USArray TA
Network Operations

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Acknowledgements

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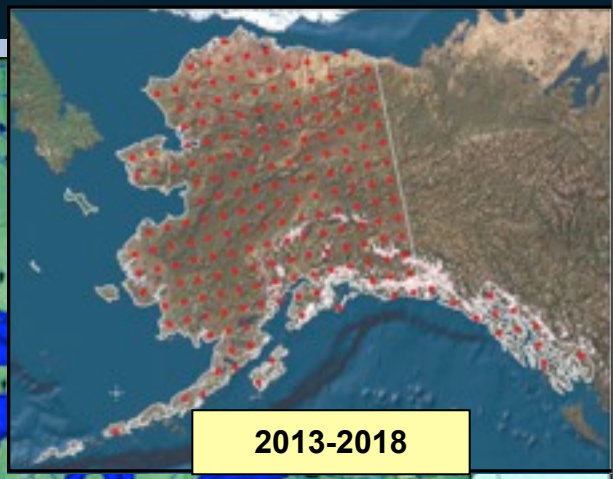
Transportable Array



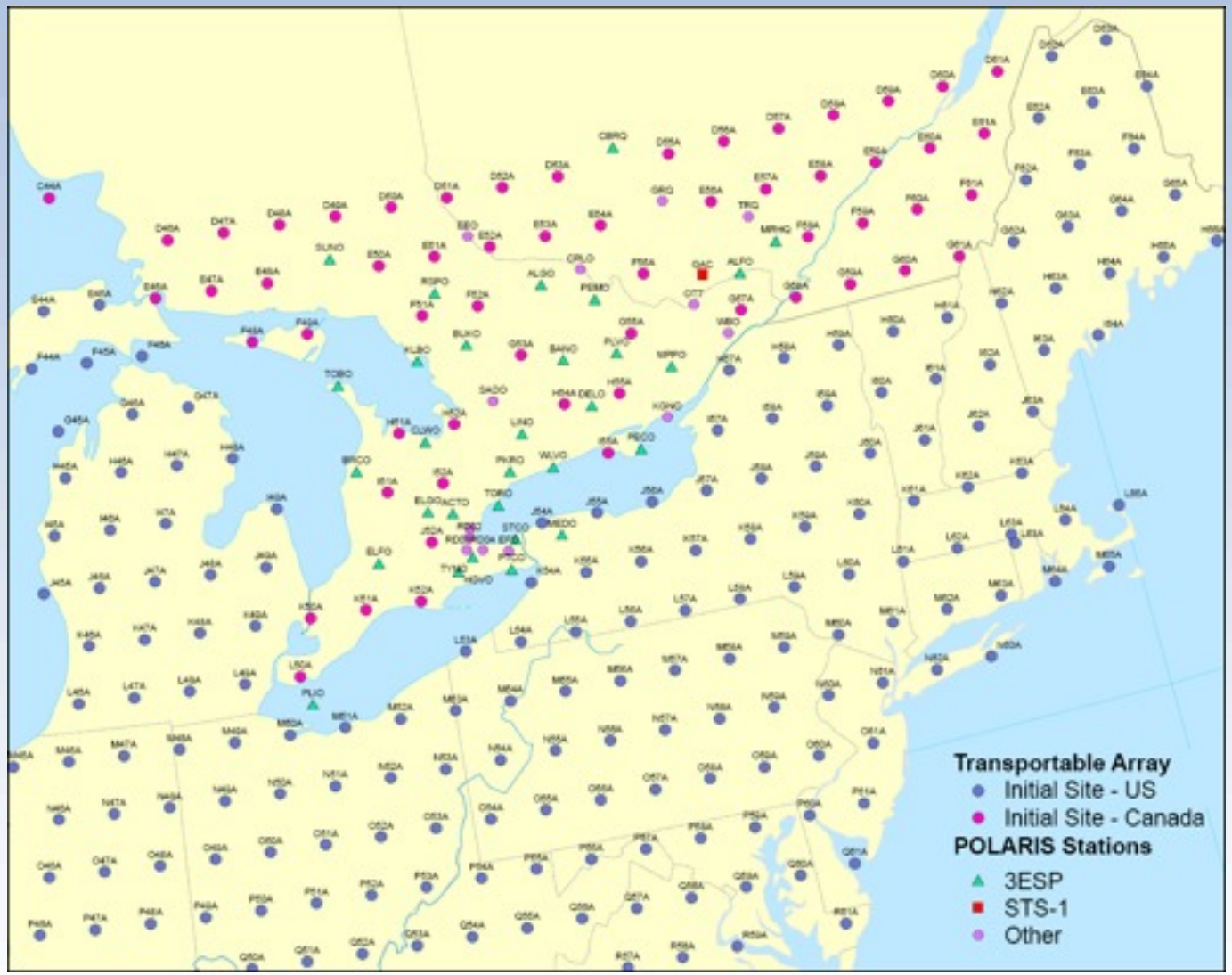
2009 - 2013

2009 09

- 850 stations so far; ~800 to go
- Station “adoptions” in the western US are creating a wake of permanent education and research stations

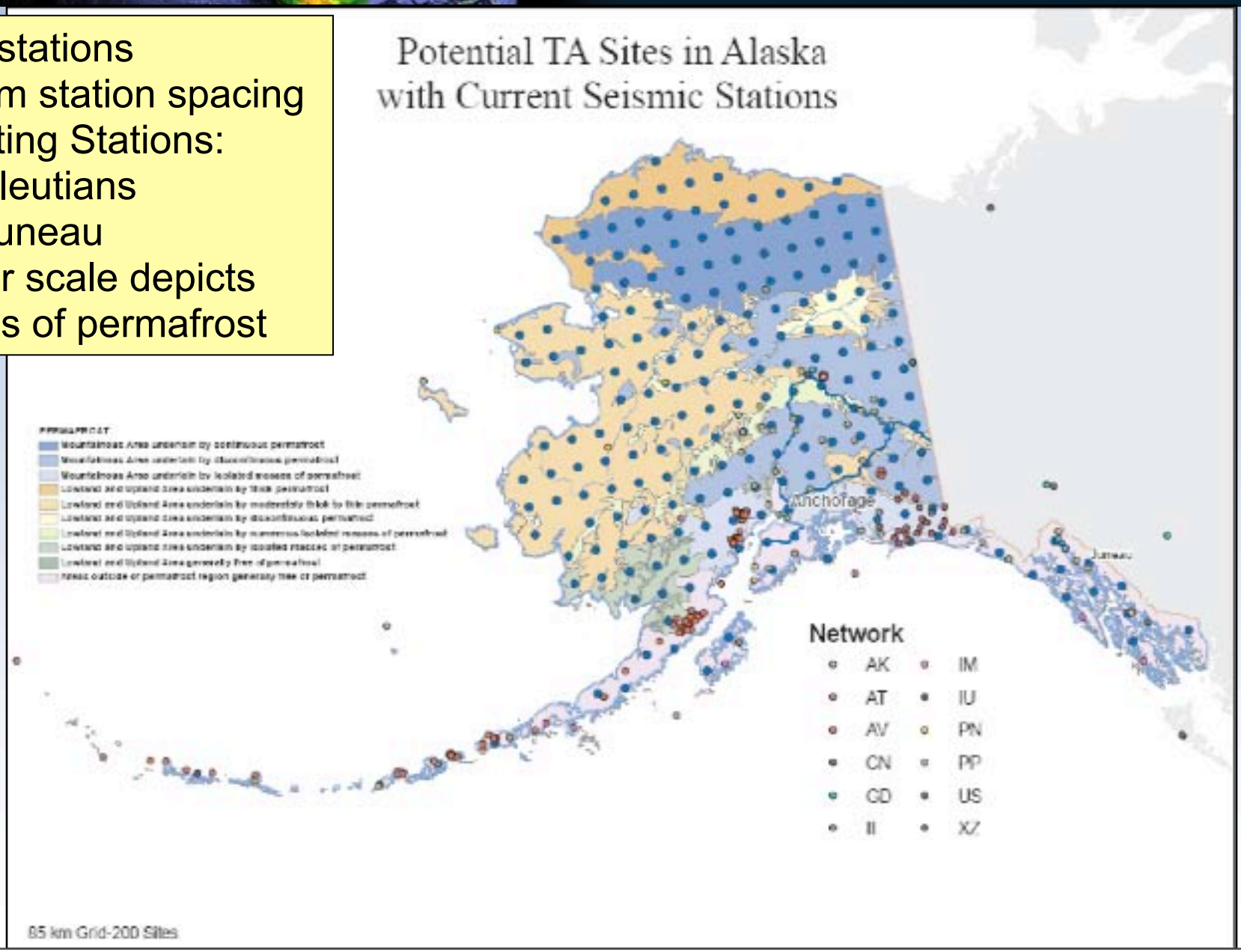
Plans: TA in Eastern Canada

- Collaboration with POLARIS in Canada
- Adds 50 stations to 1000 in plan
- Opportunity if budget allows- no new money
- TA Installs in summer 2012



