DESCRIPTION

Computer Networks is an international, archival journal providing a publication vehicle for complete coverage of all topics of interest to those involved in the computer communications networking area. The audience includes researchers, managers and operators of networks as well as designers and implementors. The Editorial Board will consider any material for publication that is of interest to those groups.

SUBJECT COVERAGE

The topics covered by the journal but not limited to these are:

1. Communication Network Architectures:
   New design contributions on Local Area Networks (LANs), Metropolitan Area Networks (MANs), Wide Area Networks (WANs) including Wired, Wireless, Mobile, Cellular, Sensor, Optical, IP, ATM, and other related network technologies, as well as new switching technologies and the integration of various networking paradigms.

2. Communication Network Protocols:
   New design contributions on all protocol layers except the Physical Layer, considering all types of networks mentioned above and their performance evaluation; novel protocols, methods and algorithms related to, e.g., medium access control, error control, routing, resource discovery, multicasting, congestion and flow control, scheduling, multimedia quality of service, as well as protocol specification, testing and verification.

3. Network Services and Applications:
   Web, Web caching, Web performance, Middleware and operating system support for all types of networking, electronic commerce, quality of service, new adaptive applications, and multimedia services.

4. Network Security and Privacy:
   Security protocols, authentication, denial of service, anonymity, smartcards, intrusion detection, key management, viruses and other malicious codes, information flow, data integrity, mobile code and agent security.

5. Network Operation and Management:
Including network pricing, network system software, quality of service, signaling protocols, mobility management, power management and power control algorithms, network planning, network dimensioning, network reliability, network performance measurements, network modeling and analysis, and overall system management.

6. **Discrete Algorithms** and **Discrete Modeling**
Algorithmic and discrete aspects in the context of computer networking as well as mobile and wireless computing and communications. Fostering cooperation among practitioners and theoreticians in this field.

**TYPES OF CONTRIBUTIONS CONSIDERED**

The primary purpose of the journal is to publish original and complete papers covering a specific topic or project in the above mentioned areas in sufficient detail and depth to be of practical use to interested readers. The readers should benefit from the novel solutions and analyses presented in the papers. Enhanced, extended versions of quality papers presented at conferences or workshops can be submitted to our journal for review. Note that papers which were already published with the same contents or simultaneous submission of the same paper to other journals or conferences will not be considered for publication in our journal and will be immediately rejected.

**Dataset Articles.** Computer Networks also publishes *micro-articles* that describe open datasets available in a redacted and organized way. The purpose is for researchers to easily share and reuse each other's datasets by publishing data articles that:

(i) Describe collected data in detail, facilitating reproducibility of experiments and improvements over proposed techniques, thus promoting rigorous experimentation and data analysis.
(ii) Describe tools developed to collect, analyze, and visualize data.

**Open-Source Software Articles.** Computer Networks additionally publishes micro-articles that describe open source software that has been used to obtain scholarly results in the area of computer networks. This may include articles describing discrete-event or other simulators, emulation tools, software implementations of networking and communication functionalities and protocols, standard implementations, monitoring tools, among others.

**AUDIENCE**

Managers and Operators of Networks as well as Designers, Implementors, Researchers, Regulatory Lawyers, Economists, Policy Analysts and Sociologists specializing in the area.

**IMPACT FACTOR**

2018: 3.030 © Clarivate Analytics Journal Citation Reports 2019

**ABSTRACTING AND INDEXING**

ABI/Inform
Science Citation Index Expanded
INSPEC
Ei Compendex
Pascal Francis
Inside Conferences
Information Science & Technology Abstracts
Scopus

**EDITORIAL BOARD**

*Editors-in-Chief*
Tommaso Melodia, Northeastern University, United States
Antonio Iera, University of Calabria, Italy
Editors Emeriti
Philip Enslow Jr.
Ian Akyildiz
Harry Rudin
Burkhard Stiller

