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Research Output on Global Warming: A Scientometric Analysis

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Abstract: Global warming is the term used to describe a gradual increase in the average temperature of the Earth's atmosphere and its oceans, a change that is believed to be permanently changing the Earth's climate. There is great debate among many people and sometimes in the news on whether global warming is real. Study particularly concentrated about scientometric on the records indexed in the web of science database during the period 2008-2017, i.e., for 10 years on global warming. The researcher's analysed the research publication that has been published only on 'Global Warming' climate and retrieved 19969 records. Methodology of this study was downloaded articles from the web of science database; the search term used was "Global warming" and considered as central keyword of the topic discussed. Each record contains English language abstract with the bibliographic information, e.g., researcher, name of journal, researcher address, affiliation, key words and cited items, etc., the downloaded data was analyzed for source items to find out the research trend. The downloaded data has been stored in MS-Excel files for further analysis. Objectives of the researche has been done under the growth of scholarly publications, ranked list of journals, form wise distribution of records, authorship pattern and researchers productivity, country-wise productivity, year wise distribution of records etc.

Key words: Global warming, climate, citation analyses, scientometric and collaborative research, affiliation, scholarly publications

INTRODUCTION

Global warming is the term used to describe a gradual increase in the average temperature of the Earth's atmosphere and its oceans, a change that is believed to be permanently changing the Earth's climate. There is great debate among many people and sometimes in the news, on whether global warming is real (some call it a hoax). But climate scientists looking at the data and facts agree the planet is warming. While many view the effects of global warming to be more substantial and more rapidly occurring than others do, the scientific consensus on climatic changes related to global warming is that the average temperature of the Earth has risen between 0.4 and 0.8°C over the past 100 years (Hinze and Glanze, 2013; CAGR., 2014; Mahapatra, 1985). The increased volumes of carbon dioxide and other greenhouse gases released by the burning of fossil fuels, land clearing, agriculture and other human activities are believed to be the primary sources of the global warming that has occurred over the past 50 years. Scientists from the intergovernmental panel on climate carrying out global warming research have recently predicted that average global temperatures could increase between 1.4 and 5.8°C by the year 2100. Changes resulting from global warming may include rising sea levels due to the melting of the polar ice caps as well as an increase in occurrence and severity of storms and other severe weather events (Garg and Padhi, 2002; Lawani, 1980).

Web of science: Web of science (previously known as web of knowledge) in an online subscription-based scientific citation indexing service originally produced by the Institute for Scientific Information (ISI) now maintained by Clarivate Analytics (previously the intellectual property and science business of Thomson Reuters) that provides a comprehensive citation search (Subramanyam, 1983).

Proposed Research: Scientific literature is a mirror of scientific research around the world. All the scientific works end up as publication in the open literature, most of it in the journals (Ajiferuke *et al*., 1988). Research output in journal article as significant message or research activity in a field or subfield and publication analysis, scientometric, bibliometric, informatics, mapping of subject, quantity analysis of publication, citation analysis have become standard tool for research evaluation.

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All these metric sciences (scientometric, bibliometric, informatics, mapping of subject, quantity analysis of publication) have been widely applied to evaluate the research performance of the scientists and the growth of various disciplines. Further, bibliometric data have been used in the identification of emerging research areas and in the evaluation of research performance of individual scientists, research groups and countries. These aims to integrate the cognitive or intellectual structure of research with a view to appraise the relations among the researchers, institutions, journals and articles and as a means of assisting the peer review procedure (Duraipandi, 2016; Ranganathan, 2014).

A review of literature in the area reveals that no such studies have been conducted either at macro or micro level on the growth pattern of literature in the field of agriculture literature. Hence, it is proposed to study quantitatively the literature published on global worming by using web of science database. Thus, this study aims assessing the world wide research activity in global worming as it is reflected by mainstream journal literature.

Need for the study: India's greenhouse gas emissions are increasing, making up 4.47% of the global total in 2000. This places India in the top ten emitters of the world. The United States leads the way, producing five times more emissions than India at almost 16% of the world total. China is the largest developing country emitter, accounting for nearly 12% of global emissions.

