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# Journals with open-discussion forums are excellent educational resources for peer review training exercises

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**Abstract.** Journals with open-discussion forums lend themselves well for peer review exercises to train early career scientists. *Earth System Science Data* (*ESSD*) is an open-access journal for the publication of interdisciplinary datasets and articles, and it is thus an example of an educational resource in the peer review process. We offer our experiences in peer review training with manuscripts submitted to *ESSD*, and we do so from the disparate perspectives of workshop instructor, student, and author. We then provide recommendations for the structure of a peer review workshop. We seek to promote the use of open-discussion forums, including *ESSD*, for educational purposes, as they can provide mutual benefits to trainees, authors, reviewers, and editors.

## 1 Introduction

The peer review process is an integral part of the scientific endeavor, yet most reviewers have no formal training. The learning process may have occurred by observing what reviewers write from experiences as authors or by advice from an advisor. There are resources available from publishers and scientific associations, such as Nature Research's Focus on Peer Review master class (Nature Masterclasses, 2023), American Chemical Society's Reviewer Lab (ACS Reviewer Lab, 2023), and Wiley's Peer Review Training (Wiley, 2023). There are also published articles by researchers describing strategies and tips, like "Learning the Ropes of Peer Reviewing" (Pain, 2008), "How to write a thorough peer review" (Stiller-Reeve, 2018), "'Refereeing Template': A Guide to Writing an Effective Peer Review" (Berlinguette et al., 2021), and "The Golden Rule of Reviewing" (McPeek et al., 2009). Gratifyingly, there is a growing number of outlets to help recognize the reviewers' behind-the-scenes contributions to the peer review process, such as Publons (now Web of Science), and reviewer awards by journals. These resources are great, but structured implementa-

tion of these tips and templates are required to train early career scientists.

Here, we describe a framework to apply this peer-reviewing advice to a workshop for trainees. For instance, instructors can run peer reviewer training workshops within their groups or classrooms to provide formal schooling in this important process. Research outlets like *Earth System Science Data* (*ESSD*), which is an open-access, interactive, peer-reviewed journal for the publication of interdisciplinary data for the advancement of earth science, lend themselves particularly well to teaching the peer review process. Manuscripts are often extensive; therefore, different sections and dataset components can be delegated to different trainees to review. This exercise can lead to a thorough review that is mutually beneficial to trainees, reviewers, editors, and authors.

Authors of data publications benefit from rigorous peer review, especially in an open-access, interactive forum like that of *ESSD*. Published datasets are intended to be used widely, and interactions with potential users help ensure that the products are ready for research and applications. The interactive, public discussion style of peer review can pro-

vide valuable end-user documentation beyond what is included in the final data paper or product metadata. However, a large earth science dataset may be challenging to review adequately within the typical time constraints of a publication outlet.

Since *ESSD* datasets and articles can be extensive, the reviewer benefits from having a team of trainees to evaluate the data and the manuscript. This process ensures a high quality and thorough review, beyond what one senior reviewer could produce. Editors can help facilitate the communication between the authors and the review team of trainees. If this peer review training practice becomes more common, editors can start relying on these group exercises as regular reviewers.

We, the authors of this paper, have collective experience with manuscripts published as preprints in *ESSD* that have been used in peer review training exercises, and we share here our experiences. In the following sections we – Nadine Borduas-Dedekind (NBD), Samuel Carlson (SC), and Karen Short (KS) – describe these experiences from the perspective of instructor, student trainee, and author, respectively. We then offer recommendations for others interested in using open-discussion publishing forums for peer review training exercises.

## 2  Personal perspectives

### Perspective from a workshop instructor (NBD)

I am an assistant professor, and my research group is composed of young researchers new to the peer review process. To help provide transparency to the process of publishing research, I ran a workshop within my research group (2 PhD, 3 MSc, and 2 BSc students) using an *ESSD* manuscript with a large suite of instruments and data (Kremser et al., 2021). The students were enthusiastic about participating, and I was particularly impressed with the quality of the review we wrote as a group. During the review, the students took leadership in evaluating the data, checking databases and code, and asking questions about the operation of different instruments. At the end of the process, our group review was substantially more thorough than a review I could have written on my own. In addition, we included all our names on the review to ensure the students also received credit. The authors' and editor's feedback was excellent. Following our posted reviewer comment, we communicated with the authors and shared the presentation of the overview of the sections of the manuscript. Importantly, the students appreciated the behind-the-scenes look at how a peer review was conducted. I plan to run this exercise again, either using manuscripts I receive for review or articles posted in open-discussion forums. I recommend that authors, reviewers, editors, and readers consider this peer-reviewing practice to help train the next generation of reviewers.

