Final Technical Report
USGS Cooperative Agreement for Seismic Network Operations

Title:	Anza Broadband Network
Cooperative Agreement Number:	G10AC00074
C.A. Start Date & End Date:	2/1/2010 - 1/31/2015
Seismic Network Web Site:	http://eqinfo.ucsd.edu
Network Code:	AZ
Network Name:	ANZA Seismic Network
ANSS Region:	California
Operator Address:	IGPP, UCSD, La Jolla, CA, 92093-0225
Principal Investigator/Primary Contact:	Frank Vernon
Email Address:	flvernon@ucsd.edu
Phone:	858-534-5537

Abstract

The ANZA seismic network operated continuously starting 2010 February 1 through 2015 January 31. During this time the ANZA network expanded from 18 stations to 29 stations, 15 of these were funded by the ANSS. ANZA was categorized as a Tier 2 network that contributed real time waveform data to the Southern California Seismic Network (SCSN). All waveform data are archived at UCSD, IRIS DMC, and SCSN in real-time. Metadata have been delivered to the IRIS DMC and SCSN. The data return rates for the ANSS supported stations was 99.0% for the five years with data latencies of less than three seconds on average. The ANZA seismic network provided on scale strong motion records for the 2010 Mw 5.4 and 2013 Mw 4.7 earthquakes located inside the network with epicentral distances as close as 5 km. Data from the ANZA network were used Mw 4.7 in the successful demonstration of the CISN ShakeAlert Earthquake Early Warning System.

Report

In 2010 the ANZA network comprised 18 broadband and strong motion data and was a Tier 2 network in the ANSS providing real time data to SCSN (Figure 1).

Figure 1. ANZA seismic network map in 2010 with 18 broadband and strong motion stations.

During the period of this project, the ANZA network added 11 stations with posthole strong motion sensors deployed close to the San Jacinto Fault for earthquake early warning and for near fault observations of seismic events. The real time data latency is between 2 and 3 seconds for all broadband and strong motion channels which is excellent for earthquake early warning. Data from the ANZA seismic network is publicly available through the IRIS DMC and the SCEC data center with 99.0% data availability for the 15 ANSS supported stations over the 5 year duration of this funding. When the non-ANSS stations are included, the ANZA network return is 98.3%. Metadata has been provided in a timely manner to the IRIS DMC and the SCSN.

In 2010 there was a Mw 5.4, 4.2, and 4.0 located inside the network. In 2013 there was a Mw 4.7 also located inside the network. Additionally in 2010 the Mw 7.2 El Mayor-Cucapah earthquake was located ~100 km south of the center of the network. All these events were well recorded by the ANZA network (Figures 2, 3, 4).

In 2015 the ANZA network comprised 18 broadband and strong motion data and was a Tier 2 network in the ANSS providing real time data to SCSN (Figure 5).

The details of each year are provided in the following annual progress reports.

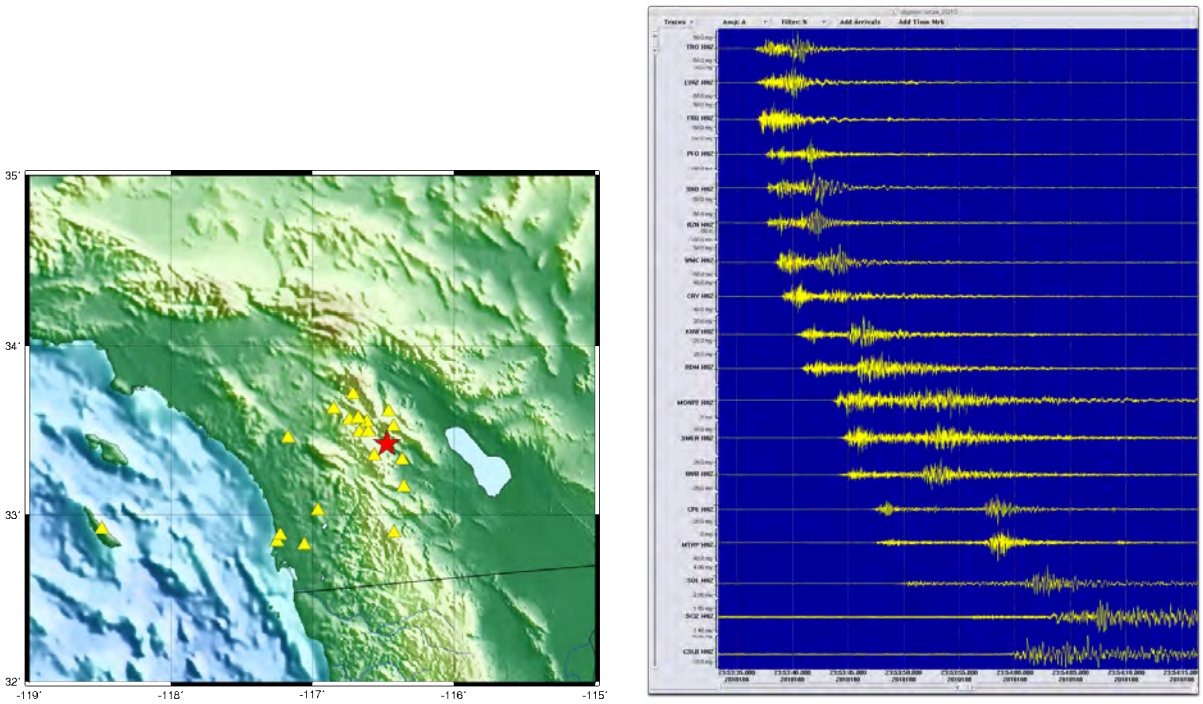

Figure 2. Wednesday July 7, 2010 at 23:53 GMT recording of Mw 5.4 earthquake (located near Borrego Springs, southern California with on scale strong motion recordings.

