

Analysis of Natural Hazards Research from 2011-2020: A Scientometric Perspective

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ABSTRACT

This paper examines the scientometric analysis of 13282 global publications trends on natural hazards using web of science database during the period 2011-2020. The average number of publications published per year was 1328.2. The highest number of publications (2124) was published in the year 2020. The relative growth rates (RGR) has decreased from 2012 (0.79) to 2020 (0.17) in the span of 10 years. The doubling time (DT) has gradually increased from 0.88 in 2012 to 4.08 in 2020. The exponential growth of publications was observed during the study period. Majority of publications were found in English language. Authors from USA have contributed maximum number of publications compared to the other countries and India stood 6th rank in terms of productivity in this period. A total of 7652 different institutions were involved in publication of articles. University of California System, USA contributed highest number of 342 articles. The scientific literature on natural hazards is spread over 136 different subjects. Environmental sciences ecology has highest number of articles with 3320 (25.00%) followed by Geology contributing 3089 (23.26%) articles.

KEYWORDS: Natural hazards, Scientometrics, Relative growth rate and Doubling time.

1. INTRODUCTION

A natural hazard is a natural phenomenon that might have a negative effect on humans or the environment. Natural hazards are naturally occurring physical phenomena caused either by rapid or slow onset events which can be grouped into two broad categories. Geophysical hazards encompass geological and meteorological phenomena such as avalanche, earthquakes, volcanic eruption, wildfire, cyclonic storms, floods, drought, blizzard, hailstorm, heat wave, tornado, ice storm, climate change, coastal erosion, fires are socio-natural hazards since their causes are both natural and manmade. Biological hazards can refer to a diverse array of disease and infestation. So the natural hazards effects are increasing day by day and creating danger for human life in the coming years. This is clear from the scientometric evidence from 2011 to 2020, that the number of publications in the Web of Science database was increased from 738 to 2124. Therefore the present study has been undertaken to know the growth and development of publications in the field of natural hazards.

2. OBJECTIVES FOR THE STUDY

The present study has been undertaken with the objectives of analysing the following aspects:

- ❖ Document types of publications
- ❖ Annual growth rate of publications
- ❖ Most prolific authors
- ❖ Highly productive countries
- ❖ Highly productive institutes
- ❖ Language-wise distribution of publications
- ❖ Most preferred source titles
- ❖ High productive subject areas

3 MATERIALS AND METHODS

The Web of Science database was used for retrieving data on natural hazards in topic field. A total of 13282 publications were downloaded and analysed by using the Microsoft excels per the objectives of the study. The Web of Science database allows us to refine the results in terms of publication years, countries, institutes, authors, language, subjects and source titles.

4 DATA ANALYSIS AND INTERPRETATIONS

4.1 Forms of publications

Table 1 Forms of publications

S. No.	Forms of publications	No. of publications	Percentage
1	Journal articles	12004	90.38
2	Review articles	757	5.70
3	Conference papers	294	2.21
4	Editorial material	129	0.97
5	Early access	56	0.42
6	Book chapters	16	0.12
7	Data papers	10	0.08
8	Book reviews	5	0.04
9	Letter	4	0.03
10	News item	4	0.03
11	Meeting abstract	3	0.02
Total		13282	100.00

The table 1 reveals that the major source of publications covered by web of science databases on natural hazards research is Journal articles with 12004 publications (90.38%) followed by Review articles with 757 publications (5.70%). Conference papers ranks the third position with 294 publications (2.21%) and remaining forms are less than one percentage as seen in the table. The results indicate that the research outputs on natural hazards of the period covered by the study are mostly published in the form of journal articles.