Alaska

- 200 stations
- 85 km station spacing
- Existing Stations:
  - Aleutians
  - Juneau
- Color scale depicts levels of permafrost



USArray

- Requirements
  - Data Quality
  - Clock Quality
  - Data Completeness
- Objective
  - Minimize Data Latency

USArray Mistakes

- Duty cycling gps clocks
  - Purpose - Save .1 watts
  - Consequences
    - Timing accuracy reduced
    - Time alignment degraded
    - Time resets observable in data
    - ALL data users must address issue for analysis
- Unilateral instrumentation decisions
  - Purpose - Create on-site data backup
  - Consequences
    - Create man-years of work repairing data

Essential Elements

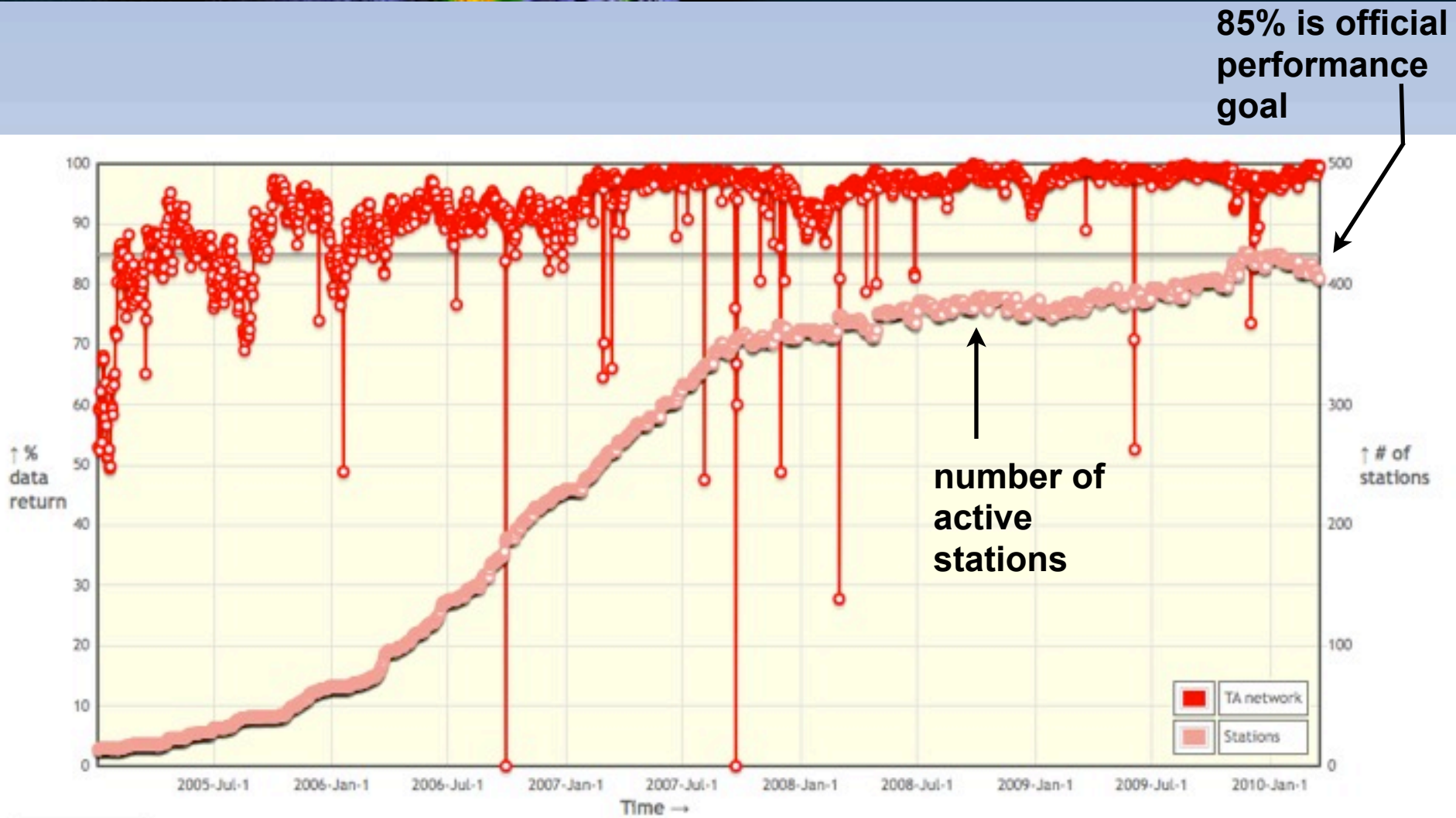
- Quality of Data
  - Information Quality
    - Calibrated Waveforms
    - Accurate Parametric Data
  - Clock Quality
    - Correlating different sensors and locations
- Availability of Data
  - Completeness
    - Recording unexpected observations
      - episodic tremor
      - noise field tomography
    - Resolving low frequency periodic components at high resolution (days to years)

USArray Data Flow

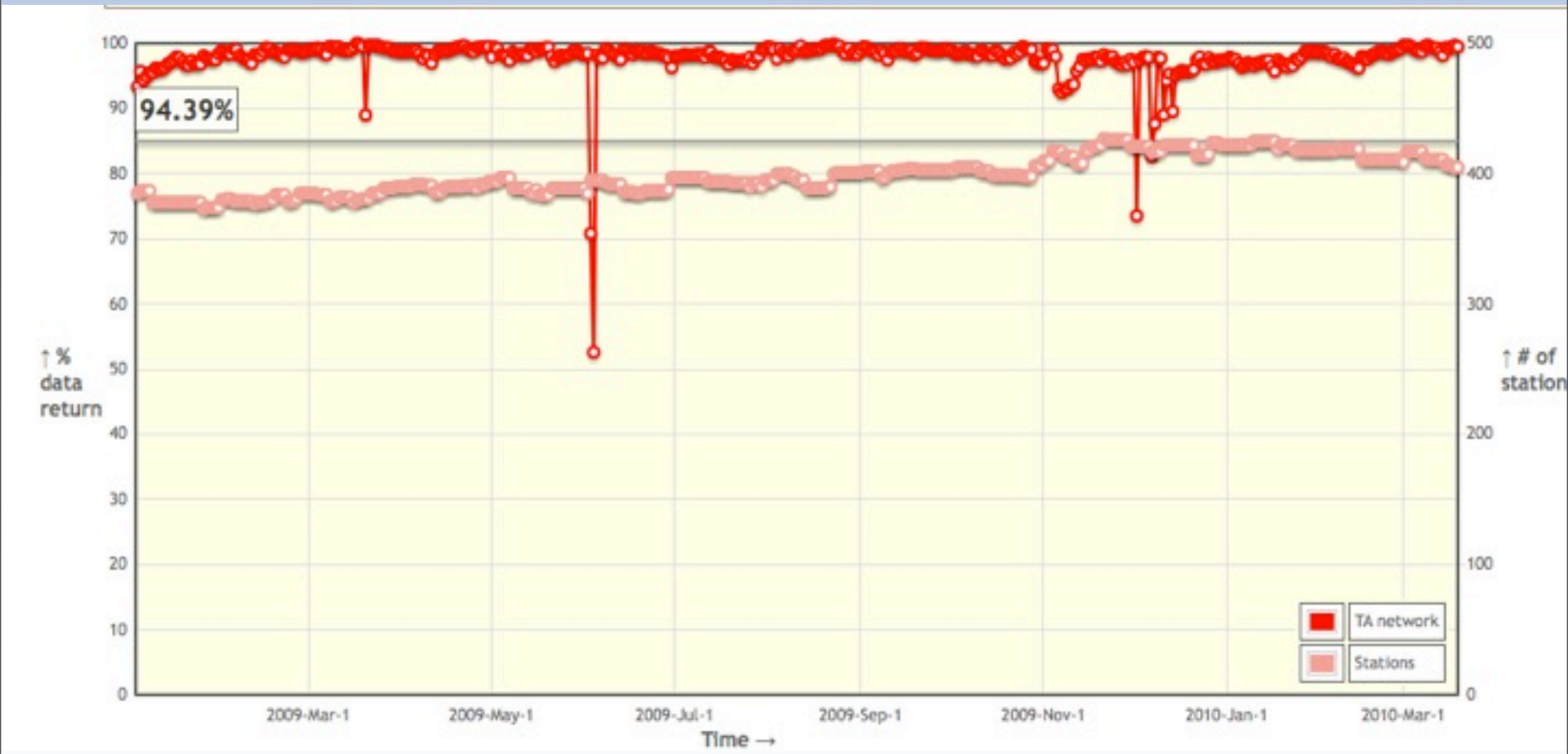
- 6 Tbytes of compressed data
  April 2004 - March 2010

