



A Bibliometric Analysis (2008 To 2022) of Mausam Journal: Uncovering Scientific Impact

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सार – मौसम का प्रकाशन भारत मौसम विज्ञान विभाग द्वारा आधिकारिक रूप से किया जाता है और इसका कार्यक्षेत्र मौसम विज्ञान, जल विज्ञान तथा भूभौतिकी के क्षेत्र में व्यापक है। इस अध्ययन का उद्देश्य मौसम पत्रिका के प्रकाशन प्रतिरूप तथा लेखकों से संबंधित मेट्रिक्स का 15 वर्ष की अवधि के दौरान विश्लेषण करना है, जिसमें 2008 से यह पत्रिका लगातार स्कोपस (Scopus) में अनुक्रमित रही है। यह अध्ययन समय के साथ अनुसंधान के विकास एवं प्रवृत्तियों को समझने में उपयोगी है। Scopus डेटाबेस से प्राप्त आँकड़ों का आर सॉफ्टवेयर के बिबलिओशाइनी (Biblioshiny) का उपयोग करके विश्लेषण किया गया। परिणामों से पता चला कि 2008 से 2022 तक 15 वर्षों की अवधि में पत्रिका में 958 दस्तावेज प्रकाशित हुए, जिनमें 1,633 लेखक सम्मिलित थे और इन प्रकाशनों को कुल 3,905 उद्धरण प्राप्त हुए। पत्रिका की वार्षिक वृद्धि दर 2.94% रही। खोले एम. सर्वाधिक उत्पादक लेखक रहे, जिनके 38 शोध-पत्र प्रकाशित हुए। वर्ष 2014 में प्रकाशित पाई डीएस Pai D.S. के शोध-पत्र को सर्वाधिक 969 उद्धरण प्राप्त हुए। भारत मौसम विज्ञान विभाग प्रमुख योगदानकर्ता संस्थान तथा भारत प्रमुख योगदानकर्ता देश रहा। वर्षों के दौरान सर्वाधिक प्रयुक्त प्रमुख शब्दों में वर्षा, जलवायु परिवर्तन, प्रवृत्ति विश्लेषण और तापमान शामिल रहे।

ABSTRACT. MAUSAM is officially published by India Meteorological Department. It has a huge scope in the field of meteorology, hydrology and geophysics. This study aimed to analyse the publication pattern and author's metrics of MAUSAM journal over a period of 15 years in which the journal was indexed continuously in Scopus from 2008. The study is useful to know about the research evolution trends over a period. Data extracted from Scopus database were analyzed using Biblioshiny with R software. The results showed that in the period of 15 years from 2008 to 2022 the journal published 958 documents with 1633 authors during the period which received 3905 citations. The journal has an annual growth rate of 2.94 %. Khole M was the most prolific author with 38 articles. Pai DS paper published in 2014 received the highest citation of 969 citations with India Meteorological Department being the major contributing institution and India is the major contributing country. The top keywords used over the years include rainfall, climate change, trend analysis and temperature.

Key words – Bibliometric analysis, Biblioshiny, IMD, India, MAUSAM, Meteorology, R software, Scopus.

1. Introduction

MAUSAM, previously known as the Indian Journal of Meteorology, Hydrology and Geophysics, started in January 1950, is a quarterly scientific research journal published by the India Meteorological Department (IMD). It serves as a platform for original research work in the fields of Meteorology, Hydrology and Geophysics. Initially named the “Indian Journal of Meteorology and Geophysics” in 1950, it evolved into the “Indian Journal of Meteorology, Hydrology and Geophysics” in 1975 and was later renamed “MAUSAM” in 1979.

It remains the sole scientific research journal in this region for Meteorology and related subjects, producing regular issues alongside thirteen special editions on current topics.

The journal has continuously published since 1950, encompassing papers on Numerical Weather Prediction in India. It has an Impact Factor of 1.4 in 2022 and NAAS rating of 6.91 in 2023. Until November 2023, the journal has published 74 volumes with 4 issues per volume and the journal is available in both online and print versions (MAUSAM, 2023).

Bibliometrics is a multidisciplinary analysis that involves statistical and quantitative methods to describe literature (Hawkins, 1977). Bibliometric analysis is essential to quantitatively evaluate the impact, relevance, and influence of scholarly publications. It helps in assessing the productivity and significance of research output, identifying influential authors, journals, or institutions within a specific field (Dede and Ozdemir, 2022). Bibliometrics aid in mapping trends, determining citation patterns, and measuring the impact of scientific work, providing valuable insights for researchers, institutions, and policymakers. This analysis supports decision-making processes, funding allocations, and understanding the evolution of scientific knowledge within a discipline or across multiple fields. Bibliometrics are used to assess the quality and impact of academic journals, aiding authors in choosing the right venues for publication (Ismail *et al.*, 2012).

In the present study, bibliometric analysis of MAUSAM Journal was carried out with the objective of performing a scientometric evaluation of the journal, analyzing annual publication growth and average citations along with the utilization of visual tools for analyzing the trends in author's metrics.

2. Data and methodology

2.1. Data

A bibliometric analysis was conducted on the "MAUSAM" journal, utilizing data sourced from the Scopus database spanning a 15-year period from 2008 to 2022. The comprehensive bibliographic data extraction (.csv format), which occurred between September and November 2023, was based on the Scopus source ID 13430 and a filter string (SOURCE-ID (13430) AND PUBYEAR > 2007 AND PUBYEAR < 2023) to select publications within the specified years (Scopus, 2023). The Scopus database was chosen due to its reputation as a reliable source of peer-reviewed literature. Any documents not indexed in the Scopus database were excluded from the analysis.

The analysis was performed using the open-source R software (version 4.3.2) in conjunction with RStudio. The bibliometrix package (version 4.1.3) was installed, along with all necessary libraries from CRAN and <https://bibliometrix.org/Biblioshiny.html> (Aria and Cuccurullo, 2017). Biblioshiny, a shiny app designed for bibliometrix, was employed to facilitate the bibliometric analysis. For a more detailed examination of the descriptive statistics, Excel was also utilized.

TABLE 1

Overview of MAUSAM journal

Timespan	2008:2022
Documents	958
Annual Growth Rate %	2.94
Total citations	3905
Document Average Age	7.59
Average citations per document	4.076
References	18122
Author's Keywords (DE)	2528
Authors	1633
Authors of single-authored documents	78
Single-authored documents	113
Co-Authors per Document	3.32
International co-authorships %	4.28
Impact Factor	0.6

3. Results and discussion

3.1. Overview

The primary overview extracted from Biblioshiny for the 15-year period (2008-2022) is summarized in Table 1. The MAUSAM journal has been consistently indexed in Scopus since 2008. With 958 documents published over this period and an annual growth rate of 2.94%, the journal demonstrates a steady publication output and continuity within the atmospheric and meteorological sciences. The accumulation of 3905 citations, corresponding to an average of 4.07 citations per paper, reflects a moderate yet stable citation impact typical of specialized disciplinary journals. The average document age of 7.59 years indicates that articles published in MAUSAM maintain relevance over time, contributing to long-term citation accumulation. Authorship patterns reveal a strong collaborative research culture, with an average of 3.32 co-authors per document, while single-authored papers constitute a relatively small proportion of total publications. However, the international co-authorship rate of 4.28% suggests limited global collaboration, indicating potential scope for enhancing international visibility. Overall, these metrics position MAUSAM as a consistently performing peer-reviewed journal within its domain, with opportunities to further strengthen its impact through increased international engagement and broader citation outreach.

