In summary, the research on mountain floods is centered on the USA and China, with other developed countries as important components and developing countries as supplements.

Science and technology, personnel cultivation, as well as economic and social development levels, in these countries all made important contributions to the development of this field.

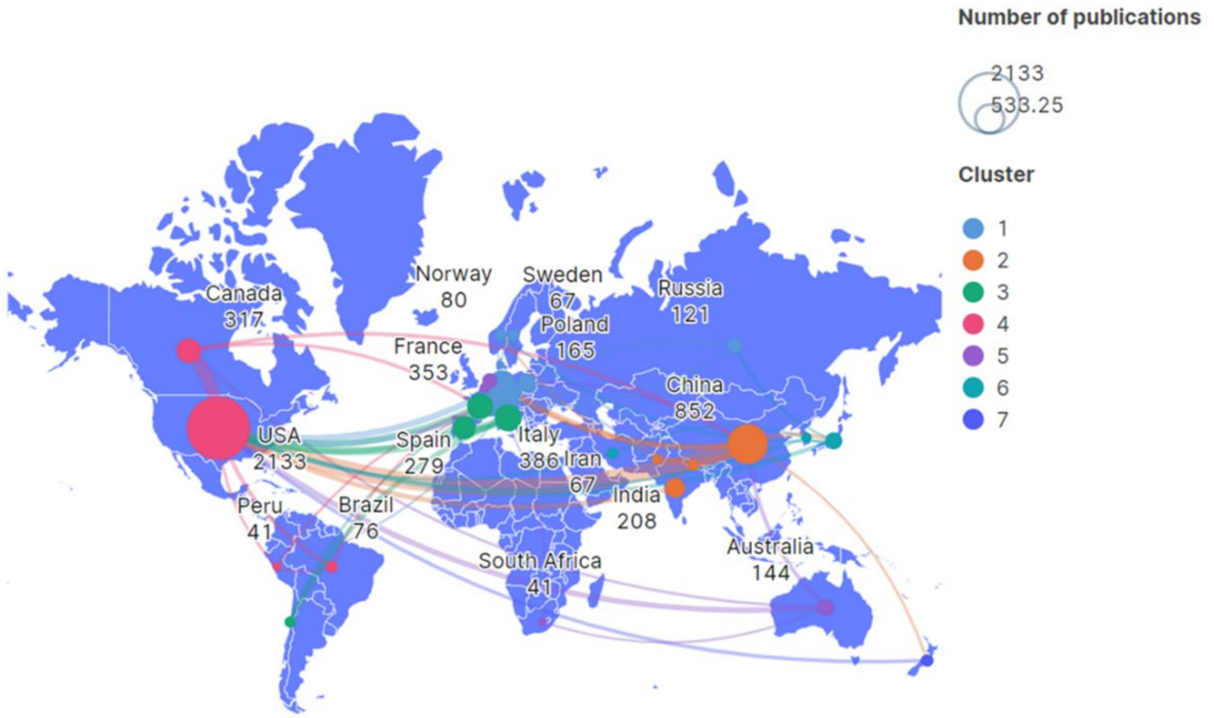

Figure 2. Number of publications by country and cooperation between them from 1991 to 2022.

Table 1. Activity and research metrics of top ten countries in mountain flood research. (The color temperature from warm to cold respectively represents the strength to weakness of the corresponding country in this category.).

No.	Country	Continent	Link	Total Link Strength	NP	APY	AC	PR
1	USA	N. America	29	574	2133	2011.92	37.97	642.47
2	China	Asia	28	329	852	2016.75	19.70	60.34
3	Germany	Europe	29	244	450	2013.73	34.77	528.67
4	England	Europe	29	308	418	2013.58	43.96	620.92
5	Switzerland	Europe	28	255	388	2013.79	45.26	4459.77
6	Italy	Europe	28	213	386	2013.47	44.72	654.24
7	France	Europe	29	201	353	2012.73	45.04	522.96
8	Canada	N. America	26	162	317	2012.83	36.90	834.21
9	Spain	Europe	27	157	279	2014.37	33.61	589.60
10	India	Asia	24	75	208	2017.211	20.96	14.93

Note: No. = Number, NP = Number of publications, APY = Average publication year, AC = Average citations per article, PR = Publication ratio.

In terms of the number of publications in WOSCCD, the Chinese Academy of Sciences topped the list, with 327, accounting for 5.7% of the total. The United States Geological Survey ranked second with 267 publications, followed by Colorado State University, the University of the Chinese Academy of Sciences, and the University of Arizona (Figure 3). The cooperation relationship map shows the cooperation among the countries to which the publication belongs, with a thicker connecting line between two countries indicating more frequent cooperation. The USA is the most frequent collaborator with other countries, with the highest number of collaborations with Canada at 46, followed by 33 with the UK. China cooperated frequently with the USA, Canada, Australia and Japan. Sweden co-operated more with Norway, Belgium with France, and the Netherlands with Germany. Inter-institutional collaborative relationships were analyzed based on the number of collaborative publications greater than 30. The VOSviewer results show that the United States Geological Survey, the Chinese Academy of Sciences, the University of the Chinese Academy of Sciences, the University of Bern and the University of Geneva in Switzerland are institutions with the most collaborations with other institutions, having collaborative publication numbers of 151, 143, 115, 98, and 88, respectively.

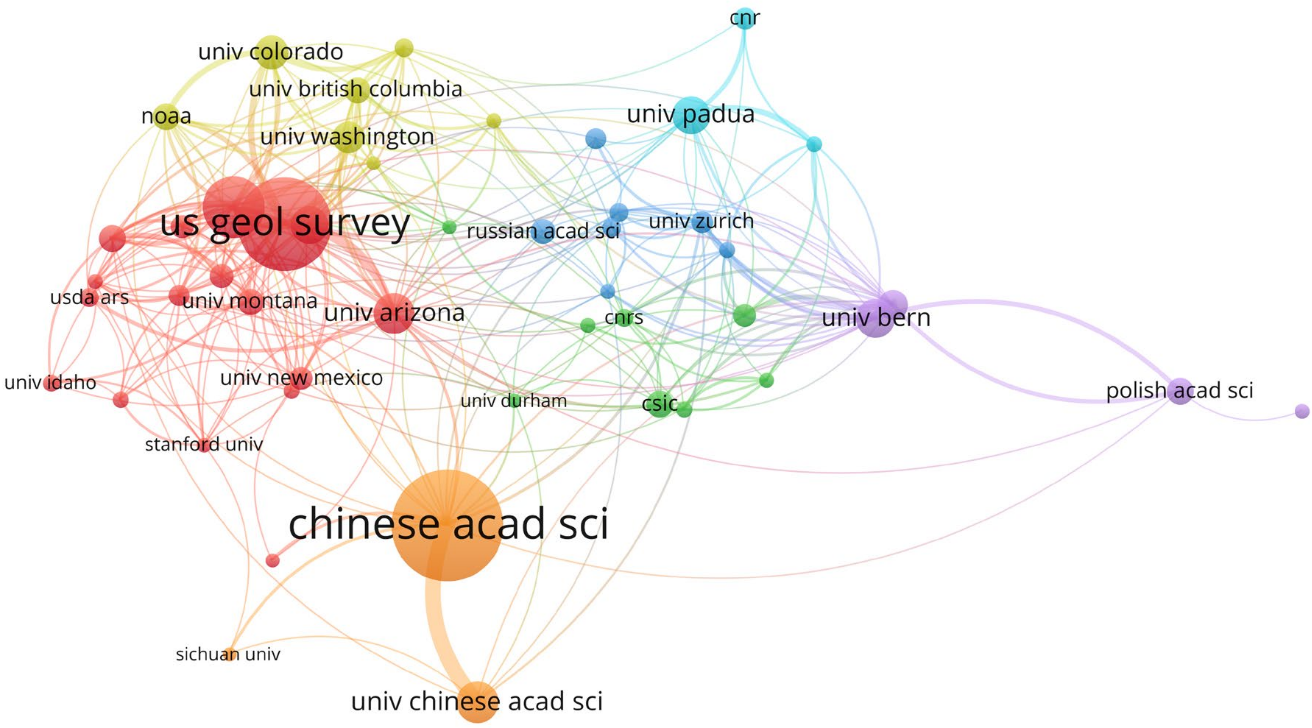

Figure 3. Number of publications by institution and cooperation between them from 1991 to 2022.