- As of March 2010
  - 4 Gbytes/day compressed data
  - 2 Mbit/sec data export
  - 456 seismic stations
  - 2736 seismic channels
  - 14136 soh channels
  - 2.9M picks
  - 48K events

TA Total Data Return



TA 2009-10 Data Return



State of Health of System

- Sensor
- Datalogger
- Time Quality
- Baler
- Power supply
- Telemetry
- Networking

Q330 Status and Configuration

- Problems
  - Does metadata match actual network configuration?
  - Are station balers functioning properly?
- Initial tools
  - Willard
    - Complete access to Q330 status and configuration
- Network review
  - Willard does not scale well
  - How to access data for all stations efficiently?

TA Requirements

Q330

- Q330 or Q330HR?
- 3 channel or 6 channel Q330?
- What are Q330 filter bank settings?
- What are Q330 pre-amp settings?
- What is the Q330 firmware version?
- What is the Q330 memory size?
- How many times has Q330 rebooted?
- When was the last Q330 reboot?

Baler

- Are balers down loading data?
- PB14 or PB44?
- What is the baler firmware version?
- What is the baler serial number version?
- How many times has baler rebooted?
- When was the last baler reboot?
- How many times has baler 14 registered in past 24 hours?
- When was the last baler registration on Q330?

q330_baler

Q330_BALER(1) User Commands Q330_BALER(1)

NAME

q330_baler - collects system information about q330 and balers

SYNOPSIS

q330_baler [-v] [-V] [-n] [-a] [-b] [-q]
[-s subset] [-p pfsource_name]
[-m mail_to_operator] [-M mail_to_field_ops]
status_orb cmd_orb db

SUPPORT

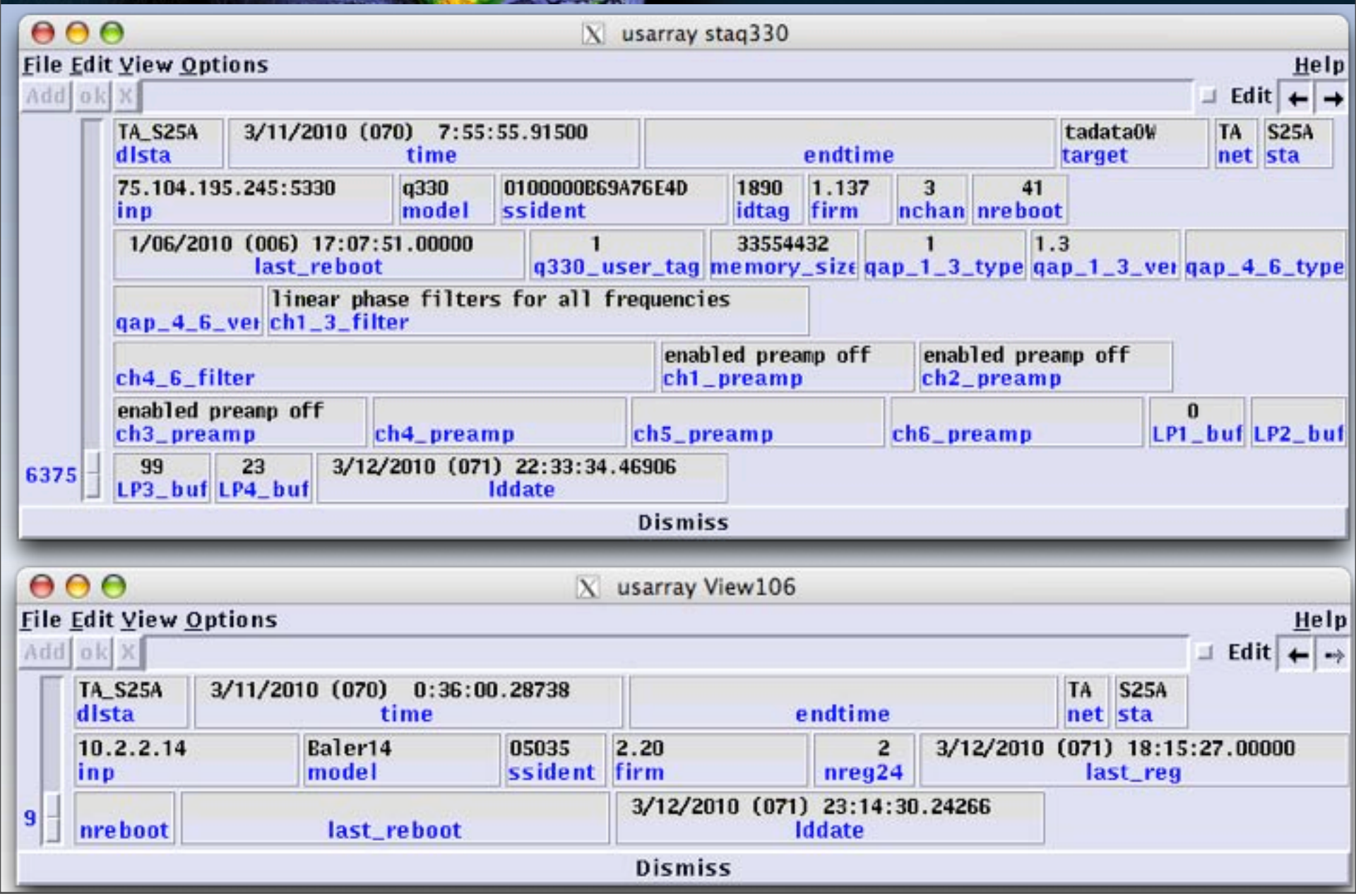
Contributed: NO BRTT support -- please contact author.