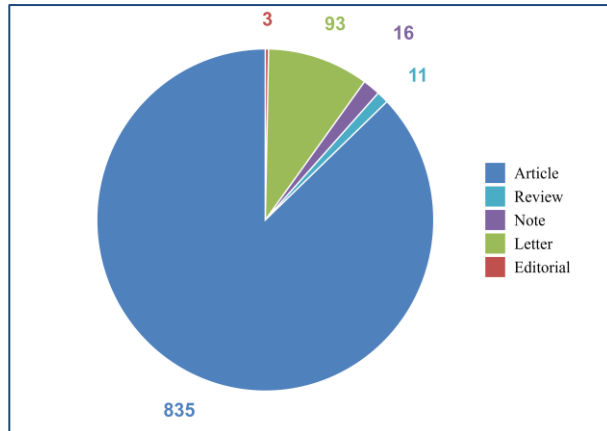


Fig. 1. Type of document

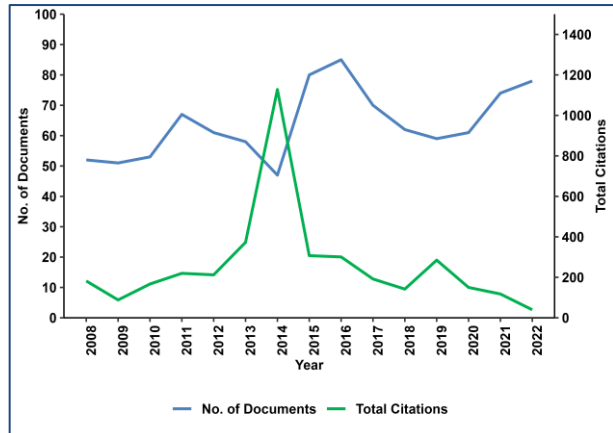


Fig. 2. Year-wise No. of documents and Total citations per year

TABLE 2

Year-wise no. of documents and total citations per year

Year	No. of Documents	Mean TC per Document	TC	Mean TC per Year	Citable Years
2008	52	3.5	182	0.22	16
2009	51	1.73	88.23	0.12	15
2010	53	3.15	166.95	0.22	14
2011	67	3.28	219.76	0.25	13
2012	61	3.48	212.28	0.29	12
2013	58	6.43	372.94	0.58	11
2014	47	24	1128	2.4	10
2015	80	3.84	307.2	0.43	9
2016	85	3.54	300.9	0.44	8
2017	70	2.74	191.8	0.39	7
2018	62	2.29	141.98	0.38	6
2019	59	4.83	284.97	0.97	5
2020	61	2.46	150.06	0.62	4
2021	74	1.59	117.66	0.53	3
2022	78	0.51	39.78	0.26	2

*TC – Total Citations

3.2. Type of document

Fig. 1 illustrates the distribution of document types published in the MAUSAM journal, with research articles forming the dominant category (835 publications). This highlights the journal's strong emphasis on original scientific contributions. This distribution profile, characterized by a heavy dominance of original research, is a common pattern in many specialized scientific journals. However, a notable distinction when compared to high-impact international journals in the field is the relatively smaller proportion of review articles

(11) in MAUSAM. Leading journals typically publish a higher share of reviews to synthesize emerging knowledge and attract wider citation attention. Regarding other formats, Letters (93) in MAUSAM support the rapid communication of timely research findings, while Notes (16) provide concise technical insights. Editorials (3) are published sparingly and mainly serve journal - specific purposes. While the document distribution of MAUSAM is robust, strategically increasing the proportion of high-quality review articles could enhance its citation impact and international visibility.

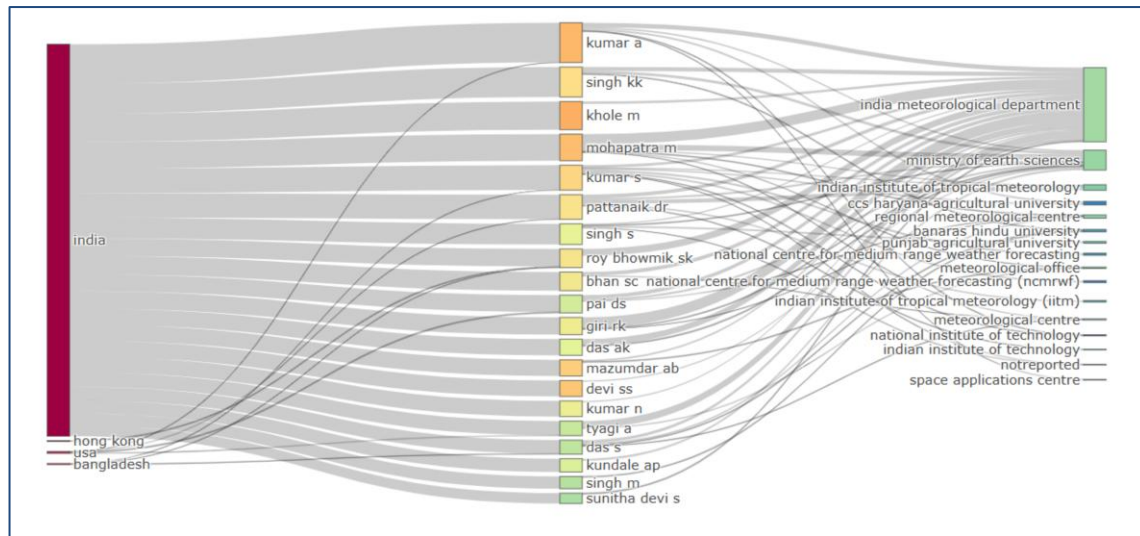


Fig. 3. Three field plot of author with country and affiliations

TABLE 3

Source local impact of MAUSAM Journal

Journal	h-index	G-index	m-index
MAUSAM	20	43	1.25

3.3. Annual scientific production & citations

The term "annual scientific output" refers to the volume of scholarly publications produced within a given year (Musbahi *et al.*, 2022). Table 2 and Fig. 2 present the yearly distribution of documents and citations for the period 2008-2022. The annual publication output shows year-to-year fluctuations without a consistent upward or downward trend. This pattern is characteristic of many specialized peer-reviewed journals in the atmospheric sciences, where publication volumes naturally vary in response to submission rates and editorial workflows. The temporary decline in publications during 2017-2018 may be attributed to ordinary fluctuations in the submission cycle, while the modest increase in 2019 indicates temporary stabilization. Although 2016 recorded the highest number of publications (85 documents), the citation peak occurred in 2014 (1,128 citations), despite that year having the lowest publication output (47 documents). This highlights that citation performance is driven more by the influence and relevance of individual high-quality articles than by the sheer volume of publication. The notable citation impact in 2014 is significantly driven by the publication of foundational datasets, most notably the development of high-resolution daily gridded rainfall data for India (Pai *et al.*, 2014). Such data-centric studies naturally attract substantial citations within the meteorological community,

as they serve as essential baselines for numerous subsequent climate research and hydrological applications. The comparatively lower citation counts observed in recent years (2020-2022), despite relatively stable publication output, should be interpreted with caution. Newly published articles typically require several years to accumulate significant citations. This "citation lag" effect is a well-recognized bibliometric phenomenon, particularly in fields relying on long-term data analysis. Therefore, the apparent decline in recent citations reflects the time-dependent nature of citation accrual rather than a reduction in research quality. Overall, the observed peaks and troughs arise from a combination of natural editorial dynamics, the presence of specific high-impact papers, and the inevitable effect of citation lag.

3.4. Three field plot

Fig. 3 presents a Three-Field Plot (Sankey diagram) visualizing the structural linkages between authors, their institutional affiliations and countries. This diagram tracks the flow of research output, highlighting the dominant contributors and institutional structures. The visualization reveals a distinct dominance of Indian research output, with the majority of prolific authors linked to the India Meteorological Department (IMD) and the Ministry of Earth Sciences. These institutions serve as the central hubs connecting the country's output to specific individual authors. However, it is important to note that this visualization is strictly based on formal affiliation of metadata available in Scopus. Consequently, independent researchers or those with unaffiliated status are not explicitly captured in this high-level structural overview. While this plot effectively maps the institutional