Editorial Board
Marco Ajmone Marsan, Polytechnic of Turin, Turin, Italy
George C. Alexandropoulos, National and Kapodistrian University of Athens, Athens, Greece
Angelos Antonopoulos, Catalonia Technological Centre of Telecommunications, Barcelona, Spain
Hassan Artail, American University of Beirut, Beirut, Lebanon
Chadi Barakat, Inria Sophia Antipolis Mediterranean Research Centre, Sophia Antipolis, France
Nicola Blefari Melazzi, University of Rome Tor Vergata, Roma, Italy
Joseph Camp, Southern Methodist University, Dallas, Texas, United States
Claudia Campolo, University of Reggio Calabria, Reggio, Italy
Berk Canberk, Istanbul Technical University, Istanbul, Turkey
Xiaojun Cao, Georgia State University Department of Computer Information Systems, Atlanta, Georgia, United States
Kaushik R. Chowdhury, Northeastern University, Boston, Massachusetts, United States
Tomaso de Cola, German Aerospace Center DLR Oberpfaffenhofen Site, Oberpfaffenhofen-Wessling, Germany
Mauro Conti, University of Padua, Padova, Italy
Marilía Curado, University of Coimbra, Coimbra, Portugal
Nelson Luis Saldanha Da Fonseca, State University of Campinas, Campinas, São Paulo, Brazil
Zaher Dawy, American University of Beirut, Beirut, Lebanon
Roberto Di Pietro, Hamad Bin Khalifa University College of Science and Engineering, Doha, Qatar
David Eckhoff, TUMCREATE Limited, Singapore, Singapore
Ilario Filippini, Polytechnic of Milan, Milano, Italy
Luoyi Fu, Shanghai Jiao Tong University, Shanghai, China
Carol Fung, Virginia Commonwealth University, Richmond, Virginia, United States
Laura Gallicchio, University of Catania, Catania, Italy
Ivan Ganchev, University of Limerick, Limerick, Ireland and University of Plovdiv “Paisii Hilendarski”, Plovdiv, Bulgaria
Wolfgang Gerstacker, Friedrich-Alexander University Erlangen-Nuremberg, Erlangen, Germany
Domenico Giustiniano, IMDEA Networks, Leganes, Spain
Maria Gorlatova, Duke University, Durham, North Carolina, United States
Zhangyu Guan, University at Buffalo - The State University of New York, Buffalo, New York, United States
Mohan Gurusamy, National University of Singapore, Singapore, Singapore
Ibrahim Habib, City University of New York, New York, New York, United States
Stratis Ioannidis, Northeastern University, Boston, Massachusetts, United States
Carlee Joe-Wong, Carnegie Mellon University, Pittsburgh, Pennsylvania, United States
Andreas Kassler, Karlstad University, Karlstad, Sweden
Hyoi Kim, Ulsan National Institute of Science and Technology, Ulsan, Korea, Republic of
Edward Knightly, Rice University, Houston, Texas, United States
Turgay Korkmaz, University of Texas at San Antonio, San Antonio, Texas, United States
Thomas Lagkas, The University of Sheffield International Faculty CITY College Thessaloniki, Thessaloniki, Greece
Kyunghan Lee, Ulsan National University of Science and Technology and Department of Electronics and Communication Engineering, Ulsan, Korea, Republic of
Albert Levi, Sabanci University, Res. And Graduate Policy, School of Management, Istanbul, Turkey
Marco Levorato, University of California Irvine, Irvine, California, United States
Zexian Li, Nokia Bell Labs Espoo, Espoo, Finland
Phone Lin, National Taiwan University, Taipei, Taiwan
Y.-D. Ying-Dar Lin, National Chiao Tung University, Hsinchu, Taiwan
Valeria Loscri, Inria Lille North France, Villeneuve d'Ascq, France
Cintia B. Margi, University of Sao Paulo, São Paulo, Brazil
Saverio Mascolo, Polytechnic University of Bari, Bari, Italy
Barbara M. Masini, National Research Council Padua Research Area, Padova, Italy
Marco Mellia, Polytechnic of Turin Department of Electronics and Telecommunications, Turin, Italy
Enzo Mingozzi, University of Pisa, Pisa, Italy
Aziz Mohaisen, University of Central Florida Department of Electrical Engineering and Computer Science, Orlando, Florida, United States
Antonella Molinaro, University of Reggio Calabria, Reggio, Italy
Luca Mottola, Polytechnic of Milan, Milano, Italy
Siva Ram C. Murthy, Indian Institute of Technology Madras, Chennai, India
Enrico Natalizio, University of Lorraine, Vandoeuvre-lès-Nancy, France
José Neuman de Souza, Federal University of Ceara, Fortaleza, Ceará, Brazil
Sotiris Nikoletseas, University of Patras, Patras, Greece
GUIDE FOR AUTHORS

Your Paper Your Way
We now differentiate between the requirements for new and revised submissions. You may choose to submit your manuscript as a single Word or PDF file to be used in the refereeing process. Only when your paper is at the revision stage, will you be requested to put your paper in to a 'correct format' for acceptance and provide the items required for the publication of your article.

To find out more, please visit the Preparation section below.

INTRODUCTION
Welcome to the online submission and editorial system for Computer Networks.

Computer Networks is an international, archival journal providing a publication vehicle for complete coverage of all topics of interest to those involved in the computer communications networking area. The audience includes researchers, managers and operators of networks as well as designers and implementors. The Editorial Board will consider for publication any material that is of interest to those groups.

The topics covered by the journal but not limited to these are:

1. Communication Network Architectures
2. Communication Network Protocols
3. Network Services and Applications
4. Network Security and Privacy
5. Network Operation and Management
6. Discrete Algorithms and Discrete Modeling

TYPES OF CONTRIBUTIONS CONSIDERED

The primary purpose of Computer Networks is to publish original and complete research papers covering a specific topic or project in the above-mentioned areas in sufficient detail and depth to be of practical use to interested readers.

Note that papers that were already published with the same content or simultaneous submission of the same paper to other journals or conferences will not be considered for publication in our journal and will be immediately rejected.

Dataset Articles. Computer Networks also publishes micro-articles that describe open datasets available in a redacted and organized way. The purpose is for researchers to easily share and reuse each other's datasets by publishing data articles that:

(i) Describe collected data in detail, facilitating reproducibility of experiments and improvements over proposed techniques, thus promoting rigorous experimentation and data analysis.
(ii) Describe tools developed to collect, analyze, and visualize data.

Open-Source Software Articles. Computer Networks additionally publishes micro-articles that describe open source software that has been used to obtain scholarly results in the area of computer networks. This may include articles describing discrete-event or other simulators, emulation tools, software implementations of networking and communication functionalities and protocols, standard implementations, monitoring tools, among others.

Types of paper

Full Article

Computer Networks publishes original and complete articles covering a specific topic or project in the above-mentioned areas in sufficient detail and depth to be of practical use to interested readers. The readers should benefit from the novel solutions and analyses presented in the papers. Enhanced, extended versions of quality papers presented at conferences or workshops can be submitted to our journal for review.

