Development of Big Seismic Data Processing Tools

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Abstract

Seismology is a data-driven science with a huge amount of data gathered for over a century. Though seismic data recording started in 1900, the growth of seismic data has obviously been exponentially in the last three decades. This data growth can be easily noticed if one takes a close look at just one of the largest seismological data centers in the US, the Data Management Center (DMC) of the Integrated Research Institutions in Seismology (IRIS). Data at the DMC grew from less than 10 Tebibytes in 1992 to about 800 Tebibytes in 2022. With the availability of such a large amount of seismic data, it is paramount to develop new seismic data processing and management tools to help analyze and find new and better seismic models. Developing new big seismic data processing and management tools will be helpful to make the best use of such growing big seismological data sets.

The main goal of this investigation is the development of efficient data manipulation and processing tools for retrieval, processing, merging, aggregation, and management of big seismic data from disparate data sources. In this study, such big seismic data processing tools are being developed using python programming language and open source python libraries, and the tools we are developing will be helpful to extract, split, and convert, merge and process big seismic data. In addition, python is very suitable for data science and has powerful libraries to process and manage data and applications. Significant contributions have been made in recent python based libraries for seismic data processing, though there are still some rooms for improvement when it comes to seismic applications to merge, convert, manage and process big seismic data from disparate data sources and converting different file formats. Seismic data from different networks surrounding the Rio Grande Valley have been collected from different data sources. Our attempt is to test the developed tools and evaluate their performance. This study has made important progress in this regard and the results are promising.

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