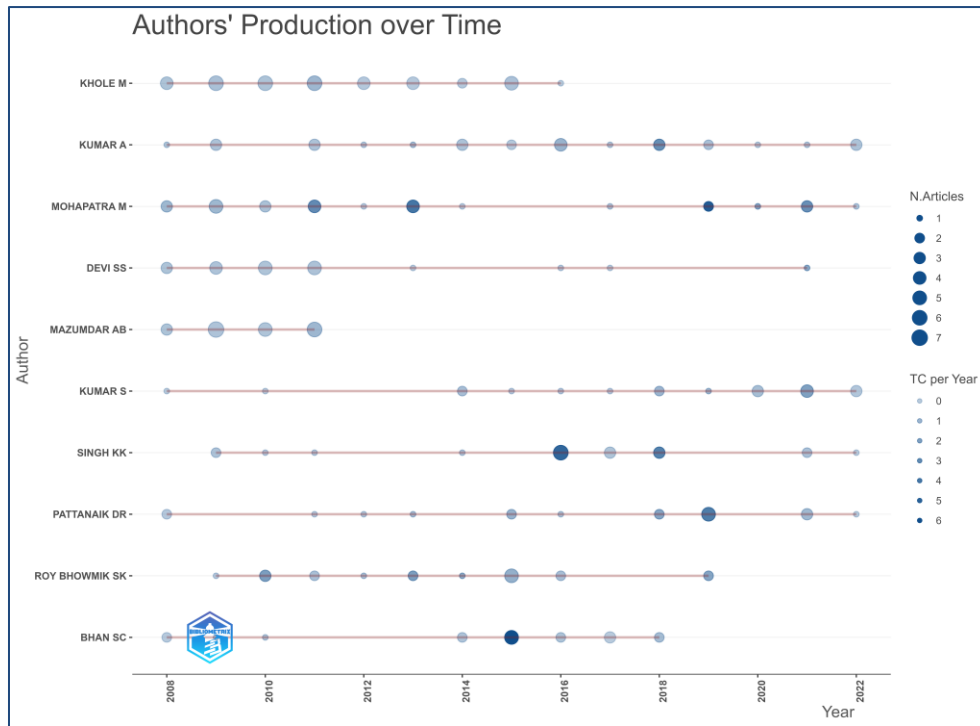


Fig. 4. Top 10 author's production over time

TABLE 4

Top 10 Productive Authors of MAUSAM Journal

Authors	Articles	Articles Fractionalized	Institution
KHOLE M	38	14.83	Meteorological Office, Pune
KUMAR A	29	6.64	Indian Institute of Science Education and Research, Bhopal
MOHAPATRA M	29	10.44	India Meteorological Department, New Delhi
DEVI SS	21	7.20	Weather Forecast Development Division, Pune
MAZUMDAR AB	21	7.50	Meteorological Office, Pune
KUMAR S	20	5.04	Agro Climate Research Centre, Tamil Nadu Agricultural University, Coimbatore
SINGH RK	20	4.14	Indian Institute of Technology (ISM), Dhanbad
PATTANAIK DR	19	6.01	India Meteorological Department, New Delhi
ROY BHOWMIK SK	19	5.61	India Meteorological Department, New Delhi
BHAN SC	18	5.56	India Meteorological Department, New Delhi

landscape, detailed interpersonal collaboration dynamics are further examined in the subsequent co-authorship network analysis.

3.5. Source local impact

The data provided in Table 3 offers a comprehensive analysis of the impact of the MAUSAM Journal. The h-index, G-index, and m-index are all metrics used to measure the influence and productivity of this journal. The h-index of 20 signifies that there are at least 20 articles

from the MAUSAM Journal that have been cited at least 20 times each. This is an indicator of the consistent quality of the journal's publications and their relevance to the field. The G-index of 43 indicates that the top 43 articles from the journal have collectively received 1849 citations. This metric highlights the significant influence and reach of the journal's most impactful articles. The m-index of 1.25 is a measure of the journal's impact over time, considering the age of the journal. An m-index of 1.25 suggests a steady and sustained contribution to the field since the journal's inception.

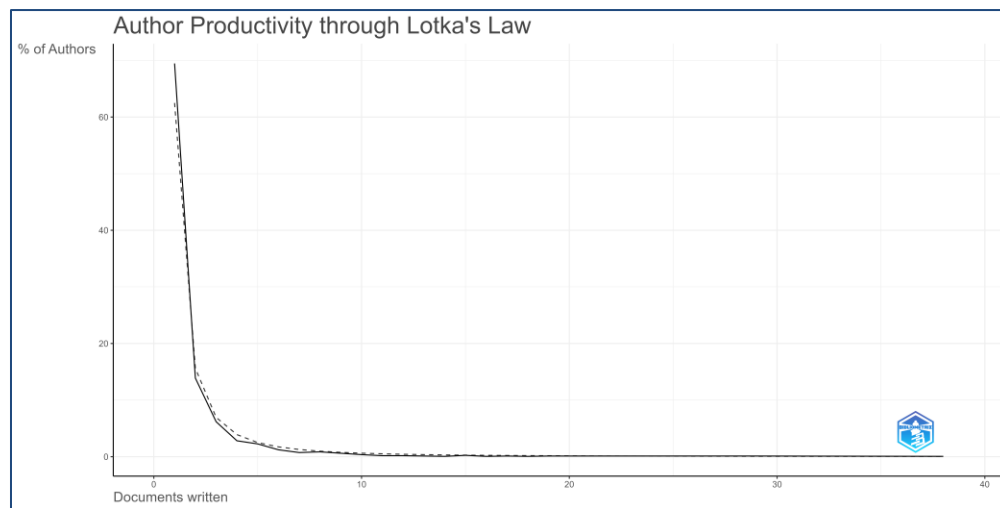


Fig. 5. Author Productivity through Lotka's Law

TABLE 5

Author Productivity through Lotka's Law

Documents written	No. of Authors	Proportion of Authors
1	1135	0.695
2	226	0.138
3	101	0.062
4	46	0.028
5	37	0.023
6	20	0.012
7	12	0.007
8	14	0.009
9	10	0.006
10	6	0.004
11	3	0.002
12	3	0.002
13	2	0.001
14	1	0.001
15	4	0.002
16	1	0.001
17	2	0.001
18	1	0.001
19	2	0.001
20	2	0.001
21	2	0.001
29	2	0.001
38	1	0.001

3.6. *Most productive authors and authors' production over time*

The bibliometric analysis of the Mausam journal reveals the top 10 authors who have published the most documents, along with their respective article fractionalization, as shown in Table 4. To provide insight

into organizational hubs, the institutional affiliations of these authors have been included. The data indicates that the India Meteorological Department (IMD) and its regional offices serve as the primary organizational hubs contributing to the journal. Among these authors, Khole M stands out with a contribution of 38 articles, accounting for 14.83% of the total.

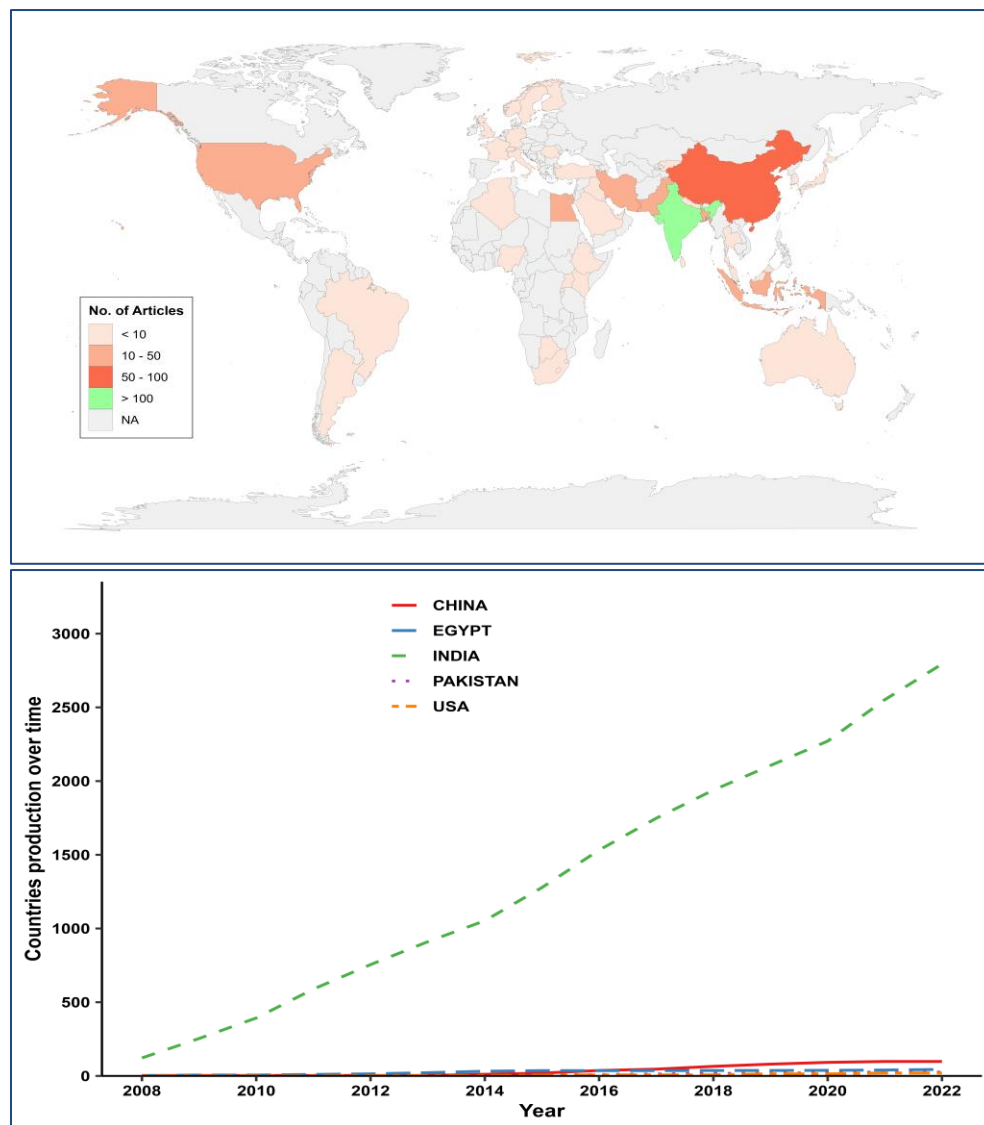


Fig. 6. (a&b). (a) Country's Scientific Production (b) Top 5 Countries' Production over Time