Micro Article
Computer Networks publishes two types of micro articles

1. Dataset Articles
2. Open-Source Software Articles

1. Dataset Articles

Dataset articles describe datasets made publicly available through a repository. These articles ensure that data, which is often buried in supplementary material, is actively peer-reviewed, curated, formatted, indexed, given a DOI and publicly available to all upon publication. All Dataset Article submissions must contain data produced and owned by either the author or the author's institution. Computer Networks will not accept any submissions that contain datasets with scant variables or samples.

Article Structure

Authors are advised to use our Dataset Article template when preparing their manuscript. All Dataset Articles must contain the following sections:
- title, authors and author affiliations
- abstract
- a completed Specifications Table
- 3-5 bullet points that explain why the data is valuable to other researchers
- a direct link to the deposited data (when applicable)
- a complete description of the experimental design and materials and methods
- description of tools developed to obtain, manipulate, and analyze the data
- references

How to Submit your Data Article

To submit a Data article, fill in this template. Submit the document along with well-documented code needed to analyze the data through the journal's online submission system. Important: choose 'Dataset Article' as the article type when submitting your paper.

2. Open-Source Software Articles

Open-Source software articles describe software tools for designing and/or evaluating the performance of computer networks and systems that have already been used in research with the outputs published in at least one scholarly, peer-reviewed article. This may include articles describing discrete-event or other simulators, emulation tools, software implementations of networking and communication functionalities, protocol standards, monitoring tools, among others.

Article Structure

We ask all authors to use our Open-Source Software Article template when preparing their manuscript. All Open-Source Software Articles must contain a short descriptive paper including an Impact Overview and references to publications where the software has been used and an open source software distribution with support material. The software must adhere to a recognized legal license, such as 'OSP approved licenses'. All software articles published in Computer Networks are hosted on a repository on GitHub. A copy of the 'accepted for publication' version of software/code will be copied to the journal's GitHub repository for indexing purposes.

How to Submit your Open-Source Software Article

To submit a software article, fill in this template. Submit the document through the journal's online submission system. Important: choose 'Open-Source Software Article' as the article type when submitting your paper.

Submission checklist

You can use this list to carry out a final check of your submission before you send it to the journal for review. Please check the relevant section in this Guide for Authors for more details.

Ensure that the following items are present:

One author has been designated as the corresponding author with contact details:
• E-mail address
• Full postal address

All necessary files have been uploaded:

**Manuscript:**
• Include keywords
• All figures (include relevant captions)
• All tables (including titles, description, footnotes)
• Ensure all figure and table citations in the text match the files provided
• Indicate clearly if color should be used for any figures in print

**Graphical Abstracts / Highlights files** (where applicable)

**Supplemental files** (where applicable)

Further considerations
• Manuscript has been 'spell checked' and 'grammar checked'
• All references mentioned in the Reference List are cited in the text, and vice versa
• Permission has been obtained for use of copyrighted material from other sources (including the Internet)
• A competing interests statement is provided, even if the authors have no competing interests to declare
• Journal policies detailed in this guide have been reviewed
• Referee suggestions and contact details provided, based on journal requirements

For further information, visit our [Support Center](www.elsevier.com/locate/comnet).

**BEFORE YOU BEGIN**

**Ethics in publishing**
Please see our information pages on [Ethics in publishing](www.elsevier.com/locate/comnet) and [Ethical guidelines for journal publication](www.elsevier.com/locate/comnet).

**Studies in humans and animals**
If the work involves the use of human subjects, the author should ensure that the work described has been carried out in accordance with [The Code of Ethics of the World Medical Association](www.elsevier.com/locate/comnet) (Declaration of Helsinki) for experiments involving humans. The manuscript should be in line with the [Recommendations for the Conduct, Reporting, Editing and Publication of Scholarly Work in Medical Journals](www.elsevier.com/locate/comnet) and aim for the inclusion of representative human populations (sex, age and ethnicity) as per those recommendations. The terms **sex** and **gender** should be used correctly.

Authors should include a statement in the manuscript that informed consent was obtained for experimentation with human subjects. The privacy rights of human subjects must always be observed.

All animal experiments should comply with the [ARRIVE guidelines](www.elsevier.com/locate/comnet) and should be carried out in accordance with the U.K. Animals (Scientific Procedures) Act, 1986 and associated guidelines, [EU Directive 2010/63/EU for animal experiments](www.elsevier.com/locate/comnet), or the National Institutes of Health guide for the care and use of Laboratory animals (NIH Publications No. 8023, revised 1978) and the authors should clearly indicate in the manuscript that such guidelines have been followed. The sex of animals must be indicated, and where appropriate, the influence (or association) of sex on the results of the study.

**Declaration of interest**
All authors must disclose any financial and personal relationships with other people or organizations that could inappropriately influence (bias) their work. Examples of potential conflicts of interest include employment, consultancies, stock ownership, honoraria, paid expert testimony, patent applications/registrations, and grants or other funding. Authors should complete the declaration of interest statement using [this template](www.elsevier.com/locate/comnet) and upload to the submission system at the Attach/Upload Files step. If there are no interests to declare, please choose: 'Declarations of interest: none' in the template. This statement will be published within the article if accepted. [More information](www.elsevier.com/locate/comnet).