3.3. Co-Citation Analysis of Publications

Co-citation network analysis and cluster analysis of literature are the core functions of the CiteSpace software and are the focus of this study. Based on the construction of citation networks in the mountain flood field, we explored the research history and development of this field from the time dimension. When two (or more) articles are simultaneously cited by one or more subsequent articles, these articles constitute a co-citation relationship, and the number of articles citing these papers is referred to as the co-citation strength. A literature co-citation network is a knowledge network consisting of two articles cited by other articles at the same time, where nodes represent literature citations; more nodes indicate more articles involved in this cluster—the higher the homogeneity, the stronger the relevance as well as the aggregation within the cluster. Connecting lines indicate literature co-citation relationships; nodes with high intermediary centrality are key pivotal literature for constructing connections in different fields. Co-citation cluster analysis is the basis of this function, in which cool color to warm color represents the time from far to near. The citation relationship of the literature can be used to derive the research hotspots in different time periods. Based on the literature in the WOSCCD, the modularity value of the cluster map of the co-citation network in the mountain flood field is 0.9031, which is much larger than 0.3, indicating good performance of the cluster network. The silhouette value of each cluster is larger than 0.7, indicating that these clusters are large and that the cluster structure is effective and convincing. The profile values, labels, and average years for the top five clusters are summarized in Table 2; Table 3 shows the top five most cited references in the top five co-citation clusters. The five main clusters of the literature co-citation network are

#0 “high mountain Asia”, #1 “riparian vegetation”, #2 “fremont cottonwood”, #3 “glacial lake outburst flood risk” and #4 “large wood dynamics” (Figure 4).

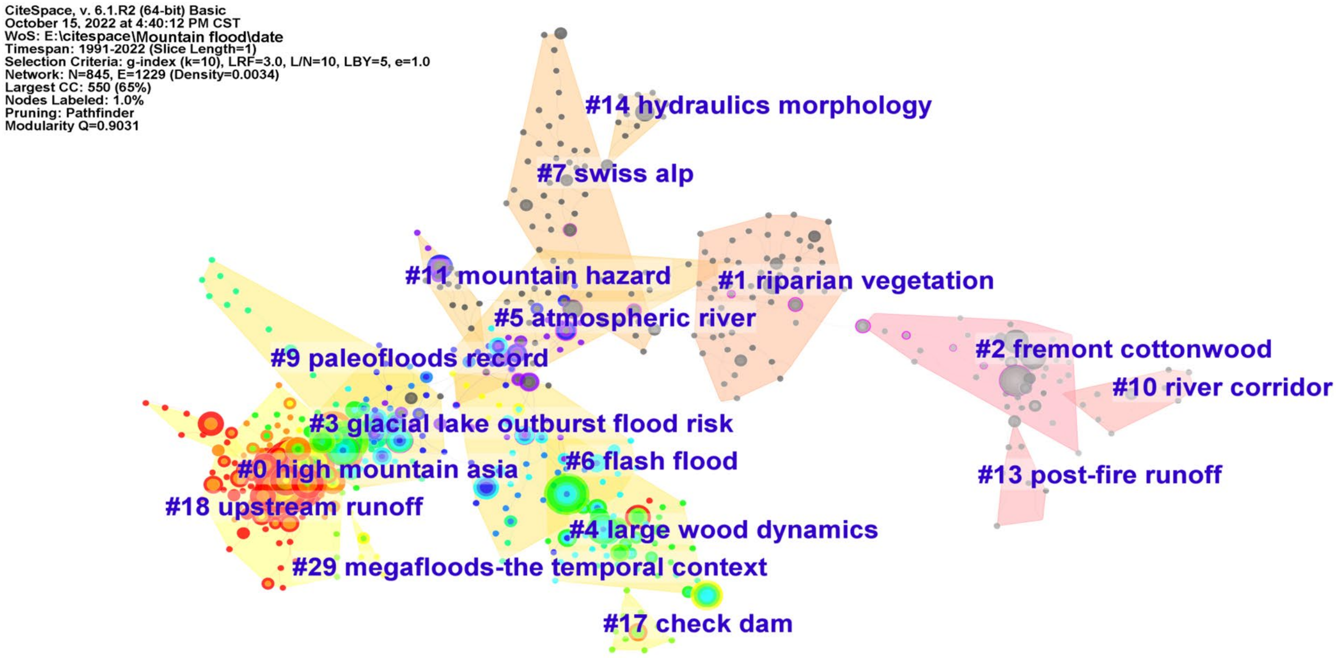

Figure 4. Cluster analysis of literature co-citation networks. Note: There are 845 nodes and 1229 nodal links in the map. Nodes indicate high-frequency co-cited literature, marked with black text labels according to the author and year of the literature, with larger nodes indicating higher co-citation frequency and greater influence of the article. Nodal links indicate interconnection of nodes. The color change of the nodes and node links from blue to orange indicates the temporal evolution of the research hotpots. The blue text indicates clustering terms, and the size of the number of clustering labels (#) indicates the number of articles in the cluster, with more articles corresponding to smaller numbers. Here, the link retaining factor (LRF) is 3.0, the maximum links per node (L/N) is 10, the look back years (LBY) is 5, and the minimum citation number (e) is 1.0.

High mountain Asia (#0) is the subject of the largest literature cluster with a silhouette value of 0.951, having 96 articles relating to glacial lake outbursts. The most cited article in this cluster concerns hydropower systems on the high mountain Asia region threatened by climate-driven landscape instability, in which the authors argued that global climate change is causing the cryosphere to melt and severely altering water resources in the high mountain Asia region, thereby exacerbating mountain flooding [24]. High frequency terms used in this cluster include “high mountain Asia”, “glacial lake” and “glacial lake outburst floods (GLOFs)”. The highly cited references in this cluster focus on tracking the impacts on glacial lake formation of climate change [25–27], the erosion processes of GLOFs [28], and the spatial and temporal patterns associated with GLOFs and their social impacts [29].

The theme of the second major cluster is riparian vegetation (#1) with a silhouette value of 0.974, relating to the ecological environment. There are 65 articles in the cluster, with high-frequency terms of “riparian vegetation”, “river regulation” and “high-flow characteristics”, indicating that ecological issues are frequently mentioned in the field, with many studies on vegetation, especially that on both sides of river banks. Some of these studies concern the relationship between fluvial patterns on geomorphic processes and riparian vegetation [30] and some the flow patterns of floods and the relationship between flow changes and riparian vegetation growth and reproduction [31,32].

The theme for the third largest cluster is fremont cottonwood (#2) with a silhouette value of 1 and having 56 articles. High frequency terms that appear in the cluster include “fremont cottonwood”, “semi-arid north America” and “riparian ecosystem”. The most cited author is Patten [33], who argued that riparian ecosystems in western north America were greatly affected by human production activities, and that floods may alter the channel characteristics and the extent of riparian vegetation, while increasing the replenishment of riparian species and alluvial water tables.

The fourth largest cluster is the topic of GLOF risk (#3) with a silhouette value of 0.955 including 53 articles, in which, "glacial lake", "lake outburst flood risk" and "Cordillera Blanca" are the high-frequency terms. Highly cited references in this cluster focus on numerical simulations of GLOFs in the context of climate change, sensitivity assessments of glacial lake outbursts [34,35], and risk assessments related to the probability of glacial lake outbursts based on the probability, potential threat extent, and degree of damage [36]. Westoby et al. noted that work related to the modeling and prediction of glacial lakes or GLOFs needs to be explored in detail [37].

The theme of the fifth largest cluster is large wood dynamics (#4) relating to 47 articles with a silhouette value of 0.982. High-frequency terms in this cluster include "large wood", "large wood dynamics" and "large flood". Forest land is an area with a high potential for mountain floods and mudslides, and cluster #4 focuses on the impact of mountain floods on forest land dynamics. The highly cited references in this cluster focus on the role of meteorological and hydrological factors on extreme heavy rainfall and flood [38], as well as the amplification of extreme flood disasters by forest trees (large wood) [39]. Based on the literature, Borga et al. proposed that the development of rainfall estimation and warning schemes that take into account differences in different spatial and temporal scales, the integration of multiple hydrogeological hazard monitoring and warning methods, the establishment and enhancement of dataset collection for mountain floods and debris flow, and scientific and technological advances in the above three areas, would play a direct and important substantive role in the monitoring and warning of mountain floods [38].

Table 2. Co-citation analysis of literature.

Cluster ID	Silhouette	Size	Cluster Label (LLR)	Top 3 Terms (LSI)	Mean Year	Representative Documents
#0	0.951	96	high mountain Asia	high mountain Asia; glacial lake; glacial lake outburst flood	2020	[24]
#1	0.974	65	riparian vegetation	riparian vegetation; river regulation; high-flow characteristics	2006	[40]
#2	1	56	fremont cottonwood	fremont cottonwood; semi-arid north America; riparian ecosystem	1999	[33]
#3	0.955	53	glacial lake outburst flood risk	glacial lake; glacial lake outburst flood risk; Cordillera Blanca	2015	[41]
#4	0.982	50	large wood dynamics	large wood; large wood dynamics; large flood	2016	[42]

Table 3. The top five highly cited references in the first five major clusters according to Table 2 (the colors represent different clusters).

