

Regulatory effect of document samples on the fluctuation of journal impact factor

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Abstract

Exploring the intrinsic relationship between document sample composition and the fluctuation characteristics of journal impact factors (JIFs) is necessary to improve the scientific rigor and rationality of journal evaluation system. In this work, we selected three top-tier international journals—*Nature*, *Science*, and *Cell*—along with six professional physics journals from China and the United States as research objects. Citation data of all documents in the journals were retrieved from the Web of Science (WoS) database, and they were ranked based on their citation counts. Adopting a sample trimming strategy of removing documents at both ends of the citation ranking distribution, this study recalculates the JIF values of these journals and conducts a systematic comparative analysis with those released by the Journal Citation Reports (JCR). The results demonstrate that excluding a certain proportion of documents at both ends of the citation distribution can effectively lower the fluctuation amplitude of JIFs and enhance the stability of the indicator. Furthermore, the amplitude gradually decreases as the proportion of retained document samples declines. After weighing the balance between the stability of JIFs and the maximization of sample representativeness, the optimal sample retention threshold is determined to be 90% of the total documents. These findings indicate that appropriately reducing the sample size can effectively avoid the abnormal fluctuations of JIF caused by the extreme citation of document, hence shedding light on the standardized calculation of JIFs and the improvement of journal evaluation system.

1. Introduction

The journal impact factor (JIF) was first proposed by Dr. Eugene Garfield, founder of the Institute for Scientific Information (ISI), in 1955 (Garfield, 1955). Every June, Clarivate officially releases the Journal Citation Reports (JCR), which publishes the annual JIF values of all journals indexed in the Web of Science (WoS). Moreover, all included journals are categorized by disciplinary subject areas and ranked based on their corresponding JIFs to form the JCR partitions. At present, the JIF has evolved into one of the most widely adopted quantitative indicators for assessing the quality of academic journals and the scientific influence of published papers. It has also been extensively applied in research performance assessment and academic evaluation practices by universities and institutions worldwide.

In general, the JIF of a specific journal for a given year is calculated based on two components: the numerator and the denominator, with the former referring to the total number of citations received in the current year by all documents published in the journal over the preceding two years, while the latter representing the total number of source documents published by the journal during the same two-year window (Garfield, 1999). Academic journals typically publish multiple types of scholarly documents, including Articles, Reviews, Communications, Letters, Corrections, Book Reviews, Editorial Materials, and Proceedings, among others. According to the JIF calculation rules stipulated by JCR, only articles and reviews are counted toward the denominator of the JIF formula, while other document types only contribute to the citation counts without being included in the denominator. In recent years, various methods and strategies have been adopted by individual journals to artificially boost their JIFs. For

example, some journals deliberately increase the publication volume of non-denominator documents, such as letters to the editors and commentaries, which can bring additional citations to journals without being counted in the JIF denominator (Manley, 2022). As reviews systematically summarize and sort out a large number of original research achievements in a specific field, they generally obtain significantly higher citations than research articles. Accordingly, intensive publication of reviews is beneficial to increasing JIF (Bennett¹ et al., 2024). Recently, some journals have even formed mutual cross-citation alliances to avoid official suppression by Clarivate due to excessive self-citation behaviors (Chen, 2024). Besides, other mainstream methods for raising JIFs include shortening the document dissemination cycle via the “Article In Press” online advance publication mode (Gonzalez-Betancor & Dorta-González, 2020), controlling the total number of documents (articles and reviews), focusing on publishing papers in research hotspots (Zheng & Ni, 2024), and actively soliciting high-quality and high-citation potential manuscripts (García, 2014).

Although JIF plays positive roles in the existing journal evaluation system, its inherent statistical limitations have become increasingly prominent in practical application (Geng, 2014; Torres-Salinas, et al., 2022; Gupta, et al., 2025). One critical drawback of the JIF is its high susceptibility to drastic numerical fluctuations caused by extreme citations of individual documents. A typical representative case is *Acta Crystallographica Section A*, a crystallography-focused journal. According to JCR data, the JIF of this journal was merely 2.051 in 2008, but it surged sharply to 49.926 in 2009 and further reached 54.333 in 2010, before quickly falling back to 2.076 in 2011. The abnormally high JIFs in 2009 and 2010 even far exceeded those of top-tier comprehensive journals such as *Nature* and *Science*. This extreme and abnormal JIF fluctuation was entirely attributed to a single highly cited article titled by “A short history of SHELX” published in 2008 (Jain, 2011). The specific effect of such single highly cited papers on JIF was thoroughly explored in our previous study (Li & Shao, 2018; Li & Shao, 2019). Evidently, the significant surge of JIF induced by individual documents not only deviates from the original intention of the indicator but also triggers unfair outcomes in journal evaluation, ultimately undermining the scientificity and credibility of academic assessment relying on JIF as a core indicator.

As aforementioned, the current rule for JIF calculation renders the indicator highly sensitive to extreme citations of individual documents, which greatly hinders the objective and fair evaluation of academic journals. Against this backdrop, it is imperative to develop a targeted improved scheme to suppress the abnormal interference, so as to restore JIF as a reliable and authentic quantitative indicator for standardized journal evaluation. Given that the distribution relationship between the number of documents published in a journal and their corresponding citation counts approximates a normal distribution, with extreme citations concentrated at both ends of the distribution curve, this work proposes a statistical sample truncation strategy, *i.e.*, trimming documents at both ends of the citation ranking distribution. We first verify the stabilizing effect of the proposed strategy on JIF fluctuations based on three top international journals including *Nature*, *Science*, and *Cell*. On this basis, six representative physics journals from China and the United States are further selected to validate the universality and practical effectiveness of the truncation strategy. This work not only provides a novel

perspective for the standardized and reasonable calculation of JIF, but also offers a valuable reference for the improvement of the existing journal evaluation system.