**Submission declaration and verification**
Submission of an article implies that the work described has not been published previously (except in the form of an abstract, a published lecture or academic thesis, see 'Multiple, redundant or concurrent publication' for more information), that it is not under consideration for publication elsewhere, that its publication is approved by all authors and tacitly or explicitly by the responsible authorities where
the work was carried out, and that, if accepted, it will not be published elsewhere in the same form, in English or in any other language, including electronically without the written consent of the copyright-holder. To verify originality, your article may be checked by the originality detection service Crossref Similarity Check.

Preprints
Please note that preprints can be shared anywhere at any time, in line with Elsevier's sharing policy. Sharing your preprints e.g. on a preprint server will not count as prior publication (see 'Multiple, redundant or concurrent publication' for more information).

Use of inclusive language
Inclusive language acknowledges diversity, conveys respect to all people, is sensitive to differences, and promotes equal opportunities. Articles should make no assumptions about the beliefs or commitments of any reader, should contain nothing which might imply that one individual is superior to another on the grounds of race, sex, culture or any other characteristic, and should use inclusive language throughout. Authors should ensure that writing is free from bias, for instance by using 'he or she', 'his/her' instead of 'he' or 'his', and by making use of job titles that are free of stereotyping (e.g. 'chairperson' instead of 'chairman' and 'flight attendant' instead of 'stewardess').

Author contributions
For transparency, we encourage authors to submit an author statement file outlining their individual contributions to the paper using the relevant CRediT roles: Conceptualization; Data curation; Formal analysis; Funding acquisition; Investigation; Methodology; Project administration; Resources; Software; Supervision; Validation; Visualization; Roles/Writing - original draft; Writing - review & editing. Authorship statements should be formatted with the names of authors first and CRediT role(s) following. More details and an example

Changes to authorship
Authors are expected to consider carefully the list and order of authors before submitting their manuscript and provide the definitive list of authors at the time of the original submission. Any addition, deletion or rearrangement of author names in the authorship list should be made only before the manuscript has been accepted and only if approved by the journal Editor. To request such a change, the Editor must receive the following from the corresponding author: (a) the reason for the change in author list and (b) written confirmation (e-mail, letter) from all authors that they agree with the addition, removal or rearrangement. In the case of addition or removal of authors, this includes confirmation from the author being added or removed.

Article transfer service
This journal is part of our Article Transfer Service. This means that if the Editor feels your article is more suitable in one of our other participating journals, then you may be asked to consider transferring the article to one of those. If you agree, your article will be transferred automatically on your behalf with no need to reformat. Please note that your article will be reviewed again by the new journal. More information.

Copyright
Upon acceptance of an article, authors will be asked to complete a 'Journal Publishing Agreement' (see more information on this). An e-mail will be sent to the corresponding author confirming receipt of the manuscript together with a 'Journal Publishing Agreement' form or a link to the online version of this agreement.

Subscribers may reproduce tables of contents or prepare lists of articles including abstracts for internal circulation within their institutions. Permission of the Publisher is required for resale or distribution outside the institution and for all other derivative works, including compilations and translations. If excerpts from other copyrighted works are included, the author(s) must obtain written permission from the copyright owners and credit the source(s) in the article. Elsevier has preprinted forms for use by authors in these cases.
For gold open access articles: Upon acceptance of an article, authors will be asked to complete an 'Exclusive License Agreement' (more information). Permitted third party reuse of gold open access articles is determined by the author's choice of user license.

**Author rights**
As an author you (or your employer or institution) have certain rights to reuse your work. More information.

**Elsevier supports responsible sharing**
Find out how you can share your research published in Elsevier journals.

**Role of the funding source**
You are requested to identify who provided financial support for the conduct of the research and/or preparation of the article and to briefly describe the role of the sponsor(s), if any, in study design; in the collection, analysis and interpretation of data; in the writing of the report; and in the decision to submit the article for publication. If the funding source(s) had no such involvement then this should be stated.

**Open access**
Please visit our Open Access page from the Journal Homepage for more information.

**Elsevier Researcher Academy**
Researcher Academy is a free e-learning platform designed to support early and mid-career researchers throughout their research journey. The "Learn" environment at Researcher Academy offers several interactive modules, webinars, downloadable guides and resources to guide you through the process of writing for research and going through peer review. Feel free to use these free resources to improve your submission and navigate the publication process with ease.

**Language (usage and editing services)**
Please write your text in good English (American or British usage is accepted, but not a mixture of these). Authors who feel their English language manuscript may require editing to eliminate possible grammatical or spelling errors and to conform to correct scientific English may wish to use the English Language Editing service available from Elsevier's Author Services.

**Submission**
Our online submission system guides you stepwise through the process of entering your article details and uploading your files. The system converts your article files to a single PDF file used in the peer-review process. Editable files (e.g., Word, LaTeX) are required to typeset your article for final publication. All correspondence, including notification of the Editor's decision and requests for revision, is sent by e-mail.

**Submit your article**
Please submit your article via http://ees.elsevier.com/comnet/

**Referees**
Please submit the names and institutional e-mail addresses of several potential referees. For more details, visit our Support site. Note that the editor retains the sole right to decide whether or not the suggested reviewers are used.

**PREPARATION**

**NEW SUBMISSIONS**
Submission to this journal proceeds totally online and you will be guided stepwise through the creation and uploading of your files. The system automatically converts your files to a single PDF file, which is used in the peer-review process. 
As part of the Your Paper Your Way service, you may choose to submit your manuscript as a single file to be used in the refereeing process. This can be a PDF file or a Word document, in any format or layout that can be used by referees to evaluate your manuscript. It should contain high enough quality figures for refereeing. If you prefer to do so, you may still provide all or some of the source files at the initial submission. Please note that individual figure files larger than 10 MB must be uploaded separately.

