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Publishing Reproducible Geoscientific Papers: Status quo, benefits, and opportunities

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Abstract:
Open reproducible research (ORR) is the practice of publishing the source code and the datasets needed to produce the computational results reported in a paper. Since many geoscientific articles include geostatistical analyses and spatiotemporal data, reproducibility should be a cornerstone of the computational geosciences but is rarely realized. Furthermore, publishing scientific outcomes in static PDFs does not adequately report on computational aspects. Thus, readers cannot fully understand how the authors came to the conclusions and how robust these are to changes in the analysis. Consequently, it is difficult for reviewers to follow the analysis steps, and for other researchers to reuse existing materials. This talk starts with obstacles that prevented geoscientists from publishing ORR. To overcome these barriers, the talk suggests concrete strategies. One strategy is the executable research compendium (ERC) which encapsulates the paper, code, data, and the entire software environment needed to produce the computational results. Such concepts can assist authors in adhering to ORR principles to ensure high scientific standards. However, ORR is not only about reproducing results but it involves a number of additional benefits, e.g. an ERC-based workflow. It allows authors to convey their computational methods and results by also providing interactive access to code and data, and readers to deeply investigate the computational analysis while reading the actual article, e.g. by changing the parameters of the analysis. Finally, the presentation introduces the concept of a binding; a binding connects those code lines and data subsets that produce a specific result, e.g. a figure or number. By also considering user interface widgets (e.g. a slider), this approach allows readers to interactively manipulate the parameters of the analysis to see how the results change.

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