2. Methodology

2.1 Sample selection and data acquisition

In this work, a total of nine representative academic journals are selected as research objects, which are divided into two categories. The first category covers three top-tier international journals, including *Nature*, *Science* and *Cell*. The second category consists of six professional physics journals from China and the United States, i.e., *Chinese Physics Letters*, *Chinese Physics B*, *Chinese Physics C*, *Physical Review Letters*, *Physical Review B*, and *Physical Review C*.

The research dataset covers citation statistical indicators spanning from 2010 to 2025. Core research data required for this study, including the JIF values of JCR, the number of published source documents, and individual document citation counts, are all retrieved and extracted from the WoS database. Since the database is dynamically updated, all statistical data adopted in this work are based on the latest real-time retrieval and statistical results.

2.2 Definition of the original JIF

According to the computational criteria formulated by JCR, the original JIF is defined as follows. Assuming that P denotes the total number of valid source documents (only including articles and reviews) published by a journal over two consecutive statistical years, and C denotes the total number of citations received by these documents in the subsequent statistical year, the JIF is calculated by

$$R = C/P. (1)$$

Notably, other non-source document types (excluded from the JIF denominator) can also generate citation counts, the total citation value is usually higher than the sum of citations solely generated by articles and reviews.

2.3 Modified JIF model

To quantitatively investigate the influence of documents with extreme citations on JIF fluctuations and journal evaluation indicators, we introduce the “dual-end trimming” method to improve the original JIF calculation model. According to Eq. (1), the modified JIF is redefined as

$$R_n = C_n/P_n. (2)$$

The computational procedures for the modified JIF are detailed as follows. First, extract the citation data of all valid documents included in the original JIF calculation scope (corresponding to Eq. (1)) from the WoS database. Second, rank all these valid documents in descending order according to their individual citation counts. Third, remove the top $n\%$ and the bottom $n\%$ of the documents in the citation ranking list

(i.e., trimming the two ends of the citation distribution), and take the remaining documents as the new statistical sample of the modified JIF calculation. The relevant variables are defined as follows:

P_n —The number of the remaining documents after removing the top $n\%$ and the bottom $n\%$ of the documents in the citation ranking, i.e., $P_n = (1-2n\%) \times P$;

C_n —The total citation counts of the remaining documents P_n ;

R_n —The modified JIF after eliminating $2n\%$ of the documents at both ends.

Evidently, the modified JIF is dependent on truncation proportion n . When $n = 0$, the modified JIF is close to the original JIF calculated by Eq. (1). Since the modified model should retain a sufficient number of valid documents for calculation, n is set to range from 0 to 25. Correspondingly, the proportion of retained statistical document decreases from 100% to 50%, ensuring that the effective sample number for the modified JIF calculation is no less than half of the total valid documents.

3. Results and discussion

3.1 Comparative analysis of three top journals

Nature, *Science* and *Cell* selected in this work are globally recognized top-tier international academic journals with profound influence and disciplinary benchmarking significance. Founded in 1869, *Nature* dedicates to publishing high-quality peer-reviewed original research achievements covering all disciplines of science and technology, ranking among the world's oldest and most influential academic journal. *Science* was established in 1880, focusing on disseminating cutting-edge and high-level research findings across the entire scientific field, and has long stood alongside *Nature* as a core carrier for publishing landmark global scientific discoveries. As the leading benchmark journal in biology, *Cell* was founded in 1974 and exclusively publishes groundbreaking research outcomes with extraordinary scientific significance in all branches of experimental biology. Collectively, these three journals represent the highest publishing standard for contemporary scientific research.

Figure 1a shows the official and recalculated JIFs of *Nature* between 2010 and 2025. Note that the official JIFs in 2025 has not yet been released by JCR. According to the retrieved historical JCR data, its JIF started at 36.104 in 2010. After a slight temporary decline to 38.158 in 2015, the JIF restores a continuous rise, reaching an all-time peak of 69.504 in 2021, before gradually falling to 48.5 in 2024. From a holistic perspective, the JIF of *Nature* remained steadily above 40 for most of the past decade. However, it exhibited drastic fluctuations between 2020 and 2023, with the numerical gap between the peak value in 2021 and the minimal value in 2010 exceeding 33.

When the citations of only articles and reviews were counted for statistics, the calculated JIF with no document trimming (corresponding to a 100% sample retention) is slightly lower than the official value of JCR (see Fig. 1a). This confirms that although non-source document types can generate a certain

number of citations, their contribution to the JIF is not dominant. The similar phenomena are also observed for *Science* and *Cell* (see Fig. 1b and 1c), with their JIFs reaching respective peak values of 63.832 and 66.850 in 2021. The subtle difference lies in the trend characteristics: the JIF of *Science* maintained a steady upward trend before 2021, while *Cell* shared a similar fluctuation trajectory with *Nature*, featuring a mild initial increase followed by a temporary decline in 2015, and then a sharp rebound to the historical peak in 2021. According to our modified model, the predicted JIFs of JCR for *Nature*, *Science* and *Cell* in 2025 are no less than 52.2, 41.7 and 43.6, respectively.