**References**
There are no strict requirements on reference formatting at submission. References can be in any style or format as long as the style is consistent. Where applicable, author(s) name(s), journal title/book title, chapter title/article title, year of publication, volume number/book chapter and the article
number or pagination must be present. Use of DOI is highly encouraged. The reference style used by
the journal will be applied to the accepted article by Elsevier at the proof stage. Note that missing
data will be highlighted at proof stage for the author to correct.

Formatting requirements
There are no strict formatting requirements but all manuscripts must contain the essential elements
needed to convey your manuscript, for example Abstract, Keywords, Introduction, Materials and
Methods, Results, Conclusions, Artwork and Tables with Captions.
If your article includes any Videos and/or other Supplementary material, this should be included in
your initial submission for peer review purposes.
Divide the article into clearly defined sections.

Figures and tables embedded in text
Please ensure the figures and the tables included in the single file are placed next to the relevant text
in the manuscript, rather than at the bottom or the top of the file. The corresponding caption should
be placed directly below the figure or table.

Peer review
This journal operates a single blind review process. All contributions will be initially assessed by the
editor for suitability for the journal. Papers deemed suitable are then typically sent to a minimum of
two independent expert reviewers to assess the scientific quality of the paper. The Editor is responsible
for the final decision regarding acceptance or rejection of articles. The Editor’s decision is final. More
information on types of peer review.

REVISED SUBMISSIONS
Use of word processing software
Regardless of the file format of the original submission, at revision you must provide us with an
editable file of the entire article. Keep the layout of the text as simple as possible. Most formatting
codes will be removed and replaced on processing the article. The electronic text should be prepared
in a way very similar to that of conventional manuscripts (see also the Guide to Publishing with Elsevier).
See also the section on Electronic artwork.
To avoid unnecessary errors you are strongly advised to use the 'spell-check' and 'grammar-check'
functions of your word processor.

LaTeX
You are recommended to use the Elsevier article class elsarticle.cls to prepare your manuscript and
BibTeX to generate your bibliography.
Our LaTeX site has detailed submission instructions, templates and other information.

Article structure
Subdivision - numbered sections
Divide your article into clearly defined and numbered sections. Subsections should be numbered
1.1 (then 1.1.1, 1.1.2, …), 1.2, etc. (the abstract is not included in section numbering). Use this
numbering also for internal cross-referencing: do not just refer to 'the text'. Any subsection may be
given a brief heading. Each heading should appear on its own separate line.

Introduction
State the objectives of the work and provide an adequate background, avoiding a detailed literature
survey or a summary of the results.

Material and methods
Provide sufficient details to allow the work to be reproduced by an independent researcher. Methods
that are already published should be summarized, and indicated by a reference. If quoting directly
from a previously published method, use quotation marks and also cite the source. Any modifications
to existing methods should also be described.

Conclusions
The main conclusions of the study may be presented in a short Conclusions section, which may stand
alone or form a subsection of a Discussion or Results and Discussion section.

Vitae
Submit a short (maximum 100 words) biography of each author, along with a passport-type
photograph accompanying the other figures. Please provide the biography in an editable format (e.g.
Word), not in PDF format.
Essential title page information

• Title. Concise and informative. Titles are often used in information-retrieval systems. Avoid abbreviations and formulae where possible.

• Author names and affiliations. Please clearly indicate the given name(s) and family name(s) of each author and check that all names are accurately spelled. You can add your name between parentheses in your own script behind the English transliteration. Present the authors' affiliation addresses (where the actual work was done) below the names. Indicate all affiliations with a lower-case superscript letter immediately after the author's name and in front of the appropriate address. Provide the full postal address of each affiliation, including the country name and, if available, the e-mail address of each author.

• Corresponding author. Clearly indicate who will handle correspondence at all stages of refereeing and publication, also post-publication. This responsibility includes answering any future queries about Methodology and Materials. Ensure that the e-mail address is given and that contact details are kept up to date by the corresponding author.

• Present/permanent address. If an author has moved since the work described in the article was done, or was visiting at the time, a 'Present address' (or 'Permanent address') may be indicated as a footnote to that author's name. The address at which the author actually did the work must be retained as the main, affiliation address. Superscript Arabic numerals are used for such footnotes.

Highlights

Highlights are optional yet highly encouraged for this journal, as they increase the discoverability of your article via search engines. They consist of a short collection of bullet points that capture the novel results of your research as well as new methods that were used during the study (if any). Please have a look at the examples here: example Highlights.

Highlights should be submitted in a separate editable file in the online submission system. Please use 'Highlights' in the file name and include 3 to 5 bullet points (maximum 85 characters, including spaces, per bullet point).

Abstract

A concise and factual abstract is required. The abstract should state briefly the purpose of the research, the principal results and major conclusions. An abstract is often presented separately from the article, so it must be able to stand alone. For this reason, References should be avoided, but if essential, then cite the author(s) and year(s). Also, non-standard or uncommon abbreviations should be avoided, but if essential they must be defined at their first mention in the abstract itself.