TABLE 6

Top 10 affiliate Institutions

Affiliation	Articles	Percentage contribution of each institution
India Meteorological Department	428	44.68
Indian Institute of Tropical Meteorology	74	7.72
Ministry of Earth Sciences	68	7.10
Regional Meteorological Centre	67	6.99
Meteorological Office	54	5.64
Meteorological Centre	53	5.53
Punjab Agricultural University	35	3.65
Tamil Nadu Agricultural University	22	2.30
Banaras Hindu University	20	2.09
Indian Institute of Technology	17	1.77

TABLE 7

Most global cited documents

Paper	Total Citations	TC per Year	Normalized TC
Pai DS, 2014, MAUSAM	969	96.90	40.38
Pai DS, 2013, MAUSAM	113	10.27	17.57
Ashok K, 2019, MAUSAM	35	7.00	7.25
Jaswal AK, 2015, MAUSAM	33	3.67	8.60
Mohapatra M, 2019, MAUSAM	31	6.20	6.42
Mohapatra M, 2013, MAUSAM	29	2.64	4.51
Kotal SD, 2013, MAUSAM	27	2.45	4.20
Mall RK, 2016, MAUSAM	26	3.25	7.34
Sawaisarje GK, 2014, MAUSAM	26	2.60	1.08
Agrawal R, 2012, MAUSAM	24	2.00	6.91

TABLE 8

Citation Profile

No. of Citations	Total Documents	Total Documents (%)	Total Citations	Total Citations (%)
0	328	34.24	0	0.00
1-5	472	49.27	1048	26.84
6-10	97	10.13	728	18.64
11-25	27	2.82	343	8.78
26-50	32	3.34	704	18.03
51-100	0	0.00	0	0.00
100-250	1	0.10	113	2.89
251-500	0	0.00	0	0.00
>500	1	0.10	969	24.81
	958	100.00	3905	100.00

TABLE 9

Most cited references

Cited References	Citations
KENDALL M.G., RANK CORRELATION METHODS, (1975)	18
SAJI N.H., GOSWAMI B.N., VINAYACHANDRAN P.N., YAMAGATA T., A DIPOLE MODE IN THE TROPICAL INDIAN OCEAN, NATURE, 401, PP. 360-363, (1999)	13
IMD, CYCLONE MANUAL, (2003)	9
GOSWAMI B.N., VENUGOPAL V., SENGUPTA D., MADHUSOODANAN M.S., XAVIER P.K., INCREASING TREND OF EXTREME RAIN EVENTS OVER INDIA IN A WARMING ENVIRONMENT, SCIENCE, 314, PP. 1442-1445, (2006)	9
PATTANAIK D.R., KUMAR A., PREDICTION OF SUMMER MONSOON RAINFALL OVER INDIA USING THE NCEP CLIMATE FORECAST SYSTEM, CLIMATE DYNAMICS, 34, PP. 557-572, (2010)	8
NORTHEAST MONSOON, (1973)	7
PETERSON T.C., GOLUBEV V.S., GROISMAN P.Y., EVAPORATION LOSING ITS STRENGTH, NATURE, 377, PP. 687-688, (1995)	7
TYAGI A., THUNDERSTORM CLIMATOLOGY OVER INDIAN REGION, MAUSAM, 58, 2, PP. 189-212, (2007)	7
DE U.S., RAO G.S.P., JASWAL A.K., VISIBILITY OVER INDIAN AIRPORTS DURING WINTER SEASON, MAUSAM, 52, 4, PP. 717-726, (2001)	6
GEORGE J.J., WEATHER FORECASTING FOR AERONAUTICS, (1960)	6
MANN H.B., NONPARAMETRIC TESTS AGAINST TREND, ECONOMETRICA, 13, PP. 245-259, (1945)	6

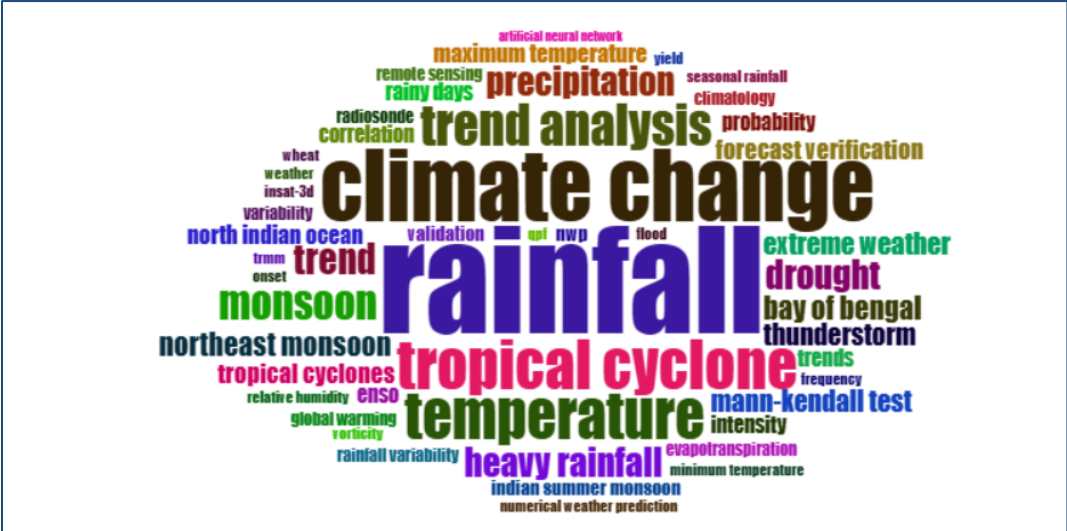


Fig. 7. Word Cloud of Most frequent Author's key words

Fig. 4 provides a visual representation of the top 10 authors' productivity over time, indicating the number of publications and yearly citations per author (Gilani *et al.*, 2019). In this Fig., the size of each circle corresponds to the number of documents authored, the color density of the circle signifies the total number of citations per year, and the line indicates the timeline of the author's publications. The citation counts presented here reflect overall visibility and distinction between self-citations and peer citations was not performed due to metadata limitations.

3.7. Author Productivity through Lotka's Law

Lotka's law describes the frequency of publication by authors in a given field (Jahina *et al.*, 2021). It is an approximate inverse-square law, suggesting that the number of authors publishing a certain number of articles is a fixed ratio to the number of authors publishing a single article. A total of 1633 authors contributed to the documents published in the Mausam journal from 2008 to 2022 (Table 5 and Fig. 5), out of which 1135 authors had only one publication, 226 authors had two publications, 101 authors had three publications, and so on.

This distribution is broadly consistent with the author productivity pattern described by Lotka’s Law, characterized by a large proportion of low-productivity authors and a small core of highly productive contributors.

The present analysis is descriptive in nature and does not involve formal statistical goodness-of-fit or power-law testing; therefore, the observed pattern should be interpreted as indicative rather than as a confirmed mathematical fit. Similar author productivity distributions have been widely reported in bibliometric studies across

scientific disciplines, including atmospheric and environmental sciences (Bisaria, 2020; Lotka, 1926).

3.8. Most relevant affiliation

Table 6 delineates the leading 10 affiliate institutions that have contributed publications to MAUSAM from 2008 to 2022. The India Meteorological Department (IMD) emerges as the dominant contributor, accounting for 428 publications, which represents 44.68% of the total output. This is followed by the Indian Institute of Tropical Meteorology (7.72%) and the Ministry of Earth Sciences (7.10%). It is noteworthy that all the top 10 institutions are based in India, highlighting the journal's strong regional grounding. The data presented here aggregates contributions over the entire study period to identify the primary, sustained organizational hubs supporting the journal.