Figure 1 further illustrates the dependence of the recalculated JIF on document retention proportion under the modified truncation model. The results reveal that as the proportion of retained document samples gradually decreases (corresponding to more documents removed from both ends of the citation distribution), the modified JIF values of all three journals exhibit a continuous declining trend, accompanied by a gradual decreasing amplitude. The most substantial JIF reduction occurs at the initial truncation stage of removing 2% of documents (corresponding to 98% sample retention). Taking the JIF peak values in 2021 as a typical example, the JIF of *Nature* decreases from 61.688 to 52.781, representing a relative decline of 14.44%; for *Science*, it drops from 56.531 to 49.969, with a decline of 11.61%; and the JIF of *Cell* falls from 63.719 to 50.625, with a marked decline of 20.55%. Such significant JIF reductions clearly indicate that a tiny fraction of documents at both ends of the citation distribution, especially extremely highly cited papers, exert a dominant and decisive impact on overall JIF fluctuations. By contrast, the marginal decline in JIF gradually diminishes as the sample retention proportion continues to decrease. Still taking 2021 dataset as an illustration, when the retained document proportion decreases from 60% to 50% (an additional 10% of documents are truncated at both ends), the corresponding JIF reduction percentages are only 3.83% for *Nature*, 3.56% for *Science*, and 3.51% for *Cell*. Overall, the sensitivity of JIF to sample proportion changes weakens continuously with the decrease of retained documents, and the stability of the modified JIF is effectively enhanced accordingly.

Figure 2a shows the averaged JIFs of the three top journals from 2010 to 2025 across different document proportions. Generally, the average JIF of *Nature* is remarkably higher than those of *Science* and *Cell*, while *Cell* maintains a slightly higher JIF than *Science*. All three journals exhibit an identical changing trend: the average JIF value declines steadily as the retained document proportion decreases. This phenomenon reveals that the boosting effect of highly cited documents on JIF elevation far outweighs the suppressing effect of lowly cited documents on JIF reduction. As the document truncation proceeds, the average JIF gradually converges toward a stable range. This result further confirms the feasibility and effectiveness of the proposed dual-end sample truncation strategy in eliminating abnormal interference from extreme citations of documents and stabilizing the JIF indicator for rational journal evaluation.

To quantitatively evaluate the fluctuation characteristics of JIFs and the influence of document sample proportion variation on the JIF's stability, we introduces the standard deviation (SD) as a statistical indicator for in-depth analysis, as shown in Fig. 2b. The results indicate that the JIF fluctuation amplitude

reaches its maximum when all valid documents are included in the calculation (corresponding to $n = 0$). After removing merely 2% of the documents at both citation tails ($n = 1$), the SD decreased significantly, reflecting an obvious improvement in JIF stability. As the retained document sample proportion continues to decrease gradually, the SDs of all three journals decline consistently and eventually converge to a relatively stable level. By comparison of these three journals, it can be seen that *Cell* exhibits the most pronounced JIF fluctuation, while *Nature* maintains the most stable JIF performance with the weakest fluctuation. The differences in SD values reflect the long-term operational stability of journal quality; that is, a lower SD value corresponds to more stable quality and sustained publishing performance of a journal over a long statistical period.

Given the differences in the absolute JIF baseline values among the three journals above, SD alone cannot fully and directly reflect the relative gap in the quality of journals. Here, we further calculated the relative standard deviation (RSD) of JIFs, as shown in Fig. 2c. The RSD results demonstrate a highly consistent variation trend with the SD analyses. Specifically, *Cell* still shows the strongest relative JIF fluctuation, while *Nature* remains the most stable with the lowest fluctuation level. Furthermore, the relative fluctuation amplitude of JIFs increases correspondingly as the retained document sample proportion rises. Notably, despite the consistently high absolute JIF levels of the three top journals, their RSDs remain below 25% throughout the statistical period. This finding confirms that the overall academic performance and publication quality of these journals have been stable since 2010. As the globally recognized benchmark journals, their bibliometric performance under different sample truncation proportions provide a critical empirical reference for improving the quality evaluation and judging the rationality of JIF fluctuations for other academic journals.

3.2 Comparative analysis of professional journals

To further explore the relationship between document citation distribution characteristics and discipline attributes, as well as verify the universality of the proposed truncation strategy across different journals, we select six representative professional physics journals from China and the United States for cross-regional and comparative analysis. The Chinese journal samples consist of three core physics journals sponsored by the Chinese Physical Society, including *Chinese Physics Letters* (CPL), *Chinese Physics B* (CPB), and *Chinese Physics C* (CPC). All three journals were successfully selected into the English journal series of the “Excellence Action Plan for Chinese Academic Journals” in 2024. The American journal samples include three classic authoritative physics journals under the sponsorship of the American Physical Society, namely *Physical Review Letters* (PRL), *Physical Review B* (PRB), and *Physical Review C* (PRC), all of which belong to the influential Physical Review family with long-term academic accumulation. In terms of disciplinary positioning and publishing scope, CPL and PRL focus on publishing concise, high-quality original research reports covering fundamental physics, applied physics, and interdisciplinary frontier research fields; CPB and PRB are devoted to reporting significant advances in condensed matter and materials physics; CPC and PRC serve as reliable core publishing platforms for cutting-edge research achievements in nuclear physics. These six selected journals not only represent the overall academic level and publishing characteristics of Chinese and American physics journals

respectively, but also provide typical professional and cross-national comparative samples for verifying the applicability and generalization of the dual-end truncation optimization strategy.

Figure 3 shows the JIF evolution of the six selected physics journals from 2010 to 2025. In general, with no document exclusion ($n = 0$), the recalculated JIFs are consistent with the JCR values, indicating that for these professional disciplinary journals, non-source document types (excluding articles and reviews) exert a negligible overall impact on the JIF. Note that the recalculated values of PRB and PRC are slightly higher than their corresponding JCR values. This minor discrepancy can be attributed to differences in statistical time window: the official JCR data are finalized based on citation records accumulated before the annual JCR release date, while the recalculated values in this work adopt the latest real-time data from WoS database, which incorporates newly added citations generated after the JCR publication cutoff date.