Graphical abstract

Although a graphical abstract is optional, its use is encouraged as it draws more attention to the online article. The graphical abstract should summarize the contents of the article in a concise, pictorial form designed to capture the attention of a wide readership. Graphical abstracts should be submitted as a separate file in the online submission system. Image size: Please provide an image with a minimum of 531 × 1328 pixels (h × w) or proportionally more. The image should be readable at a size of 5 × 13 cm using a regular screen resolution of 96 dpi. Preferred file types: TIFF, EPS, PDF or MS Office files. You can view Example Graphical Abstracts on our information site. Authors can make use of Elsevier's Illustration Services to ensure the best presentation of their images and in accordance with all technical requirements.

Keywords

Immediately after the abstract, provide a maximum of 6 keywords, using American spelling and avoiding general and plural terms and multiple concepts (avoid, for example, 'and', 'of'). Be sparing with abbreviations: only abbreviations firmly established in the field may be eligible. These keywords will be used for indexing purposes.

Abbreviations

Define abbreviations that are not standard in this field in a footnote to be placed on the first page of the article. Such abbreviations that are unavoidable in the abstract must be defined at their first mention there, as well as in the footnote. Ensure consistency of abbreviations throughout the article.

Acknowledgements

Collate acknowledgements in a separate section at the end of the article before the references and do not, therefore, include them on the title page, as a footnote to the title or otherwise. List here those individuals who provided help during the research (e.g., providing language help, writing assistance or proof reading the article, etc.).
**Formatting of funding sources**
List funding sources in this standard way to facilitate compliance to funder's requirements:

Funding: This work was supported by the National Institutes of Health [grant numbers xxxx, yyyy]; the Bill & Melinda Gates Foundation, Seattle, WA [grant number zzzz]; and the United States Institutes of Peace [grant number aaaa].

It is not necessary to include detailed descriptions on the program or type of grants and awards. When funding is from a block grant or other resources available to a university, college, or other research institution, submit the name of the institute or organization that provided the funding.

If no funding has been provided for the research, please include the following sentence:

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

**Math formulae**
Please submit math equations as editable text and not as images. Present simple formulae in line with normal text where possible and use the solidus (/) instead of a horizontal line for small fractional terms, e.g., X/Y. In principle, variables are to be presented in italics. Powers of e are often more conveniently denoted by exp. Number consecutively any equations that have to be displayed separately from the text (if referred to explicitly in the text).

**Footnotes**
Footnotes should be used sparingly. Number them consecutively throughout the article. Many word processors build footnotes into the text, and this feature may be used. Should this not be the case, indicate the position of footnotes in the text and present the footnotes themselves separately at the end of the article.

**Artwork**
*Electronic artwork*

**General points**
- Make sure you use uniform lettering and sizing of your original artwork.
- Preferred fonts: Arial (or Helvetica), Times New Roman (or Times), Symbol, Courier.
- Number the illustrations according to their sequence in the text.
- Use a logical naming convention for your artwork files.
- Indicate per figure if it is a single, 1.5 or 2-column fitting image.
- For Word submissions only, you may still provide figures and their captions, and tables within a single file at the revision stage.
- Please note that individual figure files larger than 10 MB must be provided in separate source files.

A detailed [guide on electronic artwork](#) is available.

**You are urged to visit this site; some excerpts from the detailed information are given here.**

**Formats**
Regardless of the application used, when your electronic artwork is finalized, please 'save as' or convert the images to one of the following formats (note the resolution requirements for line drawings, halftones, and line/halftone combinations given below):

- **EPS (or PDF):** Vector drawings. Embed the font or save the text as 'graphics'.
- **TIFF (or JPEG):** Color or grayscale photographs (halftones): always use a minimum of 300 dpi.
- **TIFF (or JPEG):** Bitmapped line drawings: use a minimum of 1000 dpi.
- **TIFF (or JPEG):** Combinations bitmapped line/halftone (color or grayscale): a minimum of 500 dpi is required.

**Please do not:**
- Supply files that are optimized for screen use (e.g., GIF, BMP, PICT, WPG); the resolution is too low.
- Supply files that are too low in resolution.
- Submit graphics that are disproportionately large for the content.

**Color artwork**
Please make sure that artwork files are in an acceptable format (TIFF [or JPEG], EPS [or PDF], or MS Office files) and with the correct resolution. If, together with your accepted article, you submit usable color figures then Elsevier will ensure, at no additional charge, that these figures will appear in color online (e.g., ScienceDirect and other sites) regardless of whether or not these illustrations
are reproduced in color in the printed version. **For color reproduction in print, you will receive information regarding the costs from Elsevier after receipt of your accepted article.** Please indicate your preference for color: in print or online only. **Further information on the preparation of electronic artwork.**

**Figure captions**
Ensure that each illustration has a caption. A caption should comprise a brief title (not on the figure itself) and a description of the illustration. Keep text in the illustrations themselves to a minimum but explain all symbols and abbreviations used.

**Text graphics**
Text graphics may be embedded in the text at the appropriate position. If you are working with LaTeX and have such features embedded in the text, these can be left. See further under Electronic artwork.

**Tables**
Please submit tables as editable text and not as images. Tables can be placed either next to the relevant text in the article, or on separate page(s) at the end. Number tables consecutively in accordance with their appearance in the text and place any table notes below the table body. Be sparing in the use of tables and ensure that the data presented in them do not duplicate results described elsewhere in the article. Please avoid using vertical rules and shading in table cells.