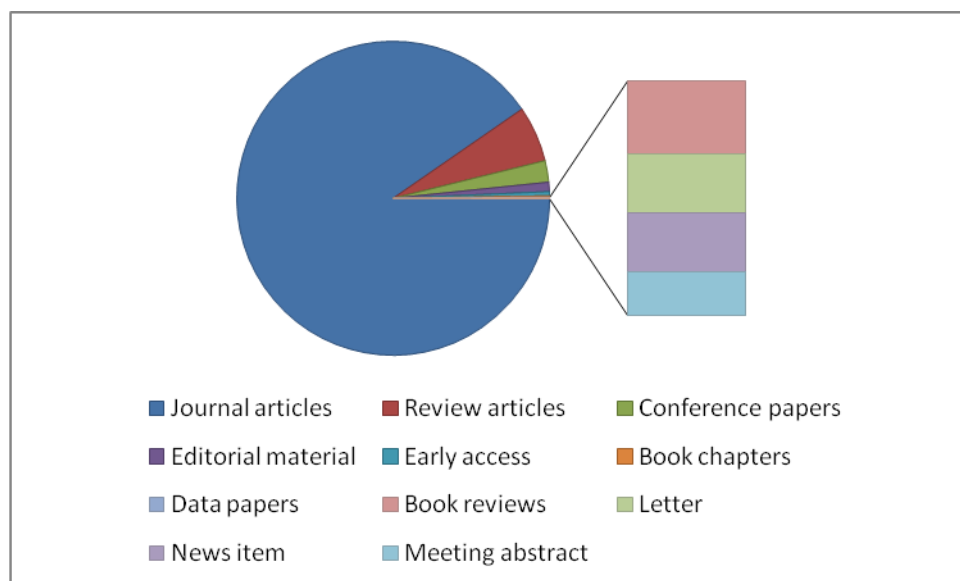


Figure 1 Form of publications

4.2 Annual Growth Rate (AGR) of publications

Table 2 provides the AGR and CAGR of the number of documents for period 2006 to 2015.

$$\text{AGR} = \frac{\text{End Value} - \text{First Value}}{\text{First Value}} \times 100$$

Table 2 AGR of Publications

Year	No. of publications	Cumulative total	Annual growth rate (AGR)
2011	738	738	-
2012	889	1627	120.46
2013	969	2596	59.56
2014	1042	3638	40.14
2015	1215	4853	33.40
2016	1314	6167	27.08
2017	1419	7586	23.01
2018	1677	9263	22.11
2019	1895	11158	20.46
2020	2124	13282	19.04

During the period of 2011 to 2020, a total of 13,282 publications were published on natural hazards research. The highest number of publications is 2124 was published in 2020. The lowest publications of 738 are published in 2011. The average number of publications published per year was 1328.2. Table 2 show that there has been a steady growth in research publications on natural hazards during the study period.

The table 2 also provides that the annual growth rate of the total publications calculated year wise. AGR reveals that it has decreased from 158.35 in 2013 to 21.15 in 2020. There is a downward trend in the growth rate as seen in the figure 2.

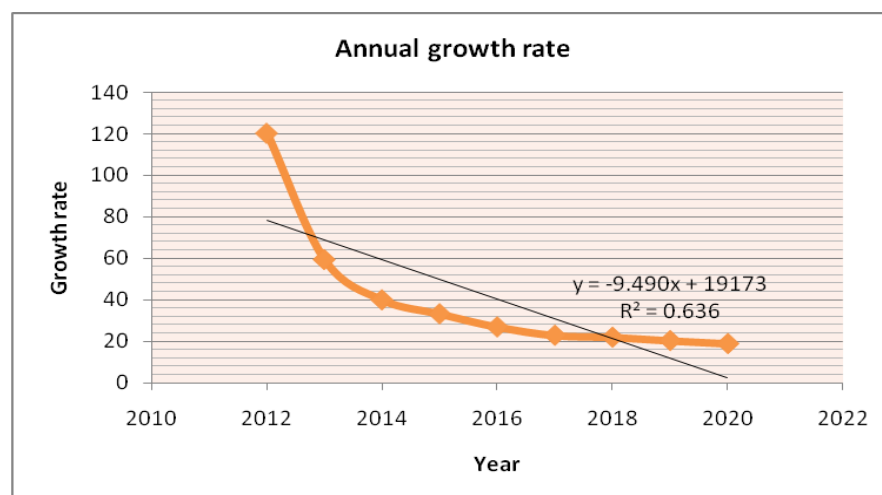


Figure 2 Annual growth rate of publications

4.3 Relative Growth Rate (RGR) and Doubling Time

The Relative Growth Rate (RGR) is the increase in number of articles or pages per unit of time. This definition derived from the definition of relative growth rates in the study of growth analysis in the field of natural hazards. The mean relative growth rate (R) over the specific period of interval can be calculated from the following equation.

Relative Growth Rate (RGR)

$$1 - 2R \cdot \log W_2 - \log W_1 / T_2 - T_1$$

Whereas

1-2 R- mean relative growth rate over the specific period of interval

$\log_e W_1$ - log of initial number of articles

$\log_e W_2$ - log of final number of articles after a specific period of interval

$T_2 - T_1$ - the unit difference between the initial time and the final time

The year can be taken here as the unit of time.