As can be seen from Fig. 3, both CPL and PRL exhibit a steady increase in JIF over the study period. In contrast, CPB, PRB, and PRC maintain relatively stable JIF performance with only minor numerical fluctuations. It is worth noting that CPC displays an abnormal fluctuation. Its JCR JIF rose sharply from 1.313 in 2014 to 5.084 in 2016 and further surged to 5.861 in 2018. Such a dramatic increase not only deviated greatly from the journal's long-term baseline level but also significantly exceeded the JIF value of its American counterpart PRC in the same years (3.820 in 2016 and 3.132 in 2018). Subsequently, the JIF of CPC fell rapidly back to 2.463 in 2019. By analyses of citation data of documents, it is found that this abnormal fluctuation is entirely caused by two successive highly cited reviews titled by "Review of Particle Physics Particle Data Group" respectively published in 2014 and 2016. The single review received 2308 citations in 2016 and 1916 citations in 2018, accounting for up to 90.62% and 70.16% of the journal's total annual citation (2547 in 2016 and 2731 in 2018). This evidence demonstrates that the JIF values of CPC in these two years were dominated by individual highly cited reviews rather than the overall performance of regular published papers. Evidently, such extreme distortion seriously deviates from the original design intention of JIF, which is supposed to objectively reflect the comprehensive and long-term academic quality of a journal. Similarly, the slight rise of JIF of CPC in 2022 and 2023 was also driven by prominent citation contributions of 9.1% and 11.58% from another single high-citation paper titled "The AME2020 atomic mass evaluation" published in CPC in 2021, respectively. In contrast, the JIFs of the remaining five journals, especially the three PR-series journals, maintained stable JIF performance over the past 16 years without being disturbed by individual extreme-citation documents.

Figure 3 further confirms the effectiveness of the proposed modified model. Taking CPC as an example, after excluding only 2% of the documents from both ends of the citation distribution, the abnormal fluctuation caused by single highly cited document completely disappear. After sample truncation, the recalculated JIFs of CPC respectively drop to 0.455 in 2016 and 1.201 in 2018, restoring to its normal baseline level. More importantly, after eliminating the interference of extremely highly cited documents, the modified JIF sequence of CPC exhibits a steady and gradual upward trend, objectively reflecting the continuous improvement of the journal's overall academic publishing quality in recent years. In contrast, the JIF evolutionary trend of the other five journals remains basically unchanged regardless of variations

in document sample retention proportions, which verifies the inherent uniformity and stability of their overall academic quality. In addition, under the same truncation proportion, the PR-series American journals still maintain higher JIF levels than the CP-series Chinese physics journals. Nevertheless, the gap between the two groups has become narrowing in recent years. This highlights the remarkable achievements of “Excellence Action Plan for Chinese Academic Journals”.

Figure 4a shows the correlation between the 16-year averaged JIFs of the six journals and different document sample retention proportions. Consistent with the findings of the three top comprehensive journals, the average JIF of all six professional physics journals shows a gradual declining trend as the retained document sample proportion decreases. Especially, CPC exhibits the most remarkable reduction after the initial 2% dual-end document truncation, which is directly associated with the interference brought by the extremely highly cited reviews published in 2014 and 2016, as elaborated in the previous analysis. Generally, the JIF variation pattern of the six professional disciplinary journals is consistent with that of the three top-tier international journals: the average JIF gradually converges to a stable and reasonable level as those documents at both ends are continuously removed.

To further explore the fluctuation characteristics of six journals, Fig. 4b illustrates the variation of SD across different document sample proportions. All six journals exhibit a consistent trend: the SD decreases steadily as the proportion of retained statistical documents declines. This result verifies again that appropriate reduction of statistical samples can effectively suppress the JIF fluctuation. Among the six journals, CPL and CPC present relatively higher SD values, which is highly consistent with their prominent JIF fluctuation amplitudes observed in Fig. 3a and 3e. In contrast, PRB and PRC maintain consistently low SD levels throughout the truncation process, indicating exceptional long-term JIF stability over the past decade.

For further comparison of fluctuation amplitude of JIFs, Fig. 4c illustrates the RSDs of these journals. Evidently, the three PR-series journals consistently maintain considerably low RSDs ($< 8\%$) regardless of changes in document sample proportions. This indicates that the JIF performances of these journals are insensitive to the sample truncation adjustments, reflecting their inherently stable and reliable academic quality. For Chinese physics journals, CPL and CPC show markedly higher RSD values, which rise gradually as the retained document proportion decreases. This phenomenon can be attributed to their relatively low average JIF baselines under sample truncation conditions, originating from their ultralow initial JIF levels in the early statistical years (see Fig. 3a and 3e). By comparison, the RSD of CPB is lower than or comparable to those of *Science* and *Cell*, exhibiting a similar high level of JIF stability. Despite the relatively higher RSD performance of Chinese journals, their overall SD values still follow the universal declining trend with the reduction of retained documents.

The above comparative analysis reveals a clear evolutionary pattern of JIF changes under the dual-end truncation strategy. Specifically, for all journals, both the absolute JIF values and their fluctuation amplitudes decline gradually as the proportion of retained document samples decrease. The PR-series journals exhibit extremely high JIF uniformity and long-term stability, while the CP-series journals have

achieved substantial improvements in overall academic publishing quality under the support of “Excellence Action Plan” in recent years.