Cluster ID	Title	Source	Co-Citation	Reference
#0	A regional-scale assessment of Himalayan glacial lake changes using satellite observations from 1990 to 2015	Remote Sensing of Environment	56	[25]
#0	Climate change and the global pattern of moraine-dammed glacial lake outburst floods	Cryosphere	48	[26]
#0	A spatially resolved estimate of high mountain Asia glacier mass balances from 2000 to 2016	Nature Geoscience	41	[27]
#0	Glacial lake outburst floods as drivers of fluvial erosion in the Himalaya	Science	38	[28]
#0	A global assessment of the societal impacts of glacier outburst floods	Global and Planetary Change	38	[29]

Table 3. *Cont.*

Cluster ID	Title	Source	Co-Citation	Reference
#1	Multiple pathways for woody plant establishment on floodplains at local to regional scales	Journal of Ecology	13	[31]
#1	Patterns of nitrogen accumulation and cycling in riparian floodplain ecosystems along the Green and Yampa rivers	Oecologia	9	[43]
#1	Riparian vegetation and channel change in response to river regulation: A comparative study of regulated and unregulated streams in the Green River Basin, USA	Regulated Rivers-Research and Management	8	[30]
#1	Extreme floods, channel change, and riparian forests along ephemeral streams	Ecological Monographs	8	[32]
#1	Response of herbaceous riparian plants to rain and flooding on the San Pedro River, Arizona, USA	Wetlands	7	[44]
#2	The natural flow regime	BioScience	23	[45]
#2	Flood dependency of cottonwood establishment along the Missouri River, Montana, USA	Ecological Applications	18	[46]
#2	Streamflow requirements for cottonwood seedling recruitment—An integrative model	Wetlands	15	[47]
#2	Fluvial process and the establishment of bottomland trees	Geomorphology	10	[48]
#2	Mechanisms associated with decline of woody species in riparian ecosystems of the southwestern U.S.	Ecological Monographs	10	[49]
#3	Modelling outburst floods from moraine-dammed glacial lakes	Earth-Science Reviews	37	[37]
#3	The state and fate of Himalayan glaciers	Science	29	[50]
#3	882 lakes of the Cordillera Blanca: An inventory, classification, evolution and assessment of susceptibility to outburst floods	Catena	28	[34]
#3	Glacial lakes in the Indian Himalayas—from an area-wide glacial lake inventory to on-site and modeling-based risk assessment of critical glacial lakes	Science of the Total Environment	26	[36]
#3	Modelling glacier-bed overdeepenings and possible future lakes for the glaciers in the Himalaya–Karakoram region	Annals of Glaciology	20	[35]
#4	Hydrogeomorphic response to extreme rainfall in headwater systems: Flash floods and debris	Journal of Hydrology	40	[38]
#4	The great Colorado Flood of September 2013	Bulletin of the American Meteorological Society	26	[51]
#4	Floodplains and wood	Earth-Science Reviews	24	[52]
#4	Recent advances quantifying the large wood dynamics in river basins: New methods and remaining challenges	Reviews of Geophysics	20	[53]
#4	Large wood recruitment processes and transported volumes in Swiss mountain streams during the extreme flood of August 2005	Geomorphology	20	[39]

3.4. Evolution of Research Hotspots

3.4.1. Keyword Connection Network

Each journal in the WOSCCD is divided into different scientific categories, indicating the scientific disciplines that have contributed to the field and the corresponding level of contribution [54]. The global scientific categories map of mountain flood field shows that the research in this field is further divided into five discipline categories: #1 "Biology and Medicine", #2 "Psychology and Social Sciences", #3 "Ecology and Environmental Science and Technology", #4 "Chemistry and Physics", and #5 "Engineering and Mathematics" (Figure 5).

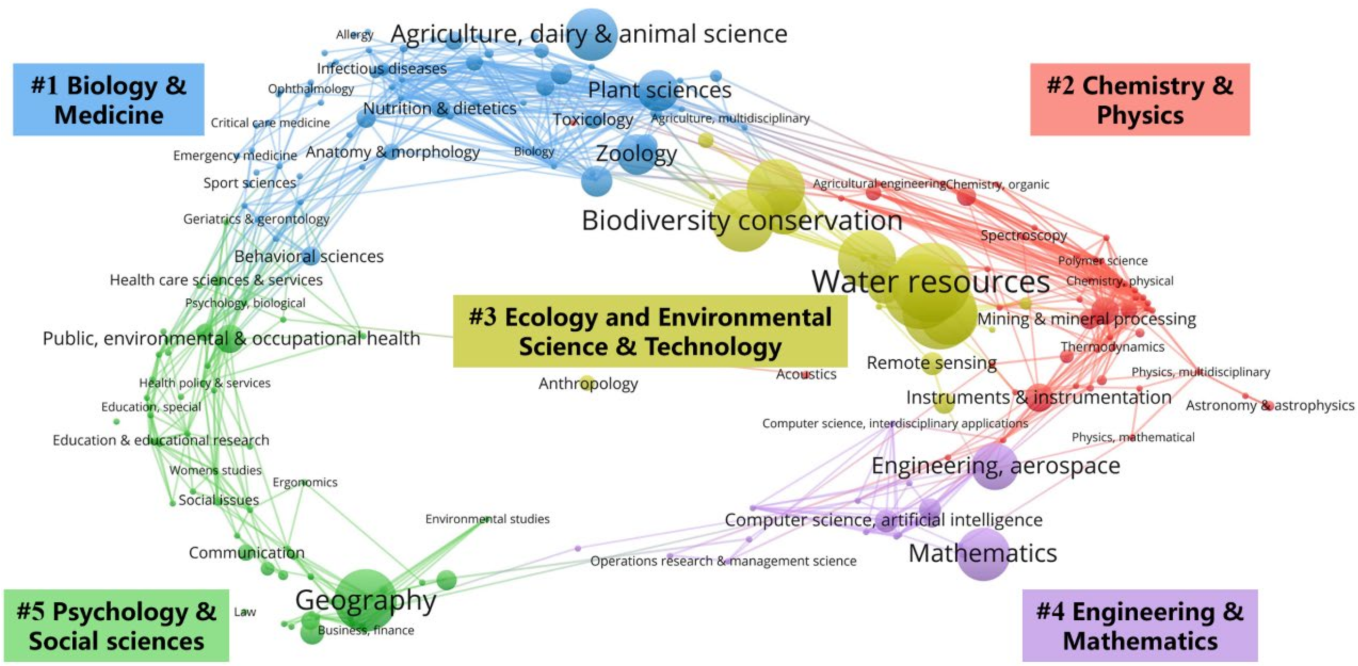

Figure 5. Categories of mountain flood research on the global scientific category map.

The thematic clustering of keywords is shown in Figure 6. Table 4 shows the keyword cluster analysis statistics based on Figure 6, containing the most common scientific categories in mountain floods based on keywords appearing more than 200 times, the associated clusters, as well as the average number and year of citation. These clusters provide a unique perspective on the broad range of topics of interest to mountain flood research. Early work of Cluster #A (red column in Figure 6) focused on specific hazard events in Colorado and Arizona, USA, and on ecological changes before and after a mountain flood. Recent work in this cluster has focused on landscape, conservation, and management. Cluster #B (green column in Figure 6) is associated with "Natural and Major Disasters". The regional focus is mainly on China and New Zealand. Early work focused on obtaining information on mountain floods and their associated hazards in the context of climate change. As the research progressed, the focus gradually changed to mountain hazards, natural hazards, debris flow, landslides, etc., and geohazard assessment became a hot topic. Cluster #C (blue column in Figure 6) focuses on models; its central theme is model construction and disaster prediction, with an early focus on specific cases of mountain floods in the USA and other countries. Later, the focus shifted to technical tools, such as radar, remote sensing, model building, and attempted to establish quantitative relationships between precipitation, runoff, drought, climate variability and the magnitude of mountain flood events, as well as the monitoring techniques and prediction and early warning techniques of mountain flood events. Cluster #D (yellow column in Figure 6) deals with sediment transport with the central topics of erosion and dynamics. The early keywords were "floods", "mountain streams", "bedload transport", "sediment", "accumulation", and "storage", which later shifted to "sediment transport", "erosion", "transport", "human impact", etc. The process of mountain flooding is often accompanied by the transport and movement of sediment; therefore, the influence of human activities, such as land use, on the sand content of mountain floods, was also focused on. Cluster #E (purple column in Figure 6) is related to fluvial geomorphology, with the important keywords of "climate", "basin", "evolution", "deposit", and "valley". Compared to the previous four clusters, this cluster has a lower number of keywords, publications and citations and has become less active in recent years. The cluster is mainly linked to cluster #3 "Ecological and Environmental Sciences and Technologies" in Figure 5, especially to the scientific categories "Environmental Sciences" and "Multidisciplinary Earth Sciences".