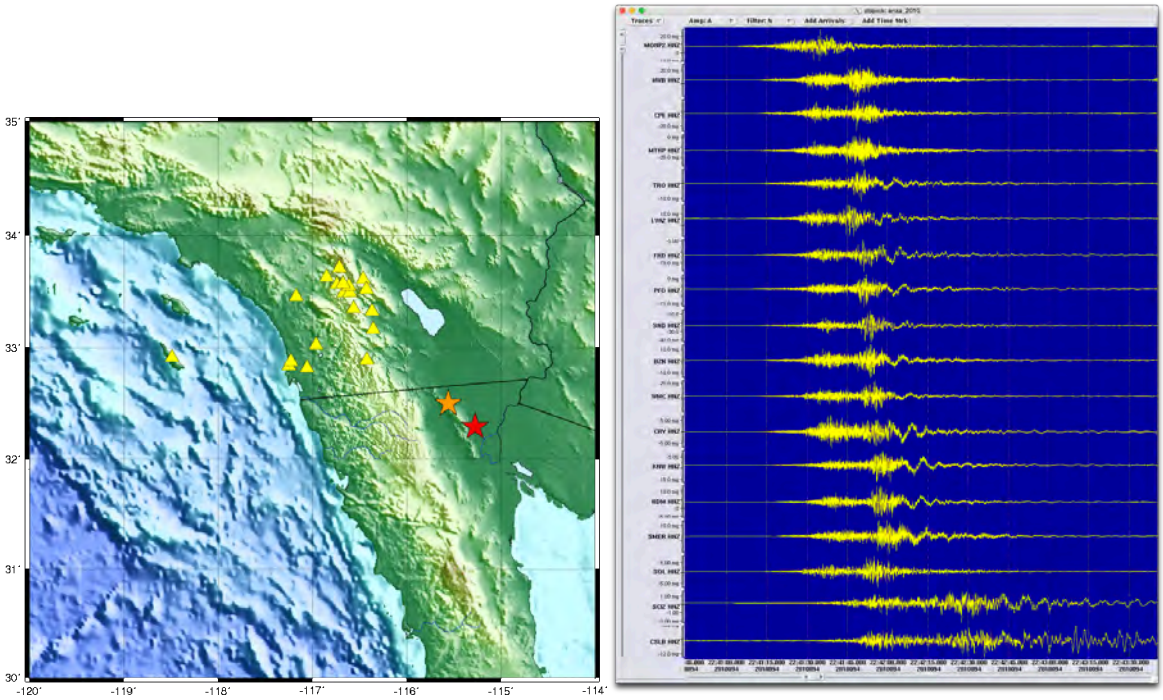

Figure 3. Sunday April 4 2010 at 22:40 GMT recording of Mw 7.2 earthquake located near El Mayor, Baja California Norte, Mexico with on scale strong motion recordings.

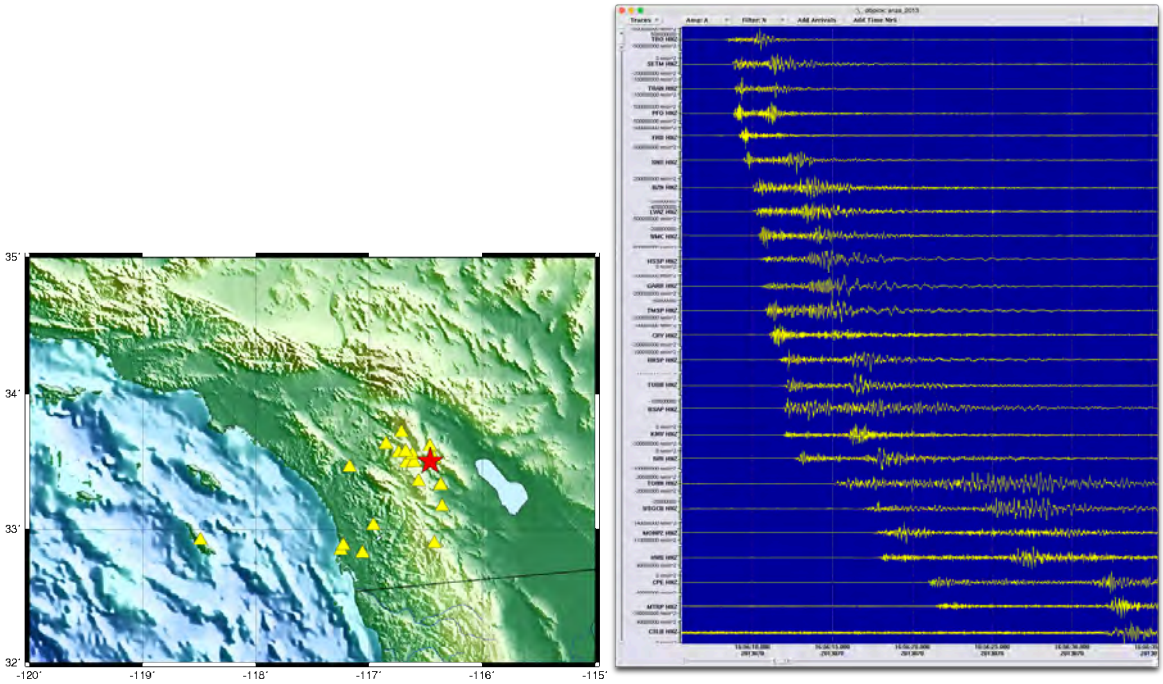

Figure 4. Monday March 11 2013 at 17:56 GMT recording of Mw 4.7 earthquake located near Anza and within the San Jacinto fault zone with on scale strong motion recordings.

Figure 5. ANZA seismic network map in 2015 with 29 broadband and strong motion stations.

Progress Report for 2011
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Email Address: flvernon@ucsd.edu
Phone: 858-534-5537
Co-Principal Investigator/Alternate Contact: Luciana Astiz
Email Address: lastiz@ucsd.edu
Phone: 858-534-2976

Changes Implemented in this Reporting Period
Describe what changes have taken place in your network's operations since the start date of the current cooperative agreement (new stations, new procedures, new partnerships, major tasks accomplished, etc.

- Upgraded ARRA stations to use Quanterra Q330 digitizers
- Implemented State Of Health (SOH) Round Robin Database (RRD) archives for all station Q330 SOH channels. This allows for near real-time analysis of operating station health, including diagnostics to determine when and what failed. Last hour, day, week, month, year and lifetime plots are available to look for temporal changes.
- Implemented real-time table monitor (webdlmon) of Anza network stations to monitor network state of health. Problem stations 'float' to the top of the list.
- Online tool to send calibrations to Q330 dataloggers via a web interface using the Q330 dlcmd command
- Moved primary data acquistion systems to new Colocation facility at the San Diego Supercomputer center.

Figure 1. Map of Seismic Stations:
Provide a page-width map of your network, distinguishing between ANSS backbone, broadband, and short-period stations.

Summary Statistics for Regional/Urban Seismic Network

Total no. of stations operated and/or recorded	**18**
Total no. of channels recorded	**228**
No. of short-period (SP) stations	**0**
No. of broadband (BB) stations	**16**
No. of stations maintained & operated by network	**18**
No. of stations maintained & operated as part of ANSS	**18**
Total data volume archived (mbytes/day)	

Data Management Practices

- *Describe briefly your state of progress toward meeting ANSS data management performance standards (standards 4.1, 4.2, 4.3, 5.1 and 5.2).*
- *Provide timeliness for importing your data into an ANSS archive.*

4.1 Waveform Availability Timeliness:

Waveform latencies are normally < 5seconds from realtime.

4.2 Amplitude Availability Timeliness:

Amplitude latencies are normally < 60 seconds from realtime.

4.3 Phase Picks Availability Timeliness:

Phase Picks latencies are normally < 60 seconds from realtime

5.1 Availability of Waveforms to External Users:

All waveform data are archived at UCSD, IRIS DMC, and SCSN. All waveform data are available in real-time through UCSD and the IRIS DMC.

5.2 Availability of Event Bulletin:
SCSN has the regional responsibility to produce picks, amplitudes/durations, and earthquake locations incorporating ANZA data with SCSN data and to provide these results to CISN and NEIC.