3.3 Threshold determination of optimal document sample proportion

Based on the above analyses, one can find that the proposed dual-end truncation strategy can effectively filter the abnormal interference caused by a small number of extremely highly cited documents, enabling the modified JIF to accurately reflect the real citation baseline and intrinsic academic quality of regular published papers. However, the specific proportion of retained document samples exerts a significant impact on the reconstruction of JIF. To quantify the specific correlation between document sample proportion and JIF effectiveness, we further examine the evolutionary trend of JIF reduction under different truncation levels. Considering that the substantial disparities in JIF baselines across different journals and statistical years, here we introduce the relative JIF reduction value to eliminate the influence of inherent JIF differences and ensure comparative analysis validity.

Figure 5 illustrates the relative JIF reduction value at different document sample proportions. The relative JIF reduction value is defined as the ratio of the absolute JIF reduction caused by each 2% decrement in retained document samples to the JIF with no document truncation. In this study, a total of 3600 valid data point covering nine journals from 2010 to 2025 and sample retention proportions ranging from 100% to 50% at a 2% decrement are incorporated into Fig. 5. Further, we employ the least squares method to fit these scattered points, and the corresponding fitted curve is also shown in this figure.

From the fitting curve and data distribution, it can be seen that the inhibitory effect of the dual-end truncation operation on JIF reduction shows a typical “diminishing marginal effect”. When respectively removing 1% of documents from both ends of the citation distribution (that is, retaining 98% of all valid documents), the relative reduction of JIF is the most remarkable, which is reflected by the steepest slope of the fitting curve at this point. This phenomenon demonstrates that a small number of extremely highly cited documents make an outsized contribution to the elevation of JIF. As the dual-end truncation proceeds and more extreme-citation documents are continuously removed, the marginal effect of sample truncation on JIF reduction weakens rapidly. When the retained document proportion reaches 90%, the relative JIF reduction caused by each additional 2% truncation of documents decreases to less than 2%. When the retained documents proportion drops below 80% of the total documents, the fitting curve tends to flatten into a smooth horizontal line, indicating that the marginal effect of further sample truncation on JIF reduction becomes negligible.

Based on the above evolutionary trend, a clear optimal threshold for document sample retention can be determined. Specifically, removing only 1% of documents from both ends of the citation distribution can effectively eliminate the abnormal oscillation of JIF. After comprehensively weighing the anti-interference ability of the modified JIF and the maximization of statistical sample representativeness, the optimal sample retention threshold is determined to be 90% of all valid documents, which are located

in the middle of the citation distribution. This 90% retention threshold achieves a fine balance between scientific rigor and practical operability: it not only effectively avoids the statistical deviation caused by a small number of extremely highly cited documents but also ensures that the retained sample volume is sufficient to reflect the overall bibliometric characteristics and intrinsic academic quality of the journal.

4. Conclusions

In the context of an increasingly refined and standardized academic evaluation system, scientifically avoiding the interference of extreme citations on JIF calculation has become an urgent issue to be addressed for improving the rationality and fairness of journal evaluation. Based on the past 16 years (2010–2025) of continuous citation data of nine representative journals, this work proposes a document screening strategy based on “cutting the head and removing the tail” of the citation distribution, and explores the regulatory effect of this strategy on the fluctuation characteristics of JIFs. The results reveal that removing extremely highly cited documents can effectively suppress the abnormal fluctuation of JIF and improve the stability of the indicator. Generally, the JIF value decreases with the reduction of retained document samples, and the fluctuation amplitude of JIF also reduces synchronously. By thoroughly balancing the anti-interference ability of the modified JIF and the maximization of document sample representativeness, an optimal threshold for sample retention is determined to be 90% of all valid documents, which are located in the middle of the citation distribution. In conclusion, the dual-end truncation strategy proposed in this work can effectively avoid the accidental statistical deviation caused by a small number of extreme-citation documents, enabling the JIF to restore its essential function of measuring the overall academic quality and long-term stability of journals. This study not only provides a novel and practical approach for the standardized calculation of JIF but also opens up a new perspective for improving the current journal evaluation system.

Declarations

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Author contributions JL designed the research, collected, analysed, and interpreted the data, drafted, and edited the manuscript; GS interpreted the data, edited, and revised the manuscript.

Conflict of interest The authors declare that they have no competing interests.

