

Current status and trends in research on the concept of Anthropocene—a CiteSpace-based bibliometric analysis

Liwen Cui, Wenwen Liu, Shiya Yang, Yiqi Liu, Hongjie Dai

Nanjing University of Aeronautics and Astronautics, Nanjing Jiangsu 210000, China

Abstract: To conduct a visual metric analysis of the literature on the Anthropocene concept in Web of Science in the past 15 years, and collect a total of 504 academic papers, with a focus on Arts and Humanities Citation Index. This study analyzes the status and dynamic changes of the research in this field in terms of the number of publications, co-authors, collaborating institutions, cutting-edge developments, research hotspots, and research trends, to provide operational theoretical basis and practical guidance for the subsequent research on this concept. CiteSpace was used to visualize and analyze the literature on the concept of the Anthropocene in the past 15 years, and systematically analyze the status, institutions, hotspots and trends of the research on this concept. We analyzed the co-citations of the literature to identify the most influential publications in the research of the Anthropocene concept. Analysis of the evolution of research hotspots to identify the research trends of the concept at different stages and to explore deeper research hotspots.

Keywords: Anthropocene; CiteSpace; Bibliometric Analysis; Research Hotspots

1. Introduction

With the increasing intervention of human activities on the Earth's natural environment, ecological and environmental problems on a global scale have become more and more prominent, and the concept of the Anthropocene has gradually come into people's view. This concept emphasizes the far-reaching impact of human activities on the earth's system and has become an important perspective for global change research. To comprehensively understand the current research status and development trend of the Anthropocene concept, this paper systematically compiles and analyzes the relevant literature at home and abroad based on the CiteSpace bibliometric analysis tool. By visually processing vast amounts of literature data using CiteSpace software, we aim to identify key research themes, trends, and collaborations within the field of the Anthropocene studies. This analysis will provide insights into the evolving landscape of the Anthropocene research, highlighting important contributions, gaps, and future directions. The findings of this bibliometric analysis will inform our understanding of the current research landscape and identify potential areas for future exploration. This study aims to contribute to the ongoing discussion and advancement of the Anthropocene concept, promoting interdisciplinary collaboration and innovative research approaches.

2. Methodology

Data collection. Given that this research centers on the Anthropocene, we retrieved and examined published documents through an advanced search in the Web of Science (WoS), specifically Thomson Reuters Core Collection. The selection of WoS as the data source, with a focus on the Arts and Humanities Citation Index (A and HCI), is based on two considerations. For one thing, WoS boasts an independent and comprehensive editorial procedure, which guarantees the high quality of the journals included. Moreover, it has developed a unique data structure built on 15 years of consistent, precise, and complete indexing, making the articles indexed in WoS of superior quality. Totally, 4252 papers were collected from 40 WoS categories, including environmental sciences, environmental studies, ecology, geosciences multidisciplinary, geography, green sustainable science, technology, and cultural studies. After excluding some works that were unrelated to the Anthropocene, 504 publications remained for further analysis.

Descriptive analysis. Prior to visualizing data via CiteSpace, we performed a descriptive analysis to discern annual publication trends, with the goal of pinpointing the most prolific journals, authors, and institutions. These descriptive analyses were carried out directly using the data extracted from the WoS platform. The WoS website provides information on the annual number of published works; we utilized SPSS software to generate the annual publication trend. Additionally, the WoS website offers data on the number of publications per journal, author, and institution. The diagram illustrates the annual publication counts as well as the overall trend.

CiteSpace-based analysis. The descriptive analysis of WoS data merely offers a fundamental outline of the research domain, failing to comprehensively depict research initiatives over past decades or indicate future research orientations. Previous review studies that lacked bibliometric tools predominantly depended on existing knowledge and subjective assessments. To tackle this issue, we employed CiteSpace to explore the knowledge structures of Anthropocene research developed over the years.

In the present study, we utilized CiteSpace—a bibliometric analysis software developed by Chen (2004, 2006, 2017; see also Chen et al. 2010; Chen & Song 2019). Bibliometric analysis provides an objective and quantitative approach to examining published literature within a specific research area (Chen 2020). The bibliographic data files collected from WoS were formatted in the Institute for Scientific Information Export Format, with “full record and cited references” selected as the content. This ensured that CiteSpace could readily recognize the files. After loading the files into CiteSpace, we executed the following procedural steps: time slicing, threshold setting, modeling, pruning, merging, and mapping (Chen 2006, 401-21).