Objectives: The study is undertaken by the following objectives:

- To analysis the year wise distribution of research output on global warming
- To determine the relative growth rate and doubling time analysis of the global warming
- To find out the language wise publications about global warming research

Literature review: Mooghali *et al*. conducted a scientometrics study of scientometric journal, findings revealed that out of 691 study in the field of scientometrics, a total number of 183 articles (26.48%) were written during 1980-2009 by the top ten researchers. Some of these articles were produced in researcher's collaboration and some of them were by single researchers. Geographical analysis indicated that the field had evolved considerably in different regions of the world. Hungarian Academy of Science with 40 records (5.71%) was the most productive institution in the field of scientometrics.

Swain and Panda in 2012 study is a scientometrics analysis of the magnitude of contributions of Prof. K.C. Panda, an eminent information scientist and academician of LIS. The study highlights his 130 publications (120 study and 10 books) during 1982- 2011. The analysis of his 120 articles reveals that he has contributed 20 single papers and co-authored 80 papers with 45 collaborators that appeared 115 times yielding a greater collaboration coefficient of 0.79 which indicates his versatility of promoting research from the collaborative front (Anil *et al*., 2017).

By Jena *et al*., Annals of Library and Information Studies, 2002-2010, a bibliometric study research publications are the embodiments of the intellectual thought contents expressed in published literature whose key objective is to transmit innovative ideas or information to any specific field of knowledge towards the further development of a subject or a discipline. In this respect bibliometrics study is regarded as one of the crucial areas of research in the field of library and information science (Sangam and Agadi, 2010).

By Kotti Thavamani this study presents a bibliometrics study of library-focused journals represented in the Directory of Open Access Journals (DOAJ). A total of 151 library and information science journals were examined related to a number of issues: subject-specific distribution of library journals, interdisciplinary aspects, country of origin, language-used and other language characteristics, numbers of titles first appearing in given years, publication fees, the existence of license agreements and the types of organizations having journals in the directory that focus on libraries or librarianship (Sangam and Meera, 2009).

By Devi B. Mini the study analyses scientometrically the growth of nuclear medicine literature. The data was taken from the database web of science core collection provided by Thomson Reuters from 1999-2014. A total of 6366 records were analysed by using scientometrics analysis and information visualization software package Hist Cite. The most productive year is 2011 having 585 study followed by 2012 (8.6%) and 2010 (8.5%). The relative growth rate of publications decreased from the rate of 0.67 in 2000-0.09 in 2013. The rate of growth of publications was decreased, corresponding doubling time was increased (Gupta *et al*., 2011).

Harinarayana *et al*. conducted study on Facebook posts and Lotka's law, the study examined the participation of librarians in Facebook by testing whether it follows the pattern given by Lotka's law. The result shows that it does not. The study analysed the reasons and also provides the methods of collecting data for bibliometric study (Ajiferuke *et al*., 1988).

MATERIALS AND METHODS

Research design: The methodology applied in the current study is scientometric scrutiny which is used to analyze in detail the global warming publications. The data collected from the web of science (an international multidisciplinary indexing and abstracting database) on global warming were uploaded in open source software "Bib Excel". This study mainly focused on the year wise publications, country wise output, authorship pattern, source wise, key word and type of document wise publications were analyzed with proper scientometric tools.

Statistical tools used: The following statistical tools were used for analysis of data of the present study:

- Relative growth rate
- Doubling time
- Simple percentages
- Averages and cumulative percentages are the statistical methods used for this study

RESULTS AND DISCUSSION

Data analysis and interpretation

Year wise distribution of papers: The year wise research publication of records on global warming published from the year 2008-2017 and indexed in the web of science were retrieved and processed in the form of tabulation which is displayed in Table 1 (Fig. 1).

Table 1 shows the distribution of research articles indexed in web of science during the period 2008-2017. The total of 19969 research articles was published with an average of 1996.9 articles per year. Out of 19969 articles, the highest number of research articles were published in the year 2017 with 2894 research articles 2636 articles followed by the 2016; 2636 articles, 2008; 1250 articles, 2009; 1503 articles and the lowest number of articles were published in the year 2009 with 1250 articles. Table 1 shows the distribution of research articles indexed in web of science during the period 2008-2017.