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Figures

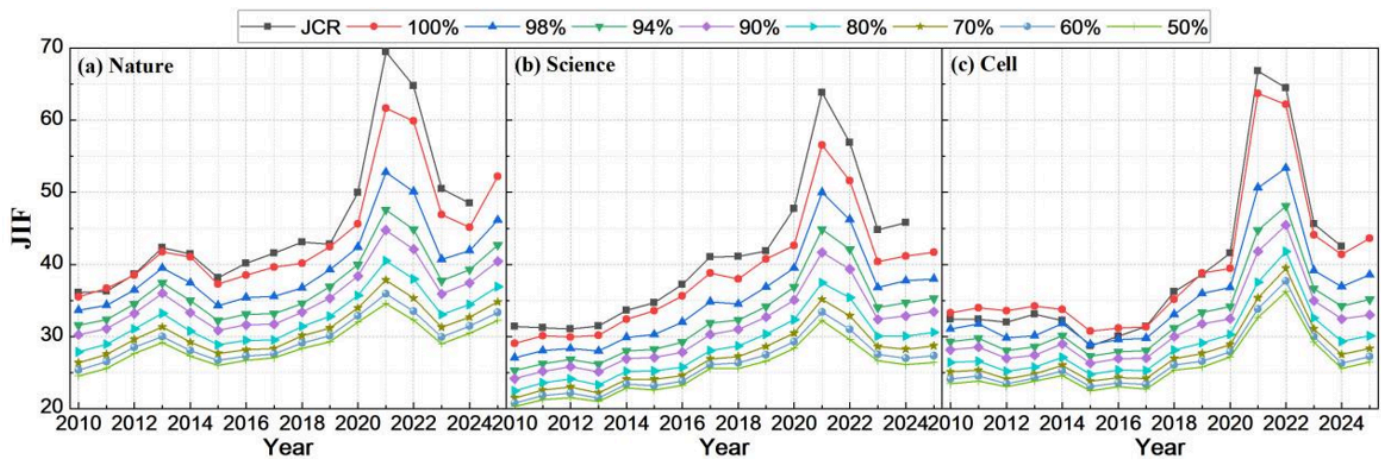


Figure 1

JIF changes of three journals since 2010. Note that the percentage of statistical documents is shown in the figure, the same below.

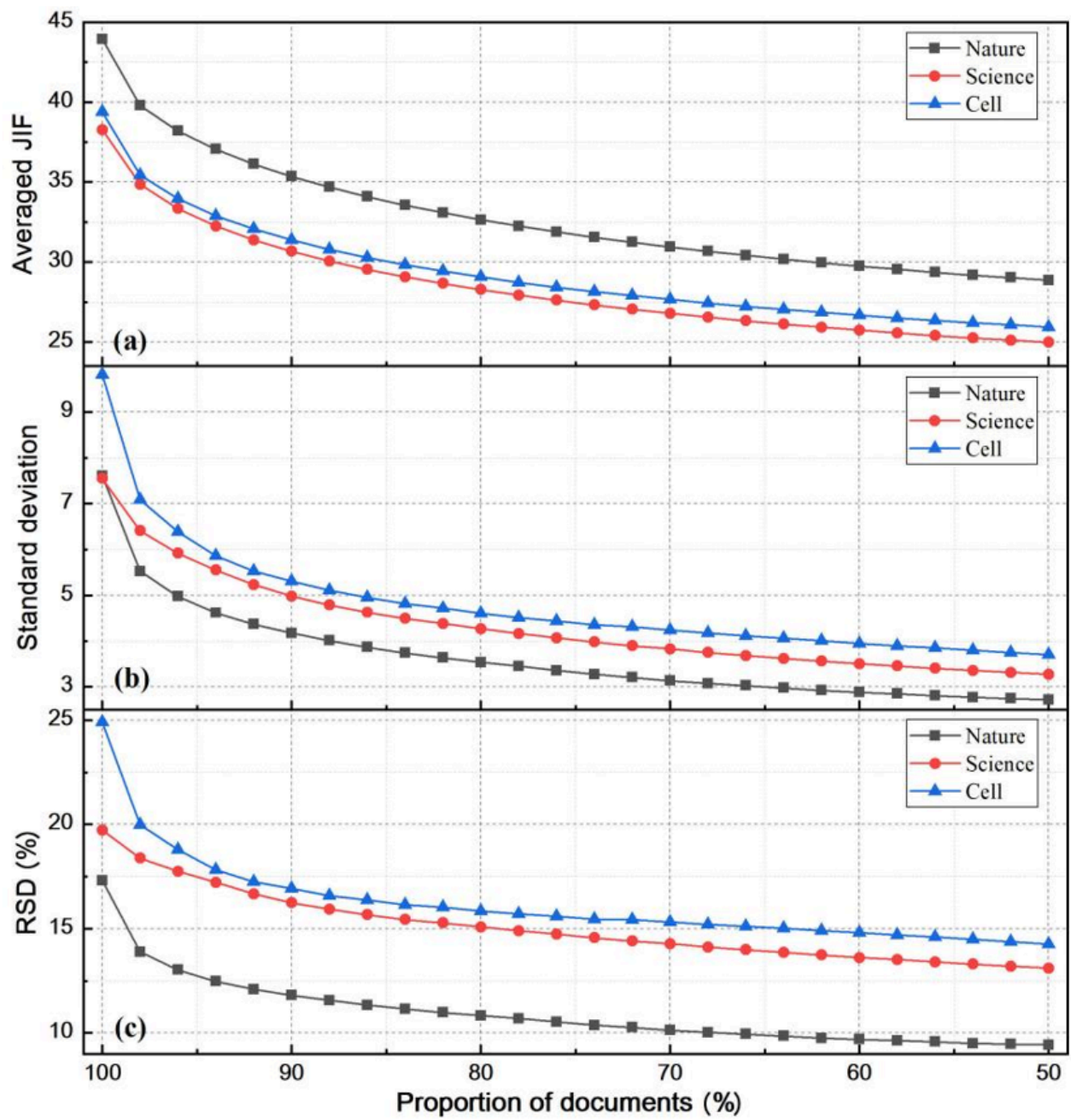


Figure 2

Dependence of averaged JIFs (a), their standard deviation (b), and relative standard deviation (c) on the proportion of documents.