3.9. Country's Scientific Production

Fig. 6a illustrates the geographical distribution of scientific production, where the different colours represents the frequency of publications. Among the 42 countries that have contributed to Mausam, India holds a dominant position with 2794 documents, accounting for approximately 89% of the total scientific production. This overwhelming share highlights the journal's primary role as a key outlet for Indian meteorological research. Following India, China ranks second with 98 documents and Egypt ranks third with 44 documents. To examine the evolution of these contributions, Fig. 6b presents the annual production of the top five countries from 2008 to 2022. India exhibits a steep, consistent upward trajectory, growing from 122 articles in 2008 to 2794 in 2022, reinforcing its status as the primary contributor. In

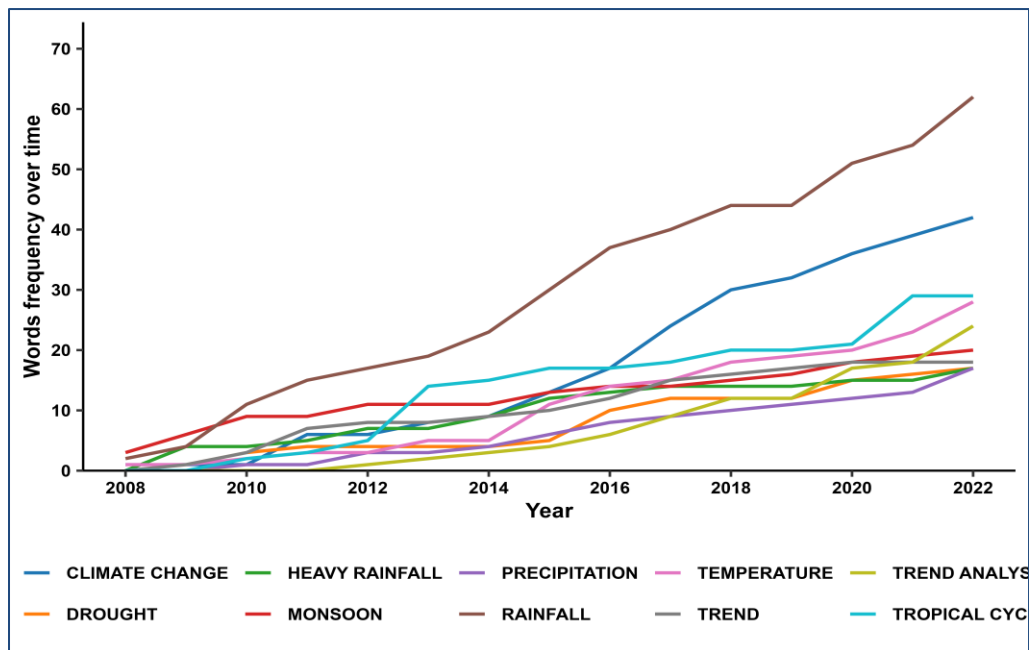


Fig. 8. Author's key words frequency over time (2008-2022)

contrast, China's contribution remained relatively static until 2013 but experienced a significant surge post-2014, rising from 11 articles in 2014 to 98 by 2022. Egypt displays a steady, gradual increase, while Pakistan and the USA have emerged as notable contributors in recent years. This temporal analysis confirms that while the journal attracts international submissions, India's dominance has strengthened over time.

3.10. Most Global Cited Documents

Table 7 represents top papers that were globally cited over the years. The citation data is derived from Scopus, encompassing citations from all indexed document types, including journals, conference papers and books. To ensure a fair comparison between older and more recent publications, the Normalized Citation Count (Normalized TC) is presented. This metric adjusts for citation time bias and is calculated by dividing the total citations received by a paper by the average number of citations of all documents published in the same year within the dataset.

Among the papers published in *Mausam*, the study authored by Pai *et al.* (2014) stands out with an impressive citation count of 969, a high annual citation rate of 96.90, and a Normalized TC of 40.38. Another noteworthy publication by the same author in 2013 garnered a total citation count of 113 (Normalized TC: 17.57). The exceptionally high citation impact of Pai's papers is likely attributable to their focus on foundational datasets and

broadly relevant monsoon and climate variability themes, which serve as essential references for the researchers. Furthermore, the high normalized citation values suggest a sustained citation accumulation over time rather than short-lived citation peaks. It is important to note that all other publications in *Mausam* recorded fewer than 50 citations individually during the study period.

3.11. Citation Profile

Table 8 presents the citation profile of the 958 documents published in *Mausam*, which cumulatively received 3,905 citations. The data reveals that nearly 35% of the documents (328) have received no citations to date, while approximately 49% (472) have received between 1 and 5 citations. Only two papers have achieved more than 100 citations: one paper with 113 citations and one with 969 citations. Together, these high-impact publications contribute significantly to the total citation count. The remaining documents all recorded fewer than 50 citations, indicating that the majority of the journal's output accumulates citations at a moderate rate.

3.12. Most Cited References

Among the references cited by various authors in *MAUSAM* journal from 2008 to 2022, Paper by Kendall (1975) is the most cited reference with 13 times closely followed by Saji *et al.* (1999), IMD (2003) and Goswami *et al.* (2006). The most cited references in *MAUSAM* journal are listed in Table 9.

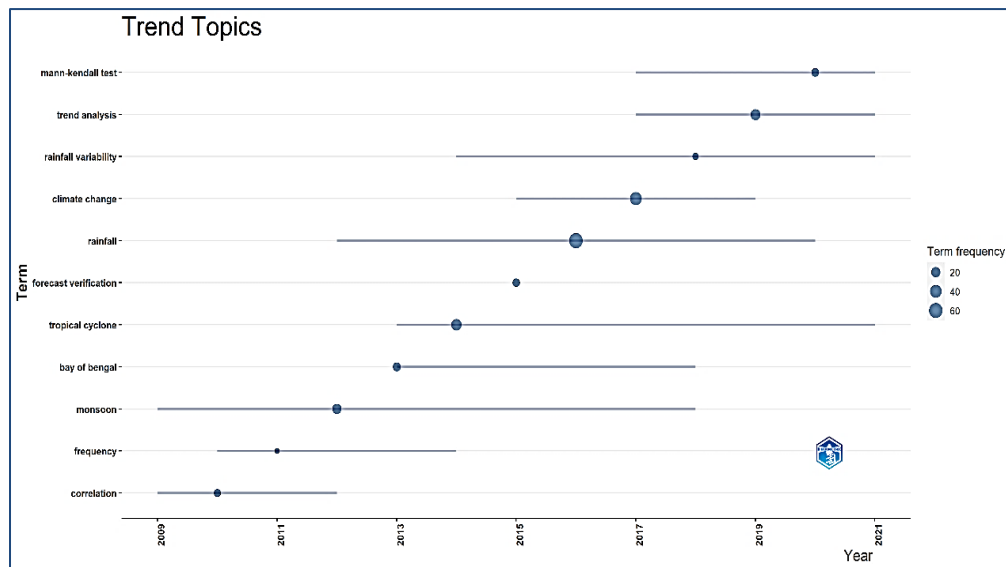


Fig. 9. Trend topics of MAUSAM journal (2008 - 2022)

3.13. Author Keywords and Thematic Evolution

Figs 7 and 8 jointly illustrate the frequency and temporal evolution of author keywords in Mausam from 2008 to 2022, providing insights into dominant research themes and shifts in scholarly focus over time. The word cloud (Fig. 7) highlights "rainfall" as the most frequently occurring keyword (62 occurrences), followed by "climate change" (42), "tropical cyclone" (29), "temperature" (28), "trend analysis" (24) and "monsoon" (20). These keywords collectively indicate that the journal's primary thematic emphasis lies in precipitation variability, climate change impacts, extreme weather events and climate trend assessment.

The temporal analysis of keyword frequencies (Fig. 8) reveals that rainfall, climate change and tropical cyclone exhibit consistent and steadily increasing cumulative occurrences across the study period, reflecting their sustained importance and growing relevance in atmospheric research. Keywords such as temperature, precipitation, monsoon and heavy rainfall show moderate but persistent growth, suggesting continued interest in hydroclimatic variability and regional climate processes. In contrast, terms related to statistical methods, such as "trend" and "trend analysis," display gradual increases, indicating an expanding application of quantitative and diagnostic approaches in climate studies.

The increasing prominence of climate change and extreme event-related keywords in recent years points to an evolving research focus aligned with global scientific

priorities and societal concerns, particularly in the context of climate variability over the Indian region. Overall, the observed thematic structure and its evolution are broadly consistent with trends reported in other atmospheric and climate science journals, where precipitation dynamics, climate change, and extreme weather events dominate research outputs. This suggests that Mausam maintains a thematic focus comparable to peer journals while retaining a strong regional emphasis.

