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## **Computers & Geosciences**

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## Nurturing a growing field: Computers & Geosciences

Computational issues are becoming increasingly critical for virtually all fields of geoscience. This includes the development of improved algorithms and models, strategies for implementing high-performance computing, or the management and visualization of the large datasets provided by an ever-growing number of environmental sensors. Such issues are central to scientific fields as diverse as geological modeling, Earth observation, geophysics or climatology, to name just a few. Related computational advances, across a range of geoscience disciplines, are the core focus of Computers & Geosciences, which is thus a truly multidisciplinary journal.

From an editorial point of view, a consequence of this relevance to multiple growing fields is that the number of submissions has been increasingly steadily over the last years. To give a few numbers, Computers & Geosciences received 429 submissions in year 2006, 696 submissions in 2011, 831 submissions in 2016, and we expect close to one thousand submissions this year. These increasing numbers are encouraging as they indicate that the journal represents an expanding community. However, they also pose an editorial challenge because all these submissions have to be handled in a timely manner. In addition, the large number of domains covered by the journal means that no single editor has the necessary expertise to confidently overview the revision process of all manuscripts. In 2016-2017, these issues have been addressed by a significant expansion of the Editorial Board, which went from 9 to 24 Associate Editors that are experts in a range of domains relevant to the scope of the journal. As a result of this significant change, the turnover time has drastically reduced. The average time from the initial editorial assignment of a manuscript to the first decision has decreased from 56 days in 2015 to 33 days in 2017

For any journal, an increase in submissions can be seen as an opportunity to either grow the size of the journal (i.e. the number of papers published), or to increase the quality of the published research by raising the bar for manuscripts to be accepted. Computers & Geosciences has taken the second option, with the number of published papers having seen only a moderate rise in the last decade, from 160 papers published in 2006 to 201 papers published in 2016. Inevitably, this has led to a steep hike in the rate of rejected manuscripts. However, a high rejection rate does not mean that the quality of the submitted manuscripts has decreased. Indeed, the most frequent cause for rejection is that many manuscripts do not adequately fit the scope of the journal. The interface between computer science and geoscience is a well-defined domain, and papers that are not at the crossroads of these two disciplines should be submitted to more specialized journals. Indeed, the name "Computers & Geosciences" can give the false impression that any geoscience study using a computer could fit in this journal. However, this title should rather be understood as a contraction of "Computer Science and Geoscience": the focus of this journal is at the intersection of these two domains.

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As editors, one criterion we use for deciding whether a manuscript fits the scope of the journal is that the research has to present a novel aspect of computer science as well as a novel geoscience contribution. This double requirement is quite particular, and many valuable manuscripts unfortunately have to be rejected because one of these aspects is not covered. For example, a manuscript that applies an existing software to model an ore deposit, or a GIS-based analysis of novel data, will likely be desk rejected (i.e. without even being reviewed) as it does not present a significant novel development of the modeling framework. For such a manuscript to be considered, we would require advances such as new algorithms that push the state-of the art, a novel parallelization scheme, or a an improved way of storing, managing or visualizing data. Similarly, even very smart computational advances will not be considered for publications unless they have a clear application in a field of geosciences.

Another aspect, which has been emphasized in the last years, is the transparency regarding computer codes that often accompany papers. For a long time already, authors have been encouraged to put such codes at the disposal of the scientific community using the GitHub platform (https://github.com/cageo/author\_instruc tions). Recently, this encouragement for transparency has been pushed to a requirement, as we now systematically desk reject papers presenting software that is not open-source. For example, a manuscript presenting a new algorithm or methodology and advertising it in a closed source package will be desk rejected. The rationale is that it would be impossible for reviewers and readers to verify the reported results. Open-source code is both a way of ensuring reproducibility and an incentive for the distribution and re-use of research software, which will then be at the disposal of other members of the scientific community, for the greater good of the advancement of science. For each software-accompanied submission, a compulsory software availability section will be requested, detailing how to access the source code, how to use it and who to contact for related inquires.

Transparency is not an issue confined to code distribution, but a general ethic that is necessary for the blossoming of science. Each accepted paper represents a significant investment from the authors, and there should be a clear way of assigning credit proportionally to the contribution of each individual author. In a multidisciplinary area which often involves papers with a long list of authors, the contribution of individual authors can be difficult to decipher. One could argue that the order of authors is an

indication, however one quickly realizes that it is a poor proxy because the practice varies wildly across different disciplines. For example in geology the first author is often a PhD student, the second author is the advisor, and other collaborators are listed subsequently. The practice is different in environmental science, where the advisor is listed as last author. In other cases, several authors can have equally contributed to the research (i.e. co-first authors), however in practice only a single author can appear as first author. In this context, it can be difficult for authors to claim credit for their contribution, especially for younger academics who need to receive credit for career advancement. To palliate this situation. Computers & Geosciences will introduce a compulsory authorship contribution statement with each multi-authored submission, describing the contribution of each co-author. The authorship contribution statement will appear on the first page of the published paper.

The various changes brought to Computers & Geosciences reflect the focus of the journal on a rapidly evolving and multidisciplinary field. We anticipate that change will continue in the future – more global geodatabases, improved efficient models, algorithms and infrastructure to handle these, new data streams generated by improved sensors. Some of the most pressing issues of our time are pure geoscience questions, such as quantifying the effects of climate change, optimizing the use of natural resources or the storage of unwanted products like  $CO_2$  or nuclear waste. Addressing them will require advances in computer science to push the limits of what current geomodels can do. It is therefore clear that the intersection of Computer Science and Geoscience is a fertile place, where much remains to be done.

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