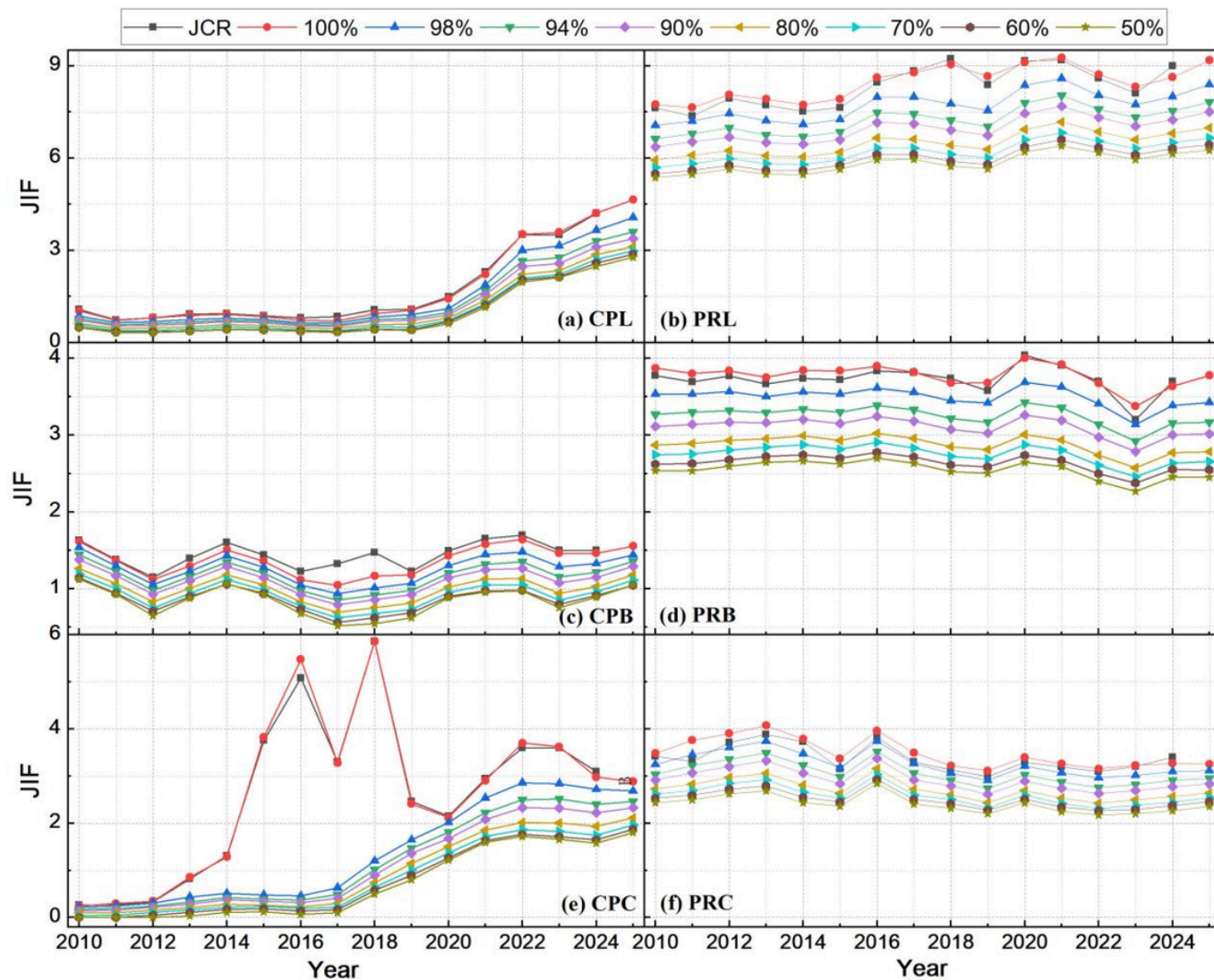


Figure 3

JIF evolution of six physical journals with the proportion of documents.

