Geophysical Research Abstracts
Vol. 19, EGU2017-10721, 2017
EGU General Assembly 2017

Compressing climate model simulations: reducing storage burden while preserving information

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Climate models, which are run at high spatial and temporal resolutions, generate massive quantities of data. As our computing capabilities continue to increase, storing all of the generated data is becoming a bottleneck, which negatively affects scientific progress. It is thus important to develop methods for representing the full datasets by smaller compressed versions, which still preserve all the critical information and, as an added benefit, allow for faster read and write operations during analysis work. Traditional lossy compression algorithms, as for example used for image files, are not necessarily ideally suited for climate data. While visual appearance is relevant, climate data has additional critical features such as the preservation of extreme values and spatial and temporal gradients. Developing alternative metrics to quantify information loss in a manner that is meaningful to climate scientists is an ongoing process still in its early stages. We will provide an overview of current efforts to develop such metrics to assess existing algorithms and to guide the development of tailored compression algorithms to address this pressing challenge.