DESCRIPTION

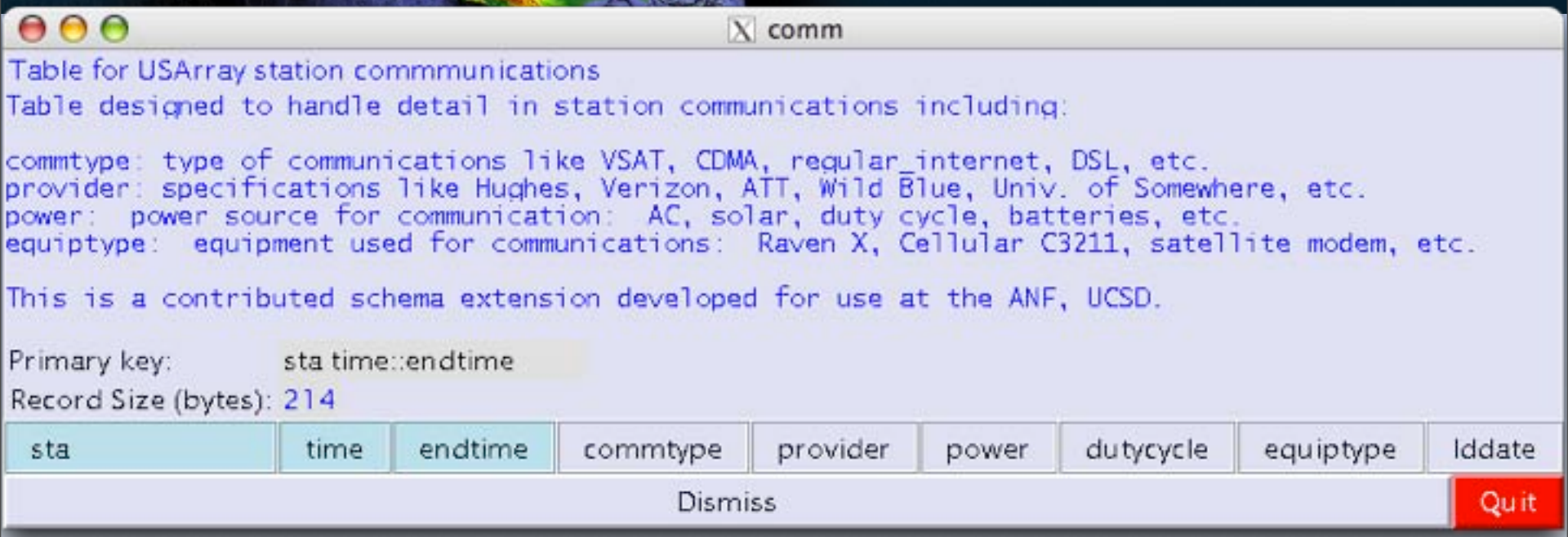
q330_baler collects information about the configuration and status of Q330 dataloggers and Quanterra PB14 and PB44 packet balers. **q330_baler** gets information about the Q330 by using **dlcmd** in the getconfig and getstatus modes. **q330_baler** gets information about the PB14 from the User Messages in the packets in the status_orb. **q330_baler** gets information about the PB44 from the User Messages in the packets in the status_orb as well as from the baler status.html page.

q330_baler writes into the db.staq330 and the db.stabaler tables.

staq330 & stabaler



comms



- Time history of communications type and provider for each station
- Stations with “no comms” also tracked
- Currently no script to auto-populate
- Used by Rob Newman’s web scripts

comms table

usarray comm

File Edit View Options Graphics Help

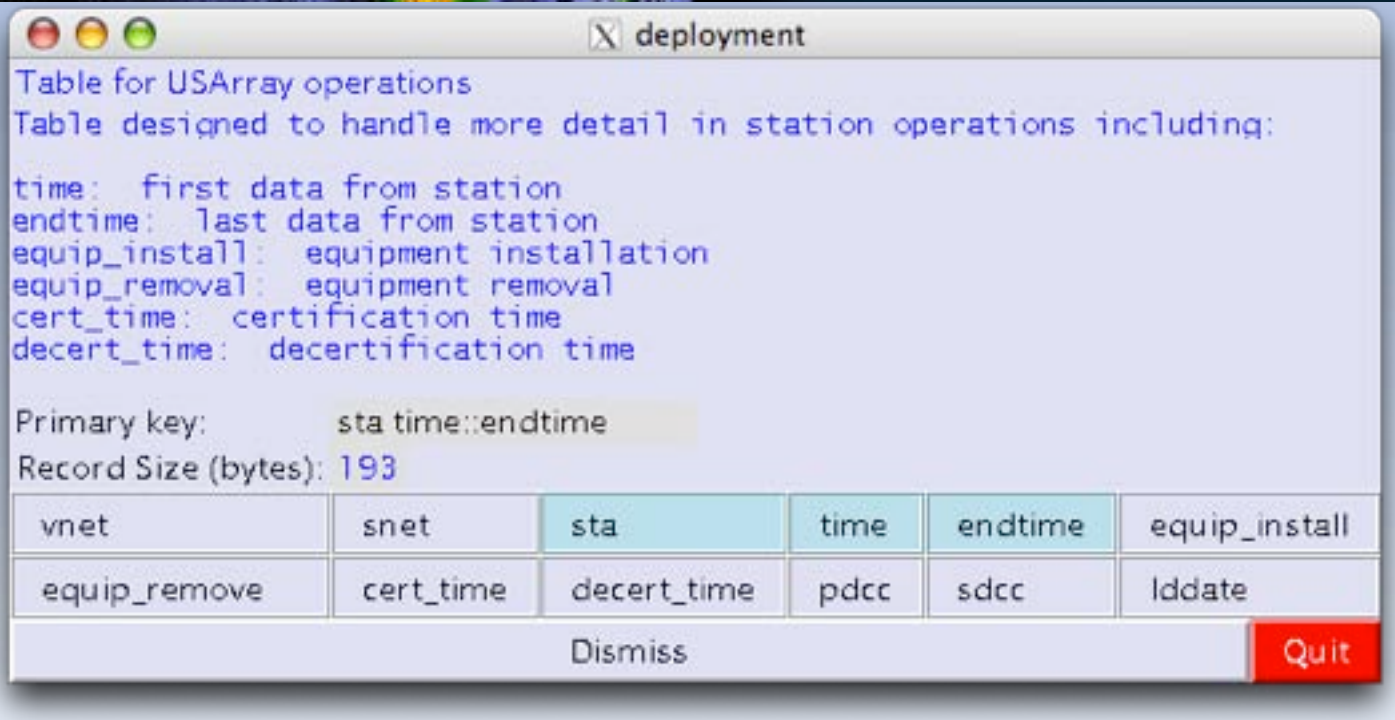
ok X

0	sta	time	endtime	commtype	provider
	109C	5/04/2004 (125) 23:00:00.00000		vsat	spacenet
	112A	5/06/2007 (126) 0:00:00.00000		cdma poc	cingular
	113A	5/08/2007 (128) 0:00:00.00000		cdma poc	cingular
	114A	2/05/2008 (036) 0:00:00.00000		cdma poc	verizon
	115A	3/23/2006 (082) 23:00:00.00000		vsat	Wild Blue
	116A	3/20/2006 (079) 20:32:00.00000		cdma poc	verizon
	117A	4/07/2007 (097) 0:42:00.00000		cdma poc	verizon
	118A	4/06/2007 (096) 0:45:00.00000		cdma poc	verizon
	119A	3/11/2007 (070) 0:00:00.00000	3/27/2008 (087) 0:00:00.00000	cdma poc	verizon
	119A	3/27/2008 (087) 1:06:40.00000		cdma poc	cingular
	120A	2/02/2008 (033) 0:00:00.00000		cdma poc	verizon
	121A	2/12/2008 (043) 0:00:00.00000		cdma poc	verizon
	122A	2/01/2008 (032) 0:00:00.00000		cdma poc	verizon
	124A	2/27/2008 (058) 0:00:00.00000		vsat	Wild Blue
	125A	3/13/2008 (073) 0:00:00.00000		cdma poc	cingular
	126A	3/15/2008 (075) 0:00:00.00000		cdma poc	cingular
	127A	3/16/2008 (076) 0:00:00.00000		cdma poc	cingular
	214A	5/07/2007 (127) 0:00:00.00000	9/08/2007 (251) 0:20:00.00000	cdma poc	cingular
	214A	9/08/2007 (251) 0:21:00.00000		vsat	Wild Blue
	216A	3/02/2007 (061) 0:00:00.00000		cdma poc	verizon
	217A	3/03/2007 (062) 0:00:00.00000		cdma poc	verizon
	218A	3/05/2007 (064) 0:00:00.00000		cdma poc	verizon
	219A	3/10/2007 (069) 0:00:00.00000		vsat	Wild Blue
	220A	2/15/2008 (046) 0:00:00.00000		cdma poc	verizon
	221A	2/11/2008 (042) 0:00:00.00000		cdma poc	verizon