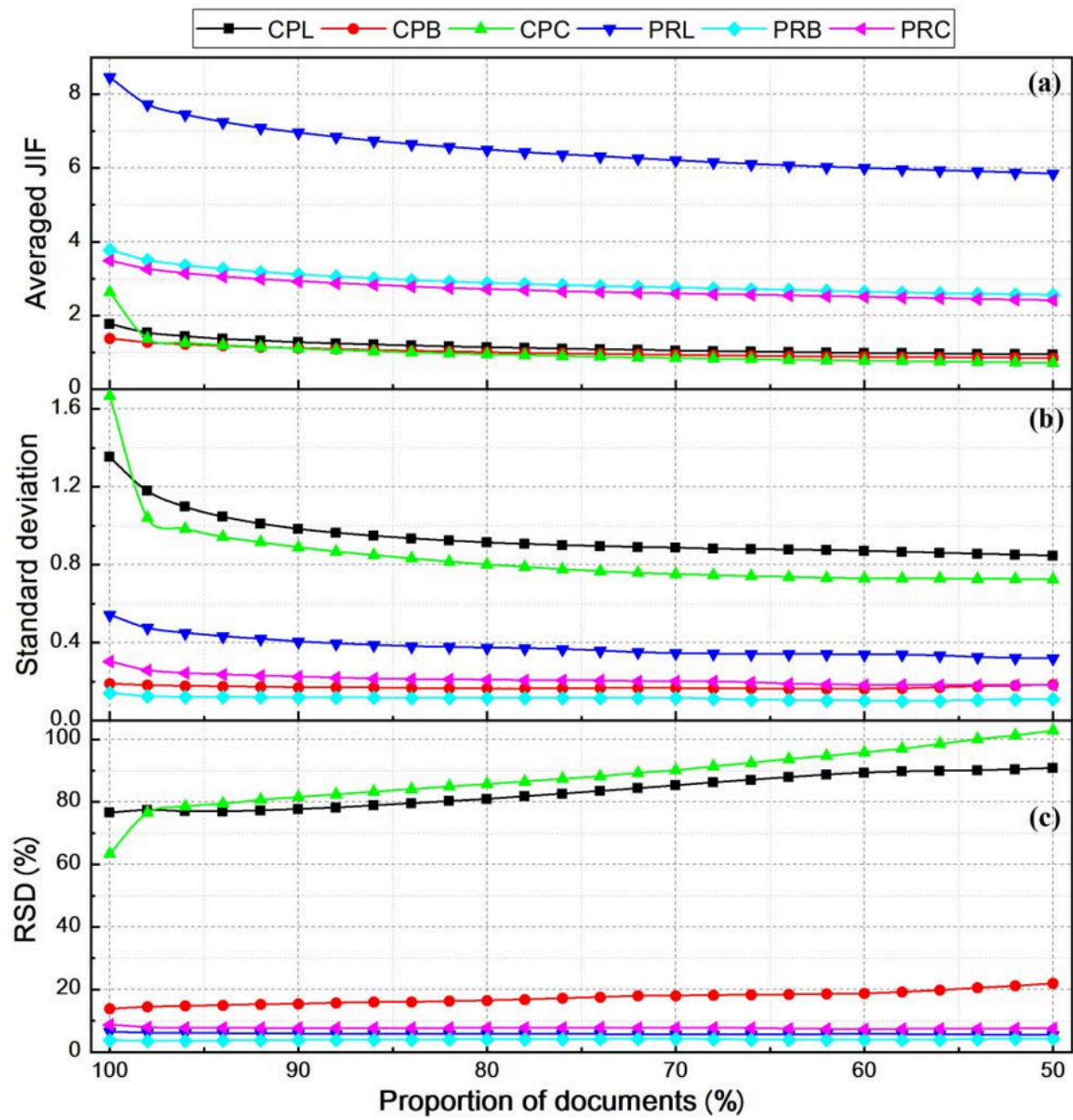


Figure 4

Dependence of averaged JIFs (a), their standard deviation (b), and relative standard deviation (c) on the proportion of documents.

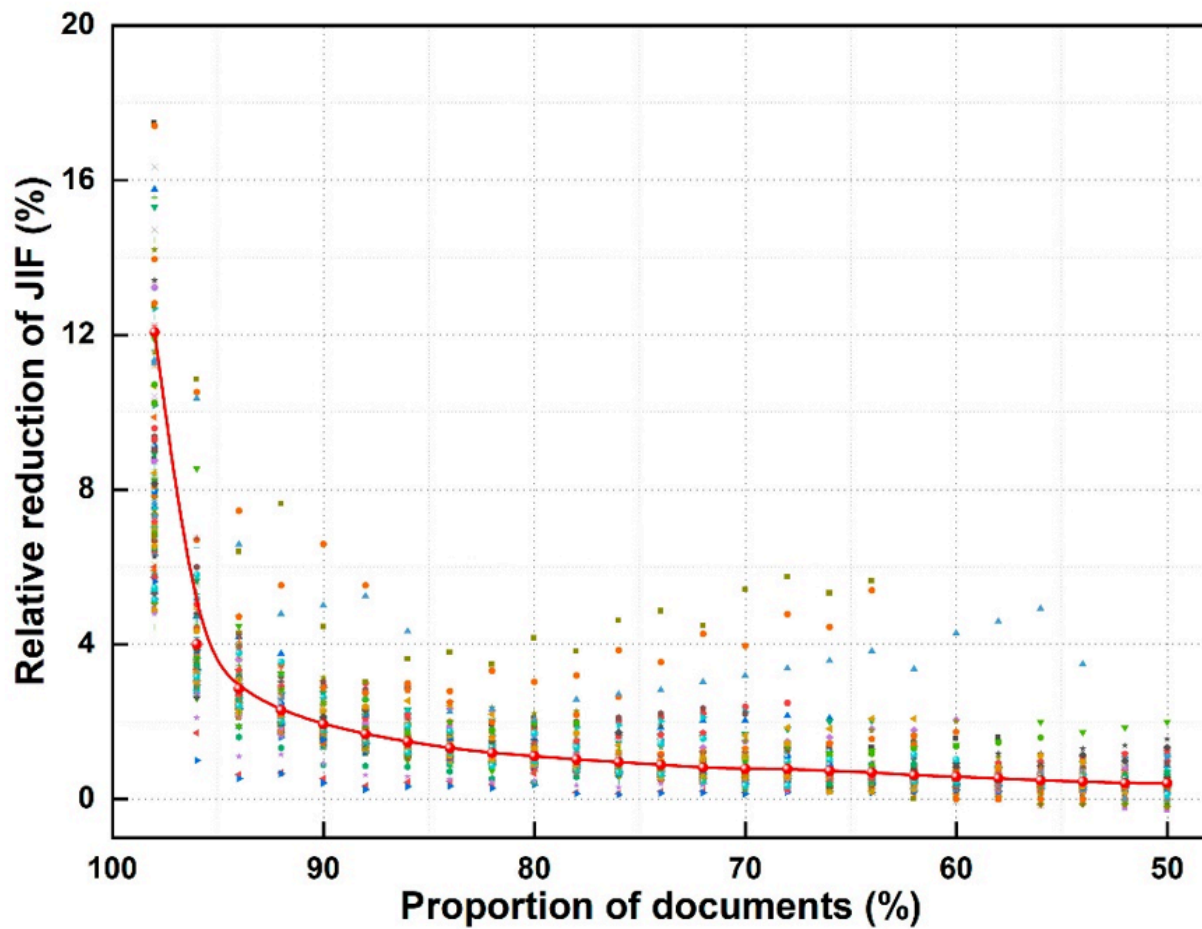


Figure 5

Relationship between the relative reduction of JIF and the proportion of statistical documents. Scatter points represent the calculated data, and the solid line is a nonlinear fitting curve. Red sphere denotes the averaged value of all relative reduction of JIFs at the fixed proportion of documents.