Doubling Time (DT) = $0.693/R$

Table 3 Relative growth rate (RGR) and Doubling time (DT) of publications

Year	No. of Publications	Cumulative Total	W1	W2	RGR	DT
2011	738	738	-	6.60	-	-
2012	889	1627	6.60	7.39	0.79	0.88
2013	969	2596	7.39	7.86	0.47	1.47
2014	1042	3638	7.86	8.20	0.34	2.04
2015	1215	4853	8.20	8.49	0.29	2.39
2016	1314	6167	8.49	8.73	0.24	2.89

2017	1419	7586	8.73	8.93	0.20	3.47
2018	1677	9263	8.93	9.13	0.20	3.47
2019	1895	11158	9.13	9.32	0.19	3.65
2020	2124	13282	9.32	9.49	0.17	4.08

The year wise RGR is found to be in the range of 0.79 to 0.17. It has been observed from Table 3 and figure 3 that RGR is downward trend from 2012 (0.79) to 2020 (0.17). The doubling time (DT) was upward trend from 2012 (0.88) to 2020 (4.08).

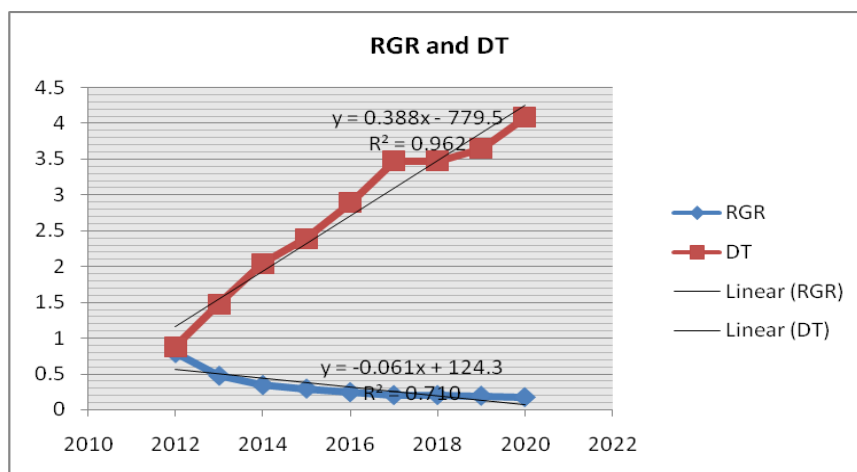


Figure 3 Relative growth rate for research output

4.4 Language wise distributions

Table 4 Language wise distribution of publications

S.No.	Language	No. of Publications	S.No.	Language	No. of Publications
1	English	13142 (98.94%)	9	Croatian	3 (0.02%)
2	Spanish	36 (0.27%)	10	Portuguese	3 (0.02%)
3	German	34 (0.44%)	11	Czech	2 (0.02%)
4	French	29 (0.25%)	12	Dutch	1 (0.01%)
5	Chinese	10 (0.08%)	13	Hungarian	1 (0.01%)
6	Polish	9 (0.07%)	14	Korean	1 (0.01%)
7	Italian	5 (0.04%)	15	Malay	1 (0.01%)
8	Japanese	4 (0.03%)	16	Slovenian	1 (0.01%)

Publications on natural hazards are spread over 16 languages. The study reveals that the maximum number of publications have been published in English language with 13142 (98.94%) publications, followed by Spanish language with 36 (0.27%) publications, German language ranks third position with 34 (0.44%) publications, French language with 29 (0.25%) publications, Chinese language with 10 (0.08%) publications, Polish language with 9 (0.07%) publications and Italian language with 5 (0.04%) publications. The most predominant language used for communication was English in every year in total productivity on the subject during the study period.