Two distinct visualization analyses were conducted on the data in this study. One was document co-citation analysis, which helped identify pivotal documents in Anthropocene research. The other was keyword co-occurrence analysis, aimed at pinpointing the most frequently discussed areas in Anthropocene-related research.

3. Analysis

3.1 Journals, Productive Authors, and Institutions on the Anthropocene

Table 1 Top 10 most fruitful journals for the Anthropocene research

Rank	Journals	Published papers	Rank	Journals	Published papers
1	Cultural Studies	156	6	Philosophy	34
2	History	106	7	Geosciences, Multidisciplinary	33
3	Philosophy of Science	60	8	Environmental Studies	30
4	Anthropology	44	9	Archaeology	28
5	Sociology	37	10	Geography, Physical	25

The 504 articles and reviews analyzed in this study were distributed across multiple journals. Table 1 presents the top 10 journals with the highest publication output in this research area. Among them, Cultural Studies ranked first, with 156 publications on the Anthropocene. History and Philosophy of Science followed in second and third places, with 106 and 60 publications respectively. As shown in Table 1, most of these top 10 journals fall within the domains of cultural studies and environmental research.

The 10 authors having the highest number of publications in the Anthropocene are listed in Table 2. The authors with the most papers published on the Anthropocene were Simon, Zoltan Boldizsar (6) and Yusoff, Kathryn (6). Table 3. lists the 10 institutions having the highest number of published works in the Anthropocene. The University of London is at the top of this list with 28 publications in total, followed by the University of California System with 18 articles and University System of Ohio with 15 articles (Table 3).

Table 2 Top 10 most productive authors for the Anthropocene research

Rank	Authors	Published papers	Rank	Authors	Published papers
1	Simon, Zoltan Boldizsar	6	6	Luke, Timothy W.	4
2	Yusoff, Kathryn	6	7	Erlandson, Jon M.	3
3	Clark, Nigel	5	8	Chandler, David	3
4	Rosen, Arlene M.	4	9	Riebeling, Zachary	2
5	Blok, Vincent	4	10	Duara, Prasenjit	2

Table 3 Top 10 most productive institutions for the Anthropocene research

Rank	Institutions	Published papers	Rank	Institutions	Published papers
1	University of London	28	6	Max Planck Society	9
2	University of California System	18	7	University College London	9
3	University System of Ohio	15	8	University of Texas System	9
4	Lancaster University	10	9	Australian National University	9
5	Harvard University	10	10	University of Texas Austin	8

3.2 Document Co-citation Analysis

Citation frequency stands as a key metric within academic circles for evaluating the influence of a publication. The significance of a published work and its repercussions on the field are, to a certain extent, determined by the number of times it has been cited. Through the analysis of document co-citations, we can pinpoint the pivotal documents within a specific knowledge domain. CiteSpace proves to be an effective tool for carrying out such analyses.

Figure 1 Critical publications in the Anthropocene research



Table 4 The top 10 most cited publications in the Anthropocene study

Rank	Citation count	Author (year)	Publication name	Journal or press
1	37	Malm and Hornborg (2014)	The Geology of Mankind? A Critique of the Anthropocene Narrative	The Anthropocene Review
2	37	Lewis and Maslin (2015)	Defining the Anthropocene	Nature
3	31	Moore (2015)	<i>Capitalism in the Web of Life: Ecology and the Accumulation of Capital</i>	Verso books
4	27	Haraway (2015)	Anthropocene, Capitalocene, Plantationocene, Chthulucene: Making Kin	Environmental Humanities
5	24	Chakrabarty (2018)	Anthropocene Time	History & Theory
6	23	Waters (2016)	The Anthropocene is Functionally and Stratigraphically Distinct from the Holocene	Science
7	22	Steffen (2015)	The Trajectory of the Anthropocene: The Great Acceleration	The Anthropocene Review
8	20	Steffen et al (2011)	<i>The Anthropocene: Conceptual and Historical Perspectives</i>	Philosophical Transactions of the Royal Society A. University of Minnesota Press
9	17	Yusoff (2018)	<i>A Billion Black Anthropocenes or None</i>	John Wiley & Sons
10	15	Latour (2017)	Facing Gaia: Eight Lectures on the New Climatic Regime	John Wiley & Sons