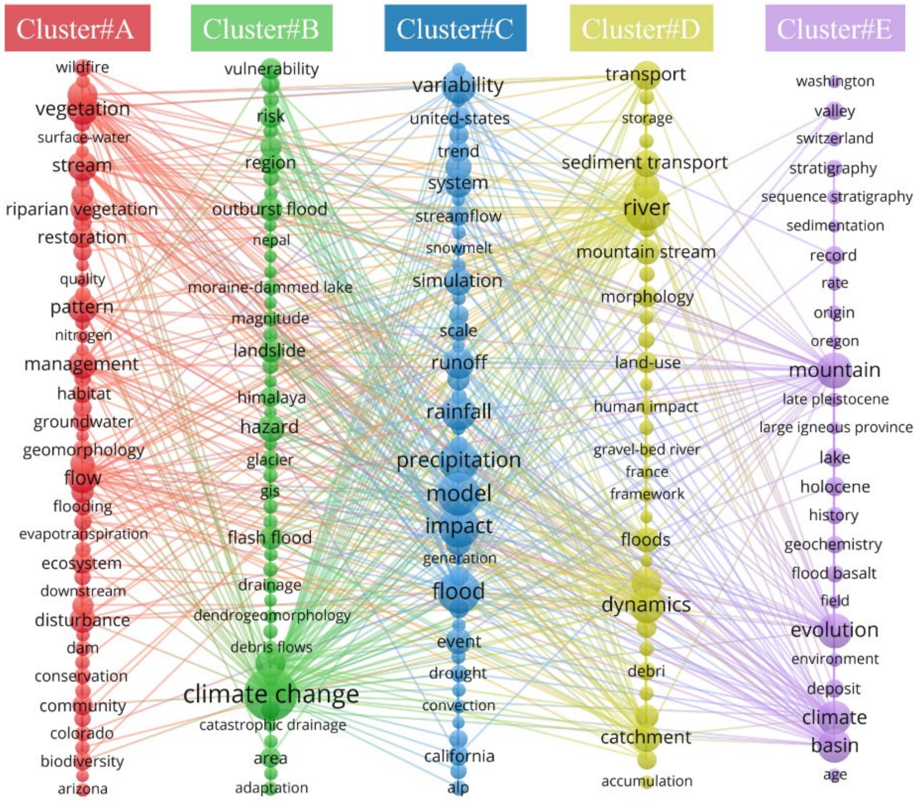

Figure 6. Topic clusters for mountain flood research based on literature keywords (the minimum number of keyword occurrences was 38).

Table 4. Common keywords in the field of mountain floods.

Label	Cluster	Links	Link Strength	Publication	APY	AC
climate change	2	194	2785	679	2016.46	30.27
river	4	186	2078	484	2012.93	29.82
model	3	189	1659	440	2014.53	32.09
flood	3	193	1861	436	2014.15	31.85
precipitation	3	160	1541	402	2014.61	32.73
impact	3	188	1771	401	2016.25	22.87
mountain	5	188	1265	315	2013.50	40.85
variability	3	180	1339	297	2015.39	26.95
dynamics	4	184	1439	294	2014.31	25.44
evolution	5	178	956	288	2013.78	26.30
rainfall	3	157	1128	283	2015.00	32.87
basin	5	184	1112	279	2014.32	23.88
climate	5	186	1106	276	2014.95	28.95
vegetation	1	168	1070	245	2011.56	36.05
runoff	3	146	1067	235	2014.63	28.03
flow	1	173	874	223	2013.13	33.30
erosion	4	153	1021	222	2013.78	35.52
water	1	164	839	221	2013.56	27.79
pattern	1	171	985	218	2012.99	27.20
stream	1	155	1043	217	2011.89	38.85
debris flow	2	159	873	216	2014.15	38.14
transport	4	158	936	203	2013.93	28.09

Note: APY = Average publication year, AC = Average citations per article.

3.4.2. Frontier Analysis of Phase Research Hotspots

Timeline analysis can precisely characterize the temporal properties of co-citation clusters and help to uncover frontier hotspots of disciplinary development. Compared with traditional analysis of high-frequency words or keywords, burst analysis can more intuitively characterize the changing trends and development direction of disciplinary research based on the growth rate of the occurrence frequency of keywords in the title, keywords or abstract of the literature [55]. In this study, literature keywords obtained from the WOSCCD were analyzed for burst analysis using the "burstness" function in CiteSpace software with a time slice of one year, finally yielding the timeline map (Figure 7) and the keyword burst map (Figure 8). Figure 7 depicts the transitional phases and evolutionary trends in mountain flood study over the time span, which shows when the keywords appear and how they relate to each other through a horizontal analysis. Figure 8 shows the 25 focus keywords and their sequences sorted by burst start time, where the long red bars indicate the start to end time of a keyword. The research frontiers of mountain flood are substantially represented by four phases.

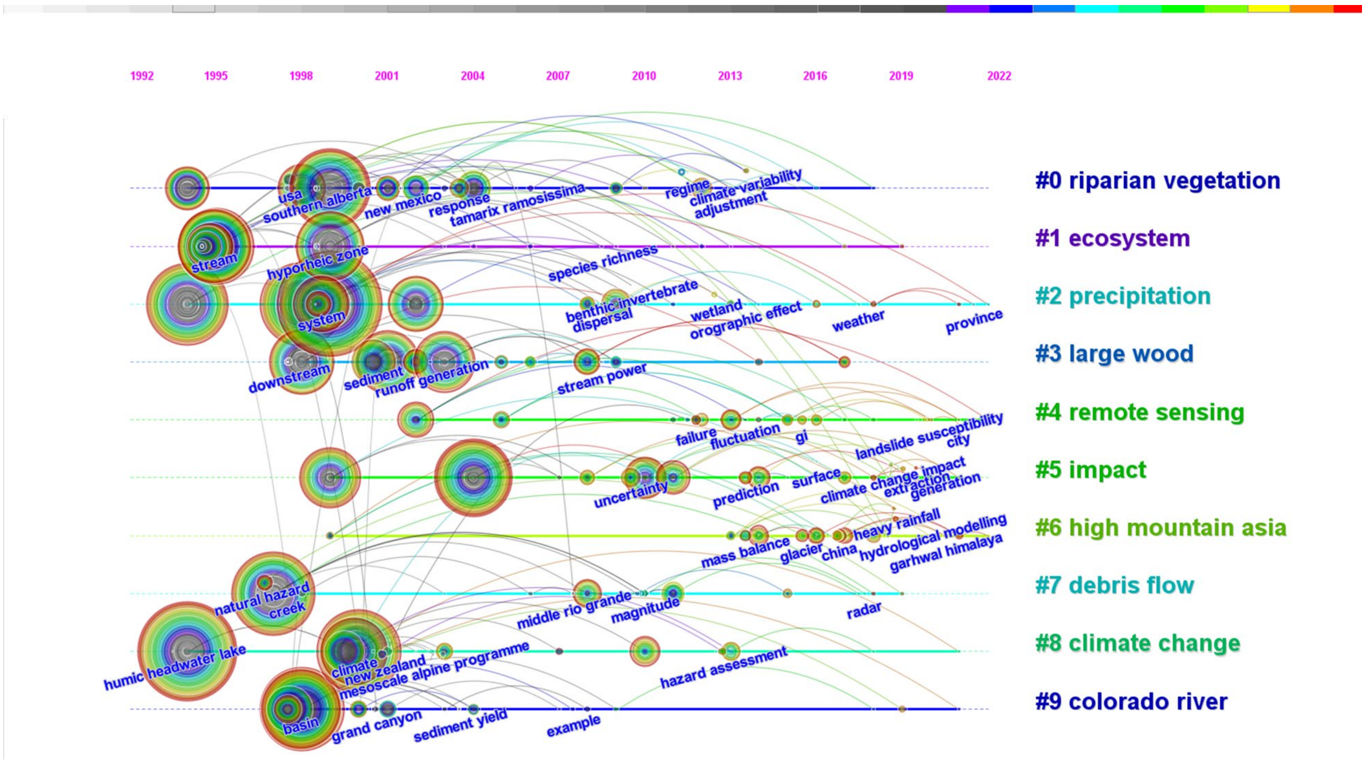

Figure 7. Timeline view of research trends. Note: The horizontal axis is the time and the vertical axis on the right side is the name of the keyword cluster. The colored curves characterize the literature citation relationships, with the cooler and warmer colors representing the far and near years, respectively; the clusters are arranged vertically according to size. The more keywords crossed, the more frequently they appeared, indicating that such keywords were hot in this period.