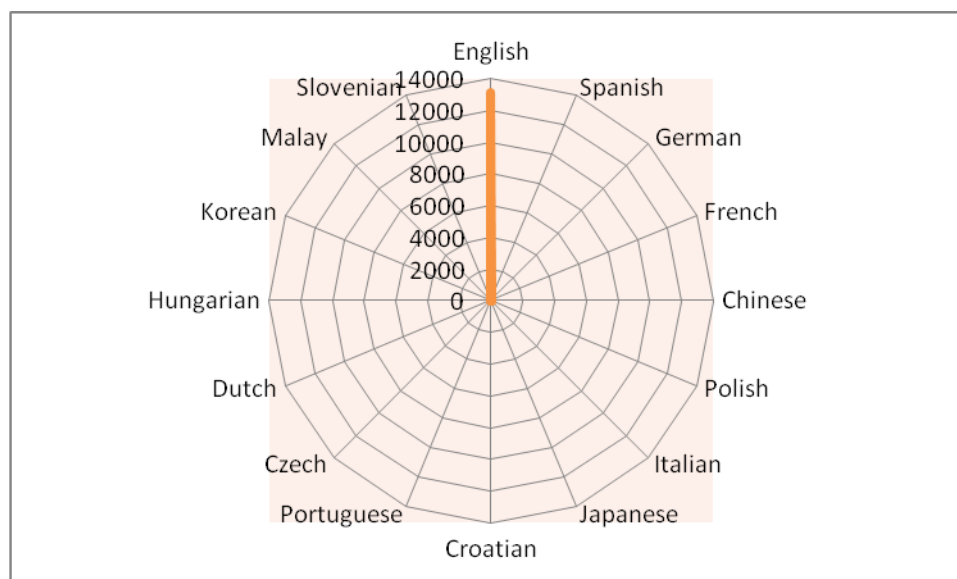


Figure 4 Language wise distributions of publications

4.5 Highly productive countries

Table 5 Highly productive countries

S. No.	Country	Total Publications	Percentage
1	USA	3461	26.06
2	China	1702	12.81
3	Italy	1165	8.77
4	England	1072	8.07
5	Germany	863	6.50
6	India	708	5.33
7	Australia	701	5.28
8	France	681	5.13
9	Canada	664	5.00
10	Spain	553	4.16
11	Switzerland	491	3.70
12	Netherlands	487	3.67
13	Japan	476	3.58

In all, there were 138 countries involved in the research in natural hazards field and which published at least one publication. The publications share of highly productive countries (≥ 400 publications) in natural hazards varies from 3.58% to 26.06% as seen in the table 5 and figure 5. USA topped the list with highest share 3461 (26.06%) of publications. China ranked second with 1702 (12.81%) share of publications followed by Italy with 1165 (8.77%) share of publications, England with 1072 (8.07%) share of publications, Germany with 863 (6.50%) share of publications, India with 708 (5.33%) share of publications, Australia with 701 (5.28%) share of publications, France with 681 (5.13%) share of publications and Canada with 664 (5.00%) share of publications and the remaining countries are publishing less than 5% of the research output in this study period.

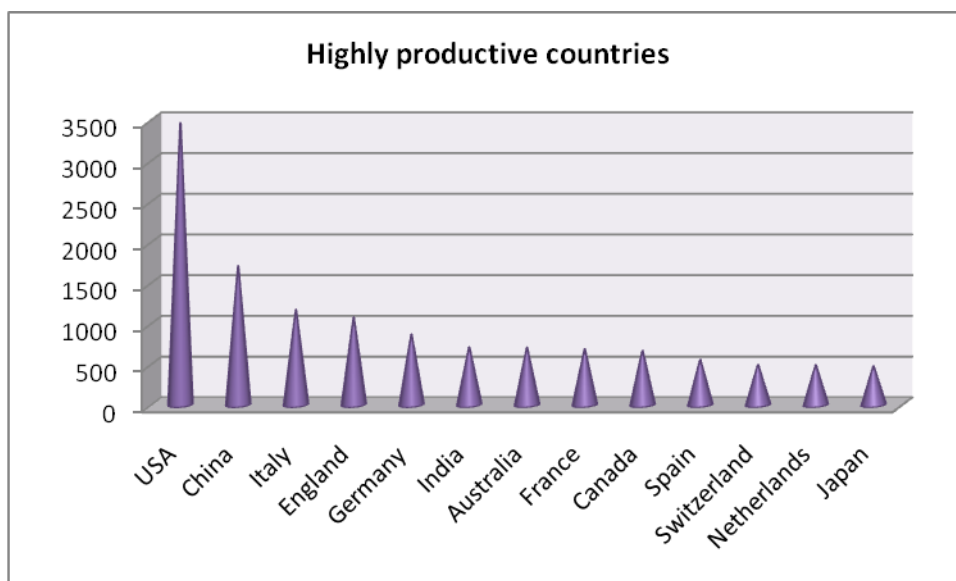


Figure 4 Highly productive countries

4.6 Identification of most prolific authors

Table 6 Identification of most prolific authors

S. No.	Author	No. of publications	Percentage
1	Zhang Y	48	0.36
2	Pradhan, B	47	0.35
3	Liu Y	44	0.33
4	Wang Y	44	0.33
5	Li, Y	39	0.29
6	Stoffel, M	34	0.26
7	Zhang, Q	34	0.26
8	Liu, J	30	0.23
9	Li, J	29	0.22
10	Wang, L	28	0.21
11	Mehra, R	27	0.20
12	Fuchs, S	26	0.19
13	Lee, J H	26	0.19