3.14. Trend topics

Fig. 9 illustrates the chronological evolution of research topics in the Mausam journal. This visualization was derived using the biblioshiny trend topics analysis, which tracks author keywords based on their first and last year of occurrence and their cumulative frequency over the study period. The horizontal span represents the active duration of each topic, while the size of the circles indicates their relative frequency, with larger circles denoting higher occurrence.

The keyword "monsoon" emerges as a long-standing research theme, with continuous occurrences from 2008 to 2018, highlighting its sustained importance in the journal's thematic profile. In contrast, the "Mann-Kendall test" appears as a relatively recent topic, emerging in the later years of the study period. This appearance reflects an increasing emphasis on statistical trend detection methods in climate and rainfall analysis, suggesting a growing methodological rigor and the adoption of quantitative approaches in recent research.

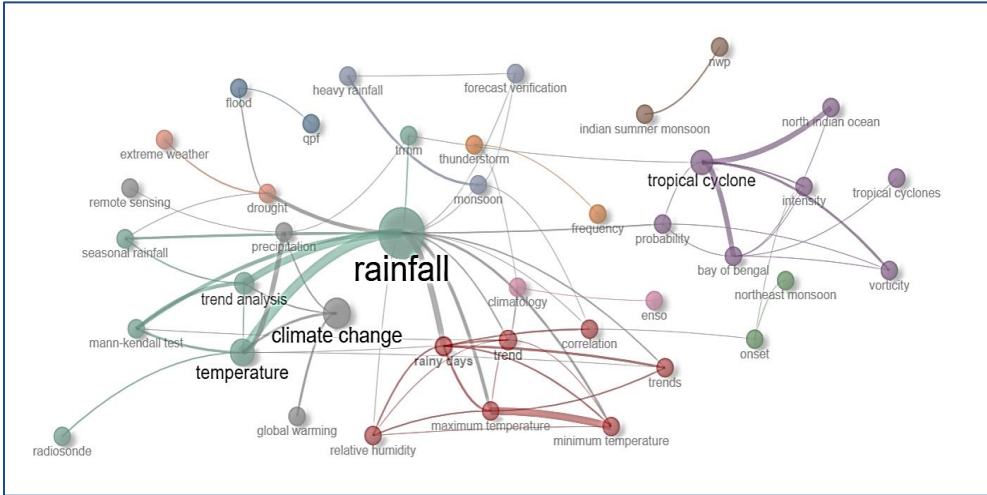


Fig. 10. Co-occurrence network of Author's Keywords

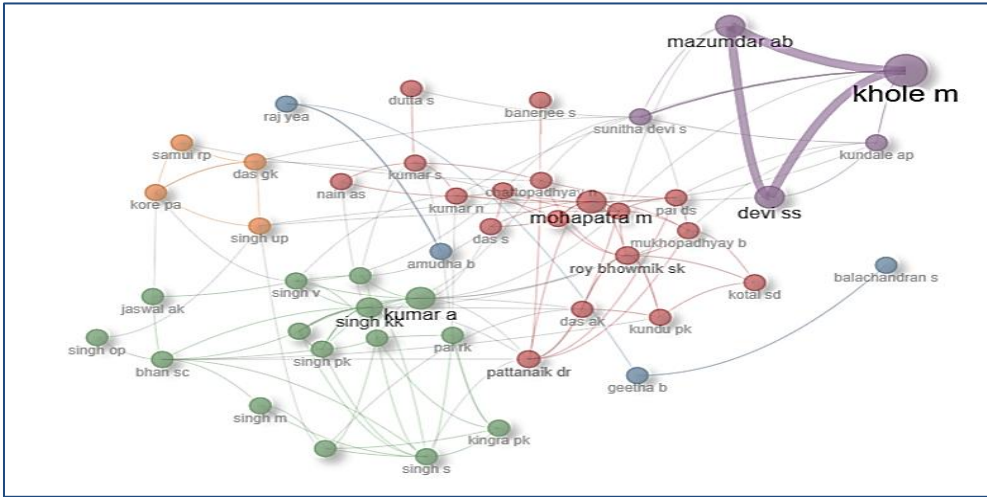


Fig. 11. Collaborative network of authors

Other keywords such as "rainfall variability," "climate change", "tropical cyclone", "trend analysis" and "forecast verification" show varying periods of activity, indicating both persistent and evolving research interests. Collectively, the temporal distribution of these topics reflects a transition from traditional descriptive climatological studies toward more analytical, impact-oriented, and statistically driven climate research within the journal.

3.15. Co-occurrence network of Author's Keywords

Keyword co-occurrence networks map relationships among author keywords based on their joint occurrence within publications, where node size reflects keyword frequency, link strength indicates co-occurrence intensity and clusters represent thematically related research areas. Fig. 10 emphasizes the analytical techniques reliant on

Keyword Co-occurrence Networks (KCNs) employed in both theoretical and empirical investigations to probe research subjects and their interconnections within specific scientific domains. When keywords are grouped together in the same cluster, they are more inclined to represent related topics. Each cluster comprises a varying number of subject keywords. The dominant cluster centered on rainfall and climate change reflects the journal's core focus on hydroclimatic variability, while a distinct tropical cyclone cluster (including Bay of Bengal and intensity) highlights research on extreme weather dynamics. Additionally, the emergence of a methodological cluster comprising "trend analysis" and the "Mann-Kendall test" indicates a growing emphasis on rigorous statistical approaches in climate research. These clusters collectively help identify established research strengths and guide future studies toward emerging and methodologically advanced themes.