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Table 1: Year wise distribution of publication

No. of years	Records	Research records (%)
2008	1250	6.2600
2009	1503	7.5300
2010	1578	7.9000
2011	1668	8.3500
2012	1874	9.3800
2013	2065	10.340
2014	2096	10.500
2015	2405	12.040
2016	2636	13.200
2017	2894	14.490
Total	19969	100.00
Average	1996.9	

Table 2: Year wise publication output citation count in global warming research

	World publication output		
Publication periods	TP	TC	CPP
2008	1250	65581	52.46
2009	1503	63974	42.56
2010	1578	61728	39.11
2011	1668	55051	33
2012	1874	47875	25.55
2013	2065	48005	23.25
2014	2096	32930	15.71
2015	2405	24495	10.18
2016	2636	14936	5.67
2017	2894	5922	2.05

Table 3: Relative Growth Rate (RGR) and Doubling Time (DT)

No.of years	Records	Research records (%)	Cumulative records	Cumulative percentage	W1	W2	RGR	DT
2008	1250	6.26	1250	6.26				
2009	1503	7.53	2753	13.79				
2010	1578	7.90	4331	21.69				
2011	1668	8.35	5999	30.04				
2012	1874	9.38	7873	39.43				
2013	2065	10.34	9938	49.77				
2014	2096	10.50	12034	60.26				
2015	2405	12.04	14439	72.31				
2016	2636	13.20	17075	85.51				
2017	2894	14.49	19969	100				
	19969	100	19969	100				
Average	1996.9							

Language wise distribution of research publications on global warming: Table 4 and Fig. 2 clearly states that the publications on global warming were published in 22 different languages. Among the research publications published on global warming from the year 2008-2017 it is found out that totally 22 languages were involved towards publications.

Out of that the English language plays vital role towards dominating the whole publications of global warming on web of science, worldwide. The table reveals that 19574 publications were published in English which is the highest among all the languages. Not only were the number of publications high but also the global citation score and local citation score.

Table 4: The publications on global warming

Name of the languages	Records	Percentage	Cumulative percentage
English	19574	98.02	98.02
Spanish	75	0.38	98.32
Chinese	59	0.30	98.62
French	58	0.29	98.91
German	40	0.20	99.11
Portuguese	36	0.18	99.29
Japanese	25	0.13	99.42
Korean	21	0.11	99.53
Polish	17	0.09	99.62
Russian	16	0.08	99.70
Turkish	15	0.08	99.78
Croatian	10	0.05	99.83
Hungarian	7	0.04	99.87
Italian	7	0.04	99.91
Rumanian	2	0.01	100.00
Slovak	1	0.00	100.00
Afrikaans	1	0.00	100.00
Lithuanian	1	0.00	100.00
Serbian	1	0.00	100.00
Dutch	1	0.00	100.00
Persian	1	0.00	100.00
Czech	1	0.00	100.00
	19969	100.00	

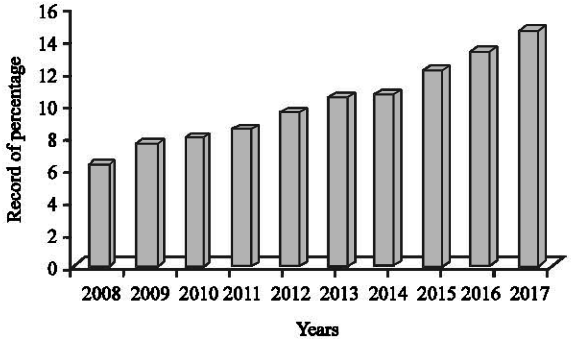

Fig. 1: Year wise distribution of papers

Growth rate of publications 2 years block: For the purpose of the analysis with regard to the study of research productivity the whole period in dived into six blocks each comprising 11 years. The block wise distribution is presented in Table 5 (Fig. 3).

It can be observed from the above table that there has been an increasing trend in the production quantum of global warming literature from one block to the next. From first block (2008-2009) to the next block (2010-2011) the increase was half times through in total it was a slight increase. It was nearly the same rate of increase during the next block. The highest percentage of increase was recorded during 2016-2017. It was during this period the research in global warming received a major impetus quantitatively.