The period 1991–1999 was the basic stage of mountain flood research, with main themes of ecological environment [33,49], geological hazard evaluation [56], and theoretical and technical practical research in disaster prevention and mitigation [48]. The first published article in 1991 marks the beginning of scholarly interest in research related to mountain floods (Figure 1). In 1991–1995, this field receives less attention. However, in 1995 and after, a large number of articles appeared, such as the new disciplinary frontiers in vegetation and ecosystems. Numerous keywords emerged at this stage, such as "vegetation", "ecosystem", "establishment", "disturbance", "USA", "community" and "flood basalt", and the research focus was relatively dispersed. The number of publications and literature citations in this phase has increased year-by-year, and the burst keywords have lasted for a long time (about ten years on average), indicating that the ecological environment, watersheds, and disaster prevention and mitigation in this field were receiving increasing and long-term attention from the academic community. In addition, stream, natural hazard, hyporheic zone, and downstream became the frontier research branches that have received more attention in the early stages of the field, showing a high degree of burst.

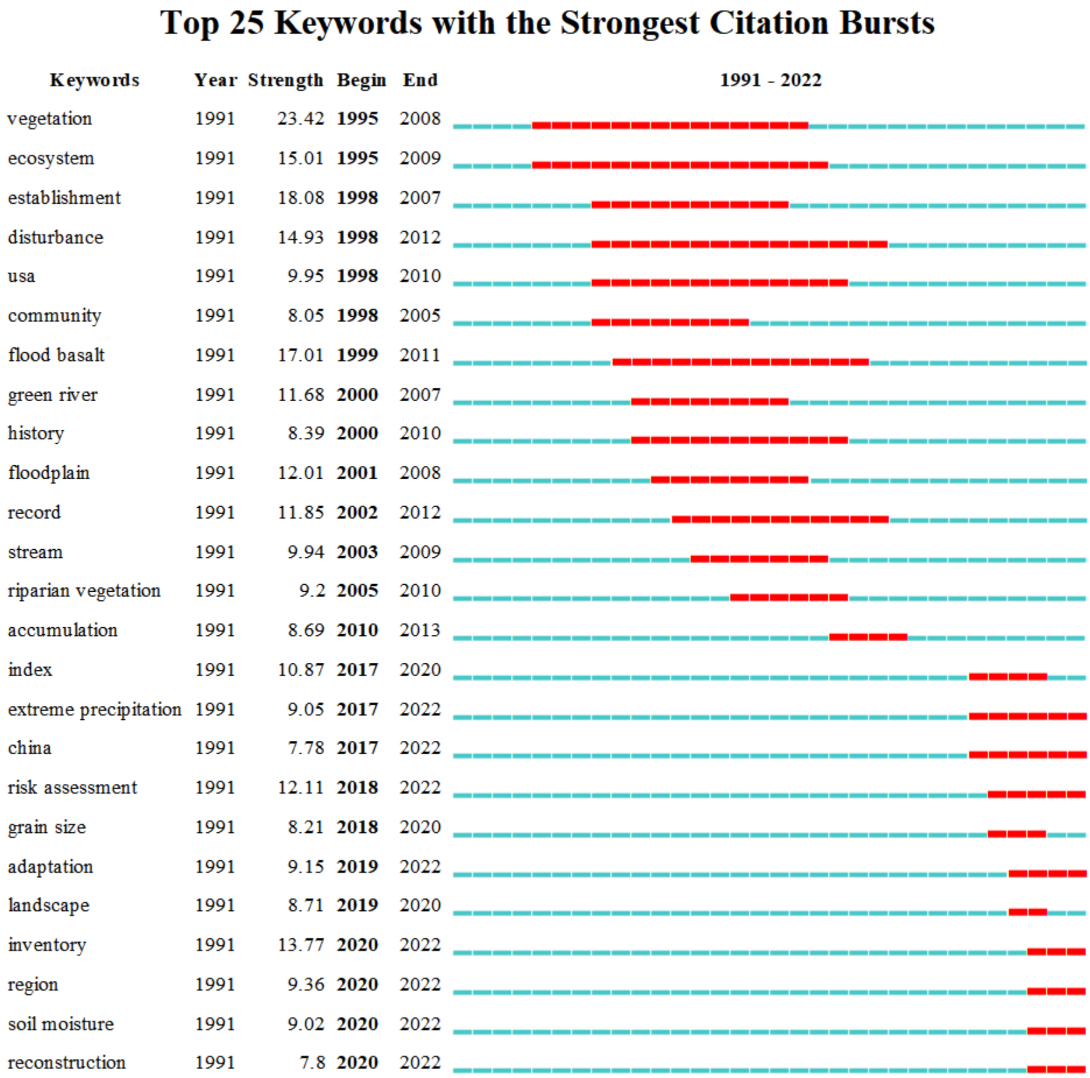

Figure 8. Keyword burst analysis.

The years 2000–2013 show a centralized distribution of multiple research clusters and a concentrated burst, and several new frontier research branches have been derived in the mountain flood field based on the research in 1991–1999. The keywords that characterize the research frontier in this period are "green river", "history", "floodplain", "record", "stream", "riparian vegetation", and "accumulation". In addition, ecosystem research clusters oriented to specific watersheds [57] and research clusters centered on field survey records [34] expand more, indicating that the research field was entering an active period, with branches of research shifting to applied research and tending toward specificity.

The period 2014–2016 was a bottleneck for frontier research in the mountain flood field, during which no new frontier research directions emerged and studies mainly built on previous ones. In this period, "climate variability" for riparian vegetation clusters, "wetland" and "orographic" for precipitation clusters, "glacial" and "China" and "mass balance" for high mountain Asia clusters, and "hazard assessment" for the climate change cluster were hot topics of research.

The fourth phase is from 2017 to the present, in which more keywords emerged, including those characterizing the research frontier: "extreme precipitation", "China", "risk assessment", "grain size", "adaptation", "landscape", "region", "soil moisture", and "reconstruction". During this phase, various research branches in the field of mountain flooding tend to concretize and a large number of new frontier research directions emerged. The research focus is scattered—the main hot literature revolved around hazard-sensitive type analysis and urban hazard analysis using remote sensing [23,58], flood risk from global climate change at long time scales [59], mountain floods in high mountain regions of the Himalayas [60], mechanisms of heavy rainfall in mountain flooding [28], and hydrological modeling [61].

4. Discussion

4.1. Participating Countries and Institutions in the Mountain Flood Field

The USA is the most significant participant in the mountain flood field, with 2133 publications from 2001–2022. This is mainly due to the strong economic power of the USA, as Kumar et al. [62] found that there is a strong relationship between scientific research and economic conditions. China (852), Germany (450), the UK (418), Switzerland (388), Italy (386), France (353), and Canada (317), all with more than 300 publications, are the countries with the highest participation in the mountain flood field. Countries in Europe are the most involved, followed by these in North America and finally those in Asia. From a disaster perspective, the Asia–Pacific region is the most disaster-prone zone in the world according to the United Nations 2030 Agenda for Sustainable Development [63]. The Global Disaster Data Platform website [64] shows that the five countries that have been affected by the highest number of floods in the last 10 years are Indonesia (111), China (99), India (74), the United States (46), and Brazil (47). Therefore, countries with high participation in the research into mountain floods do not coincide with countries that are severely affected, which is similar to the findings of Sweileh's study on disaster medicine [18].

Figure 2 shows that cooperation among countries is highly regional. For example, there is more cooperation among the USA, China, and Germany, but countries in South America and Africa are rarely involved in cooperation, and the three disaster-prone countries of Indonesia, India, and Brazil all have low participation. Therefore, to promote the development of the mountain flood field, exchange and cooperation among countries should be enhanced. The institutions with frequent collaborations and high levels of production are both located in the USA and China. The Chinese Academy of Sciences was the most published institution, having three co-authored papers cited more than 200 times. These three papers discussed the potential for earthquake triggered weir collapse [65,66], weir hazard assessment [67], and glacial lake outburst potential under the influence of landslides [68]; they have undoubtedly had a significant impact on the mountain flood field.

