The scientific method is the foundation upon which we seek answers to questions and the pathway we use to build on previous knowledge. The notion that experimental results should be reproducible has been part of this method for centuries, since the days of Kepler and Galileo. Reproducibility reduces experimental biases and circumstances that influence results. A lack of it can hamper our ability to generalize and extend physical processes outside of the limited conditions of the experiment.

In today’s world, and relevant to vadose zone sciences, we rely on computational approaches, advanced mathematical and statistical models, and simulation software, to process and analyze complex datasets. Much like yesterday’s physical experimentalists, modern-day computational scientists also must insure that algorithms and analytical approaches can be replicated by the scientific community.

Opportunities for scientific progress are greatly diminished if reproducing and building on published research is difficult or impossible due to the complexity or opacity of computational systems. The need for transparency in these approaches has been recognized by scientific journals (e.g., Science and Nature) and funding agencies (e.g., National Institutes of Health). These days, transparency also influences public discourse and acceptance of research results.

Reproducible Research Program Launching

As described in a recent article by Skaggs et al. (see http://dx.doi.org/doi:10.2136/vzj2015.06.0088), Vadose Zone Journal (VZJ) is launching a new Reproducible Research (RR) program, in which the code and data (less than 10 MB in size) accompanying a research article will be hosted by the Alliance of Crop, Soil, and Environmental Science Societies (ACSESS). Author participation in RR is voluntary, but benefits are many. For example, availability of supporting information will enable readers to analyze data in a manner similar to that presented in the article, more efficiently building on results in future research and applications.

It’s expected that by year’s end, RR policies and procedures will be in place and tested on articles selected by VZJ editors. Policies will cover author and reviewer guidelines, including allowable file types and copyright issues. Where applicable, all code and datasets will have a Creative Commons license that credits authors and permits non-commercial use of the material. Vadose Zone Journal does not expect source code in commercial software packages to be released, but the software version should be stated so that readers can replicate experimental conditions.

The article’s authors also discuss the challenges of providing RR supplemental material, including the need for authors to “clean” and document their code more than they would otherwise, a possible loss of competitive advantage to other colleagues, to name just two examples. So, there is some effort to archiving this extra material, but the effort could substantially widen how the research is used by the community.

To make the process easier, VZJ will add associate editors who understand RR concepts and can manage both the technical review and RR archive review. The latter will focus on readability, understandability, and technical soundness of the code so that key results can be reproduced from the publication.

Vadose Zone Journal is developing this program due to the strong computational and analytical nature of many articles, and because the public and funding agencies accept and support research more readily when its underpinnings are available for review and use. The authors of this article and editors of VZJ believe this level of transparency is necessary for healthy discussions and advances in our sciences, and will ultimately be used in many earth sciences journals.

M. Young, Editor of VZJ; T. Skaggs, Associate Editor of VZJ

Reproducible Research in the Vadose Zone Sciences

by Michael Young and Todd Skaggs

doi:10.2134/csa2015-60-10-5