Table 5: Growth rate of publications 2 years block

2 years block	Number of publications	Percentage
2008-2009	2753	13.79
2010-2011	3246	16.26
2012-2013	3939	19.73
2014-2015	4501	22.54
2016-2017	5530	27.69
Total		100.00

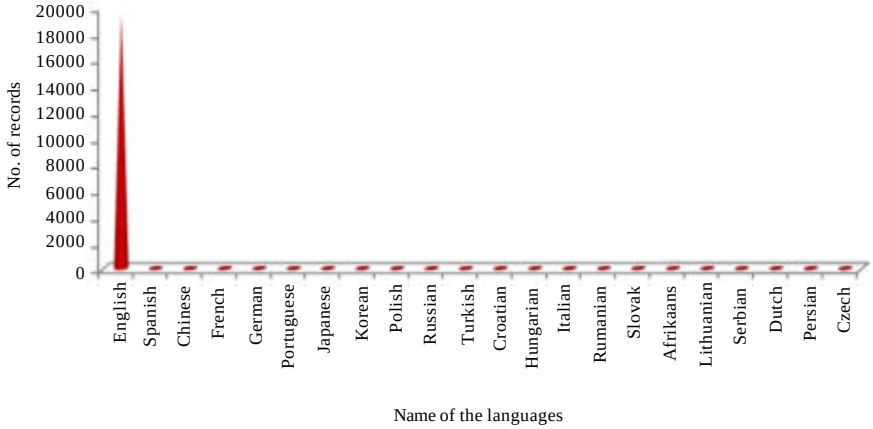

Fig. 2: Language wise distribution of research publications on global warmings

Table 6 shows that top 15 cited articles in global warming research. Among the 6154 (100%) records, "climate change 2007: the physical science basis" is first place with 822 (13.36%) cited records its article written by S. Solomon, followed by "Am Meteorol Soc" 471 (7.65%) cited records, published by "Taylor and Francis", "Nature" 436 (7.08%) cited records, written by C. Parmesan "Climate Change 2007: the physical science basis" 428 cited records, written by P. Forster "Climate Change 2007: the physical science basis" has published 424 cited records, written by G.A. Meehl, "Physics" has published 419 cited records, written by Ipcc,, "Nature" has published 403 cited records, written by G.R. Walther, "S. Annu Rev Ecol Evol" has published 381 cited records, written by C. Paramesan, "Nature" has published 258 cited records, written by E. Thomas and followed by " Nature" has published 252 cited records, respectively written by T.L. Root (Fig. 4).

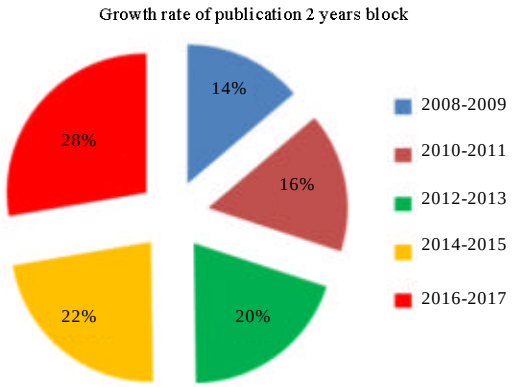

Fig. 3: Growth rate of publication in global warming literature during different 10 years blocks

Distribution of authorship and publication counts: The authorship pattern of the web of science publications were ascertained and the same is shown in Table 7. The data pertaining to No. of researchers in year wise have been given in the Table 7. Regarding single authored contributions, the years 2008-2010 have the highest contributions with 11 and the lowest in 2009. Regarding double authored contributions, the year 2009 has the highest contributions with 359. The year 2017 has the highest contributions regarding three to five authored contributions with 553,496 and 357, respectively. The year 2017 has the highest contributions of multi authored (more than five researchers).

Table 6: Source wise output top 15

Source wise top	Records	Percentage
S. Solomon, 2007, P19, climate change 2007: The physical science basis	822	13.36
K.E. Taylor, 2012, V93, P485, B Am Meteorol Soc	471	7.65
C. Parmesan, 2003, V421, P37, nature	436	7.08
Anonymous, 2006, 14040 Iso	433	7.04
P. Forster, 2007, P129, climate change 2007: The physical science basis	428	6.95
G.A. Meehl, 2007, P747, climate change 2007: The physical science basis	424	6.89
Ipcc, 2007, clim chang 2007 Phys	419	6.81
Ipcc (Intergovernmental panel on climate change), 2007, Climate change 2007	409	6.65
G.R. Walther, 2002, V416, P389, nature	403	6.55
C. Parmesan, 2006, V37, P637, Annu Rev S. Ecol Evol	381	6.19
I.M. Held, 2006, V19, P5686, J Climate	381	6.19
Anonymous, 2006, 14044 Iso	352	5.72
E. Kalnay, 1996, V77, P437, B Am Meteorol Soc	325	5.28
C.D. Thomas, 2004, V427, P145, Nature	258	4.19
T.L. Root, 2003, V421, P57, Nature	252	4.09
Total	6154	100