4.2. Hot Issues and Research Limitations in the Mountain Flood Field

Currently, the research hotspots in mountain flooding are focused on the ecological environment and its evolution [69], geological hazard evaluation [70], theoretical and technical practical research on disaster prevention and mitigation [71], remote sensing and geographic information system (GIS) technologies in mountain floods [23], flood risk in the context of global climate change at long time scales [38], mechanisms of heavy rainfall on mountain floods [72], and mountain flood hydrological model construction [73]. The keyword cluster map shows that "climate change", "impact", "variability", and "rainfall" are the most frequently appearing keywords (>200), indicating their relatively high research heat and the research depth in the mountain flood field, including, for example, risk analysis of glacial lake outburst under different scenarios [3,24] and physical vulnerability assessment of mountain floods in storm catchments [58,74]. In addition, distributed, multiphysical, multi-scale flood hydrological models considering rainfall and weather forecasts have been developed based on a large amount of basic monitoring data in some study areas [75,76]. These computational models have been well used in flood control and water resource planning and for quantifying flood risk [59,76].

In recent years, many mountain floods have occurred around the world, causing serious negative impacts on social development and the safety of people's lives. Research into mountain floods, including disaster prediction and warning, disaster risk management and post-disaster recovery strategies provides a basis for improving disaster resilience. However, due to the uncertainty of disaster occurrence and the uneven development of different countries, there is still a lot of potential for research in this field, such as disaster management solutions in specific disaster contexts. This study provides a timely and valuable summary of the current research progress on mountain floods, enabling scholars to better understand current research priorities and pointing out potential areas for future research and collaboration. However, there are some limitations to the study. Firstly, the search subject terms could not include all the literature in the field, impacting the underlying data and the analysis of the bibliometric results. Secondly, some research results could not be included in the bibliometric study—for example, the most important factors driving mountain flood management in practice are national or regional economic and political systems; however, it is difficult to conduct targeted studies of specific events in research because much of the underlying critical hazard data is secret or cannot be released for particular reasons. Finally, the multidisciplinary nature of the mountain flood field (e.g., management and physics) makes it difficult for quantitative analysis to fully cover the research topic.

5. Conclusions

Natural disaster risk prevention and control is a rapidly developing and emerging field in disaster science that requires a gradual process of deepening. The status of research over the years shows a growing trend of natural disaster risk prevention and control research. Based on the WOSCCD database, in this paper, we conducted a statistical and visual analysis of the relevant literature information in the mountain flood field using the literature statistical visualization tools VOSviewer and CiteSpace to explore the current status, research hotspots, evolutionary features and future trends of the field. The main conclusions drawn are as follows:

(1) The number of publications and citations in mountain flood research showed a general upward trend, experiencing three stages of steady growth–slow increase–rapid growth. The USA and China are the most important participating countries in the mountain flood field, some scientific institutions in the USA and China are the most important participating institutions, the important players in the field have a high-level of cooperation with each other, and academic circles have been formed. Therefore, the following suggestions are made to improve national influence and disaster management in this field in the future. Countries with less research in this field should strengthen cooperation with countries with a high research level to learn advanced techniques and improve their own scientific research level and personnel training. Countries with a high research level in the mountain flood field should strengthen cooperation with countries frequently affected, especially developing countries, such as by providing timely assistance to affected countries, which cannot only improve their international influence, but also enhance the accumulation of experience in dealing with disaster problems and provide good examples for mountain flood research.

(2) The co-citation analysis revealed the temporal evolution trend of research frontiers and related key literature. This paper focused on the top five clusters of literature on mountain flooding: #0 "glacier lake", #1 "riparian vegetation", #2 "fremont cottonwood", #3 "glacial lake outburst flood risk", and #4 "large wood dynamics". The research hotspots in mountain flooding were classified into three categories based on co-citation cluster analysis: high mountain Asia, especially glacial lake outburst

floods; ecological issues, especially vegetation on both sides of river banks; and the impact of mountain floods on the dynamics of forest land. The analysis of scientific categories shows that research into mountain floods has received much attention in several fields, such as ecology, environmental and science technology, urban, rural and municipal planning, biology and medicine, psychology and social sciences, chemistry and physics, and engineering and mathematics, indicating that mountain flood research is characterized by multiple research hotspots, multiple research objectives, and cross-fertilization of multiple disciplinary categories.

(3) There are various research themes in the mountain flood field. Those that have remained high in popularity over a long period include riparian vegetation, hazard prediction, and climate change. Frontier research themes in the last five years include extreme precipitation, risk assessment, adaptability of models and post-disaster reconstruction. The evolutionary path of the research frontiers in different periods is clear, with strong inheritance relationships and strong links between them, and the core evolutionary path can be divided into four stages.

(4) The period 1991–1999 was the basic stage of mountain flood research, with the main themes of ecological environment, geological hazard evaluation, and theoretical and technical practical research on disaster prevention and mitigation. From 2000 to 2013, several new frontier research branches in the mountain flood field emerged, with a strong expansion of ecosystem research clusters oriented towards specific watersheds and centered on field survey records, indicating that the research field had entered an active phase, with branches turning towards applied research and tending towards concreteness. The period 2014–2016 was a bottleneck in research frontiers in the field, with riparian vegetation, precipitation, high mountain Asia, and climate change becoming hot topics, but no new frontier directions emerged. The fourth phase is from 2017 to the present, in which various research branches in the field of mountain floods tend to concretize and a large number of new frontier research directions emerge, indicating that research concerning mountain floods is gradually changing from macroscopic, qualitative theoretical scientific research to regional, quantitative and specific applied engineering research.

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References

1. Kishorbhai, V.Y.; Vasantbhai, N.N. AON: A survey on emergency communication systems during a catastrophic disaster. *Procedia Comput. Sci.* **2017**, *115*, 838–845. [CrossRef]
2. Yuan, X.M.; Liu, Y.S.; Huang, Y.H.; Tian, F.C. An approach to quality validation of large-scale data from the Chinese Flash Flood Survey and Evaluation (CFFSE). *Nat. Hazards* **2017**, *89*, 693–704. [CrossRef]
3. Huss, M.; Bookhagen, B.; Huggel, C.; Jacobsen, D.; Bradley, R.S.; Clague, J.J.; Vuille, M.; Buytaert, W.; Cayan, D.R.; Greenwood, G.; et al. Toward mountains without permanent snow and ice. *Earth's Future* **2017**, *5*, 418–435. [CrossRef]
4. Liu, Y.S.; Yuan, X.M.; Guo, L.; Huang, Y.H.; Zhang, X.L. Driving force analysis of the temporal and spatial distribution of flash floods in Sichuan Province. *Sustainability* **2017**, *9*, 1527. [CrossRef]
5. East, A.E.; Pess, G.R.; Bountry, J.A.; Magirl, C.S.; Ritchie, A.C.; Logan, J.B.; Randle, T.J.; Mastin, M.C.; Minear, J.T.; Duda, J.J.; et al. Reprint of: Large-scale dam removal on the Elwha River, Washington, USA: River channel and floodplain geomorphic change. *Geomorphology* **2015**, *246*, 687–708. [CrossRef]

