

Interactive open access publishing and collaborative peer review for improved scientific communication and quality assurance

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Abstract. The traditional ways of scientific publishing and peer review do not live up to the needs of efficient communication and quality assurance in today's highly diverse and rapidly developing world of science. Therefore, new opportunities for enhanced scientific quality assurance are among the most important advantages and perspectives of open access to scientific publications. Open access gives referees more information to work with; it enables interactive and transparent forms of review and discussion open to all interested members of the scientific community and the public; and it facilitates the development and implementation of new metrics for the impact and quality of scientific publications. The effects and advantages of open access can be efficiently and flexibly combined with the strengths of traditional scientific publishing and peer review. Among the successful initiatives pursuing this approach are the interactive open access journal *Atmospheric Chemistry and Physics* (ACP, www.atmos-chem-phys.net) and a growing number of sister journals published by the European Geosciences Union (EGU, www.egu.eu). They are practicing a two-stage publication process with public peer review and interactive discussion, which has been designed to resolve the dilemma between rapid scientific exchange and thorough quality assurance.

1. Introduction

Recent high profile cases of scientific fraud have fuelled the discussion of scientific quality control. A problem of similar, if not greater, importance is the large proportion of carelessly prepared scientific papers that dilute rather than enhance scientific knowledge. Both problems are indicative of shortcomings in the traditional peer review system, yet many scientists and publishers believe that peer review remains the best available approach for scientific quality assurance. Nevertheless, requests for improvements are commonplace. Among the suggestions are the public exchange of referee comments and author replies [1,2] and public discussion of manuscripts before formal publication [3,4]. We think and demonstrate that these concepts and their advantages can be efficiently combined with the strengths of traditional peer review.

Quality assurance of scientific publications usually proceeds through two pathways: a pre-publication short term assessment by designated referees during the peer review process, and a post-publication long term assessment by the scientific community through comments, citations, review articles and monographs. Both can be combined in a collaborative peer review process where members of the scientific community can participate in the assessment of scientific manuscripts through interactive comments in addition to designated referees' reports.

2. Interactive open access journal concept

This approach is pursued by the open access journal *Atmospheric Chemistry and Physics* (ACP, www.atmos-chem-phys.net) and a growing number of sister journals published by the scientific service provider Copernicus (www.copernicus.org) on behalf of the European Geosciences Union (EGU, www.egu.eu). These journals have a two-stage publication process with public peer review and interactive discussion [5–8]. In the first stage, manuscripts that pass a rapid pre-screening (access review) are immediately published as “discussion papers” on the journal’s website. They are then subject to interactive public discussion for a period of eight weeks, during which the comments of designated referees, additional comments by other interested members of the scientific community, and the authors’ replies are also published alongside the discussion paper. While referees can choose to sign their comments or remain anonymous, comments by other scientists must be signed. In the second stage, manuscript revision and peer review are completed in the same way as in traditional journals (with further rounds of non-public revisions and referee review where required) and, if accepted, final papers are published in the main journal. To provide a lasting record of review and to secure the authors’ publication precedence, every discussion paper and interactive comment remains permanently archived and individually citable.

3. *Atmospheric Chemistry and Physics*

ACP was established in 2001 and now publishes about 500 papers per year. On average, one in four papers receives a comment from the scientific community in addition to the comments from designated referees (in traditional journals this happens for about one in 100 papers). And there are typically 0.5 pages of comments and replies per page of original discussion paper. These cover the full spectrum of opinions – from harsh criticism to open applause – and provide a wealth of additional information and evaluation that is available to everyone.

ACP statistics confirm that collaborative peer review facilitates and enhances quality assurance. The journal has a relatively low overall rejection rate of less than 20%, but only four years after its launch ACP had already reached – and has since then maintained – the highest ISI journal impact factor in the field of “Meteorology and Atmospheric Sciences” (48 journals) and one of the highest in “Environmental Sciences” (144 journals) and “Geosciences, Multidisciplinary” (131 journals) [9]. These numbers support the anticipation that public peer review and interactive discussion deter authors from submitting low quality manuscripts and, thus, relieve editors and referees from spending too much time on deficient submissions.

This is particularly important, because refereeing capacities are the most limited resource in the publication process. While peer review depends crucially on the availability and performance of referees, it has traditionally offered little reward for those providing careful and constructive reviews. In public review, however, referees’ arguments are publicly heard and, if comments are openly signed, referees can also claim authorship for their contribution. Over six years at ACP, we have found that about two-thirds of our referees prefer to remain anonymous. There are, however, interesting differences between sub-disciplines: ~50% of modellers sign their referee comments, while only ~30% of the experimentalists do so. It appears that modellers more often provide suggestions and ideas for which they like to claim authorship as a reward [5–8].

4. Conclusions and outlook

We think that collaborative peer review with a two-stage publication process and interactive public discussion effectively resolves the dilemma between rapid scientific exchange and thorough quality assurance. It has proven to foster scientific discussion, deter submission of sub-standard manuscripts, save refereeing capacities, and enhance information density in final papers. Moreover, it can be flexibly integrated into existing journals as well as large scale publishing systems and repositories (such as arXiv.org) – simply by adding an interactive discussion forum.

In the geosciences, seven sister journals are already successfully practicing the interactive open access journal concept of ACP (*Biogeosciences*, *Climate of the Past*, *e-Earth*, *Geoscientific Model Development*, *Hydrology and Earth System Sciences*, *Ocean Science*, *The Cryosphere*, www.egu.eu), and the launch of further sister journals is foreseen. Moreover, the concept has been adopted by the recently launched journal *Economics*, which is also aimed at top quality papers involves some of that discipline's most prominent institutions and scientists (www.economics-ejournal.org). Modified concepts of public peer review and interactive discussion are pursued by the open access publications *PLoS One* (www.plosone.org) and *Biology Direct* (www.biology-direct.com) in the life sciences.

Overall, open access enables not only the maintenance but substantial improvement of scientific quality assurance, and it provides the basis for efficient usage and augmentation of scientific knowledge in a global information commons [10]. Moreover, public review, discussion, and documentation of the scientific discourse can serve as an example for rational and transparent procedures of settling complex questions, problems, and disputes, i.e. as a model for the further development of the structures, mechanisms, and processes of communication and decision making in society and politics [11,12].

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