Computers and Geosciences 115 (2018) iii–iv

Contents lists available at ScienceDirect

Computers and Geosciences

journal homepage: www.elsevier.com/locate/cageo

Who cares about impact factor?

The Impact Factor of Computers & Geosciences has again increased this year. This is generally seen as a positive result – but should we be happy about it? Many people are involved in the life of a journal, and not all have the same interests or incentives. A metric like the Impact Factor is unlikely to mean the same thing for everyone.

Before going into details, let's clarify the definition of the Impact Factor (IF). It is calculated as the average number of citations gathered by all articles published in the previous two consecutive years. For year y, the IF is:

$$IF_y = \frac{C_y(y-1) + C_y(y-2)}{n_{y-1} + n_{y-2}},$$

where $C_y(y\text{-}1)$ is the total number of citations gathered during year y by papers published in year $y\text{-}1$, and n_y is the number of articles published in year y. The IF is a measure of how many citations are received, on average, by the articles published in a given journal. It is thus an aggregate metric that pools together all papers published in a two-years period. In the case of Computers & Geosciences, it means that over 400 articles are involved in the calculation of a single IF, thus hiding the value (or defects) of any extremely good (or poor) scientific paper.

Typically, publishers should care about IF because it informs about the financial viability of a journal. Since there is a cost associated with the publication of each paper, a low IF means that, on average, there are less citations, thus less visibility and less financial returns per paper.

To some extent, editors should also care because a declining IF is a sign that, on average, published manuscripts are less cited. However, changes in IF should be analyzed in the light of the overall editorial strategy. For example, a decision to narrow the scope of a journal can result in a decrease in IF, while at the same time increasing the scientific relevance of the published science. Similarly, publishing review articles is known to increase the IF without adding new knowledge (notwithstanding the undeniable need for good quality review papers). In some cases, the IF is seen is an indication of the strength of the peer-review process of a journal, which is the business of the editors. However, this may or may not be the case, as a same scientist reviews manuscripts for a number of journals, raising doubts about a possible causality link between IF and peer-review quality.

For authors however, the only information conveyed by IF is that of the aggregated score of the other papers published in the same period. Furthermore, aggregation results in biases. In particular for interdisciplinary journals such as Computers & Geosciences, the published papers relate to very different fields, each field having citations proportional to the size of the attached community and writing tradition. In some fields researchers publish very frequently, in others they typically have long reference lists, or have many contributing authors: all factors that affect the citation count of a given paper. Aggregated metrics do not capture the resulting heterogeneity in citations count. This is illustrated by Fig. 1, which represents the distribution of the number of citations received by papers published in Computers & Geosciences during the period 2000–2017. Each whisker plot corresponds to a year, and the years are ranked by increasing IF of the journal. Some papers have received up to an average of 70 citations per year: these are worthy contributions and the authors of these pieces deserve credit. However, it should be noted that the occurrence of such highly cited papers is not correlated with the IF of the journal. A single number is not appropriate to describe the skewed distribution of the number of citations. Aggregated metrics like the IF only describe the central box of each whisker, and are thus highly non-informative regarding the impact of individual papers submitted to the journal.

These effects are known and have been described (see for example Benedictus et al., 2016; Callaway, 2016; Vanclay, 2012; Verma, 2015). Some initiatives have been proposed by groups of scientists to make a point that the scientific value of an article does not depend on the ranking of the journal where it is published. Prime examples are the DORA agreement (the San Francisco Declaration on Research Assessment, https://sfdora.org/read) or the Leiden Manifesto for Research Metrics (http://www.leidenmanifesto.org). The DORA agreement has been signed by over 10′000 scientists, including a number of editors, publishers and heads of universities. One of their recommendations is to "Encourage responsible authorship practices and the provision of information about the specific contributions of each author". Computers & Geosciences subscribes to this principle and since 2018 makes it compulsory to provide an author contribution statement for each multi-authored submission.