6. Raisig, L.M. Statistical bibliography in the health sciences. *Bull. Med. Libr. Assoc.* **1962**, *50*, 450–461. [PubMed]
7. Gao, Y.; Shi, S.Z.; Ma, W.J.; Chen, J.; Cai, Y.T.; Ge, L.; Li, L.; Wu, J.; Tian, J.H. Bibliometric analysis of global research on PD-1 and PD-L1 in the field of cancer. *Int. Immunopharmacol.* **2019**, *72*, 374–384. [CrossRef]
8. Carve, M.; Allinson, G.; Nugegoda, D.; Shimeta, J. Trends in environmental and toxicity research on organic ultraviolet filters: A scientometric review. *Sci. Total Environ.* **2021**, *773*, 145628. [CrossRef] [PubMed]
9. Cui, X.T.; Guo, X.Y.; Wang, Y.D.; Wang, X.L.; Zhu, W.H.; Shi, J.H.; Lin, C.Y.; Gao, X. Application of remote sensing to water environmental processes under a changing climate. *J. Hydrol.* **2019**, *574*, 892–902. [CrossRef]
10. Mai, X.; Chan, R.C. Detecting the intellectual pathway of resilience thinking in urban and regional studies: A critical reflection on resilience literature. *Growth Chang.* **2020**, *51*, 876–889. [CrossRef]
11. Xu, H.; Li, Y.; Tan, Y.T.; Deng, N.H. A scientometric review of urban disaster resilience research. *Int. J. Environ. Res. Public Health* **2021**, *18*, 3677. [CrossRef]
12. Shen, S.; Cheng, C.X.; Yang, J.; Yang, S.L. Visualized analysis of developing trends and hot topics in natural disaster research. *PLoS ONE* **2018**, *13*, e0191250. [CrossRef] [PubMed]
13. Wang, C.L.; Wu, J.D.; He, X.; Ye, M.Q.; Liu, W.H.; Tang, R. Emerging trends and new developments in disaster research after the 2008 Wenchuan earthquake. *Int. J. Environ. Res. Public Health* **2019**, *16*, 29. [CrossRef] [PubMed]
14. Yu, T.L.; Yang, H.; Luo, X.W.; Jiang, Y.F.; Wu, X.; Gao, J.Q. Scientometric analysis of disaster risk perception: 2000–2020. *Int. J. Environ. Res. Public Health* **2021**, *18*, 13003. [CrossRef]
15. Zhou, L.; Zhang, P.; Zhang, Z.G.; Fan, L.D.; Tang, S.; Hu, K.P.; Xiao, N.; Li, S.G. A bibliometric profile of disaster medicine research from 2008 to 2017: A scientometric analysis. *Disaster Med. Public Health Prep.* **2019**, *13*, 165–172. [CrossRef] [PubMed]
16. Chen, C.M. Science mapping: A systematic review of the literature. *J. Data. Inf. Sci.* **2017**, *2*, 1–40. [CrossRef]
17. van Eck, N.; Waltman, L. Software survey: VOSviewer, a computer program for bibliometric mapping. *Scientometrics* **2010**, *84*, 523–538. [CrossRef] [PubMed]
18. Sweileh, W.M. A bibliometric analysis of health-related literature on natural disasters from 1900 to 2017. *Health Res. Policy Syst.* **2019**, *17*, 18. [CrossRef]
19. Liu, W. The data source of this study is Web of Science Core Collection? Not enough. *Scientometrics* **2019**, *121*, 1815–1824. [CrossRef]
20. Wang, W.; Bai, J.H.; Zhang, L.; Jia, J.; Yu, L.; Zhang, S.Y. Biochar modulation of the soil nitrogen cycle: A Cite Space-based bibliometric study. *J. Beijing Norm. Univ. Nat. Sci.* **2021**, *57*, 76–85.
21. Luo, Y.; Wu, Y.G.; Duan, Z.B.; Xie, R. Bibliometric analysis of bioaccessibility of heavy metals based on CiteSpace. *J. Agro-Environ. Sci.* **2020**, *39*, 17–27.
22. Walicka, A.; Jóźków, G.; Kasprzak, M.; Borkowski, A. Terrestrial laser scanning for the detection of coarse grain size movement in a mountain riverbed. *Water* **2019**, *11*, 2199. [CrossRef]
23. Ding, L.S.; Ma, L.; Li, L.G.; Liu, C.; Li, N.W.; Yang, Z.L.; Yao, Y.Z.; Lu, H. A survey of remote sensing and geographic information system applications for flash floods. *Remote Sens.* **2021**, *13*, 1818. [CrossRef]
24. Li, D.F.; Lu, X.X.; Walling, D.E.; Zhang, T.; Steiner, J.F.; Wasson, R.J.; Harrison, S.; Nepal, S.; Nie, Y.; Immerzeel, W.W.; et al. High mountain Asia hydropower systems threatened by climate-driven landscape instability. *Nat. Geosci.* **2022**, *15*, 520–530. [CrossRef]
25. Nie, Y.; Sheng, Y.W.; Liu, Q.; Liu, L.S.; Liu, S.Y.; Zhang, Y.L.; Song, C.Q. A regional-scale assessment of Himalayan glacial lake changes using satellite observations from 1990 to 2015. *Remote Sens. Environ.* **2017**, *189*, 1–13. [CrossRef]
26. Harrison, S.; Kargel, J.S.; Huggel, C.; Reynolds, J.; Shugar, D.H.; Betts, R.A.; Emmer, A.; Glasser, N.; Haritashya, U.K.; Klimes, J.; et al. Climate change and the global pattern of moraine-dammed glacial lake outburst floods. *Cryosphere* **2018**, *12*, 1195–1209. [CrossRef]
27. Brun, F.; Berthier, E.; Wagnon, P.; Kääb, A.; Treichler, D. A spatially resolved estimate of high mountain Asia glacier mass balances from 2000 to 2016. *Nat. Geosci.* **2017**, *10*, 668–673. [CrossRef]
28. Cook, K.L.; Andermann, C.; Gimbert, F.; Adhikari, B.R.; Hovius, N. Glacial lake outburst floods as drivers of fluvial erosion in the Himalaya. *Science* **2018**, *362*, 53–57. [CrossRef]
29. Carrivick, J.L.; Tweed, F.S. A global assessment of the societal impacts of glacier outburst floods. *Glob. Planet. Chang.* **2016**, *144*, 1–16. [CrossRef]
30. Merritt, D.M.; Cooper, D.J. Riparian vegetation and channel change in response to river regulation: A comparative study of regulated and unregulated streams in the Green River Basin, USA. *Regul. Rivers Res. Manag.* **2000**, *16*, 543–564. [CrossRef]
31. Cooper, D.J.; Andersen, D.C.; Chimner, R.A. Multiple pathways for woody plant establishment on floodplains at local to regional scales. *J. Ecol.* **2003**, *91*, 182–196. [CrossRef]
32. Friedman, J.M.; Lee, V.J. Extreme floods, channel change, and riparian forests along ephemeral streams. *Ecol. Monogr.* **2002**, *72*, 409–425. [CrossRef]
33. Patten, D.T. Riparian ecosytems of semi-arid North America: Diversity and human impacts. *Wetlands* **1998**, *18*, 498–512. [CrossRef]
34. Emmer, A.; Klimeš, J.; Mergili, M.; Vilímek, V.; Cochachin, A. 882 lakes of the Cordillera Blanca: An inventory, classification, evolution and assessment of susceptibility to outburst floods. *Catena* **2016**, *147*, 269–279. [CrossRef]
35. Linsbauer, A.; Frey, H.; Haeberli, W.; Machguth, H.; Azam, M.F.; Allen, S. Modelling glacier-bed overdeepenings and possible future lakes for the glaciers in the Himalaya-Karakoram region. *Ann. Glaciol.* **2016**, *57*, 119–130. [CrossRef]