Waveform data archived:
All waveform data are archived at UCSD, IRIS DMC, and SCSN.

Earthquake parametric data submitted:
SCSN has the regional responsibility to produce picks, amplitudes/durations, and earthquake locations incorporating ANZA data with SCSN data and to provide these results to CISN and NEIC.

Bulletin data submitted:
SCSN has the regional responsibility to produce picks, amplitudes/durations, and earthquake locations incorporating ANZA data with SCSN data and to provide these results to CISN and NEIC.

Continuity of Operations and Response Planning

- *Describe briefly any changes or updates to Tier I network plans and agreements. Tier II networks should describe progress that has been made toward developing plans to respond to major earthquakes, including cooperative arrangements with other networks and plans to cope with power and communication failures.*

No new plans were made to respond to major earthquakes. All systems worked well and in real time during the 4 April 2010 Cucapah M 7.2 earthquake which occurred along the southern boundary of our coverage area. Coordination with the SCSN and the media worked well. The ANZA network moved primary data acquistion systems to new Colocation facility at the San Diego Supercomputer center which provides redundant communication and power infrastructure.

Progress on Metadata Development

- *Provide updates to your previously submitted metadata.*

During 2010, the complete metadata history for the ANZA network was regenerated under the dbbuild structures, which allows for a manageable process for current and future metadata generation. All metadata is current and complete and available through the IRIS DMC and the SCSN.

Progress on ANSS Integration

- *Describe briefly what progress you have made toward providing real-time wave form data, real-time picks, amplitudes/durations, and earthquake locations to other ANSS networks including the NEIC.*
- *Describe progress towards providing timely catalog data to the NEIC.*

Real-Time waveform data are provided to SCSN. SCSN has the regional responsibility to produce real-time picks, amplitudes/durations, and earthquake locations and to provide these results to CISN and NEIC.

Earthquake Data and Information Products

Network Products

Does the network provide the following?	Yes/No	Comments/Explanation
Primary EQ Parameters		
Picks	Y	Internal Use only
Hypocenters	Y	Internal Use only
Magnitudes (& Amplitudes)	Y	Internal Use only
Focal mechanisms	Y	Internal implementation under developemnt
Moment Tensor(s)	Y	Internal implementation under developemnt
Other EQ Parameters/Products		
ShakeMap	N	This functionality is assigned through agreement to the SCSN
Finite Fault	N	This functionality is assigned through agreement to the SCSN
Supplemental Information		
Felt Reports	N	This functionality is assigned through agreement to the SCSN
Event Summary	Y	
Tectonic Summary	Y	
Collated Maps	Y	
Refined Hypocenters (e.g. double-difference)	N	This functionality is assigned through agreement to the SCSN
Web Content		
Recent EQ Maps	Y	
Station Helicorder	N	**Replaced with Waveform Server**
Station noise PDFs	Y	**Available through IRIS DMC**
Station Performance Metrics	Y	
Network Description	Y	
Station List	Y	
Station Metadata	Y	
Email Notification Services	N	This functionality is assigned through agreement to the SCSN
Contact Info	Y	

Network Products		
Does the network provide the following?	**Yes/No**	**Comments/Explanation**
Region-specific FAQs	Y	
Region-specific EQ info	Y	
Waveforms		
Triggered		
Continuous	Y	
Processed	N	
Summary Products		
Catalogs	Y	SCSN is authoritative for the region by agreement.
Metadata		
Instrument Response	Y	
Site Info (e.g. surface geology, Vs30)	Y	**Station detail pages**

Descriptions:

***Tectonic Summary*: Text and/or figures describing the tectonic setting of the event and related activity**

***Event Summary*: Text and/or figures (press releases, collated media/disaster agencies info) that describes the earthquake and its effects**

***Collated Maps*: Any map or set of maps that illustrates the event properties, tectonics, hazards, etc**

***Processed Waveforms*: Specialized processing that is required by some portion of the community, e.g. processed strong motion records for the engineering community**

***Catalogs*: Lists of parameters that describe an earthquake(s) or information used to describe an earthquake (e.q., picks, locations, amps,..)**

***Region-specific earthquake information*: Description (text and/or maps) of historical earthquakes, faults/geology, etc.**

ANSS Cooperating Network
Performance Self-Rating

Question	Answer	Explanation (if needed)
1. What is the minimum magnitude detection threshold for your network?	1.0	
2. What is the minimum magnitude detection threshold for the best instrumented part of your network?	-0.2	
3. What is the typical hypocentral location accuracy for earthquakes occurring within your network? Is it the same for automated vs reviewed?	1.5 km reviewed 2.0 km automatic	
4. Does your network report automated earthquake locations into QDDS? If yes, how long does it take?	N	This functionality is assigned through agreement to the SCSN
5. Does your network report analyst-reviewed earthquake locations for all quakes into QDDS (i.e., the little ones)?	N	This functionality is assigned through agreement to the SCSN
7. Describe the velocity model used to locate earthquakes in your network (1-D?, multiple models?, 3-D?). Does it differ for automated vs reviewed?	1-D	Same model used for automated and reviewed.
8. What software/program does your network use to locate earthquakes? Does it differ for automated vs reviewed?	BRTT Antelope	
9. What magnitudes does your network routinely report in real time (Md, ML, Me, Mw, Ms etc.)? How long does it take to compute them?	Ml	~1 Minute
10. Does your network archive phase information at a datacenter?	N	This functionality is assigned through agreement to the SCSN
11. Does your network archive summary (i.e., earthquake catalog) information at a public datacenter?	N	This functionality is assigned through agreement to the SCSN
12. Does your network archive event waveforms at a public datacenter?	Y	IRIS DMC has ANZA event data starting in 1982.
13. Do you archive continuous waveforms at a public datacenter?	Y	All [HEBSL][HN][ZNE] channels are available with latencies typically less than 30 seconds at the IRIS DMC

ANSS Cooperating Network
Performance Self-Rating

Question	Answer	Explanation (if needed)
14. If your network archives waveforms, does it supply supporting instrument response metadata to support generation waveforms in SEED? For all waveforms?	Y	
15. Does your network compute focal mechanisms?	Y	Internal use only. This functionality is assigned through agreement to the SCSN
16. Does your network automatically distribute email to the public in near real-time for significant events?	N	This functionality is assigned through agreement to the SCSN
17. Does your network automatically distribute alphanumeric pages to the public in near real-time for significant events?	N	This functionality is assigned through agreement to the SCSN
18. Does your network automatically compute *ShakeMaps* and make them publicly available? If so, how long does it take?	N	
19. Does your network operate a fault-tolerant system (e.g., redundant computers, UPS, back-up generator with lots of fuel)?	Y	
20. What does your network do with the data recorded on ANSS strong motion instruments? For example, do you make it available to the engineering community through a Data Center?	Y	All strong motion data is sent to SCSN and the IRIS DMC in real-time

Additional Information, Comments, and Suggestions

- *Please provide additional information, comments, diagrams, photographs or suggestions you think may be helpful to USGS in evaluating your operations.*

Progress Report for 2011
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Co-Principal Investigator/Alternate Contact:	Luciana Astiz
Email Address:	lastiz@ucsd.edu
Phone:	858-534-2976

Changes Implemented in this Reporting Period

Describe what changes have taken place in your network's operations in 2011 such as new stations, new procedures, new partnerships, major tasks accomplished, etc.