From a strict scientific point of view, the IF should in principle not matter for authors. However in practice, incentives are put in place for encouraging authors to submit their work in high-IF journals. For example in Australia, the *ERA Ranked Outlets* is a list of journals released by the main research funding body. It provides the names of the journals where publications will influence decisions such as the attribution of funding or the hiring and promotion of staff. Typically, a requirement for a journal to be included in this list is that metrics, such as the IF (or alternative aggregated metrics such as the SNIP), are above a given threshold. More generally, academic appointments, tenure decisions, the award of scholarships, and more generally the value of a Curriculum Vitae in academia, are often driven by the ranking of the journals where a scientist publishes. This trend is worrying because it goes against the encouragement of good scientists and the production of good science, such as highly cited papers published in Computers & Geosciences when

https://doi.org/10.1016/S0098-3004(18)30374-1

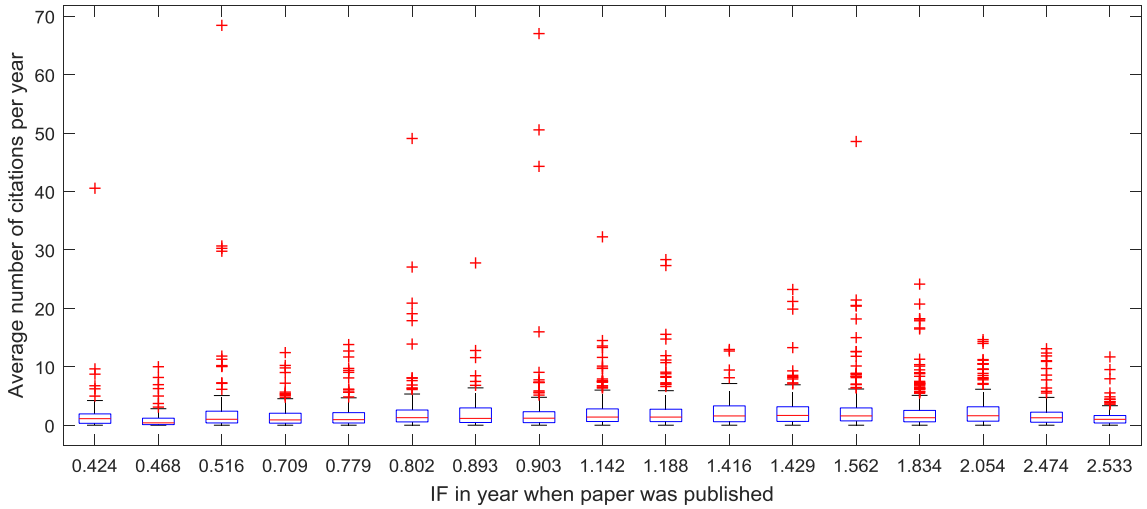

Fig. 1. Distribution of the average annual citation count as a function of IF in the year when a paper was published. Only papers published in Computers & Geosciences during the period 2000–2017 are considered, representing a population of about 200 papers per years, for a total of 3165 papers.

it had an IF of 0.5.

For this situation to change, it is the deans of Universities and the board members of funding agencies who should care about IF and learn what it really means. First of all, they should be aware that it can be a tool to rate journals (however imperfect and biased), but definitely not a tool to evaluate papers or individual scientists.

References

Benedictus, R., Miedema, F., Freguson, M., 2016. Fewer numbers, better science. Nature 538 (7626), 453–455.

Callaway, E., 2016. Beat it, impact factor! Publishing elite turns against controversial metric. Nature 535 (7611), 210–211.

Vanclay, J., 2012. Impact factor: outdated artefact or stepping-stone to journal certification? Scientometrics 92 (2), 211–238.

Verma, I., 2015. Impact, not impact factor. Proc. Natl. Acad. Sci. Unit. States Am. 112 (26), 7875–7876.

Gregoire Mariethoz*
University of Lausanne, Faculty of Geosciences and Environment, Institute of Earth Surface Dynamics, Lausanne, Switzerland

Derek Karssenberg
Utrecht University, Faculty of Geosciences, Department of Physical Geography, Utrecht, The Netherlands

Dario Grana
University of Wyoming, Department of Geology and Geophysics, Laramie, WY, USA

* Corresponding author.