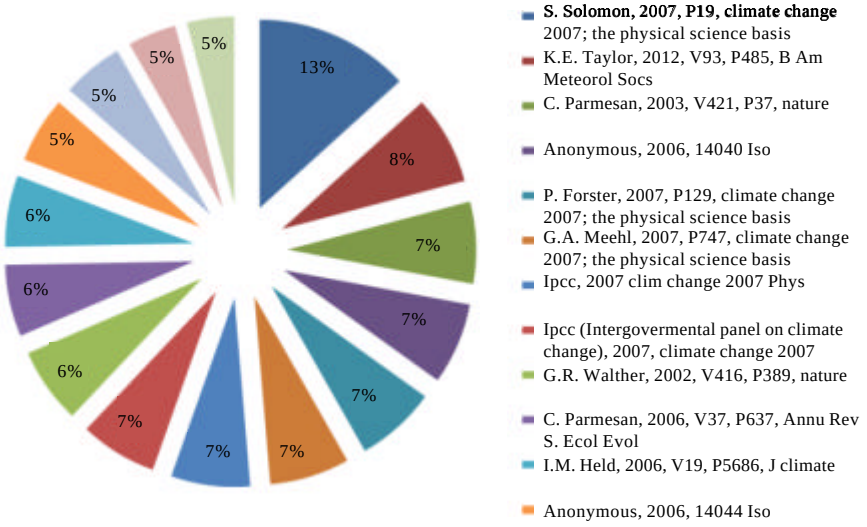

Fig. 4: Source wise output top 15

It can be seen from the Table 7 and Fig. 5 that single researcher contributionworks out 13.52%. It is followed by two researchers (18.32%) and three researchers (19%). More than five researcher's works out 12.09% finds greater than four researchers (16.10%).

It can be infer that collaborative researcher publications are more than solo research. The study has also been extended to year wise and the same is shown in Table 8.

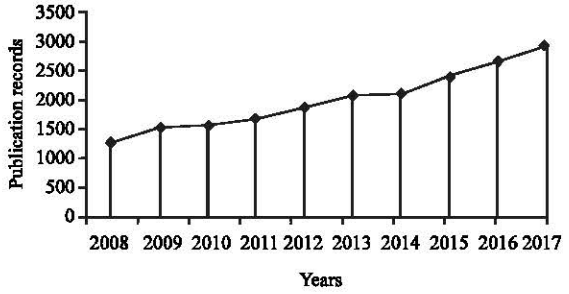

Fig. 5: Year wise authorship pattern (Publication record)

Year wise authorship pattern: In web of science indexed journals the authorship pattern-year wise has been analyzed is shown in Table 8.

In Table 8 and Fig. 5 reveals that the authorship pattern in year wise distribution of articles publications in the research literature of the total 10 years, the three researchers scored in the first place they have contribute 3792 counts. The second and third place scored for double and four researchers in each 3657 and 3215 counts.

Table 7: Researchers contribution works

No. of researchers	Records	Percentage	Cumulative percentage
1	2700	13.52	13.52
2	3657	18.32	31.84
3	3794	19.00	50.24
4	3215	16.10	66.94
5	2415	12.09	79.03
6	1548	7.75	86.78
7	922	4.62	91.4
8	576	2.88	94.28
9	389	1.95	96.23
10	198	0.99	97.22
Above 10	553	2.77	100.00
		19967	100