The authors having 25 or more publications during 2011-2020 are given in Table 6. Zhang Y is the most productive author with 48 (0.30%) publications followed by Pradhan, B with 47 (0.35%) publications, Liu, Y with 44 (0.33%) publications, Wang, Y with 44 (0.33%) publications, Li, Y with 39 (0.29) publications, Stoffel, M with 34 (0.26%) publications, Zhang, Q with 34 (0.26%) publications and Liu, J with 30 (0.23%) publications respectively. And a total of 29,642 authors are contributed entire research output of the period under study.

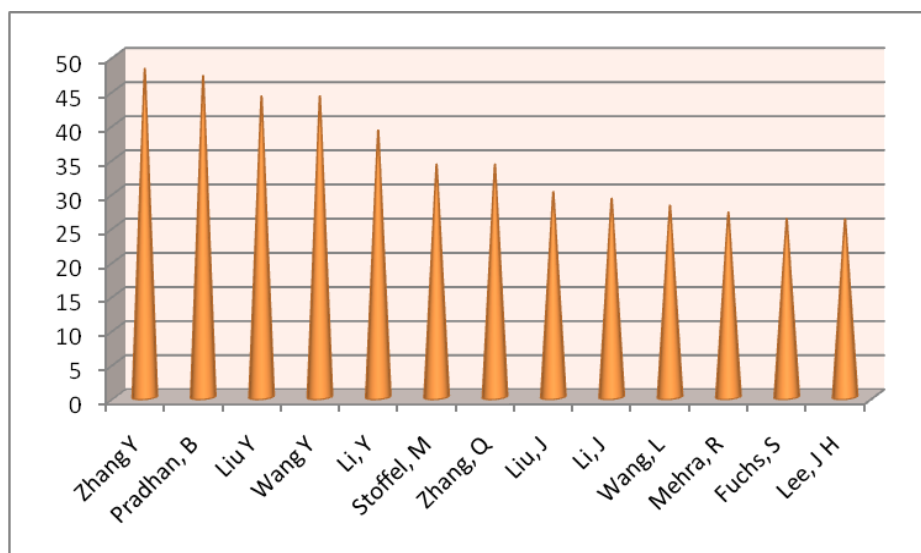


Figure 6 Most prolific authors

4.7 Highly productive institutes

Table 7 Highly productive institutes

S. No.	Institutions	Country	No. of Publications	Percentage
1	University of California System	USA	342	2.57
2	Chinese Academic of Sciences	China	295	2.22
3	Centre National de La Recherche Scientifique CNRS	France	253	1.90
4	University of London	UK	244	1.84
5	Harvard University	USA	231	1.74
6	Helmholtz Association	Germany	223	1.68
7	Consiglio Nazionale Delle Richerche CNR	Italy	220	1.66
8	State University System of Florida	USA	147	1.11
9	University College London	UK	132	0.99
10	ETH Zurich	Switzerland	130	0.98
11	University of Texas System	USA	130	0.98
12	University of Colorado System	USA	122	0.92
13	University of North Carolina	USA	114	0.86

Table 7 presents the top 13 institutes that have contributed 110 or more publications on natural hazards during 2011-2020. A total of 7,652 institutions are contributed entire research output of the study. University of California System, USA topped the list with 342 (2.57%) publications followed by Chinese Academy of Science, China with 295 (2.22%) publications, Centre National de La Recherche Scientifique CNRS, France with 253 (1.90%) publications, University of London, UK with 244 (1.84%) publications, Harvard University, USA with 231 (1.74%) publications, Helmholtz Association with 223 (1.68%) publications, Consiglio Nazionale Delle Richerche CNR with 220 (1.66%) publications and State University System of Florida, USA with 147 (1.11%) publications.