653

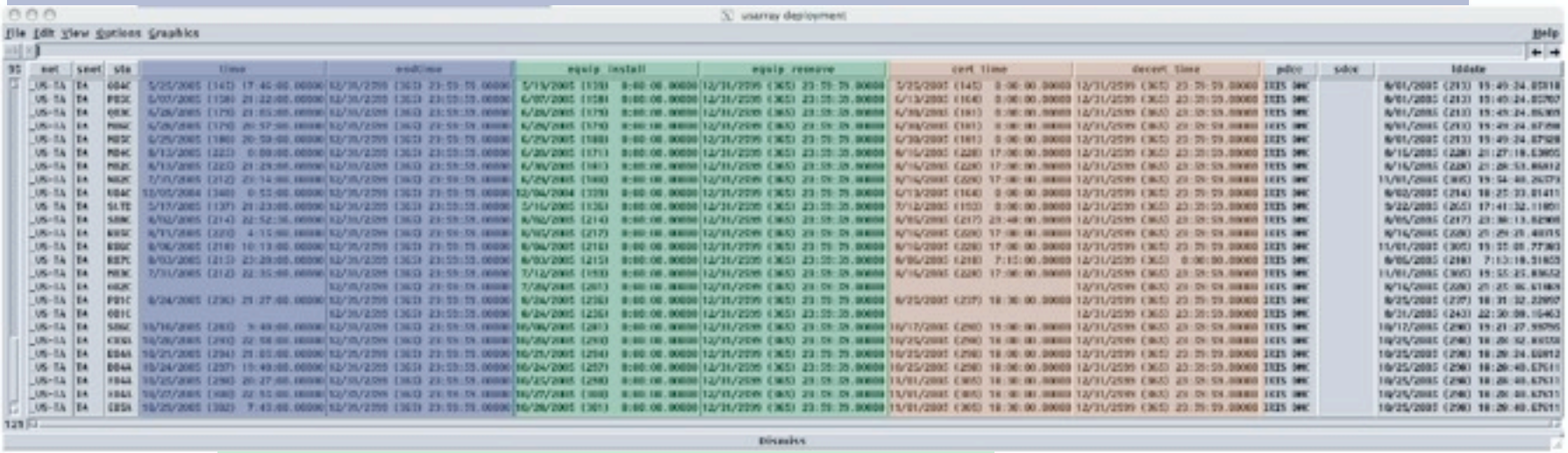
Dismiss

deployment



- Defines operational time for stations used in your experiment (cert_time::decert_time)
- No automatic population

Time of first/last data at DMC
(should be same as comm table prior to resend of old data)

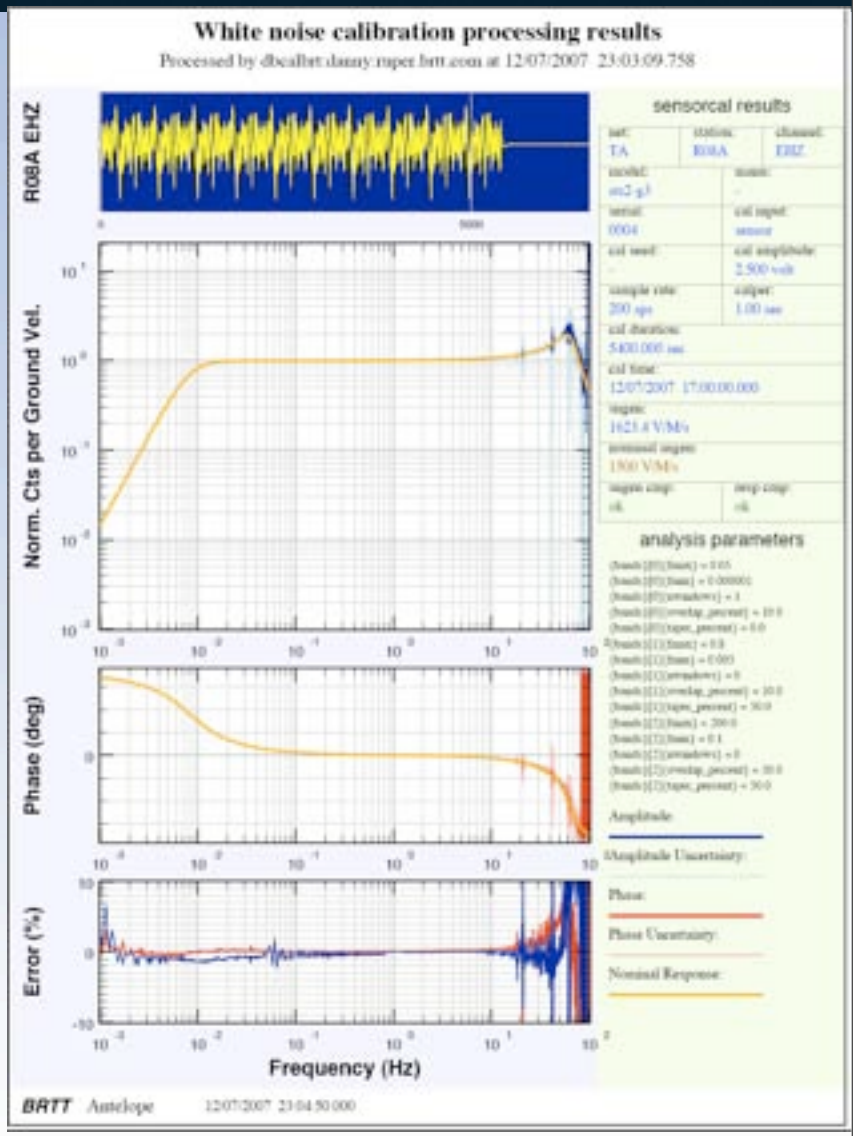


Time seismometer is installed/removed
(should be same as site table ondate/offdate)

Time data is transferred from prelim to production orb
(about the time that new dataless is made and email is sent)

Calibration

- Automated process to command, capture and analyze cal signals applied in situ using Antelope.
- Interpret calibration analyses to verify amplitude and phase response, stationarity of sensor
- Applied to all stations at beginning and end of deployment.
- Archived as Data Product



Results from BRTT Antelope software

User Commands DBCALIBRATE (1)

NAME

dbcalibrate – sensor and cross comparison calibration analysis program

SYNOPSIS

dbcalibrate [-out dbout] [-pmt] [-p pfname] [-calper calper]
[-resp_dir resp_dir] [-resp_dfile resp_dfile]
[-resp_dfilee resp_dfilee] [-resp_dfilen resp_dfilen]
[-dcalwf_sifter expr] [-sngen sngen] [-outreceno] [-v]
[-error_st_calper] [-template name] [-dbcmp dbcmp]
[-noise tstart_noise] [-type (ratio|power|coherence)]
dbin [sequence_id [sequence_id_cmp[,chan_cmp]]]

Metadata:

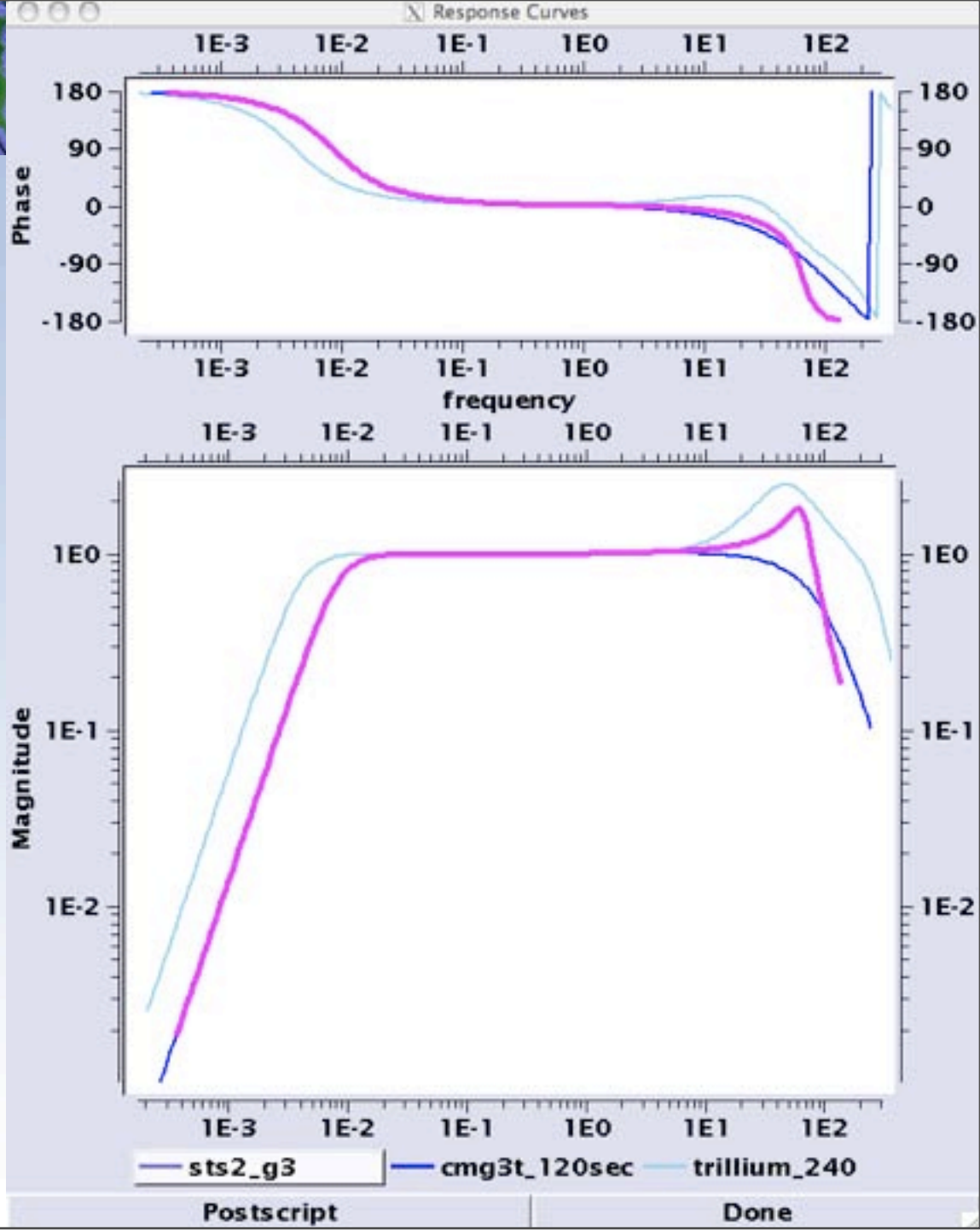
Instrument responses

STS-2

3 Generations

TA Sensors

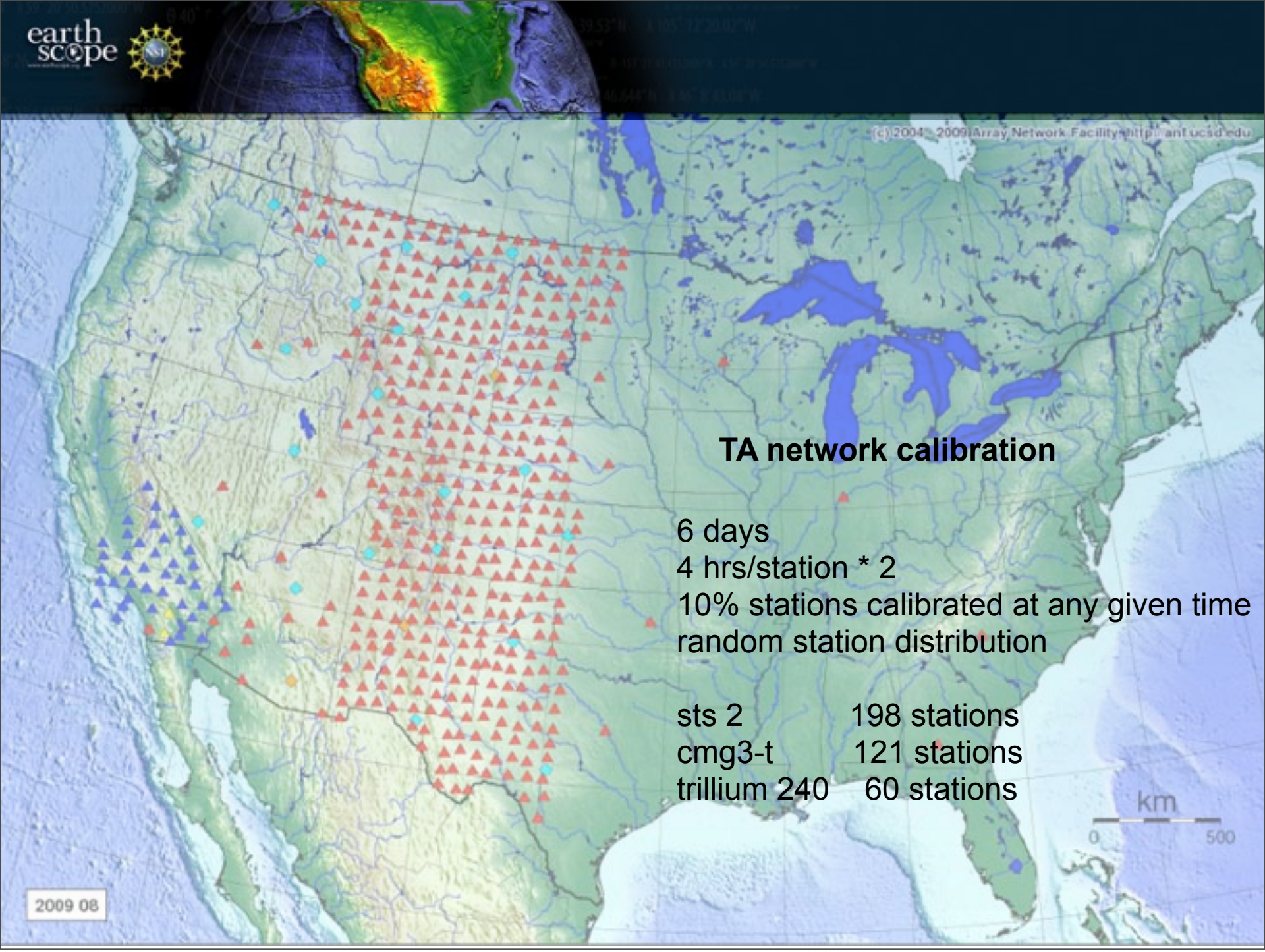
3 Types



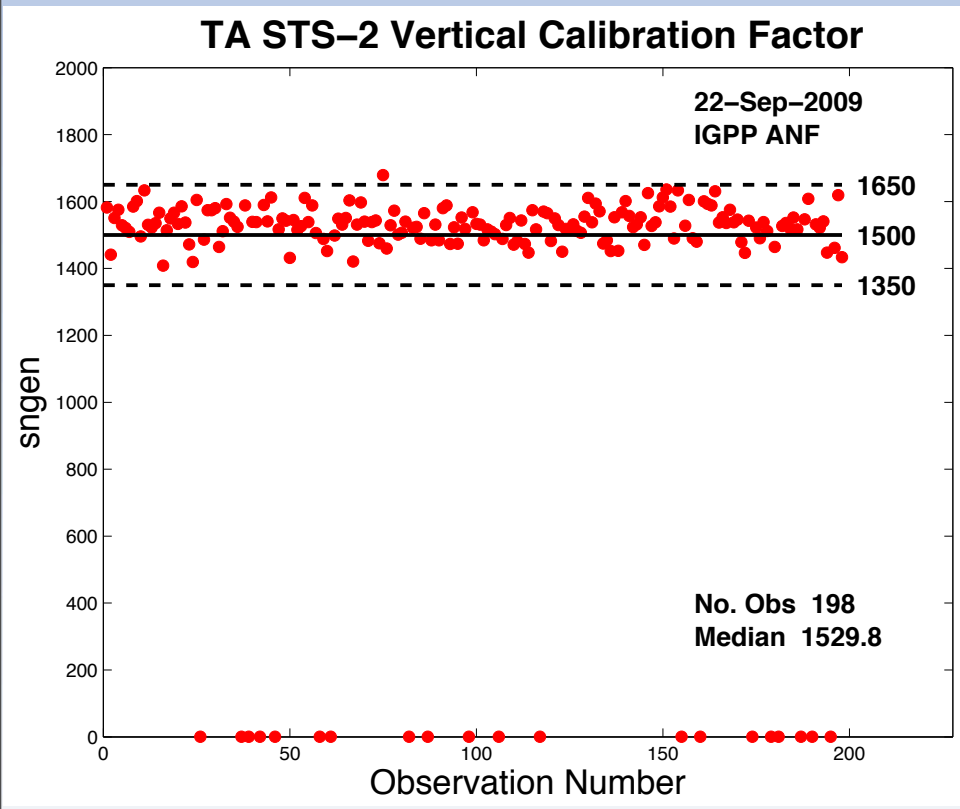
Calibration Calculation

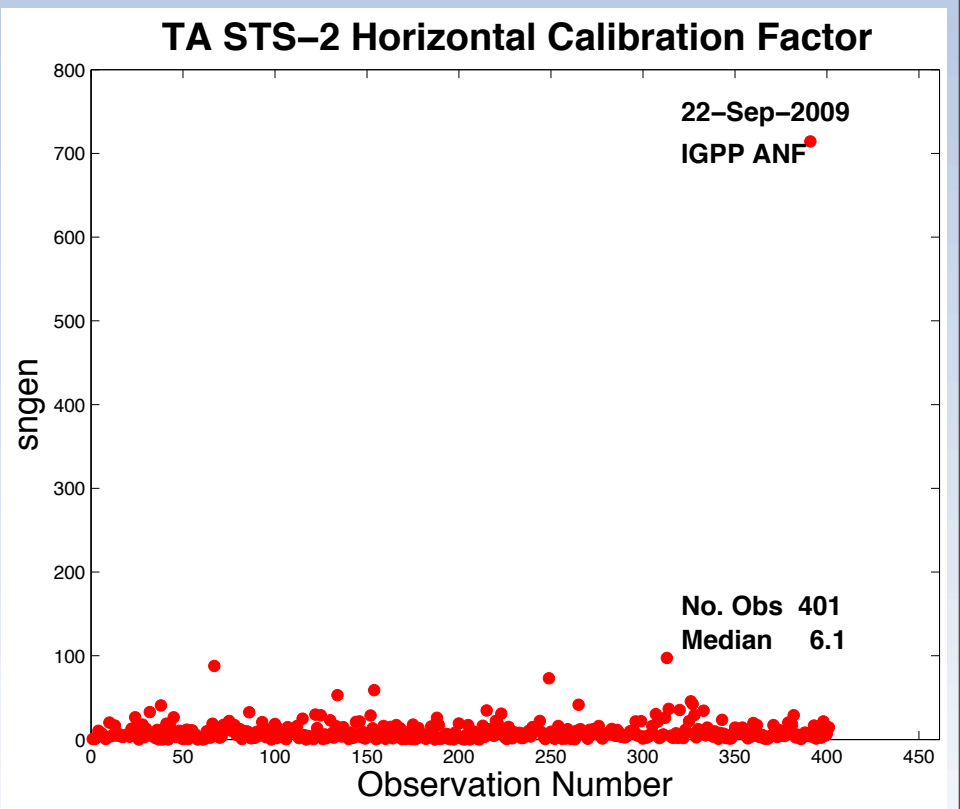
- Calibration
  - White noise signal
  - Q330 generated - input and output recorded
  - Same amplitude for each sensor type
  - Variations in gnom reflect variations in calibration circuits
  - Spectral division