Document co-citation analysis was performed on the 504 publications retrieved from WoS. Using CiteSpace, we visualized the 504 bibliographic records spanning from 2009 to 2024. A one-year time slice was adopted, with the top 50 most-cited papers selected for each year. To incorporate all references cited in these documents, regardless of their publication time, the Look Back Years (LBY) parameter was set to -1. Truncating long-range citation connections had a beneficial effect on result clarity: it enhanced the visibility of the network structure, as long-distance links often lead to a tangled, spaghetti-like network. The analysis results are presented in Figure 1, which includes 747 distinct nodes (representing cited publications) and 2056 linkages (representing co-citation relationships) across the entire dataset. Table 4

lists the top 10 most influential articles in Anthropocene research. Between 2009 and 2024, a total of 8 documents were cited more than 20 times. Notably, the third most-cited work globally in Anthropocene-related literature is a classic book focusing on ecology and capital in general, rather than the Anthropocene specifically.

In essence, this study centers primarily on narratives of the Anthropocene. The most frequently cited work in this context is by Malm and Hornborg (2014). Anthropocene narratives often depict humans as a species that has attained dominance over the rest of the Earth system. Within the critical realm of climate change, this perspective tends to link the burning of fossil fuels to traits developed during human evolution, most notably, the capacity to control fire. Yet, the fossil fuel-based economy is not a creation of all humans, nor does it enjoy universal support among humanity. This line of critique challenges the use of broad categorical labels in Anthropocene narratives, asserting that such an approach is analytically flawed and hinders practical action.

The second most frequently cited work is by Lewis and Maslin (2015). This piece has aided in reviewing the historical roots of the Anthropocene concept and assessing anthropogenic characteristics in the geological record against the formal criteria for recognizing a new epoch. The formal designation of the Anthropocene would signify a profound shift in the relationship between humans and the Earth system. The third most cited document is a book by Moore (2015), that is, *Capitalism in the Web of Life: Ecology and the Accumulation of Capital*. In this work, Moore argues that the underlying cause of today's global turmoil is capitalism—a system for organizing nature, including human nature. Integrating insights from environmentalism, feminism, and Marxism, Moore presents a pioneering synthesis: capitalism as a “world-ecology” encompassing wealth, power, and nature. By reexamining capitalism through the dynamic, ever-renewing dialectic of humanity within nature, Moore guides readers through a narrative from capitalism's emergence to the complex web of crises in the modern era. *Capitalism in the Web of Life* demonstrates that critiquing “capitalism-in-nature” (as opposed to treating capitalism and nature as separate entities) is crucial to understanding our current predicament and advancing liberation-oriented politics in the coming century.

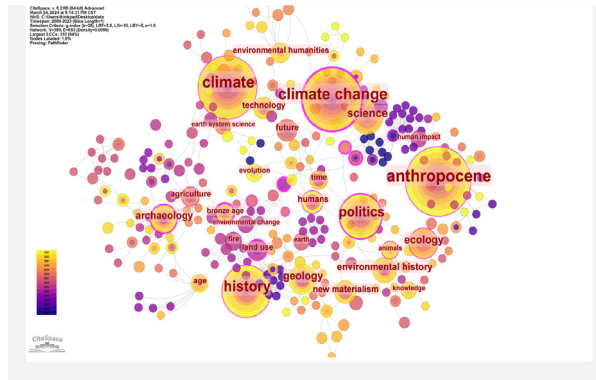
The remaining publications listed in Table 4 are explicitly tied to the Anthropocene concept within specific domains. In her article, Haraway (2015) posits that the spread of seed-dispersing plants millions of years prior to human agriculture constituted a planet-altering development, as did numerous other revolutionary events in evolutionary, ecological, and developmental history. As Haraway emphasizes, no species—including our own, which often arrogantly assumes the role of “good individuals” in the scripts of so-called modern Western thought—acts in isolation. Assemblages comprising both organic species and abiotic entities collectively shape history: the evolutionary kind, and all other forms of history as well.