- No changes in operations for the core ANSS funded stations.
- Added 6 shallow borehole accelerometers under NSF and private funding.

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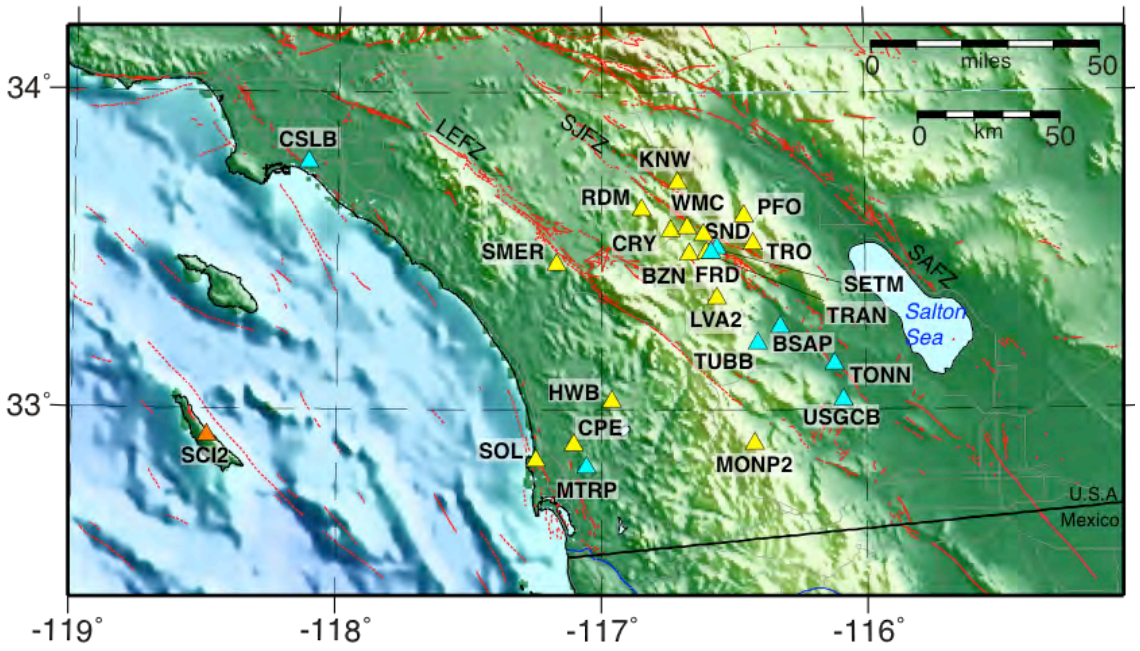

Figure 1. Map of Seismic Stations:
Page-width map of the ANZA network, ANSS backbone stations are yellow triangles (broadband and strong motion), non-ANSS stations are orange triangles (broadband and strong motion), ,and non-ANSS strong motion stations are blue triangles.

Summary Statistics for Regional/Urban Seismic Network	**Number**	**Station Response Information in dataless SEED volume(s)**
Total no. of stations operated and/or recorded	24	Yes. Complete response information available for all stations for all times of operations. Dataless seed are available through our website, the IRIS DMC, and through the SCSN. We validate stations through IRIS PDF files, magnitude comparisons, interstation waveform comparisons, intersensor comparisons, white noise calibration analysis, waveform modeling of sensor orientation, polarization analysis of sensor orientation. Feedback from researchers.
Total no. of channels recorded	304	Yes. Complete response information available for all stations for all times of operations. Dataless seed are available through our website, the IRIS DMC, and through the SCSN. We validate stations through IRIS PDF files, magnitude comparisons, interstation waveform comparisons, intersensor comparisons, white noise calibration analysis, waveform modeling of sensor orientation, polarization analysis of sensor orientation. Feedback from researchers.
No. of short-period	0	None

(SP) stations		
No. of broadband (BB) stations	16	Yes. Complete response information available for all stations for all times of operations. Dataless seed are available through our website, the IRIS DMC, and through the SCSN. We validate stations through IRIS PDF files, magnitude comparisons, interstation waveform comparisons, intersensor comparisons, white noise calibration analysis, waveform modeling of sensor orientation, polarization analysis of sensor orientation. Feedback from researchers.
No. of stations maintained & operated by network	24	Yes. Complete response information available for all stations for all times of operations. Dataless seed are available through our website, the IRIS DMC, and through the SCSN. We validate stations through IRIS PDF files, magnitude comparisons, interstation waveform comparisons, intersensor comparisons, white noise calibration analysis, waveform modeling of sensor orientation, polarization analysis of sensor orientation. Feedback from researchers.
No. of stations maintained & operated as part of ANSS	15	Yes. Complete response information available for all stations for all times of operations. Dataless seed are available through our website, the IRIS DMC, and through the SCSN. We validate stations through IRIS PDF files, magnitude comparisons, interstation waveform comparisons, intersensor comparisons, white noise calibration analysis, waveform modeling of sensor orientation, polarization analysis of sensor orientation. Feedback from researchers.

Progress on Metadata Development and Implementation

Provide details on the completeness of your dataless SEED volumes. For example: Indicate in the Summary Statistics table above whether or not your dataless SEED volume(s) contain response information on all of the stations? Provide a description of where your dataless SEED volume(s) are stored (ftp site) and/or do others maintain a current copy of your dataless SEED volume(s). Include a brief description on procedures for validating the accuracy of station metadata (e.g. use of noise PDF procedures, referencing observed waveforms to synthetic waveforms, analysis of calibration pulses, waveform modeling for sensor orientation).

Data Management Practices

- Describe briefly your state of progress toward meeting ANSS data management performance standards (standards 4.1, 4.2, 4.3, 5.1 and 5.2).
- Provide information on the completeness and timeliness for importing your data into an ANSS archive, both waveform archive and earthquake catalog. For example: What portion of your waveform data goes to an archive in real-time and what portion is deposited later as a batch process? What types of earthquake locations and magnitudes (automatic and/or reviewed) are submitted to EIDS and what is the schedule and magnitude threshold for delivery of earthquake locations and magnitudes to the ANSS Composite Catalog.

4.1 Waveform Availability Timeliness:
Waveform latencies are normally < 5seconds from realtime.

4.2 Amplitude Availability Timeliness:
Amplitude latencies are normally < 60 seconds from realtime.

4.3 Phase Picks Availability Timeliness:
Phase Picks latencies are normally < 60 seconds from realtime

5.1 Availability of Waveforms to External Users:
All waveform data are archived at UCSD, IRIS DMC, and SCSN. All waveform data are available in real-time through UCSD and the IRIS DMC.

5.2 Availability of Event Bulletin:
SCSN has the regional responsibility to produce picks, amplitudes/durations, and earthquake locations incorporating ANZA data with SCSN data and to provide these results to CISN and NEIC.