### Perspective from a student (SC)

I gained my first review experience as a participant in a collaborative student review of an *ESSD* manuscript. There were approximately 10 students who participated in a one-credit special-topic class convened for this purpose. It was instructive to learn how to develop constructive criticism of a dataset and of the methods under review. For me, this review process was the first time I had formed my own perspective on the quality and validity of data, methods, or findings, rather than treating all scientific products as beyond reproach. This experience was a key learning milestone in growing into an independent scientist. Contributing to the review thus pushed me to consider assumptions incorporated into the dataset and methods. At the end of the course, the students selected a leader who posted the reviewer comment on the open-discussion forum in their name. Overall, I benefited from the opportunity to participate in the process of science, to test my knowledge of earth science and statistical tools, and to practice creative thinking and technical problem solving.

### Perspective from an author (KS)

As an author of several large geospatial data publications, I have found the group-review assignment to be capable of providing considerably more discussion than a single-party review within the allotted time. My initial *ESSD* submission (Short, 2014) was reviewed by a class of graduate students over a six-week period. As a class assignment, the time was clearly spent putting the dataset of over 1.6 million records through its paces. Feedback included thoughtful comments on topics like data format, accessibility, quality control, and utility that I was able to respond to at length in the interactive comment process. In contrast to typical peer reviewers, who tend to be selected because they are inordinately familiar with the subject matter and data under consideration and therefore tend to keep their reviews relatively "high level," the early career scientist training exercise prompted me to respond in detail to specific questions concerning data quality and to provide usage notes that would benefit the broader user community. From an author's perspective, I recommend having a look at published discussions (Short, 2014; Kremser et al., 2021) from these peer review trainee exercises and how they led to a high quality review of a data paper.

## 3  Peer review training workshop

### Recommendations for training in peer review

We reflect on our respective experiences as an instructor, trainee, and author to offer recommendations for a workshop using open-discussion forums to provide peer review guidance for early career scientists. The workshop could be embedded into a senior undergraduate or graduate course and

count towards credit, or it could be conducted within a research group. The workshop would be suited for a group of 20 participants or less to ensure adequate time for discussion and feedback. The instructor chooses a recently posted discussion paper and plans three to four group interactions around the manuscript. The goal of the primary exercise is to submit an open review comment, reflecting the concerted efforts of the students and compiled by the instructor (who has an account with the open-discussion journal). Throughout the workshop, the students read the manuscript and come together to brainstorm on the merits – or lack thereof – of the science (and data products) presented. We recommend that the instructor provides different tasks for which the trainees can volunteer. Examples of tasks related to peer review for *ESSD* include considerations of data accessibility, data organization, uncertainties, instruments, clarity of the writing, and recency/relevance of references. Students are then responsible individually or in smaller groups to explore sections of the manuscript and generate questions about the data, the data visualization, the data interpretation, etc. One session is then dedicated to presenting these questions to the group and attempting to answer them collectively. When answers cannot be generated within the group, then these questions can be included in the reviewer document with actionable recommendations to the authors. The instructor is then responsible for the final submission of the open-discussion review.

We can also recommend an additional session within the workshop where students are asked to develop potential applications of the data relevant to their interests. This element goes beyond the fundamental components of dataset review and focuses on developing students' creativity, as well as their technical abilities and understanding of statistical methods and other analytics. Consideration of potential applications, even as a proof of concept, can also encourage closer examination of the precision, accuracy, or quality control of the dataset and manuscript under review.

The outcomes of the workshop are for early career scientists to learn how to ask critical questions, how to formulate suggestions for improvement using a teaching tone, and how to summarize a research article. In sum, the goals are to take part in the peer review process, to learn about the iterative process of the scientific method, and to appreciate the value of constructive criticism.

## 4   Concluding remarks

### Call to use open-discussion forums for peer review training

There is an intrinsic benefit when experienced scientists are investing in the future of the peer review process. If all reviewers go through a training program first, then we collectively raise the bar of the quality of the peer review process. Overall, the exposure to both the review process and the con-

cept of openly shared, quality-assured data is important in training the next generation of scientists as well as promoting critical thinking among our trainees. We see a win–win situation for the trainee and the author involved. The concept of open data is necessary to advance knowledge more effectively, and participating in all aspects of the open-data review process – as a reviewer, student trainee, and author – ensures the continued availability of high-quality datasets in *ESSD* and other science products.

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