

Final Technical Report

USGS Cooperative Agreement for Seismic Network Operations

Network name: Cooperative Mid-America Integrated Seismic Network-USC

Cooperative Agreement number: 07HQA60155

Principal Investigator & Co-Principal Investigator: Thomas J. Owens & Pradeep Talwani

Project Web Site: <http://www.seis.sc.edu/scsn/index.html>

Term Covered: 8/1/07-1/31/10 [entire period of the award]

Summary of Network, Focus of Operations, Main Accomplishments

There has been a major transition in operation and maintenance of stations funded through this Cooperative Agreement. Original Co-PI Thomas Owens became Lead PI in January of 2009. Original PI Pradeep Talwani retired in May of 2009 and is no longer formally associated with the South Carolina Seismic Network (SCSN).

Specific accomplishments during the award period:

New Broadband Station, KMSC, now operational: This station was established in collaboration with the USGS and the IRIS/USArray Transportable Array program. The station is located at Kings Mountain State Park in north-central South Carolina. USC personnel identified the site, made appropriate contacts at the state and park service levels, and did reconnaissance work for suitability and permitting. IRIS/USArray TA personnel then took over the installation and brought the site on line in September, 2008. KMSC data flows through the USArray Array Operations office at UCSD and then to USGS and IRIS. The site is an ANSS/TA Backbone station. It will be operated and maintained by USArray for the next decade, with local logistics provided by USC, for the next decade or so. At that point, it will be folded into USGS-SCSN operations.

RGR upgraded to digital recording and telemetry: RGR is a high quality three-component borehole site in the Charleston area that had been off-line for a couple of years due to analog telemetry problems and other logistical issues. Testing of cell modem data transmission was completed in the Spring/Summer of 2008. A Reftek datalogger and associated peripherals were received from the USGS depot in early December 2008 to complete this upgrade. The station went on-line on December 16, 2008, within hours after the M=3.6 earthquake in the area. Data is flowing from USC to CERI via earthworm (and upstream to NEIC as we understand it). RGR data is flowing to the IRIS DMC for permanent archive.

CSB upgraded to digital recording and telemetry: CSB is a high quality three-component borehole site in the Charleston area that had been off-line for a couple of years due to analog telemetry problems and other logistical issues. Testing of cell modem data transmission was completed in the Spring/Summer of 2008. A Reftek datalogger and associated peripherals were received from the USGS depot in early December 2008 to complete this upgrade. The

station went on-line on December 16, 2008, within hours after the M=3.6 earthquake in the area. Data is flowing from USC to CERI via earthworm (and upstream to NEIC as we understand it). There is some question about the instrument that is cemented in the borehole, so metadata is still being assembled. CSB data will flow to the IRIS DMC for permanent archive when these problems are resolved.

JSC upgraded to broadband, digital recording, strong motion recording and telemetry:

JSC is the highest quality seismic station in the Southeast due to its location on a granite outcrop in central South Carolina. A Reftek datalogger, STS-2 sensor, and an EpiSensor were received in the Summer of 2008 to upgrade this station. Adequate cell phone coverage became available at this site in the Fall of 2008. The new station was installed Dec. 22 and 30, 2008. The STS-2 data is transmitted via cell modem at 100 sps continuously to the USC earthworm system. It is sent to CERI (and points upstream) and also the the IRIS DMC for permanent archive. The EpiSensor data is recorded locally in triggered mode at 200 sps. The plan is to recover that data via a site visit in the case of a nearby earthquake of sufficient magnitude.

New Station CASEE installed with broadband and strong motion recording and digital telemetry. This site went online in the Fall of 2009 and includes a Reftek RT-130 data logger, a Trillium 120P sensor, and an EpiSensor. The broadband data is telemetered to USC via cell modem at 100 sps continuously. It is sent to CERI (and points upstream) and also the the IRIS DMC for permanent archive. The EpiSensor data is recorded locally in triggered mode at 200 sps. The plan is to recover that data via a site visit in the case of a nearby earthquake of sufficient magnitude.