  - 1.5 to 4 hour calibrations
  - 0.001 - 20 hz (standard calibration at 40 sps)
  - 0.001 - 100 hz (high freq test calibration at 200 sps)

- All current TA stations are calibrated

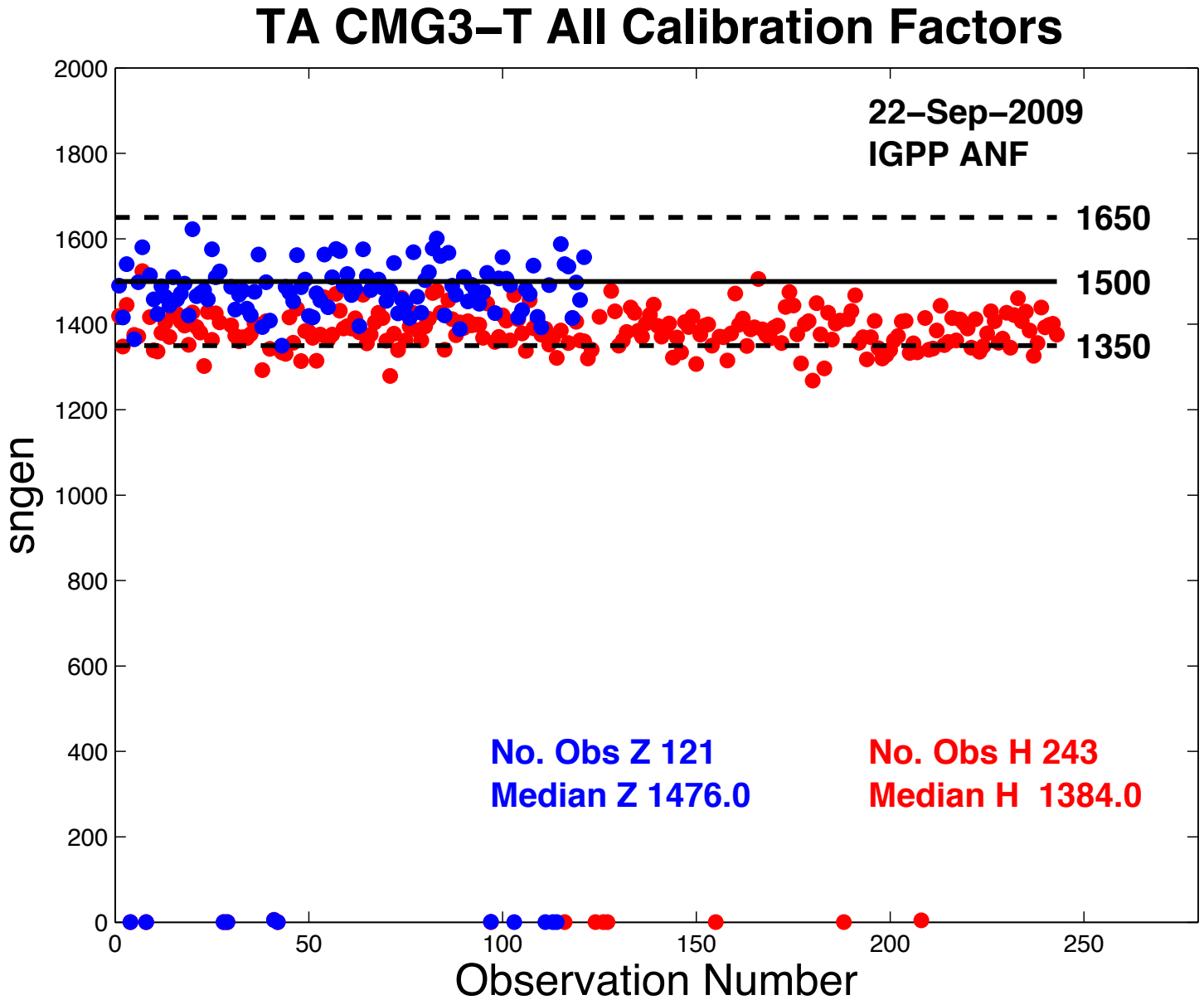

earth scope
(c) 2004 - 2009 Array Network Facility, http://anf.ucsd.edu
TA network calibration
6 days
4 hrs/station * 2
10% stations calibrated at any given time
random station distribution
sts 2 198 stations
cmg3-t 121 stations
trillium 240 60 stations
km
0
500
2009 08