**References**

*Citation in text*
Please ensure that every reference cited in the text is also present in the reference list (and vice versa). Any references cited in the abstract must be given in full. Unpublished results and personal communications are not recommended in the reference list, but may be mentioned in the text. If these references are included in the reference list they should follow the standard reference style of the journal and should include a substitution of the publication date with either 'Unpublished results' or 'Personal communication'. Citation of a reference as 'in press' implies that the item has been accepted for publication.

*Reference links*
Increased discoverability of research and high quality peer review are ensured by online links to the sources cited. In order to allow us to create links to abstracting and indexing services, such as Scopus, CrossRef and PubMed, please ensure that data provided in the references are correct. Please note that incorrect surnames, journal/book titles, publication year and pagination may prevent link creation. When copying references, please be careful as they may already contain errors. Use of the DOI is highly encouraged.

A DOI is guaranteed never to change, so you can use it as a permanent link to any electronic article. An example of a citation using DOI for an article not yet in an issue is: VanDecar J.C., Russo R.M., James D.E., Ambeh W.B., Franke M. (2003). Aseismic continuation of the Lesser Antilles slab beneath northeastern Venezuela. Journal of Geophysical Research, https://doi.org/10.1029/2001JB000884. Please note the format of such citations should be in the same style as all other references in the paper.

*Web references*
As a minimum, the full URL should be given and the date when the reference was last accessed. Any further information, if known (DOI, author names, dates, reference to a source publication, etc.), should also be given. Web references can be listed separately (e.g., after the reference list) under a different heading if desired, or can be included in the reference list.

*Data references*
This journal encourages you to cite underlying or relevant datasets in your manuscript by citing them in your text and including a data reference in your Reference List. Data references should include the following elements: author name(s), dataset title, data repository, version (where available), year, and global persistent identifier. Add [dataset] immediately before the reference so we can properly identify it as a data reference. The [dataset] identifier will not appear in your published article.

*Reference to arXiv*
As with unpublished results and personal communications, references to arXiv documents are not recommended in the reference list. Please make every effort to obtain the full reference of the published version of an arXiv document. If a reference to an arXiv document must be included in
the references list it should follow the standard reference style of the journal and should include a substitution of the volume and page numbers with 'arXiv:YYMM.NNNN' or 'arXiv:archive/YYMMNNN' for articles submitted to arXiv before April 2007.

References in a special issue
Please ensure that the words 'this issue' are added to any references in the list (and any citations in the text) to other articles in the same Special Issue.

Reference management software
Most Elsevier journals have their reference template available in many of the most popular reference management software products. These include all products that support Citation Style Language styles, such as Mendeley. Using citation plug-ins from these products, authors only need to select the appropriate journal template when preparing their article, after which citations and bibliographies will be automatically formatted in the journal’s style. If no template is yet available for this journal, please follow the format of the sample references and citations as shown in this Guide. If you use reference management software, please ensure that you remove all field codes before submitting the electronic manuscript. More information on how to remove field codes from different reference management software.

Users of Mendeley Desktop can easily install the reference style for this journal by clicking the following link:
http://open.mendeley.com/use-citation-style/computer-networks

When preparing your manuscript, you will then be able to select this style using the Mendeley plug-ins for Microsoft Word or LibreOffice.

Reference formatting
There are no strict requirements on reference formatting at submission. References can be in any style or format as long as the style is consistent. Where applicable, author(s) name(s), journal title/book title, chapter title/article title, year of publication, volume number/book chapter and the article number or pagination must be present. Use of DOI is highly encouraged. The reference style used by the journal will be applied to the accepted article by Elsevier at the proof stage. Note that missing data will be highlighted at proof stage for the author to correct. If you do wish to format the references yourself they should be arranged according to the following examples:

Reference style
Text: Indicate references by number(s) in square brackets in line with the text. The actual authors can be referred to, but the reference number(s) must always be given.
Example: '..... as demonstrated [3,6]. Barnaby and Jones [8] obtained a different result ....'
List: Number the references (numbers in square brackets) in the list in the order in which they appear in the text.
Examples:
Reference to a journal publication:
Reference to a journal publication with an article number:
Reference to a book:
Reference to a chapter in an edited book:
Reference to a website:
Reference to a dataset:
**Video**
Elsevier accepts video material and animation sequences to support and enhance your scientific research. Authors who have video or animation files that they wish to submit with their article are strongly encouraged to include links to these within the body of the article. This can be done in the same way as a figure or table by referring to the video or animation content and noting in the body text where it should be placed. All submitted files should be properly labeled so that they directly relate to the video file's content. In order to ensure that your video or animation material is directly usable, please provide the file in one of our recommended file formats with a preferred maximum size of 150 MB per file, 1 GB in total. Video and animation files supplied will be published online in the electronic version of your article in Elsevier Web products, including ScienceDirect. Please supply 'stills' with your files: you can choose any frame from the video or animation or make a separate image. These will be used instead of standard icons and will personalize the link to your video data. For more detailed instructions please visit our video instruction pages. Note: since video and animation cannot be embedded in the print version of the journal, please provide text for both the electronic and the print version for the portions of the article that refer to this content.

**Data visualization**
Include interactive data visualizations in your publication and let your readers interact and engage more closely with your research. Follow the instructions here to find out about available data visualization options and how to include them with your article.

**Supplementary material**
Supplementary material such as applications, images and sound clips, can be published with your article to enhance it. Submitted supplementary items are published exactly as they are received (Excel or PowerPoint files will appear as such online). Please submit your material together with the article and supply a concise, descriptive caption for each supplementary file. If you wish to make changes to supplementary material during any stage of the process, please make sure to provide an updated file. Do not annotate any corrections on a previous version. Please switch off the 'Track Changes' option in Microsoft Office files as these will appear in the published version.