New Station SRS approved and equipment received. This site is on the Savannah River Site in a borehole at ~1000 ft depth and is being installed in collaboration with Don Stevenson, lead seismologist at the Savannah River Site, which purchased a new borehole instrument for this site. This instrument is tested and is due to be lowered into the borehole during the last week of April. USC is providing a cell modem and technical support for splitting the recorded data so that it flows both to USC and to the local seismic network operated by the Savannah River Site. We anticipate that data will begin flowing to USC, CERI, and IRIS by the end of May, 2010.

New EarthWorm system installed at USC: An EarthWorm, v7.3, server was installed on a Linux system in this contract period. This system is monitored and maintained by Dr. Philip Crotwell, a seismologist and software developer in Owens' group. It will be the primary EarthWorm system for the new digitally-recorded stations installed and maintained under this Cooperative Agreement. The performance and status of that system is not considered in this report as it is not funded under this Cooperative Agreement.

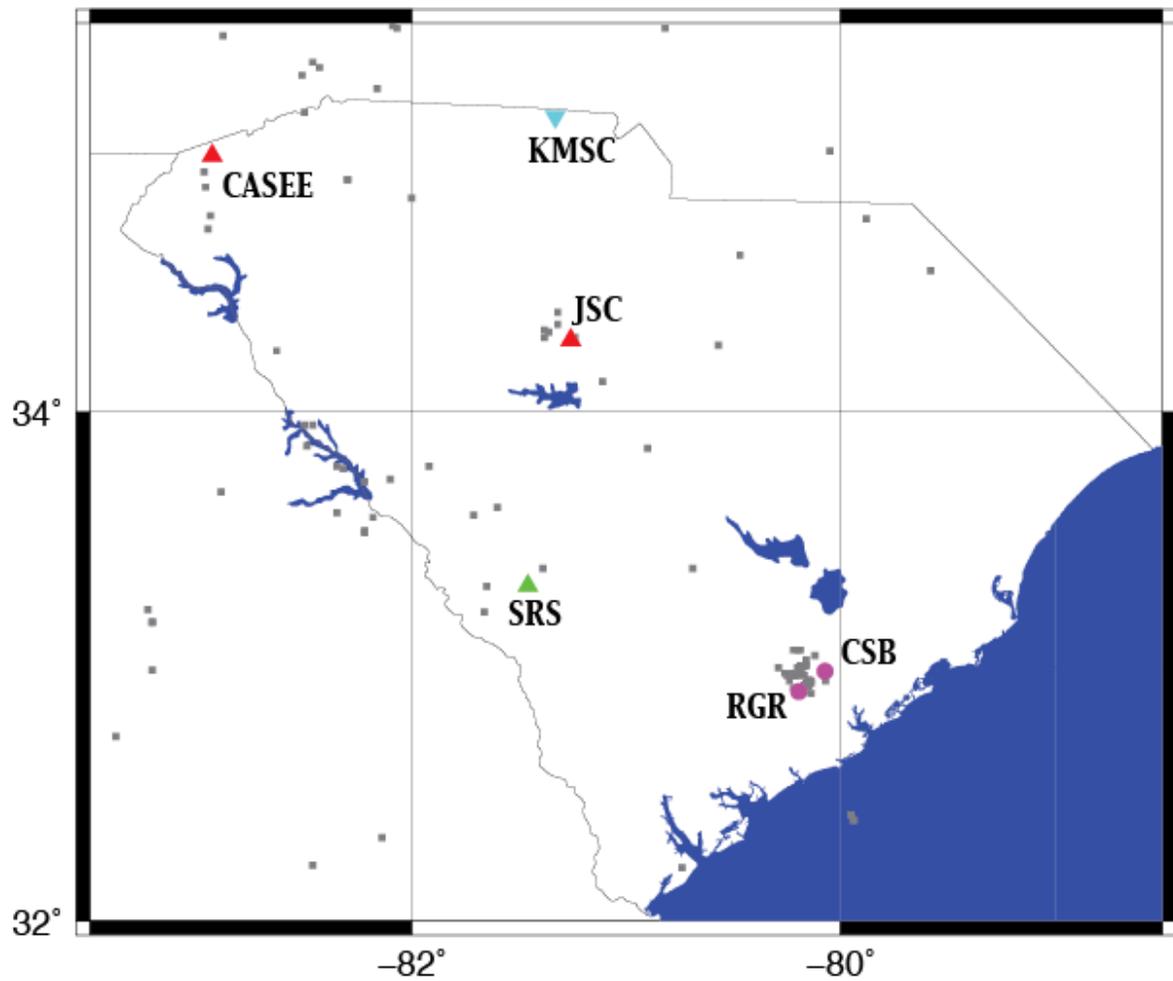


Figure 1. Map of Seismic Stations. Red triangles are broadband/strong motion sites. Green triangle is the Savannah River Site borehole station due to begin recording in May 2010. Purple circles are SCSN Short-Period borehole instruments. The blue inverted triangle is KMSC, the TA/USArray backbone site installed in collaboration with EarthScope.

Data Management Practices

All data collected under this Cooperative Agreement flows directly to CERI continuously without delay. Metadata for all sites except CSB have been transmitted as dataless SEED to the USGS and IRIS. Average network uptime exceeds 95% at this time.

Continuity of Operations and Response Planning

All new SCSN stations installed under this Cooperative Agreement are stand-alone solar power sites. We are vulnerable to outages or saturation of the cell phone networks in the event of a major earthquake, but data will be saved in RAM for up to an hour, providing some insurance against communication failures. We established a redundant server at the SC Emergency Management Division headquarters in just outside Columbia, SC. This provides a measure of continuity of operations, but only for a limited scope of interruptions.