Table 8: Year wise authorship pattern

No. of researchers	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Grand total
1	327	348	313	297	261	207	201	241	255	250	2700(13.52%)
2	264	311	324	331	370	376	324	423	445	489	3657(18.32%)
3	210	264	308	321	382	414	409	461	470	553	3792(18.99%)
4	172	231	230	250	307	326	353	393	457	496	3215(16.10%)
5	114	124	154	174	215	281	285	335	376	357	2415(12.10%)
6	70	91	96	120	119	171	189	225	234	232	1547(7.5%)
7	34	60	55	61	79	94	125	115	127	172	922(4.62%)
8	15	28	28	38	45	71	76	68	92	115	576(2.89%)
9	18	11	30	31	37	39	41	47	66	69	389(1.95%)
10	5	8	8	13	13	16	31	24	31	49	198(0.99%)
11	5	6	5	6	11	14	14	12	20	28	121(0.61%)
12	3	7	7	5	7	13	12	12	19	18	103(0.52%)
13	3	1	5	2	2	7	6	9	10	11	56(0.28%)
14	3	2	4	4	5	8	6	4	4	12	52(0.26%)
15	3	1	1	6	1	6	3	5	4	7	37(0.19%)
16	1	2		1	4	6	1	6	5	5	31(0.16%)
17	0	0	1	2		1	2	1	1	3	11(0.06%)
18	1	1		1	2	1	3	4	0	6	19(0.10%)
19	1	0	2	1	1	0	1	2	4	1	13(0.07%)
20	0	1	0	1	1	0	2	1	3	1	10(0.05%)
21	0	0	0	0	1	1	0	3	0	3	8(0.04%)
22	0	3	0	0	0	0	0	1	1	2	7(0.04%)
23	0	0	1	0	0	4	2	1	3	1	12(0.06%)
24	0	0	1	0	1	1	0	4	3	2	12(0.06%)
25	0	0	0	1	1	0	2	0	0	4	8(0.04%)
26	1	0	0	0	0	0	0	0	0	1	2(0.01%)
27	0	0	0	1	0	0	1	1	1	2	6(0.03%)
28	0	1	0	0	0	2	1	0	0	0	4(0.02%)
29	0	1	2	0	0	0	0	0	2	0	5(0.03%)
31	0	0	0	0	2	1	1	0	0	1	5(0.03%)
32	0	0	0	0	1	0	1	0	1	0	3(0.02%)
33	0	0	1	0	0	0	0	0	0	0	1(0.00%)
34	0	0	0	0	0	0	1	0	0	0	1(0.00%)
35	0	0	1	0	0	0	0	0	0	0	1(0.00%)
36	0	0	0	0	0	1	0	0	0	0	1(0.00%)
37	0	0	0	0	0	0	0	1	0	0	1(0.00%)
39	0	0	0	0	0	1	0	0	0	0	1(0.00%)
40	0	0	0	0	1	0	0	2	0	0	3(0.02%)

Table 8: Continue

No. of. researchers	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Grand total
41	0	0	0	0	0	0	1	0	0	0	1(0.00%)
42	0	0	0	0	0	1	0	0	0	0	1(0.00%)
46	0	0	0	0	0	0	0	0	0	1	1(0.00%)
47	0	0	0	0	0	0	0	1	0	0	1(0.00%)
49	0	0	0	0	0	0	0	0	1	0	1(0.00%)
52	0	0	0	0	0	0	0	2	0	0	2(0.01%)
53	0	0	0	1	0	0	0	0	0	0	1(0.00%)
54	0	0	0	0	0	0	0	0	0	1	1(0.00%)
55	0	0	0	0	0	0	0	0	0	1	1(0.00%)
56	0	1	0	0	0	0	0	0	0	0	1(0.00%)
57	0	0	0	0	0	0	0	0	1	0	1(0.00%)
61	0	0	0	0	0	1	0	0	0	0	1(0.00%)
62	0	0	0	0	1	0	0	0	0	0	1(0.00%)
63	0	0	0	0	0	0	1	0	0	0	1(0.00%)
64	0	0	0	0	0	0	1	0	0	0	1(0.00%)
156	0	0	0	0	0	1	0	0	0	0	1(0.00%)
171	0	0	0	0	1	0	0	0	0	0	1(0.00%)
423	0	0	0	0	0	0	0	1	0	0	1(0.00%)
Grand total	1250	1503	1577	1668	1871	2065	2096	2405	2636	2893	19964
	(6.26%)	(7.53%)	(7.90%)	(8.36%)	(9.37%)	(10.34%)	(10.50)	(12.05%)	(13.20%)	(14.49)	(100.00%)

Table 8 has reveals that the year wise distribution of researcher groups and their publications count over a period of 10 years revealed interesting results. It is identified from this analysis, single authored, two authored and three authored articles were started from 2008. Followed by four authored articles produced from 1990, five authored articles produced from 1992, six and eight authored articles produced from 1994, seven authored articles produced from 1999, nine authored articles produced from 2003 and ten above authored articles produced from 2002. The research has more than 100 articles are been at the year of after 2002. 2001 has highest single authored articles published followed by 2014 has highest two, seven and eight authored articles published, 2012 has highest three authored articles published, 2011 has highest four and five authored articles published, 2013 and 2014 has highest six authored articles published, 2013 has highest nine authored and more than ten authored articles published, respectively.

