A Real-time Seismic Noise Analysis System for Monitoring Data Quality and Station Performance

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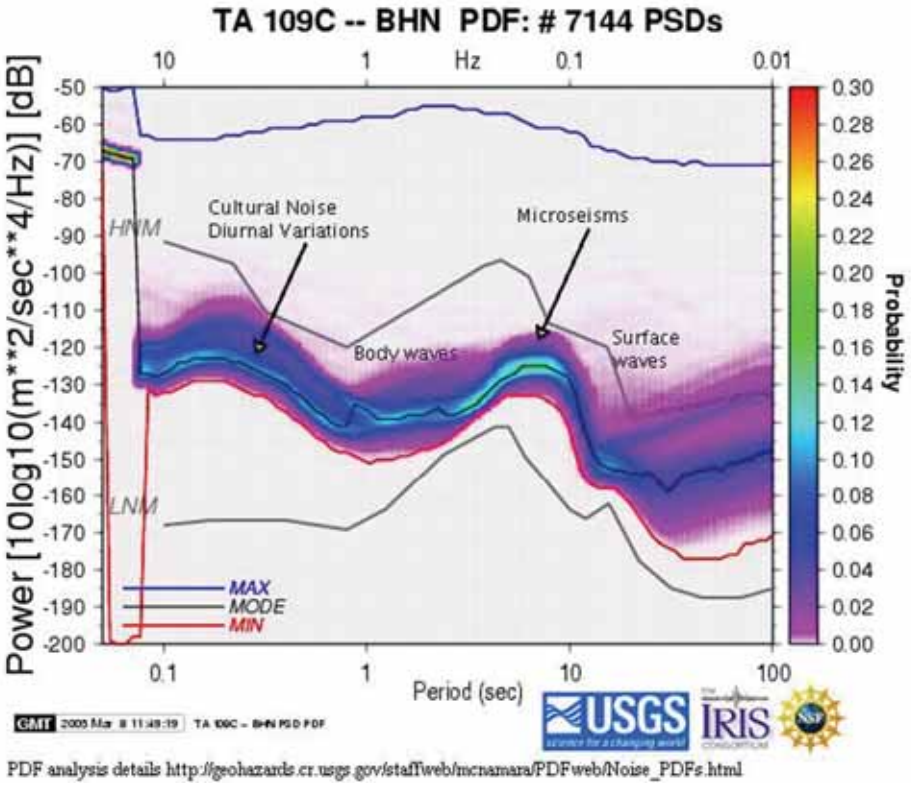
A new system for analyzing data quality is now available to the seismology community allowing users to evaluate the long-term seismic noise levels for any broadband seismic data channel streaming into the buffer of uniform data (BUD) within the Incorporated Research Institutions for Seismology (IRIS) data management system (DMS). BUD is the IRIS DMS's acronym for the online data cache from which the DMC collects and distributes near-real time miniSEED data holdings prior to formal archiving. The new noise processing software uses a probability density function (PDF) to display the distribution of seismic power spectral density (PSD) and has been implemented against most of the continuous data-stream available within the BUD utilizing the QUACK framework. QUACK is the system at the IRIS DMC responsible for managing the quality control (QC) of the real-time seismic data flowing into the BUD (see http://www.iris.washington.edu/servlet/quackquery/). This noise processing system is unique in that there is no need to screen the data for earthquakes, system glitches or general data artifacts, as is commonly done in seismic noise analysis. Instead, with this new analysis system transients map into a low-level background probability while ambient noise conditions reveal themselves as high probability occurrences. In fact, examination of artifacts related to station operation and episodic cultural noise allows us to estimate both the overall station quality and a baseline level of earth noise at each site. PDF noise plots are useful for characterizing the current and past performance of existing broadband sensors, for detecting operational problems within the recording system, and for evaluating the overall quality of data for a particular station. The advantages of this new approach include: 1) provides an analytical view representing the true ambient noise levels rather than a simple absolute minimum; 2) provides an assessment of the overall health of the instrument/station; and, 3) provides an assessment of the health of recording and telemetry systems. The figure shows a PDF example, with some artifacts and signals identified for the transportable array station TA 109C in southern California. Cultural noise due to automobile traffic, machinery and other human activity generates a strong signal that can vary by 10 dB between day and night time and is observable in the PDFs at high frequencies (1-10 Hz, 0.1-1s). Body waves from earthquakes occur as low probability signal in the 1sec range while surface waves are generally higher power at longer periods. The broad signal >10 s is due to thermal instability of the portable vault design.



PDF analysis details http://geohazards.cr.usgs.gov/staffweb/mcnamara/PDFweb/Noise_PDFs.html