Furthermore, Chakrabarty (2018, 5-32) explores “Anthropocene time” from multiple angles to uncover its underlying implications. In his article, he starts by questioning why the sense of geological time remains conspicuously absent in contemporary discussions of the Anthropocene within the human sciences, which instead tend to prioritize the more human-focused time frame of world history. In addition, Waters (2016) sought to identify evidence supporting the existence of the Anthropocene epoch. By combining an analysis of the deposition of new materials and radionuclides with human-induced changes to sedimentary processes, he endeavors to demonstrate that the Anthropocene is a stratigraphically distinct new epoch that began at some point in the mid-20th century. The last two publications mentioned here both argue that our current epoch should be distinguished from previous ones, while also raising related questions. Yusoff (2018) investigates how the grammar of geology has served as a foundational element in establishing the extractive economies of both subjective life and the earth itself under colonialism and slavery. Latour (2017) notes that over the past three centuries, new conceptions of nature have been continuously shaped by theology, politics, economics, and science—particularly the sciences focused on the material world.

3.3 Co-occurring Terms Analysis

Keywords in a paper serve as a reflection of its core theme and a concise summary of the subject matter to be explored. When two keywords appear together in a piece of writing, it signifies a close connection between them within the content of the work. The consensus is that the more frequently two or more terms co-occur, the stronger their association. Betweenness Centrality, a function within CiteSpace, quantifies the intensity of the relationship between two or more terms. This capability enables us to predict how a specific term might appear alongside others, even in related topics.

Figure 2 Keyword co-occurrence network

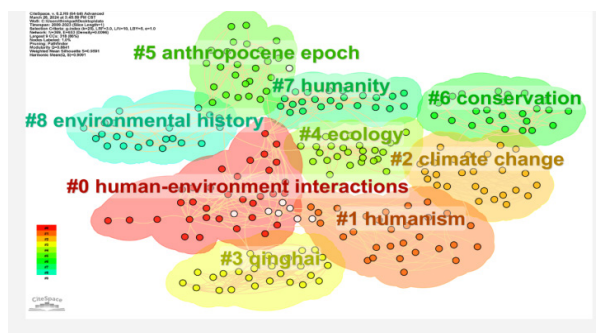


We analyzed keywords to pinpoint terms and phrases that co-occurred in at least two distinct publications. High-frequency terms are indicative of research hotspots within a specific field (Chen 2006, 368). For this study, a time slice length of 1 year was adopted. The analysis results revealed that the top 10 most frequent key terms are: anthropocene, climate change, climate, history, politics, science, ecology, geology, archaeology, and environmental history. The network of interrelated keywords is presented in Figure 2.

3.4 Cluster Interpretations

The clusters of keywords provide a structured and lucid overview of the key concepts and core elements involved in diverse studies on the Anthropocene. These clusters can illustrate which research directions are closely interconnected within Anthropocene-related inquiries. We utilized CiteSpace to conduct cluster analysis based on keyword co-occurrences, resulting in 369 nodes in the co-citation network with a 1-year time slice. The total nine greatest clusters in the research area of the Anthropocene are displayed in Figure 3. Within these clusters, warmer colors denote more recent research themes, while cooler colors indicate older ones, collectively showcasing the top nine keyword clusters. The clusters were labeled using index terms and identified via the log-likelihood ratio (LLR) method. The top nine clusters are named as follows: human-environment interactions, humanism, climate change, qinghai, ecology, Anthropocene epoch, conservation, humanity, and environmental history. The keyword co-occurrence cluster network diagram highlights the most prominent clusters in Anthropocene research.

Figure 3 A cluster illustration for keyword co-occurrence



Cluster #0, as the largest cluster, is labeled as “human-environment interactions”. The cluster refers to that humans and the environment have some unavoidable interactions in humanity research based on the keyword the Anthropocene. Agriculture and land use are two important aspects in human-environment interactions by researching the Anthropocene. Variation of HMEC in anthropogenic sediment in Hexi corridor is contemporaneous with the increases of the Cu concentrations in lacustrine sediment around 4000 BP (Zhang 2017, 93). Cluster #1 is labeled as “humanism”. This cluster has the most important keyword, that is “climate change”. Evidence indicates that among the various proposed start dates for the Anthropocene, two meet the criteria for marking its inception: 1610 and 1964. Navigating the Anthropocene from an African perspective requires treating scale as both an analytical tool and a category of actors (Hecht 2018). Thus, humanism emerges as an inescapable topic in Anthropocene research, and greater attention to it is essential for deepening the focus of related studies.