Waveform data archived:
All waveform data are archived at UCSD, IRIS DMC, and SCSN in real-time.

Earthquake parametric data submitted:
SCSN has the regional responsibility to produce picks, amplitudes/durations, and earthquake locations incorporating ANZA data with SCSN data and to provide these results to CISN and NEIC.

Bulletin data submitted:
SCSN has the regional responsibility to produce picks, amplitudes/durations, and earthquake locations incorporating ANZA data with SCSN data and to provide these results to CISN and NEIC.

Continuity of Operations and Response Planning

Describe briefly any changes or updates to Tier I network plans and agreements. For Tier II networks, describe progress that has been made toward developing plans to respond to major earthquakes, including cooperative arrangements with other networks and plans to cope with power and communication failures.

No new plans were made to respond to major earthquakes. All systems worked well and in real time during the 4 April 2010 Cucapah M 7.2 earthquake which occurred along the southern boundary of our coverage area. All data were delivered in real-time to SCSN. Coordination with the SCSN and the media worked well. In 2010, the ANZA network moved primary data acquistion systems to new Colocation facility at the San Diego Supercomputer center which provides redundant communication and power infrastructure.

Progress on ANSS Integration

Describe briefly what progress you have made toward providing real-time waveform data, real-time picks, amplitudes/durations, and earthquake locations to other ANSS networks including the NEIC. The description should specify, which partnering networks are involved in day-to-day monitoring, what types of data and information (e.g. waveforms, picks, amplitudes, magnitudes, moment tensor solutions, shakemaps) are being exchanged, and steps being taken to improve robustness and completeness of expected ANSS products within your region through coordinated/redundant earthquake response with partnering networks (e.g. locations, magnitudes, shakemaps). What other products (e.g. moment tensor solutions, finite fault models) are coordinated with partnering networks.

Real-Time waveform data are provided to SCSN. SCSN has the regional responsibility to produce real-time picks, amplitudes/durations, earthquake locations, moment tensors, shakemaps, finite fault models and to provide these results to CISN and NEIC.

Earthquake Data and Information Products

Network Products		
Does the network provide the following?	Yes/No	Comments/Explanation
Primary EQ Parameters		
Picks	Y	Internal Use only
Hypocenters	Y	Internal Use only
Magnitudes (& Amplitudes)	Y	Internal Use only
Focal mechanisms	Y	Internal implementation under developemnt
Moment Tensor(s)	Y	Internal implementation under developemnt
Other EQ Parameters/Products		
ShakeMap	N	This functionality is assigned through agreement to the SCSN
Finite Fault	N	This functionality is assigned through agreement to the SCSN
Supplemental Information		
Felt Reports	N	This functionality is assigned through agreement to the SCSN
Event Summary	Y	
Tectonic Summary	Y	
Collated Maps	Y	
Refined Hypocenters (e.g. double-difference)	N	This functionality is assigned through agreement to the SCSN

Network Products		
Does the network provide the following?	Yes/No	Comments/Explanation
Web Content		
Recent EQ Maps	Y	
Station Helicorder	Y	
Station noise PDFs	Y	Linked to IRIS DMC plots
Station Performance Metrics	Y	
Network Description	Y	
Station List	Y	
Station Metadata	Y	
Email Notification Services	N	SCSN has this resonsibility
Contact Info	Y	
Region-specific FAQs	Y	
Region-specific EQ info	Y	
Waveforms		
Triggered	N	All data are continuous
Continuous	Y	
Processed	Y	
Summary Products		
Catalogs	Y	
Metadata		
Instrument Response	Y	
Site Info (e.g. surface geology, Vs30)	Y	
Descriptions:		
Tectonic Summary: Text and/or figures describing the tectonic setting of the event and related activity		

Network Products		
Does the network provide the following?	Yes/No	Comments/Explanation
Event Summary: Text and/or figures (press releases, collated media/disaster agencies info) that describes the earthquake and its effects		
Collated Maps: Any map or set of maps that illustrates the event properties, tectonics, hazards, etc		
Processed Waveforms: Specialized processing that is required by some portion of the community, e.g. processed strong motion records for the engineering community		
Catalogs: Lists of parameters that describe an earthquake(s) or information used to describe an earthquake (e.q., picks, locations, amps,..)		
Region-specific earthquake information: Description (text and/or maps) of historical earthquakes, faults/geology, etc.		

ANSS Cooperating Network
Performance: Self-Rating

Question	Answer	Explanation (if needed)
1. What is the minimum magnitude detection threshold for your network?	1.0	
2. What is the minimum magnitude detection threshold for the best instrumented part of your network?	-0.2	
3. What is the typical hypocentral location accuracy for earthquakes occurring within your network? Is it the same for automated vs reviewed?	1.5 km reviewed 2.0 km automatic	
4. Does your network report automated earthquake locations into QDDS? If yes, how long does it take?	N	This functionality is assigned through agreement to the SCSN
5. Does your network report analyst-reviewed earthquake locations for all quakes into QDDS (i.e., the little ones)?	N	This functionality is assigned through agreement to the SCSN
7. Describe the velocity model used to locate earthquakes in your network (1-D?, multiple models?, 3-D?). Does it differ for automated vs reviewed?	1-D	Same model used for automated and reviewed.
8. What software/program does your network use to locate earthquakes? Does it differ for automated vs	BRTT Antelope	
9. What magnitudes does your network routinely report in real time (Md, ML, Me, Mw, Ms etc.)? How long does it take to compute them?	Ml	~1 Minute
10. Does your network archive phase information at a datacenter?	N	This functionality is assigned through agreement to the SCSN
11. Does your network archive summary (i.e., earthquake catalog) information at a public datacenter?	N	This functionality is assigned through agreement to the SCSN
12. Does your network archive event waveforms at a public datacenter?	Y	IRIS DMC has ANZA event data starting in 1982.
13. Do you archive continuous waveforms at a public datacenter?	Y	All [HEBSL][HN][ZNE] channels are available with latencies typically less than 30 seconds at the IRIS DMC

ANSS Cooperating Network
Performance: Self-Rating

Question	Answer	Explanation (if needed)
14. If your network archives waveforms, does it supply supporting instrument response metadata to support generation waveforms in SEED? For all	Y	
15. Does your network compute focal mechanisms?	Y	Internal use only. This functionality is assigned through agreement to the SCSN
16. Does your network automatically distribute email to the public in near real-time for significant events?	N	This functionality is assigned through agreement to the SCSN
17. Does your network automatically distribute alphanumeric pages to the public in near real-time for significant events?	N	This functionality is assigned through agreement to the SCSN
18. Does your network automatically compute ShakeMaps and make them publicly available? If so, how long does it take?	N	This functionality is assigned through agreement to the SCSN
19. Does your network operate a fault-tolerant system (e.g., redundant computers, UPS, back-up generator with lots of fuel)?	Y	
20. What does your network do with the data recorded on ANSS strong motion instruments? For example, do you make it available to the engineering community through a Data Center?	Y	All strong motion data is sent to SCSN and the IRIS DMC in real-time

Additional Information, Comments, and Suggestions

Provide additional information, comments, diagrams, photographs or suggestions you think may be helpful to USGS in evaluating your operations.