**Research data**
This journal encourages and enables you to share data that supports your research publication where appropriate, and enables you to interlink the data with your published articles. Research data refers to the results of observations or experimentation that validate research findings. To facilitate reproducibility and data reuse, this journal also encourages you to share your software, code, models, algorithms, protocols, methods and other useful materials related to the project.

Below are a number of ways in which you can associate data with your article or make a statement about the availability of your data when submitting your manuscript. If you are sharing data in one of these ways, you are encouraged to cite the data in your manuscript and reference list. Please refer to the "References" section for more information about data citation. For more information on depositing, sharing and using research data and other relevant research materials, visit the research data page.

**Data linking**
If you have made your research data available in a data repository, you can link your article directly to the dataset. Elsevier collaborates with a number of repositories to link articles on ScienceDirect with relevant repositories, giving readers access to underlying data that gives them a better understanding of the research described.

There are different ways to link your datasets to your article. When available, you can directly link your dataset to your article by providing the relevant information in the submission system. For more information, visit the database linking page.

For supported data repositories a repository banner will automatically appear next to your published article on ScienceDirect.

In addition, you can link to relevant data or entities through identifiers within the text of your manuscript, using the following format: Database: xxxx (e.g., TAIR: AT1G01020; CCDC: 734053; PDB: 1XFN).
Mendeley Data
This journal supports Mendeley Data, enabling you to deposit any research data (including raw and processed data, video, code, software, algorithms, protocols, and methods) associated with your manuscript in a free-to-use, open access repository. During the submission process, after uploading your manuscript, you will have the opportunity to upload your relevant datasets directly to Mendeley Data. The datasets will be listed and directly accessible to readers next to your published article online.

For more information, visit the Mendeley Data for journals page.

Data in Brief
You have the option of converting any or all parts of your supplementary or additional raw data into one or multiple data articles, a new kind of article that houses and describes your data. Data articles ensure that your data is actively reviewed, curated, formatted, indexed, given a DOI and publicly available to all upon publication. You are encouraged to submit your article for Data in Brief as an additional item directly alongside the revised version of your manuscript. If your research article is accepted, your data article will automatically be transferred over to Data in Brief where it will be editorially reviewed and published in the open access data journal, Data in Brief. Please note an open access fee of 600 USD is payable for publication in Data in Brief. Full details can be found on the Data in Brief website. Please use this template to write your Data in Brief.

MethodsX
You have the option of converting relevant protocols and methods into one or multiple MethodsX articles, a new kind of article that describes the details of customized research methods. Many researchers spend a significant amount of time on developing methods to fit their specific needs or setting, but often without getting credit for this part of their work. MethodsX, an open access journal, now publishes this information in order to make it searchable, peer reviewed, citable and reproducible. Authors are encouraged to submit their MethodsX article as an additional item directly alongside the revised version of their manuscript. If your research article is accepted, your methods article will automatically be transferred over to MethodsX where it will be editorially reviewed. Please note an open access fee is payable for publication in MethodsX. Full details can be found on the MethodsX website. Please use this template to prepare your MethodsX article.

Data statement
To foster transparency, we encourage you to state the availability of your data in your submission. This may be a requirement of your funding body or institution. If your data is unavailable to access or unsuitable to post, you will have the opportunity to indicate why during the submission process, for example by stating that the research data is confidential. The statement will appear with your published article on ScienceDirect. For more information, visit the Data Statement page.

AFTER ACCEPTANCE

Online proof correction
To ensure a fast publication process of the article, we kindly ask authors to provide us with their proof corrections within two days. Corresponding authors will receive an e-mail with a link to our online proofing system, allowing annotation and correction of proofs online. The environment is similar to MS Word: in addition to editing text, you can also comment on figures/tables and answer questions from the Copy Editor. Web-based proofing provides a faster and less error-prone process by allowing you to directly type your corrections, eliminating the potential introduction of errors. If preferred, you can still choose to annotate and upload your edits on the PDF version. All instructions for proofing will be given in the e-mail we send to authors, including alternative methods to the online version and PDF.

We will do everything possible to get your article published quickly and accurately. Please use this proof only for checking the typesetting, editing, completeness and correctness of the text, tables and figures. Significant changes to the article as accepted for publication will only be considered at this stage with permission from the Editor. It is important to ensure that all corrections are sent back to us in one communication. Please check carefully before replying, as inclusion of any subsequent corrections cannot be guaranteed. Proofreading is solely your responsibility.

Offprints
The corresponding author will, at no cost, receive a customized Share Link providing 50 days free access to the final published version of the article on ScienceDirect. The Share Link can be used for sharing the article via any communication channel, including email and social media. For an extra charge, paper offprints can be ordered via the offprint order form which is sent once the article is
accepted for publication. Both corresponding and co-authors may order offprints at any time via Elsevier's Author Services. Corresponding authors who have published their article gold open access do not receive a Share Link as their final published version of the article is available open access on ScienceDirect and can be shared through the article DOI link.

**AUTHOR INQUIRIES**

Visit the Elsevier Support Center to find the answers you need. Here you will find everything from Frequently Asked Questions to ways to get in touch. You can also check the status of your submitted article or find out when your accepted article will be published.

© Copyright 2018 Elsevier | https://www.elsevier.com