4.8 Most preferred source titles**Table 8** Source Title of Publications

S. No.	Source Title	No. of Publications	Percentage
1	Natural hazards	654	4.92
2	International Journal of Disaster Risk Reduction	293	2.21
3	Natural hazards and earth system sciences	242	1.82
4	Science of the total environment	190	1.43
5	Environmental earth sciences	189	1.42
6	Sustainability	161	1.21
7	PLOS One	141	1.06
8	Remote sensing	115	0.87
9	Journal of radio analytical and nuclear chemistry	112	0.84
10	Water	111	0.83

Table 8 provides the leading journals each with number of publications. The scientific literature on natural hazards is spread over 2347 different web of science source journals. It reveals that Natural Hazards the list with the highest number of publications 654 (4.92%) followed by International Journal of Disaster Risk Reduction with a share of 293 (2.21%) publications. Natural hazards and earth system sciences occupies the third position with 242 (1.82%) publications. The fourth highest source title is Science of the total environment with 190 (1.43%) publications, Environmental earth sciences with 189 (1.42%) publications and Sustainability with 161 (1.21%) publications respectively.

4.9 High productivity subject areas**Table 9** High productivity subject areas

S. No.	Subject	No. of Articles	Percentage
1	Environmental sciences ecology	3320	25.00
2	Geology	3089	23.26
3	Water resources	2299	17.31
4	Meteorology atmospheric sciences	1804	13.58
5	Engineering	1752	13.19
6	Science and Technology	748	5.63
7	Public environmental occupational health	700	5.27
8	Chemistry	573	4.31
9	Physical geography	469	3.53
10	Nuclear science technology	407	3.06

The scientific literature on natural hazards is spread over 136 different subjects. Table 9 shows high productivity subjects which are contributing more than 400 articles. It is found that Environmental sciences ecology has highest number of articles with 3320 (25.00%) followed by Geology contributing 3089 (23.26%) articles. Water resources occupy the third position with 2299 (17.31%) articles. The fourth highest articles belonged to the subject

Meteorology atmospheric sciences with 1804 (13.58%) articles, Engineering with 1752 (13.58%) articles and Science and Technology with 748 (5.63%) articles respectively.

CONCLUSIONS

The present study attempted to highlight the growth and development of research publication on natural hazards. A total of 13282 publications were published during 2011-2020 and the average number of publication per year was 1328.2. The single most prevalent type of publications is the journal, in which 90.38 % of the total literature is published. It is found that natural hazards researcher's preferred medium of communication is journal articles. The exponential growth of publication was observed during the study period. Zhang Y is the most productive author with 48 (0.30%) publications followed by Pradhan, B with 47 (0.35%) publications and Liu, Y with 44 (0.33%) publications. A total of 29,642 authors are contributed entire research output of the period under study. USA topped the list with highest share 2183 (28.50%) of publications. Italy ranked second with 682 (8.91%) share of publications followed by England with 579 (7.56%) share of publications, China with 549 (7.17%) share of publications and Germany with 524 (6.84%) share of publications. University of California System, USA topped the list with 342 (2.57%) publications followed by Chinese Academy of Science, China with 295 (2.22%) publications. The scientific literature on natural hazards is spread over 2347 different web of science source titles.

REFERENCES

- [1] Burton, I, Kates, R.W and White, G.F. (1993). *The environment as hazard*. Guilford Press. ISBN 9780898621594.
- [2] Kademani, B. S., Vijai, K., Anil, S., & Anil, K. (2006). Scientometric dimensions of Nuclear Science and Technology research in India: a study based on INIS (1970-2002) Database, University of Malaya.
- [3] Santha kumar R (2016). Publications Trends in Atomic Physics: A Global Perspective, *International Journal of Information Studies & Libraries*, 1 (1), 22-32
- [4] Anil Sagar, Kademani, B.S, Bhanumathy, K and Ramamoorthy, N (2014). Recent trend in radio isotopes: A Scientometric analysis (1993-2012), *DESIDOC Journal of Library and Information Technology*, 34(4), 349-358
- [5] Santha kumar R (2016). "Publications Trends in Nuclear Physics: A Global Perspective", *Library Philosophy and Practice (e-journal)*, Paper 1361. <http://digitalcommons.unl.edu/libphilprac/1361>
- [6] Santha kumar R (2016). Research Trends in Medical Physics: A Global Perspective", *Library Philosophy and Practice (e-journal)*, Paper 1362. <http://digitalcommons.unl.edu/libphilprac/1362>
- [7] Gangan Prathap (2014). A Bibliometric Evaluation of Research on the Monsoon, *DESIDOC Journal of Library and Information Technology*, 34(3), 191-196
- [8] https://en.wikipedia.org/wiki/Natural_hazard