36. Worni, R.; Huggel, C.; Stoffel, M. Glacial lakes in the Indian Himalayas—From an area-wide glacial lake inventory to on-site and modeling based risk assessment of critical glacial lakes. *Sci. Total Environ.* **2013**, *468*, S71–S84. [CrossRef]
37. Westoby, M.J.; Glasser, N.F.; Brasington, J.; Hambrey, M.J.; Quincey, D.J.; Reynolds, J.M. Modelling outburst floods from moraine-dammed glacial lakes. *Earth-Sci. Rev.* **2014**, *134*, 137–159. [CrossRef]
38. Borga, M.; Stoffel, M.; Marchi, L.; Marra, F.; Jakob, M. Hydrogeomorphic response to extreme rainfall in headwater systems: Flash floods and debris flows. *J. Hydrol.* **2014**, *518*, 194–205. [CrossRef]
39. Steeb, N.; Rickenmann, D.; Badoux, A.; Rickli, C.; Waldner, P. Large wood recruitment processes and transported volumes in Swiss mountain streams during the extreme flood of August 2005. *Geomorphology* **2017**, *279*, 112–127. [CrossRef]
40. Stromberg, J.C.; Beauchamp, V.B.; Dixon, M.D.; Lite, S.J.; Paradzick, C. Importance of low-flow and high-flow characteristics to restoration of riparian vegetation along rivers in arid south-western United States. *Freshw. Biol.* **2007**, *52*, 651–679. [CrossRef]
41. Zaginaev, V.; Ballesteros-Cánovas, J.A.; Erokhin, S.; Matov, E.; Petrakov, D.; Stoffel, M. Reconstruction of glacial lake outburst floods in northern Tien Shan: Implications for hazard assessment. *Geomorphology* **2016**, *269*, 75–84. [CrossRef]
42. Stoffel, M.; Wyżga, B.; Marston, R.A. Floods in mountain environments: A synthesis. *Geomorphology* **2016**, *272*, 1–9. [CrossRef]
43. Adair, E.C.; Binkley, D.; Andersen, D.C. Patterns of nitrogen accumulation and cycling in riparian floodplain ecosystems along the Green and Yampa rivers. *Oecologia* **2004**, *139*, 108–116. [CrossRef] [PubMed]
44. Bagstad, K.J.; Stromberg, J.C.; Lite, S.J. Response of herbaceous riparian plants to rain and flooding on the San Pedro River, Arizona, USA. *Wetlands* **2005**, *25*, 210–223. [CrossRef]
45. Poff, N.L.; Allan, J.D.; Bain, M.B.; Karr, J.R.; Prestegaard, K.L.; Richter, B.D.; Sparks, R.E.; Stromberg, J.C. The natural flow regime. *BioScience* **1997**, *47*, 769–784. [CrossRef]
46. Scott, M.L.; Auble, G.T.; Friedman, J.M. Flood dependency of cottonwood establishment along the Missouri River, Montana, USA. *Ecol. Appl.* **1997**, *7*, 677–690. [CrossRef]
47. Mahoney, J.M.; Rood, S.B. Streamflow requirements for cottonwood seedling recruitment-An integrative model. *Wetlands* **1998**, *18*, 634–645. [CrossRef]
48. Scott, M.L.; Friedman, J.M.; Auble, G.T. Fluvial process and the establishment of bottomland trees. *Geomorphology* **1996**, *14*, 327–339. [CrossRef]
49. Busch, D.E.; Smith, S.D. Mechanisms associated with decline of woody species in riparian ecosystems of the southwestern US. *Ecol. Monogr.* **1995**, *65*, 347–370. [CrossRef]
50. Bolch, T.; Kulkarni, A.; Kääb, A.; Huggel, C.; Paul, F.; Cogley, J.G.; Frey, H.; Kargel, J.S.; Fujita, K.; Scheel, M.; et al. The state and fate of Himalayan glaciers. *Science* **2012**, *336*, 310–314. [CrossRef]
51. Gochis, D.; Schumacher, R.; Friedrich, K.; Doesken, N.; Kelsch, M.; Sun, J.; Ikeda, K.; Lindsey, D.; Wood, A.; Dolan, B.; et al. The great Colorado flood of September 2013. *Bull. Am. Meteorol. Soc.* **2015**, *96*, 1461–1487. [CrossRef]
52. Wohl, E. Floodplains and wood. *Earth-Sci. Rev.* **2013**, *123*, 194–212. [CrossRef]
53. Ruiz-Villanueva, V.; Piégay, H.; Gurnell, A.M.; Marston, R.A.; Stoffel, M. Recent advances quantifying the large wood dynamics in river basins: New methods and remaining challenges. *Rev. Geophys.* **2016**, *54*, 611–652. [CrossRef]
54. Leydesdorff, L.; Rafols, I.; Chen, C.M. Interactive overlays of journals and the measurement of interdisciplinarity on the basis of aggregated journal-journal citations. *J. Am. Soc. Inf. Sci. Technol.* **2013**, *64*, 2573–2586. [CrossRef]
55. Abbas, G.; Murtaza, B.; Bibi, I.; Shahid, M.; Niazi, N.K.; Khan, M.I.; Amjad, M.; Hussain, M.; Hussain, M. Arsenic uptake, toxicity, detoxification, and speciation in plants: Physiological, biochemical, and molecular aspects. *Int. J. Environ. Res. Public Health* **2018**, *15*, 59. [CrossRef] [PubMed]
56. Guzzetti, F.; Carrara, A.; Cardinali, M.; Reichenbach, P. Landslide hazard evaluation: A review of current techniques and their application in a multi-scale study, Central Italy. *Geomorphology* **1999**, *31*, 181–216. [CrossRef]
57. Deng, X.Z.; Li, Z.H.; Gibson, J. A review on trade-off analysis of ecosystem services for sustainable land-use management. *J. Geogr. Sci.* **2016**, *26*, 953–968. [CrossRef]
58. Fuchs, S.; Keiler, M.; Ortlepp, R.; Schinke, R.; Papathoma, K.M. Recent advances in vulnerability assessment for the built environment exposed to torrential hazards: Challenges and the way forward. *J. Hydrol.* **2019**, *575*, 587–595. [CrossRef]
59. Musselman, K.N.; Lehner, F.; Ikeda, K.; Clark, M.P.; Prein, A.F.; Liu, C.H.; Barlage, M.; Rasmussen, R. Projected increases and shifts in rain-on-snow flood risk over western North America. *Nat. Clim. Chang.* **2018**, *8*, 808–812. [CrossRef]
60. Byers, A.C.; Shugar, D.H.; Chand, M.B.; Portocarrero, C.; Shrestha, M.; Rounce, D.R.; Watanabe, T. Three Recent and Lesser-Known Glacier-Related Flood Mechanisms in High Mountain Environments. *Mt. Res. Dev.* **2022**, *42*, A12–A22. [CrossRef]
61. Lashford, C.; Rubinato, M.; Cai, Y.; Hou, J.; Abolfathi, S.; Coupe, S.; Charlesworth, S.; Tait, S. SuDS & sponge cities: A comparative analysis of the implementation of pluvial flood management in the UK and China. *Sustainability* **2019**, *11*, 213.
62. Kumar, R.R.; Stauvermann, P.J.; Patel, A. Exploring the link between research and economic growth: An empirical study of China and USA. *Qual. Quant.* **2016**, *50*, 1073–1091. [CrossRef]
63. Hashim, J.H.; Hashim, Z. Climate change, extreme weather events, and human health implications in the Asia Pacific region. *Asia-Pac. J. Public He.* **2016**, *28*, 8S–14S. [CrossRef] [PubMed]
64. Global Disaster Data Platform. Available online: https://www.gddat.cn/newGlobalWeb/#/FeatureAnalysis (accessed on 11 October 2022).
65. Cui, P.; Zhu, Y.Y.; Han, Y.S.; Chen, X.Q.; Zhuang, J.Q. The 12 May Wenchuan earthquake-induced landslide lakes: Distribution and preliminary risk evaluation. *Landslides* **2009**, *6*, 209–223. [CrossRef]

66. Cui, P.; Chen, X.Q.; Zhu, Y.Y.; Su, F.H.; Wei, F.Q.; Han, Y.S.; Liu, H.J.; Zhuang, J.Q. The Wenchuan earthquake (May 12, 2008), Sichuan province, China, and resulting geohazards. *Nat. Hazards* **2011**, *56*, 19–36. [CrossRef]
67. Kargel, J.S.; Leonard, G.J.; Shugar, D.H.; Haritashya, U.K.; Bevington, A.; Fielding, E.J.; Fujita, K.; Geertsema, M.; Miles, E.S.; Steiner, J.; et al. Geomorphic and geologic controls of geohazards induced by Nepal's 2015 Gorkha earthquake. *Science* **2016**, *351*, aac8353. [CrossRef]
68. Beniston, M. Impacts of climatic change on water and associated economic activities in the Swiss Alps. *J. Hydrol.* **2012**, *412*, 291–296. [CrossRef]
69. Papathoma-Köhle, M.; Kappes, M.; Keiler, M.; Glade, T. Physical vulnerability assessment for alpine hazards: State of the art and future needs. *Nat. Hazards* **2011**, *58*, 645–680. [CrossRef]
70. Prieto, C.; Patel, D.; Han, D. Preface: Advances in flood risk assessment and management. *Nat. Hazard. Earth. Sys.* **2020**, *20*, 1045–1048. [CrossRef]
71. Allen, S.K.; Rastner, P.; Arora, M.; Huggel, C.; Stoffel, M. Lake outburst and debris flow disaster at Kedarnath, June 2013: Hydrometeorological triggering and topographic predisposition. *Landslides* **2016**, *13*, 1479–1491. [CrossRef]
72. Sorribas, M.V.; Paiva, R.C.; Melack, J.M.; Bravo, J.M.; Jones, C.; Carvalho, L.; Beighley, E.; Forsberg, B.; Costa, M.H. Projections of climate change effects on discharge and inundation in the Amazon basin. *Clim. Chang.* **2016**, *136*, 555–570. [CrossRef]
73. Yucel, I.; Onen, A.; Yilmaz, K.K.; Gochis, D.J. Calibration and evaluation of a flood forecasting system: Utility of numerical weather prediction model, data assimilation and satellite-based rainfall. *J. Hydrol.* **2015**, *523*, 49–66. [CrossRef]
74. Yang, Z.Q.; Zhao, X.G.; Chen, M.; Zhang, J.; Yang, Y.; Chen, W.T.; Bai, X.F.; Wang, M.M.; Wu, Q. Characteristics, dynamic analyses and hazard assessment of debris flows in Niumiangou Valley of Wenchuan County. *Appl. Sci.* **2023**, *13*, 1161. [CrossRef]
75. Naghibi, S.A.; Moghaddam, D.D.; Kalantar, B.; Pradhan, B.; Kisi, O. A comparative assessment of GIS-based data mining models and a novel ensemble model in groundwater well potential mapping. *J. Hydrol.* **2017**, *548*, 471–483. [CrossRef]
76. Zhao, G.; Pang, B.; Xu, Z.X.; Yue, J.J.; Tu, T.B. Mapping flood susceptibility in mountainous areas on a national scale in China. *Sci. Total Environ.* **2018**, *615*, 1133–1142. [CrossRef]