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Changes Implemented in this Reporting Period
Describe what changes have taken place in your network's operations in 2012 such as new stations, new procedures, new partnerships, major tasks accomplished (e.g. switchover to AQMS, conversion to PDL), etc.

- No changes in operations for the core ANSS funded stations.
- Added 5 shallow borehole accelerometers under NSF and private funding.

Table of Seismic Stations
Fill out the table below with the total number of stations either operated or used by the network.

Summary Statistics for Regional/Urban Seismic Network	**Number**	**Station Response Information in dataless SEED volume(s)**
Total no. of stations operated and/or recorded	27	Yes. Complete response information available for all stations for all times of operations. Dataless seed are available through our website, the IRIS DMC, and through the SCSN. We validate stations through IRIS PDF files, magnitude comparisons, interstation waveform comparisons, intersensor comparisons, white noise calibration analysis, waveform modeling of sensor orientation, polarization analysis of sensor orientation. Feedback from researchers.
Total no. of channels recorded	219	Yes. Complete response information available for all stations for all times of operations. Dataless seed are available through our website, the IRIS DMC, and through the SCSN. We validate stations through IRIS PDF files, magnitude comparisons, interstation waveform comparisons, intersensor comparisons, white noise calibration analysis, waveform modeling of sensor orientation, polarization analysis of sensor orientation. Feedback from researchers.

No. of short-period (SP) stations	0	None
No. of broadband (BB) stations	16	Yes. Complete response information available for all stations for all times of operations. Dataless seed are available through our website, the IRIS DMC, and through the SCSN. We validate stations through IRIS PDF files, magnitude comparisons, interstation waveform comparisons, intersensor comparisons, white noise calibration analysis, waveform modeling of sensor orientation, polarization analysis of sensor orientation. Feedback from researchers.
No. of stations maintained & operated by network	27	Yes. Complete response information available for all stations for all times of operations. Dataless seed are available through our website, the IRIS DMC, and through the SCSN. We validate stations through IRIS PDF files, magnitude comparisons, interstation waveform comparisons, intersensor comparisons, white noise calibration analysis, waveform modeling of sensor orientation, polarization analysis of sensor orientation. Feedback from researchers.
No. of stations maintained & operated as part of ANSS	15	Yes. Complete response information available for all stations for all times of operations. Dataless seed are available through our website, the IRIS DMC, and through the SCSN. We validate stations through IRIS PDF files, magnitude comparisons, interstation waveform comparisons, intersensor comparisons, white noise calibration analysis, waveform modeling of sensor orientation, polarization analysis of sensor orientation. Feedback from researchers.

Progress on Metadata Development and Implementation

Provide details on the completeness of your dataless SEED volumes. For example: Provide a description of what software is used for xtation metadata maintenance and generation of dataless SEED, including where your dataless SEED volume(s) are stored (ftp site) and/or do others maintain a current copy of your dataless SEED volume(s). Include a brief description on procedures for validating the accuracy of station metadata (e.g. use of noise PDF procedures, referencing observed waveforms to synthetic waveforms, analysis of calibration pulses, waveform modeling for sensor orientation).

Dataless SEED volumes are complete and cover the whole operational period of the ANZA network from its initial operation starting 10/1/1982 through the present.

Dataless SEED volumes are created using the BRTT Antelope software

Dataless SEED are available through the IRIS DMC and through our web site at http://eqinfo.ucsd.edu

Metadata are validated through noise PDF procedures, analysis of calibration pulses, waveform polarization analysis for sensor orientation, cross-correlation analysis between collocated broadband and strong motion sensors.

Data Management Practices

- Describe briefly your state of progress toward meeting ANSS data management performance standards (standards 4.1, 4.2, 4.3, 5.1 and 5.2).
- Provide information on the completeness and timeliness for importing your data into an ANSS archive, both waveform archive and earthquake catalog. For example: What portion of your waveform data goes to an archive in real-time and what portion is deposited later as a batch process? What types of earthquake locations and magnitudes (automatic and/or reviewed) are submitted to EIDS and what is the schedule and magnitude threshold for delivery of earthquake locations and magnitudes to the ANSS Composite Catalog.

4.1 Waveform Availability Timeliness:
Waveform latencies are normally < 5seconds from realtime.

4.2 Amplitude Availability Timeliness:
Amplitude latencies are normally < 60 seconds from realtime.

4.3 Phase Picks Availability Timeliness:
Phase Picks latencies are normally < 60 seconds from realtime

5.1 Availability of Waveforms to External Users:
All waveform data are archived at UCSD, IRIS DMC, and SCSN. All waveform data are available in real-time through UCSD and the IRIS DMC.

5.2 Availability of Event Bulletin:
SCSN has the regional responsibility to produce picks, amplitudes/durations, and earthquake locations incorporating ANZA data with SCSN data and to provide these results to CISN and NEIC.

Waveform data archived:
All waveform data are archived at UCSD, IRIS DMC, and SCSN in real-time.

Earthquake parametric data submitted:
SCSN has the regional responsibility to produce picks, amplitudes/durations, and earthquake locations incorporating ANZA data with SCSN data and to provide these results to CISN and NEIC.

Bulletin data submitted:
SCSN has the regional responsibility to produce picks, amplitudes/durations, and earthquake locations incorporating ANZA data with SCSN data and to provide these results to CISN and NEIC.

Progress on ANSS Integration

Describe briefly what progress you have made toward providing real-time waveform data, real-time picks, amplitudes/durations, and earthquake locations to other ANSS networks including the NEIC. The description should specify, which partnering networks are involved in day-to-day monitoring, what types of data and information (e.g. waveforms,

picks, amplitudes, magnitudes, moment tensor solutions, shakemaps) are being exchanged, and steps being taken to improve robustness and completeness of expected ANSS products within your region through coordinated/redundant earthquake response with partnering networks (e.g. locations, magnitudes, shakemaps). What other products (e.g. moment tensor solutions, finite fault models) are coordinated with partnering networks.

Waveform data archived:
All waveform data are archived at UCSD, IRIS DMC, and SCSN in real-time.

Earthquake parametric data submitted:
SCSN has the regional responsibility to produce picks, amplitudes/durations, and earthquake locations incorporating ANZA data with SCSN data and to provide these results to CISN and NEIC.

Bulletin data submitted:
SCSN has the regional responsibility to produce picks, amplitudes/durations, and earthquake locations incorporating ANZA data with SCSN data and to provide these results to CISN and NEIC.