Degree of collaboration: In order to determine the strength of Collaboration (DC), the following formula suggested by Subramanyam K has been employed:

$$DC = N_m/N_m+N_s$$

$$DC = 0.86$$

Where:

DC = Degree of Collaboration

N_m = Number of multiple authored papers

N_s = Number of single authored papers

The degree of collaboration of researchers by year wise is presented in the Table 9. The degree of collaboration ranges from 0.86-0.94. The average degree of collaboration is 0.86 during the period 2005-2009 and it brings out clearly that there exists a higher level of collaboration in the journal Table 10.

Table 9: Degree of collaboration

No. of. researchers	Records	Percentage
Single researcher	2700	13.52
Multi researchers	17267	86.47
Total	19967	100

H-index top 15: We have seen that the total number of citations as a metric is strongly affected by the number of papers but does not provide any information on this. At the opposite extreme, the CPP is totally insensitive to productivity. In 2005, a new metric was proposed by Hirsch that combined in a single, easy to understand, number both impact (citations) and productivity (papers). The H-index has been hugely influential since then, generating an entire literature of its own. Currently this study has well over 4000 citations in GS. In this study, here will only be able to summarise the main advantages and disadvantages formore detailed reviews see (Alonso; Bornman and Daniel; Costas and Bordons; Glanzel) and for mathematical properties see Glanzel and Franceschini and Maisano.

Table 11 shows the top fifteen researchers and their H-index with the rank. It is seen from the table Christensen T.H. has contributed 1341 publications which fetch 1470. He ranked first with 25 H-index. Xie SP stands 2781 publications, 3019 citations and H-index 23 followed by Feijoo Gwith 945 publications 1139 citations. His H-index is 23. It is also noted that Huntingford C who contributed 1499 publications stands 16th positions because of the least number of citations.

Even though he is the highest contributed researcher, gets 10th position both based on H index and average citation. The figures for top 15 researchers are presented based on publications Table 11 and rank (H-index based) (Fig. 6).

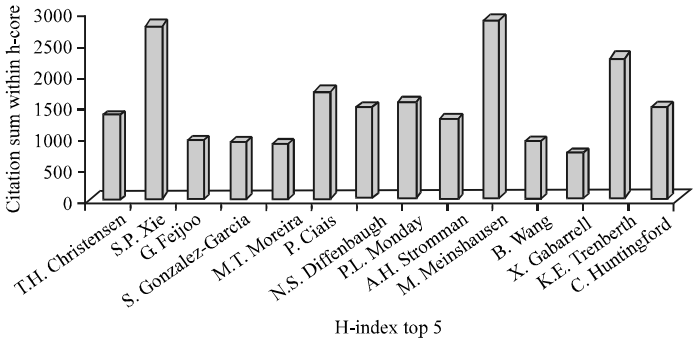

Fig. 6: H-index top 15 (Citation sum within h-core)

Table 10: Ranking of researchers top 20

Name of the researchers	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Grand total
Anonymous	8	7	6	5	6	6	1	4	5	3	51
S.P. Xie	2	0	5	4	4	9	2	9	8	4	47
Y. Zhang	0	1	1	2	5	6	6	8	9	6	44
Y. Li	1	1	3	4	4	1	3	8	8	10	43
Y. Liu	1	1	1	2	0	3	4	4	7	16	39
Y. Wang	1	0	2	3	2	3	6	5	9	6	37
L. Zhang	0	0	1	1	5	3	5	3	8	11	37
T.H. Christensen	2	17	6	2	2	3	2	2	1	0	37
J. Kim	0	2	3	2	4	4	4	6	4	8	37
A. Kumar	0	3	1	4	2	2	6	4	8	6	36
G. Feijoo	0	6	10	7	5	2	4	0	2	0	36
J. Wang	0	0	1	1	1	2	7	6	9	9	36
M.T. Moreira	0	6	9	7	5	2	4	0	3	0	36
S. Gonzalez-Garcia	0	6	5	5	8	5	4	0	1	1	35
X. Gabarrell	2	3	4	4	9	1	3	3	3	2	34
L. Wang	0	3	0	2	2	4	6	4	7	6	34
B. Wang	4	2	1	0	2	7	7	5	4	2	34
J. Zhang	2		2	2	1	4	4	5	6	7	33
J. Chen	1	1	0	3	2	3	3	3	6	10	32

