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The Global Seismographic Network (GSN): Challenges and Methods for Maintaining High Quality Network Performance

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The Global Seismographic Network (GSN) is a 152 station, globally-distributed, permanent network of state-of-the-art seismological and geophysical sensors. The GSN has been operating for over 20 years via an ongoing successful partnership between IRIS, the USGS, the University of California at San Diego, NSF and numerous host institutions worldwide. The central design goal of the GSN may be summarized as "to record with full fidelity and bandwidth all seismic signals above the Earth noise, accompanied by some efforts to reduce Earth noise by deployment strategies". While many of the technical design goals have been met, we continue to strive for higher data quality with a combination of new sensors and improved installation techniques designed to achieve the lowest noise possible under existing site conditions.

Data from the GSN are used not only for research, but on a daily basis as part of the operational missions of the USGS NEIC, NOAA tsunami warning centers, the Comprehensive Nuclear-Test-Ban-Treaty Organization as well as other organizations. In the recent period of very tight funding budgets, the primary challenges for the GSN include maintaining these operational capabilities while simultaneously developing and replacing the primary sensors, maintaining high quality data and repairing station infrastructure.

Aging of GSN equipment and station infrastructure has resulted in renewed emphasis on developing, evaluating and implementing quality control tools such as MUSTANG and DQA to maintain the high data quality from the GSN stations. These tools allow the network operators to routinely monitor and analyze waveform data to detect and track problems and develop action plans as issues are found. We will present summary data quality metrics for the GSN as obtained via these quality assurance tools.

In recent years, the GSN has standardized dataloggers to the Quanterra Q330HR data acquisition system at all but three stations resulting in significantly improved data availability. Current equipment modernization efforts are focused on the development of new very broadband sensors to replace failing KS-54000 borehole instruments and aging Streckeisen STS-1 surface instruments at many GSN stations. We will describe the sensor development activities to-date, and present examples of test data and performance.