Metadata Availability

Dataless SEED for all stations except CSB have been transmitted to IRIS and the USGS. IRIS serves as our permanent archive. We are near the point of making an intelligent guess of the instrument at CSB shortly to complete this process.

Earthquake Data and Information Products

Network Products (also as of 1/31/10)		
Does the network provide the following?	Yes/No	Comments/Explanation
Primary EQ Parameters	No	This may change as network transition continues
Picks		
Hypocenters		
Magnitudes (& Amplitudes)		
Focal mechanisms		
Moment Tensor(s)		
Other EQ Parameters/Products		
	No	
ShakeMap		
Finite Fault		
Supplemental Information		
	No	This may change as network transition continues
Felt Reports		
Event Summary		
Tectonic Summary		
Collated Maps		
Refined Hypocenters (e.g. double-difference)		
Web Content		
Recent EQ Maps	Yes	
Station Helicorder	Yes	
Station noise PDFs	No	
Station Performance Metrics	No	Under construction
Network Description	Yes	
Station List	Yes	
Station Metadata	No	
Email Notification Services	No	
Contact Info	Yes	

Network Products (also as of 1/31/10)		
Region-specific FAQs	Yes	
Region-specific EQ info	Yes	
Waveforms		
Triggered	No	
Continuous	No	
Processed	No	
Summary Products		
Catalogs	Yes	Historical Catalogs
Metadata		
Instrument Response	No	
Site Info (e.g. surface geology, Vs30)	No	
Descriptions:		
<i>Tectonic Summary:</i> Text and/or figures describing the tectonic setting of the event and related activity		
<i>Event Summary:</i> Text and/or figures (press releases, collated media/disaster agencies info) that describes the earthquake and its effects		
<i>Collated Maps:</i> Any map or set of maps that illustrates the event properties, tectonics, hazards, etc		
<i>Processed Waveforms:</i> Specialized processing that is required by some portion of the community, e.g. processed strong motion records for the engineering community		
<i>Catalogs:</i> Lists of parameters that describe an earthquake(s) or information used to describe an earthquake (e.g., picks, locations, amps,...)		
<i>Region-specific earthquake information:</i> Description (text and/or maps) of historical earthquakes, faults/geology, etc.		