Table 11: H-index top 15

H-index	Units	Citation sum within h-core	All citations	All researches
25	T.H. Christensen	1341	1470	37
23	S.P. Xie	2781	3019	47
23	G. Feijoo	945	1139	36
23	S. Gonzalez-Garcia	915	1104	35
22	M.T. Moreira	878	1078	36
21	P. Ciais	1721	1809	32
19	N.S. Diffenbaugh	1485	1562	26
19	P.L. Munday	1562	1619	28
19	A.H. Stromman	1271	1379	32
18	M. Meinshausen	2872	2944	27
18	B. Wang	930	1014	34
17	X. Gabarrell	749	907	34
16	K.E. Trenberth	2261	2261	18
16	C. Huntingford	1499	1532	24

Table 12: The Activity Index (AI)

Year	India publication	Total publications	Activity index
2008	32	1250	67
2009	55	1503	86
2010	45	1578	71
2011	80	1668	266
2012	73	1874	89
2013	94	2065	100
2014	93	2096	100
2015	122	2405	108
2016	141	2636	115
2017	162	2894	128
Total	897	19969	1130

Activity index: Activity index characterizes the relative research efforts of a country in a given subject field and takes into consideration the effect of the size of the country as well as the size of the field. Activity Index (AI) for India has been calculated for different years to see how India's performance gradually changed during different years. For this the researcher has used the activity index for 15 years period Table 12 (Fig. 7).

$$AI = \frac{\text{Given field's share in the country's publication output}}{\text{Given field's share in the word's publication output}}$$

Mathematically:

$$AI = \frac{n_{ij}/n_{io}}{n_{oj}/n_{oo}} * 100$$

Where:

n_{ij} = Indian output of papers in particular field
n_{io} = Total Indian output on all subjects
n_{oj} = World output of papers in particular field
n_{oo} = Total world output on all subjects

Activity index characterizes the relative research efforts of a country in a given publication and takes into consideration the effect of the size of the country as well

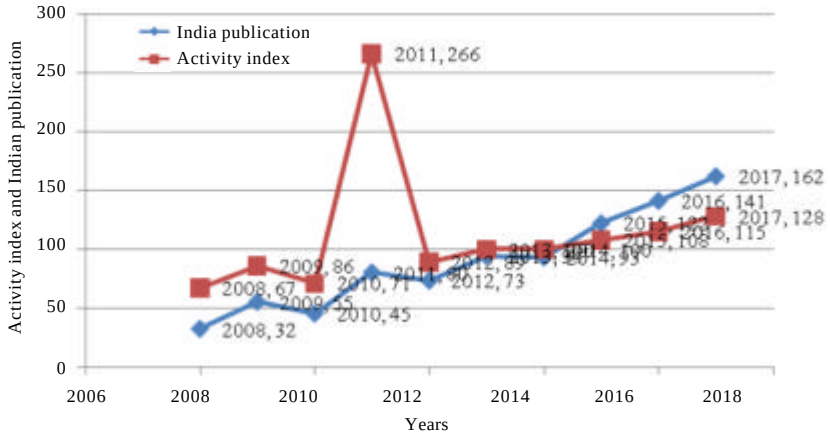

Fig. 7: Activity index and India publication

as the size of the field. Activity Index (AI) for India has been calculated for different years to see how India's performance gradually changed during different years. For this the researcher has used the activity index. The activity index is used for Indian publication output in Table 9.

CONCLUSION

The research has been organized in such a way that the introductory part briefly explains the relevant factors related to the global warming and the application of scientometric techniques towards the completion of research. The related literatures towards the scientometric analysis were reviewed in the second section. The research design is very clearly designed to implement a very good strategy in the analysis part of the research. The step by step analysis were made according to the research design and also the inferences through appropriate statistical tools and scientometric techniques.

LIMITATIONS

This study covers a period of 10 years spanning between 2008 and 2017. Records for the analysis of this investigation have been downloaded from the web of science database only.

IMPLICATIONS

Evaluation of global warming literature with the help of some indications has given some observation the implications of which would be very useful to global warming faculties, researchers, scientists who use the information and library information science professionals who organize exponential knowledge.

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