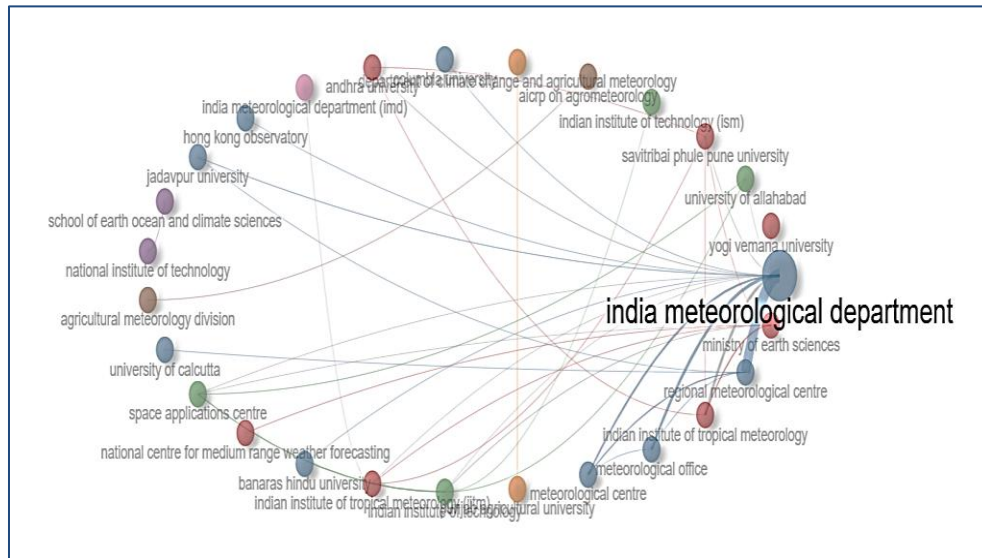


Fig. 12. Collaborative network of Institution

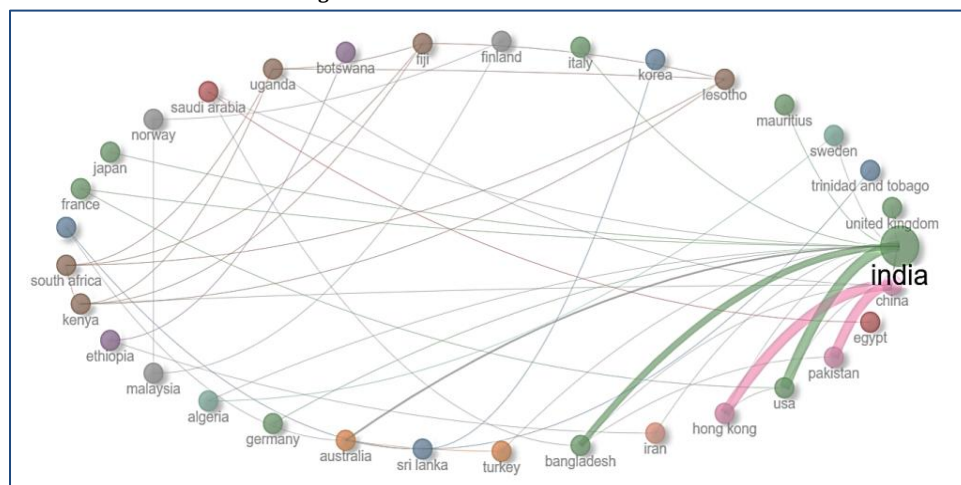


Fig. 13. Collaborative network of Country

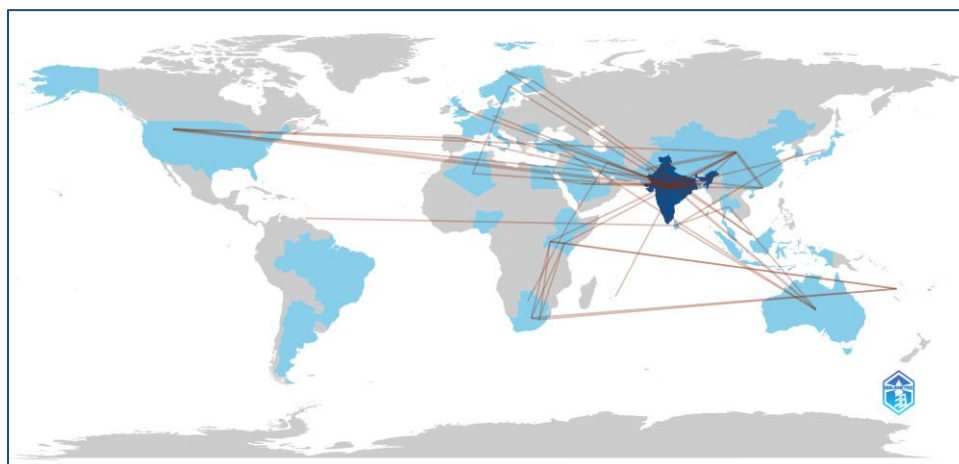


Fig. 14. Collaborative network of Country (World Map)

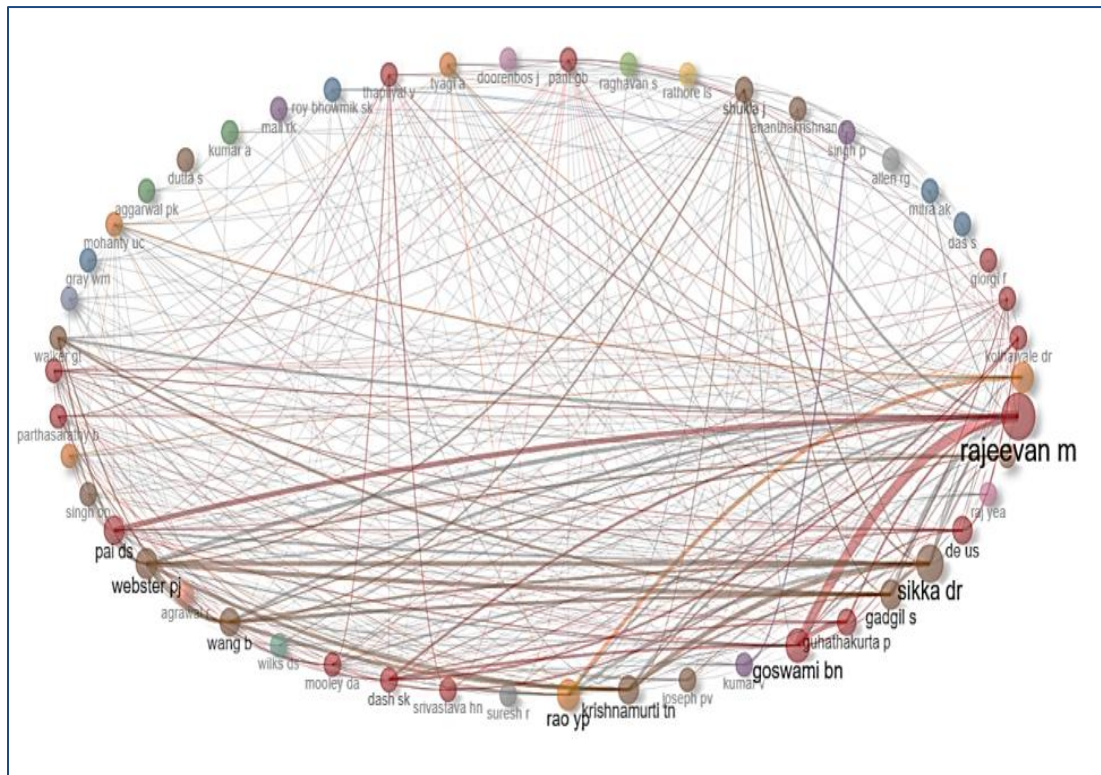


Fig. 15. Co-citation Network of Authors

3.16. Collaborative network of authors, Institutions and Country

Figs. 11 to 14 illustrate the collaboration networks of authors, institutions and countries based on coauthorship patterns, highlighting the structure and areas where research partnerships occur more frequently within the Mausam journal. In these networks, the size of each node represents the publication volume, while the thickness of the connecting links reflects the relative strength of collaboration, determined by the number of joint publications. Fig. 11 demonstrates strong connectivity among authors, with researchers from India forming a central hub and engaging in extensive collaborations (Gururaj *et al.*, 2022). At the level of institutions (Fig. 12), the India Meteorological Department (IMD) emerges as the most prominent collaborative node. This centrality is likely driven by its role as the national nodal agency for meteorology, possessing centralized data infrastructure and mandates that foster partnerships with universities and other research organizations.

At country level (Figs 13 and 14), India displays substantial collaborative connections not only with neighboring nations like China, Bangladesh, and Sri Lanka but also with the USA, UK, Iran, Turkey, Australia and several European and African nations. Although

collaborations involving countries beyond India are comparatively less intense, they are critical for introducing methodological diversity and exchange of knowledge across regions. Collectively, these collaborative networks enhance research quality by facilitating data sharing, integrating interdisciplinary perspectives, and jointly developing analytical approaches, thereby strengthening the scientific impact of research published in Mausam.

3.17. Co-citation Network of Authors

Bibliographic coupling and co-citation analysis are complementary yet conceptually distinct bibliometric methods used to examine scholarly relationships. Bibliographic coupling occurs when two documents share common references and is therefore forward-looking, reflecting similarity at the time of publication. In contrast, co-citation analysis is backward-looking and captures relationships between authors or documents that are cited together by subsequent publications, indicating their perceived relatedness and influence within the research community.

The co-citation network presented in Fig. 15 reflects these relationships using Scopus-indexed citation data. Nodes represent authors and links denote the frequency of

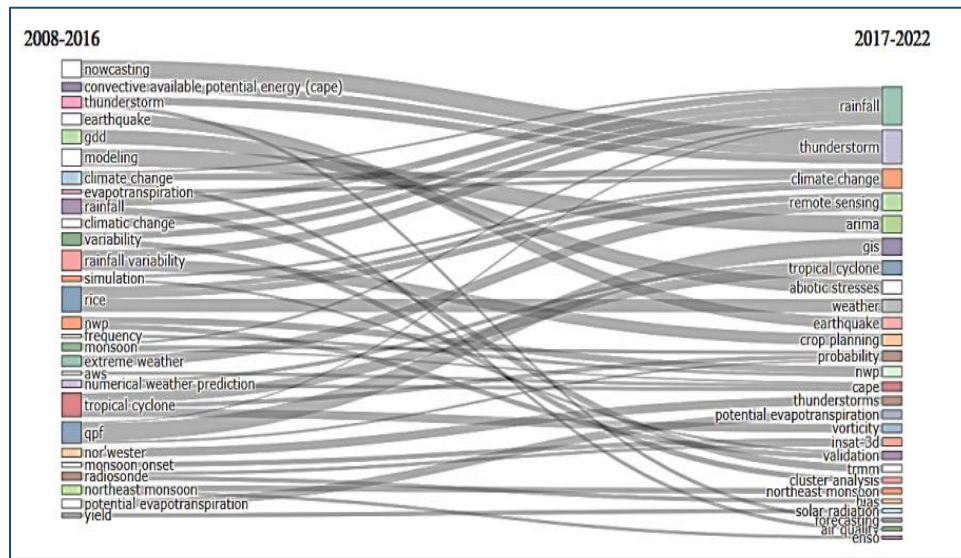


Fig. 16. Thematic Evolution

their co-citation in later studies. The network structure is defined by link strength (co-citation intensity) and organized using a modularity-based community detection algorithm, where different colours represent distinct thematic clusters.