Earthquake Data and Information Products

Network Products		
Does the network provide the following?	Yes/No	Comments/Explanation
Primary EQ Parameters		
Picks	Y	Internal Use only
Hypocenters	Y	Internal Use only
Magnitudes (& Amplitudes)	Y	Internal Use only
Focal mechanisms	Y	Internal implementation under development
Moment Tensor(s)	Y	Internal implementation under development
Other EQ Parameters/Products		
ShakeMap	N	This functionality is assigned through agreement to the SCSN
Finite Fault	N	This functionality is assigned through agreement to the SCSN
Supplemental Information		
Felt Reports	N	This functionality is assigned through agreement to the SCSN
Event Summary	Y	
Tectonic Summary	Y	
Collated Maps	Y	
Refined Hypocenters (e.g. double-difference)	N	This functionality is assigned through agreement to the SCSN
Web Content		
Recent EQ Maps	Y	
Station Helicorder	Y	
Station noise PDFs	Y	Linked to IRIS DMC plots
Station Performance Metrics	Y	
Network Description	Y	
Station List	Y	
Station Metadata	Y	
Email Notification Services	N	SCSN has this responsibility

Network Products		
Does the network provide the following?	Yes/No	Comments/Explanation
Contact Info	Y	
Region-specific FAQs	Y	
Region-specific EQ info	Y	
Waveforms		
Triggered	N	All data are continuous
Continuous	Y	
Processed	Y	
Summary Products		
Catalogs	Y	
Metadata		
Instrument Response	Y	
Site Info (e.g. surface geology, Vs30)	Y	

Descriptions:
Tectonic Summary: Text and/or figures describing the tectonic setting of the event and related activity
Event Summary: Text and/or figures (press releases, collated media/disaster agencies info) that describes the earthquake and its effects
Collated Maps: Any map or set of maps that illustrates the event properties, tectonics, hazards, etc
Processed Waveforms: Specialized processing that is required by some portion of the community, e.g. processed strong motion records for the engineering community
Catalogs: Lists of parameters that describe an earthquake(s) or information used to describe an earthquake (e.q., picks, locations, amps,..)
Region-specific earthquake information: Description (text and/or maps) of historical earthquakes, faults/geology, etc.

ANSS Cooperating Network
Performance: Self-Rating

Question	Answer	Explanation (if needed)
1. What is the minimum magnitude detection threshold for your network?	1.0	
2. What is the minimum magnitude detection threshold for the best instrumented part of your network?	-0.2	
3. What is the typical hypocentral location accuracy for earthquakes occurring within your network? Is it the same for automated vs reviewed?	1.5 km reviewed 2.0 km automatic	
4. Does your network report automated earthquake locations into QDDS? If yes, how long does it take?	N	This functionality is assigned through agreement to the SCSN
5. Does your network report analyst-reviewed earthquake locations for all quakes into QDDS (i.e., the little	N	This functionality is assigned through agreement to the SCSN
7. Describe the velocity model used to locate earthquakes in your network (1-D?, multiple models?, 3-D?). Does it differ for automated vs reviewed?	1-D	Same model used for automated and reviewed.
8. What software/program does your network use to locate earthquakes? Does it differ for automated vs	BRTT Antelope	
9. What magnitudes does your network routinely report in real time (Md, ML, Me, Mw, Ms etc.)? How long does it take to compute	Ml	~1 Minute
10. Does your network archive phase information at a datacenter?	N	This functionality is assigned through agreement to the SCSN
11. Does your network archive summary (i.e., earthquake catalog) information at a public datacenter?	N	This functionality is assigned through agreement to the SCSN
12. Does your network archive event waveforms at a public datacenter?	Y	IRIS DMC has ANZA event data starting in 1982.
13. Do you archive continuous waveforms at a public datacenter?	Y	All [HEBSL][HN][ZNE] channels are available with latencies typically less than 30 seconds at the IRIS DMC

ANSS Cooperating Network
Performance: Self-Rating

Question	Answer	Explanation (if needed)
14. If your network archives waveforms, does it supply supporting instrument response metadata to support generation waveforms in SEED? For	Y	
15. Does your network compute focal mechanisms?	Y	Internal use only. This functionality is assigned through agreement to the SCSN
16. Does your network automatically distribute email to the public in near real-time for significant events?	N	This functionality is assigned through agreement to the SCSN
17. Does your network automatically distribute alphanumeric pages to the public in near real-time for significant events?	N	This functionality is assigned through agreement to the SCSN
18. Does your network automatically compute ShakeMaps and make them publicly available? If so, how long does it take?	N	This functionality is assigned through agreement to the SCSN
19. Does your network operate a fault-tolerant system (e.g., redundant computers, UPS, back-up generator with lots of fuel)?	Y	
20. What does your network do with the data recorded on ANSS strong motion instruments? For example, do you make it available to the engineering community through a Data Center?	Y	All strong motion data is sent to SCSN and the IRIS DMC in real-time

Additional Information, Comments, and Suggestions

Provide additional information, comments, diagrams, photographs or suggestions you think may be helpful to USGS in evaluating your operations.

Progress Report 2013

USGS Cooperative Agreement for Seismic Network Operations

Reporting Period:	2/1/2013 – 1/31/2014
Cooperative Agreement Number:	G10AC00074
C.A. Start Date & End Date:	2/1/2010 - 1/31/2015
Seismic Network Web Site:	http://eqinfo.ucsd.edu
Network Code:	AZ
Network Name:	ANZA Seismic Network
ANSS Region:	California
Operator Address:	IGPP, UCSD, La Jolla, CA, 92093-0225
Principal Investigator/Primary Contact:	Frank Vernon
Email Address:	flvernon@ucsd.edu
Phone:	858-534-5537
Co-Principal Investigator/Alternate Contact:	Luciana Astiz
Email Address:	lastiz@ucsd.edu
Phone:	858-534-2976

Changes Implemented in this Reporting Period

Describe what changes have taken place in your network's operations in 2013 such as new stations, new procedures, new partnerships, major tasks accomplished (e.g. switchover to AQMS, conversion to PDL), etc. Please also note problems encountered or concerns you want to identify.

- No changes in operations for the core ANSS funded stations.
- Added 75 permanent and temporary under NSF and private funding.

Table of Seismic Stations

Fill out the table below with the total number of stations either operated or used by the network.

Summary Statistics for Regional/Urban Seismic Network	**Number**	**Station Response Information in dataless SEED volume(s)**
Total no. of stations operated and/or recorded	90/160	Yes. Complete response information available for all stations for all times of operations. Dataless seed are available through our website, the IRIS DMC, and through the SCSN. We validate stations through IRIS PDF files, magnitude comparisons, interstation waveform comparisons, intersensor comparisons, white noise calibration analysis, waveform modeling of sensor orientation, polarization analysis of sensor orientation. Feedback from researchers.
Total no. of channels recorded	934	Yes. Complete response information available for all stations for all times of operations. Dataless seed are available through our website, the IRIS DMC, and through the SCSN. We validate stations through IRIS PDF files, magnitude comparisons, interstation waveform comparisons, intersensor comparisons, white noise calibration analysis, waveform modeling of sensor orientation, polarization analysis of sensor orientation. Feedback from researchers.
No. of short-period (SP)	33	Yes. Complete response information available for all stations for all

