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HPC-scaling and energy consumption of the global seismic wave-propagation code AxiSEM

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We present the global seismic wave propagation package AxiSEM with a particular focus on scalability on diverse multi-core HPC systems and quantification of energy consumption. The code itself has only recently been adapted to large-scale HPC systems and shows excellent, near-perfect scalability up to 10'000 CPU cores. It has been released under the GPL licence and is used in the research community and on a variety of platforms. Here, we quantify its HPC performance for realistic simulation settings, including platform-independent I/O, and present these in user-friendly application-driven formulations.

Due to the physical limitations of the current generation of micro-processor technologies, energy consumption of processors has now become a primary limitation in reaching the full potential of such systems. Although the runtime scalability of large parallel systems has been investigated in the past, the energy performance and its effect on future systems scalability and development is not well understood. Additionally with the recent changes in legislation towards emissions and energy prices, traditional runtime scalability problems have been further aggravated by the energy costs and cost of ownership of large parallel systems. The emergence of the green 500 (www.green500.org) reflects this trend, but quantification of such energy consumption for real-world application lags behind. To this end, we analyse the energy characteristics using a new energy profiling software called EMPPACK and study how AxiSEM scaled with respect to energy cost and find promising results on moderate resources. We shall extend this energy analysis to run on some of the largest available HPC systems, and give a perspective on performing similar studies for different codes and GPU facilities.