Co-citation networks are particularly effective in identifying influential authors, intellectual groupings, and emerging or mature research themes, as frequently co-cited authors often form the conceptual backbone of a field. The clusters observed in Fig. 15 reveal groups of authors commonly referenced together, indicating shared thematic contributions and foundational influence in atmospheric and climate science research published in the Mausam journal. The application of co-citation and bibliographic coupling analyses to map intellectual structures and research evolution is well established in bibliometric literature, with recent studies demonstrating their effectiveness across diverse domains, including climate change research (Lindawati and Meiryani, 2024) and climate literacy (Ismail, 2024).

3.18. Thematic Evolution

Fig. 16 illustrates the thematic evolution of author keywords in the Mausam journal across two time periods (2008-2016 and 2017-2022) using a Sankey-style flow diagram, where the width of the connecting bands represents the continuity or transition of research topics between periods. This visualization highlights both persistent themes and shifts in research focus over time.

During the earlier period (2008-2016), research predominantly emphasized process-oriented and event-

specific topics such as "nowcasting", "thunderstorm", "earthquake", "modelling", "rainfall variability", "rice" and "tropical cyclone." These themes reflect a focus on observational meteorology, disaster-specific studies, and sectoral applications, consistent with the operational and descriptive priorities of that period.

In contrast, the later period (2017-2022) shows a notable shift toward integrative and data-driven themes, including "rainfall", "climate change", "remote sensing", "ARIMA", "GIS" and "tropical cyclones." The appearance and strengthening of methodological keywords such as ARIMA and GIS indicate an evolution toward advanced statistical modelling, spatial analysis and time-series forecasting approaches, reflecting increased availability of high-resolution datasets, computational capacity, and interdisciplinary research frameworks.

Fig. 16 also reveals that certain keywords, such as "rice," "earthquake," and "nowcasting," diminish or disappear in the later period. This decline may be attributed to thematic consolidation into broader climate-related frameworks, shifting research priorities toward climate variability and extremes, or the migration of highly specialized topics to more domain-specific journals. Meanwhile, the persistence of core themes like rainfall, thunderstorm, climate change, and tropical cyclone across both periods underscores their continued relevance, while changes in associated methodologies highlight evolving analytical depth.

Thematic comparison between the two periods suggests a transition from predominantly phenomenon-based studies toward analytically sophisticated,

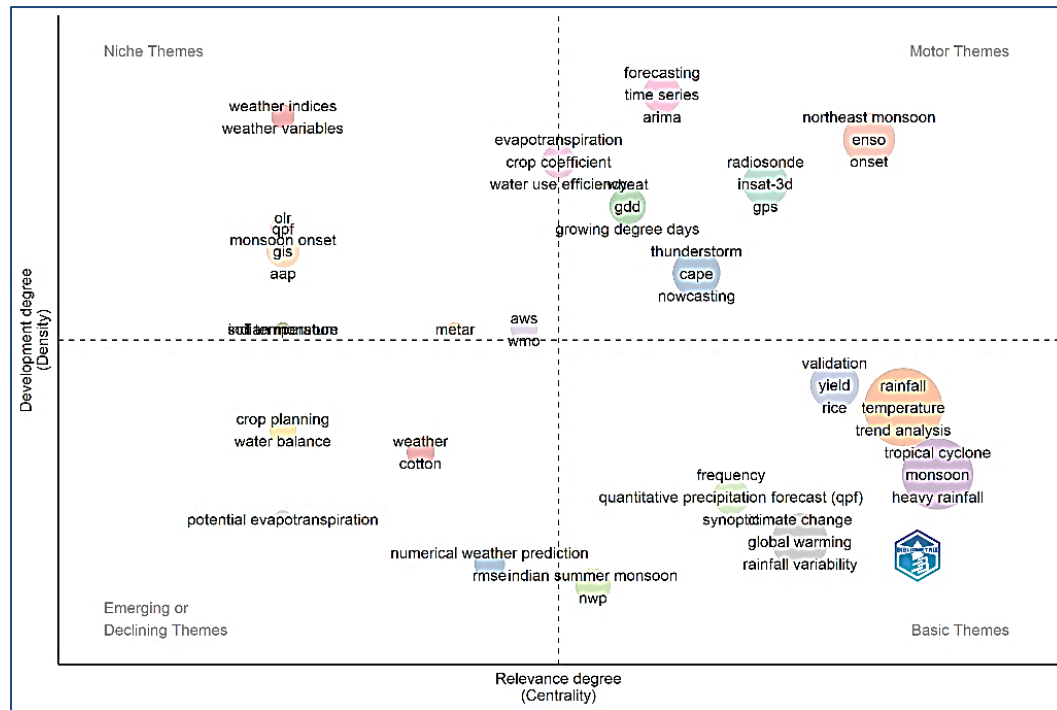


Fig. 17. Thematic map

technology-enabled climate research. Although a formal statistical comparison was not conducted, the visual transitions and emerging methodological keywords in Fig. 16 provide clear evidence of changing research orientation and growing methodological maturity within the Mausam journal over time.

3.19. Thematic Map

Fig. 17 presents the thematic quadrant map of the Mausam journal, which classifies research themes based on their centrality (relevance degree) and density (development degree) using author keywords (Kondaveeti *et al.*, 2020). In this framework, basic themes (high centrality but low density) represent foundational and widely relevant topics that are essential to the field but are still developing conceptually. In the present analysis, keywords such as "rainfall", "temperature", "monsoon" and "climate change" fall under basic themes, highlighting their central role in atmospheric and climate research.

Emerging or declining themes (low centrality and low density) correspond to topics that are either newly developing or gradually losing prominence. Keywords such as "weather", "cotton" and "crop planning" appear in this quadrant, suggesting evolving or context-specific research interests. Niche themes (high density but low centrality) are well-developed yet specialized topics, often representing focused research areas with limited

connections to other themes; examples include "weather indices" and "monsoon onset." In contrast, motor themes (high centrality and high density) are both well-developed and highly influential, driving the research field forward. Keywords such as "forecasting", "time series", "ENSO" and "nowcasting" occupy this quadrant, indicating mature and impactful research directions.

While thematic quadrant analysis provides a useful overview of the conceptual structure of the journal, it is subject to certain limitations. The results depend on the selection and consistency of author keywords, which may vary across studies and time periods. Additionally, thematic positioning may be influenced by keyword frequency rather than the full semantic depth of the research. These limitations should be considered when interpreting thematic evolution based solely on keyword-driven analyses.

4. Conclusions

This study provides a comprehensive bibliometric assessment of the Mausam journal using 958 documents indexed in the Scopus database and analyzed through R-based bibliometric tools. The results indicate a generally stable publication trajectory since 2008, with fluctuations in annual output, reaching a peak in 2016. Citation analysis reflects moderate but sustained scholarly influence, highlighted by an H-index of 20 and a total of 3905 citations, with a small number of highly cited papers

contributing disproportionately to the journal's citation profile. Authorship and institutional analyses reveal the dominant role of the India Meteorological Department (IMD) as the primary contributor and collaborative hub, while India accounts for the largest share of publications among contributing countries.

International co-authorship networks demonstrate growing but uneven global collaboration, suggesting that broader international partnerships could further enhance citation impact, methodological diversity, and the global visibility of the journal. Institutional collaboration patterns indicate strong national research integration but also reveal opportunities for expanding cross-institutional and international cooperation. Keyword and thematic analyses show that rainfall, climate change, monsoon and tropical cyclones constitute the core research themes of Mausam. Thematic evolution highlights a shift toward data-driven and analytical approaches, evidenced by the emergence of tools such as ARIMA, GIS and trend detection methods. At the same time, certain topics such as agricultural applications and localized forecasting appear comparatively underrepresented, indicating potential research gaps and opportunities for future contributions.

Despite its strengths, this study has limitations. The analysis relies solely on Scopus-indexed records, which may underrepresent regionally published literature or non-indexed outputs. Additionally, bibliometric indicators capture publication and citation patterns but cannot fully reflect research quality, societal impact or policy relevance. These constraints should be considered when interpreting the results. Overall, this study provides valuable insights for researchers, editors, and policymakers by identifying influential authors, dominant institutions, collaboration structures, thematic strengths, and underexplored areas within Mausam. Prospective authors can use these findings to align their research with emerging themes, identify collaboration opportunities, and target methodological innovations that enhance both scientific impact and visibility within the meteorological research community.

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Data Availability

All data has been taken from the Scopus database and is publicly available.

Authors' contributions

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All the authors significantly contributed to this study. All authors read and approved the final manuscript.

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