Cluster #2 is labeled as “climate change”. This cluster shows that over the past 15 years, researchers in the fields of the Anthropocene have intensively studied the role of climate change in the Anthropocene epoch. This line of inquiry includes efforts to examine how social and political agency is both constrained and enabled by the earth’s own forces (Clark and Yusoff 2017, 13). Cluster #3 is labeled as “qinghai”. This cluster focus on the research of qinghai in the Anthropocene epoch to find out the relationship between them and the behind reasons. Additionally, another study provided detailed insights into the late glacial landscape and vegetation development in Tibet (Schlütz and Lehmkuhl 2009, 1456).

Cluster #4 is labeled as “ecology”. Lorimer Jamie (2017) draws on the examples of rewilding nature reserves and reforming the human microbiome to critically assess this shift. Cluster #5 is labeled as “anthropocene epoch”. It indicates that this cluster primarily focuses on the core concept of the Anthropocene and its implications. Research within this cluster may delve into topics such as the defining characteristics of the Anthropocene, the debate surrounding its formalization as a geological epoch, and potential start dates or “golden spikes” that mark the beginning of significant human influence on the planet. Cluster #6 is labeled as “conservation”. This research cluster focuses on the preservation and protection of nature and biodiversity in the context of the Anthropocene. This cluster addresses various aspects of conservation, including strategies, policies, and management practices to mitigate the negative impacts of human activities on ecosystems, habitats, and species.

Cluster #7 is labeled as “humanity”. It suggests that this research cluster focuses on the human dimensions of the Anthropocene, examining how our species has become a dominant force shaping the planet’s systems and the implications for our future. Studying the ethical and philosophical dimensions of the Anthropocene can help us have a better understanding towards this concept, such as our responsibilities to future generations and the rights of non-human entities. Cluster #8 is labeled as “environmental history”. It indicates a focus on understanding the historical context and trajectories of human-environment interactions that have led to the Anthropocene. This cluster focuses on examining the historical roots of the Anthropocene and tracing the development of human societies alongside their evolving impacts on the environment over time. This keyword clustering provides a structured and clear overview of the core concepts involved in diverse strands of Anthropocene research, revealing which research lines are closely interconnected within this field.

3.5 Evolution of research hotspots

Depicting the general research focus areas can outline the developmental trajectory of the Anthropocene and offer a comprehensive, static, and outcome-oriented overall understanding of the field. The following research hotspot sought to identify the driving forces behind the Anthropocene, such as population growth, technological advancements, and economic development. With a clearer understanding of the drivers and consequences of the Anthropocene, the research focus turned towards developing sustainable solutions. This phase emphasized renewable energy, conservation efforts, and circular economies as potential pathways to address environmental challenges. This ongoing research hotspot highlights the importance of adaptive and collaborative governance systems in responding to complex environmental issues. Therefore, the evolution of research hotspots in Anthropocene studies demonstrates the dynamic and interdisciplinary nature of the field.

4. Conclusion

Through the visualization of a large amount of literature data by CiteSpace software, we found that the research on the concept of the Anthropocene has involved several disciplines, including earth sciences, ecology, environmental sciences, sociology, etc. Those research topics mainly focus on the definition of the concept of the Anthropocene, the impact of human activities on the Earth system, the geological characteristics of the Anthropocene, and the ecological and environmental effects of the Anthropocene. In this study, we collected a total of 504 bibliometric records from the Web of Science Core Collection, all of which were published between 2009 and 2024. Among journals, Cultural Studies and History—the only A&HCI journals dedicated to Anthropocene research—led in publication output, with 262 works on the Anthropocene. Bibliometric analyses conducted using CiteSpace software revealed that anthropocene, climate change, climate, history, and politics were the five most frequently occurring keywords. Additionally, the most prominent clusters identified were human-environment interactions, humanism, climate change, qinghai, and ecology. These results demonstrate that research on the Anthropocene has covered a wide range of diverse aspects.

From the results of bibliometric analysis, the future research on the concept of the Anthropocene will show the following trends: firstly, interdisciplinary research will be more in-depth, and the cross-fertilization of different disciplines will become an important direction of the research; secondly, empirical research will become the mainstream, and the specific impact mechanisms of human activities on the Earth system will be revealed through in-depth analysis of specific cases; thirdly, policy-oriented research will become the mainstream. Future research needs to pay more attention to interdisciplinary integration and empirical research, to provide strong support for global environmental governance and sustainable development.

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Author's Profile:

Liwen Cui(2001—), Female, Han Chinese, Anhui Province, Master's Degree, Research Direction: English Language and Literature.

Funding Project:

Research on Vulnerability Writing and Its Community Implications in 21st-century American Climate Fictions.