stations		times of operations. Dataless seed are available through our website, the IRIS DMC, and through the SCSN. We validate stations through IRIS PDF files, magnitude comparisons, interstation waveform comparisons, intersensor comparisons, white noise calibration analysis, waveform modeling of sensor orientation, polarization analysis of sensor orientation. Feedback from researchers.
No. of broadband (BB) stations	92	Yes. Complete response information available for all stations for all times of operations. Dataless seed are available through our website, the IRIS DMC, and through the SCSN. We validate stations through IRIS PDF files, magnitude comparisons, interstation waveform comparisons, intersensor comparisons, white noise calibration analysis, waveform modeling of sensor orientation, polarization analysis of sensor orientation. Feedback from researchers.
No. of stations maintained & operated by network	90	Yes. Complete response information available for all stations for all times of operations. Dataless seed are available through our website, the IRIS DMC, and through the SCSN. We validate stations through IRIS PDF files, magnitude comparisons, interstation waveform comparisons, intersensor comparisons, white noise calibration analysis, waveform modeling of sensor orientation, polarization analysis of sensor orientation. Feedback from researchers.
No. of stations maintained & operated as part of ANSS	15	Yes. Complete response information available for all stations for all times of operations. Dataless seed are available through our website, the IRIS DMC, and through the SCSN. We validate stations through IRIS PDF files, magnitude comparisons, interstation waveform comparisons, intersensor comparisons, white noise calibration analysis, waveform modeling of sensor orientation, polarization analysis of sensor orientation. Feedback from researchers.

Data Management Practices

Describe briefly your state of progress toward meeting ANSS data management performance standards (standards 4.1, 4.2, 4.3, 5.1 and 5.2). .

4.1 Waveform Availability Timeliness:
Waveform latencies are normally < 3 seconds from realtime.

4.2 Amplitude Availability Timeliness:
Amplitude latencies are normally < 60 seconds from realtime.

4.3 Phase Picks Availability Timeliness:
Phase Picks latencies are normally < 60 seconds from realtime

5.1 Availability of Waveforms to External Users:
All waveform data are archived at UCSD, IRIS DMC, and SCSN. All waveform data are available in real-time through UCSD and the IRIS DMC.

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Progress on ANSS Integration

Describe briefly details on coordinated exchange of real-time waveform data, real-time picks, amplitudes/durations, and earthquake locations to other ANSS networks . The description should specify: which partnering networks are involved in day-to-day monitoring, what types of data and information (e.g. waveforms, picks, amplitudes, magnitudes, moment tensor solutions, ShakeMaps) are being exchanged, and steps being taken to improve robustness and completeness of expected ANSS products within your region through coordinated/redundant earthquake response with partnering networks (e.g. locations, magnitudes, ShakeMaps). What other products (e.g. moment tensor solutions, finite fault models) are coordinated with partnering networks.

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Network Highlights (optional)

Provide a "one-pager" with information on your network that could be used to help promote and advertise the network. The “one-pager” could include information on the following: a map of the station network, a map of the earthquake hazard or historic large earthquakes, information on the number of earthquakes recorded per year.

Progress Report 2014

USGS Cooperative Agreement for Seismic Network Operations

Reporting Period:	2/1/2014 – 1/31/2015
Cooperative Agreement Number:	G10AC00074
C.A. Start Date & End Date:	2/1/2010 - 1/31/2015
Seismic Network Web Site:	http://eqinfo.ucsd.edu
Network Code:	AZ
Network Name:	ANZA Seismic Network
ANSS Region:	California
Operator Address:	IGPP, UCSD, La Jolla, CA, 92093-0225
Principal Investigator/Primary Contact:	Frank Vernon
Email Address:	flvernon@ucsd.edu
Phone:	858-534-5537

Changes Implemented in this Reporting Period

Describe what changes have taken place in your network's operations in 2014 such as new stations, new procedures, new partnerships, major tasks accomplished (e.g. switchover to AQMS, conversion to PDL), etc. Please also note problems encountered or concerns you want to identify.

- No changes in operations for the core ANSS funded stations.
- Added 75 permanent and temporary under NSF and private funding.

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Fill out the table below with the total number of stations either operated or used by the network.

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No. of short-period (SP) stations	33	Yes. Complete response information available for all stations for all times of operations. Dataless seed are available through our website, the IRIS DMC, and through the SCSN. We validate stations through IRIS PDF files, magnitude comparisons, interstation

		waveform comparisons, intersensor comparisons, white noise calibration analysis, waveform modeling of sensor orientation, polarization analysis of sensor orientation. Feedback from researchers.
No. of broadband (BB) stations	92	Yes. Complete response information available for all stations for all times of operations. Dataless seed are available through our website, the IRIS DMC, and through the SCSN. We validate stations through IRIS PDF files, magnitude comparisons, interstation waveform comparisons, intersensor comparisons, white noise calibration analysis, waveform modeling of sensor orientation, polarization analysis of sensor orientation. Feedback from researchers.
No. of stations maintained & operated by network	90	Yes. Complete response information available for all stations for all times of operations. Dataless seed are available through our website, the IRIS DMC, and through the SCSN. We validate stations through IRIS PDF files, magnitude comparisons, interstation waveform comparisons, intersensor comparisons, white noise calibration analysis, waveform modeling of sensor orientation, polarization analysis of sensor orientation. Feedback from researchers.
No. of stations maintained & operated as part of ANSS	15	Yes. Complete response information available for all stations for all times of operations. Dataless seed are available through our website, the IRIS DMC, and through the SCSN. We validate stations through IRIS PDF files, magnitude comparisons, interstation waveform comparisons, intersensor comparisons, white noise calibration analysis, waveform modeling of sensor orientation, polarization analysis of sensor orientation. Feedback from researchers.

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Describe briefly your state of progress toward meeting ANSS data management performance standards (standards 4.1, 4.2, 4.3, 5.1 and 5.2). .

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Waveform latencies are normally < 5 seconds from realtime.

4.2 Amplitude Availability Timeliness:
Amplitude latencies are normally < 60 seconds from realtime.

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Bulletin data submitted:
SCSN has the regional responsibility to produce picks, amplitudes/durations, and earthquake locations incorporating ANZA data with SCSN data and to provide these results to CISN and NEIC.

Progress on ANSS Integration

Describe briefly details on coordinated exchange of real-time waveform data, real-time picks, amplitudes/durations, and earthquake locations to other ANSS networks . The description should specify: which partnering networks are involved in day-to-day monitoring, what types of data and information (e.g. waveforms, picks, amplitudes, magnitudes, moment tensor solutions, ShakeMaps) are being exchanged, and steps being taken to improve robustness and completeness of expected ANSS products within your region through coordinated/redundant earthquake response with partnering networks (e.g. locations, magnitudes, ShakeMaps). What other products (e.g. moment tensor solutions, finite fault models) are coordinated with partnering networks.

Waveform data archived:
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Provide a "one-pager" with information on your network that could be used to help promote and advertise the network. The “one-pager” could include information on the following: a map of the station network, a map of the earthquake hazard or historic large earthquakes, information on the number of earthquakes recorded per year.

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