STS-2 Z & H gnom

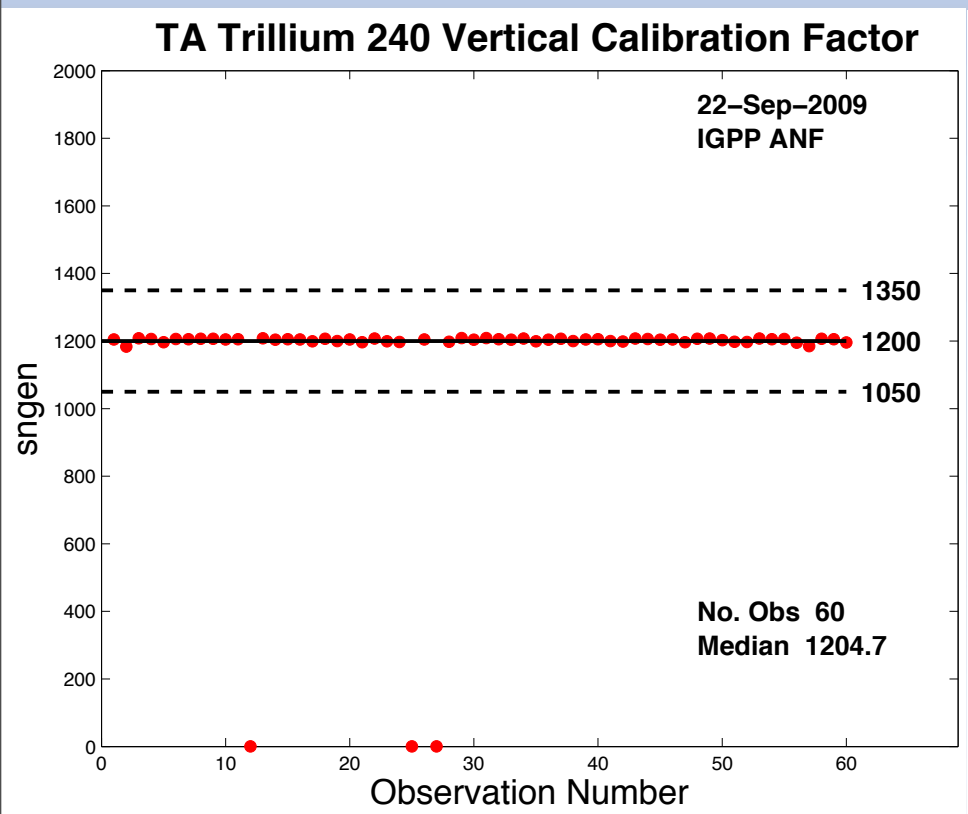

TA STS–2 Vertical Calibration Factor
22–Sep–2009
IGPP ANF
1650
1500
1350
No. Obs 198
Median 1529.8
sngen
Observation Number
2000
1800
1600
1400
1200
1000
800
600
400
200
0
0
50
100
150
200

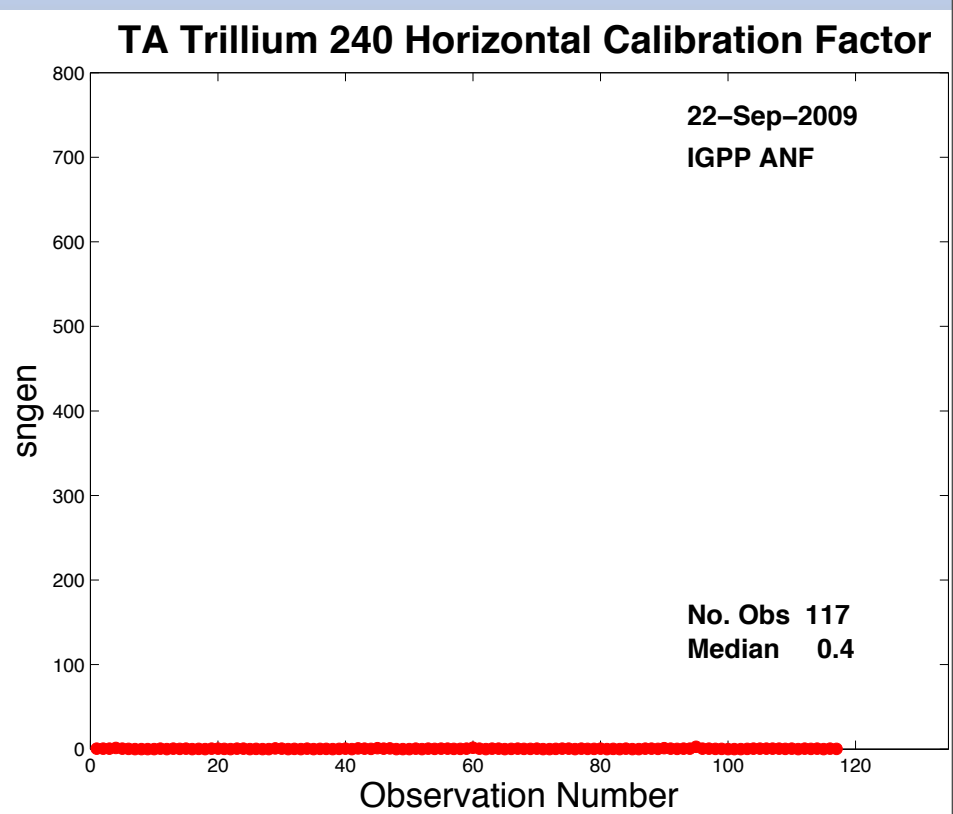

TA STS–2 Horizontal Calibration Factor
22–Sep–2009
IGPP ANF
No. Obs 401
Median 6.1
sngen
Observation Number
800
700
600
500
400
300
200
100
0
0
50
100
150
200
250
300
350
400
450

CMG3T Z & H gnom

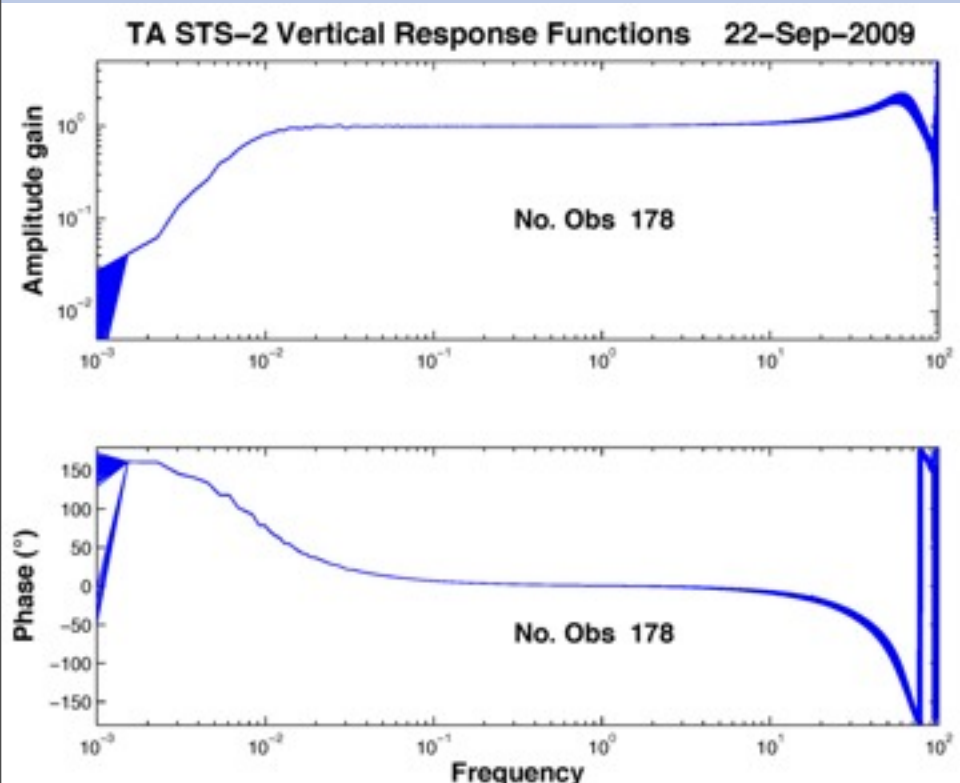


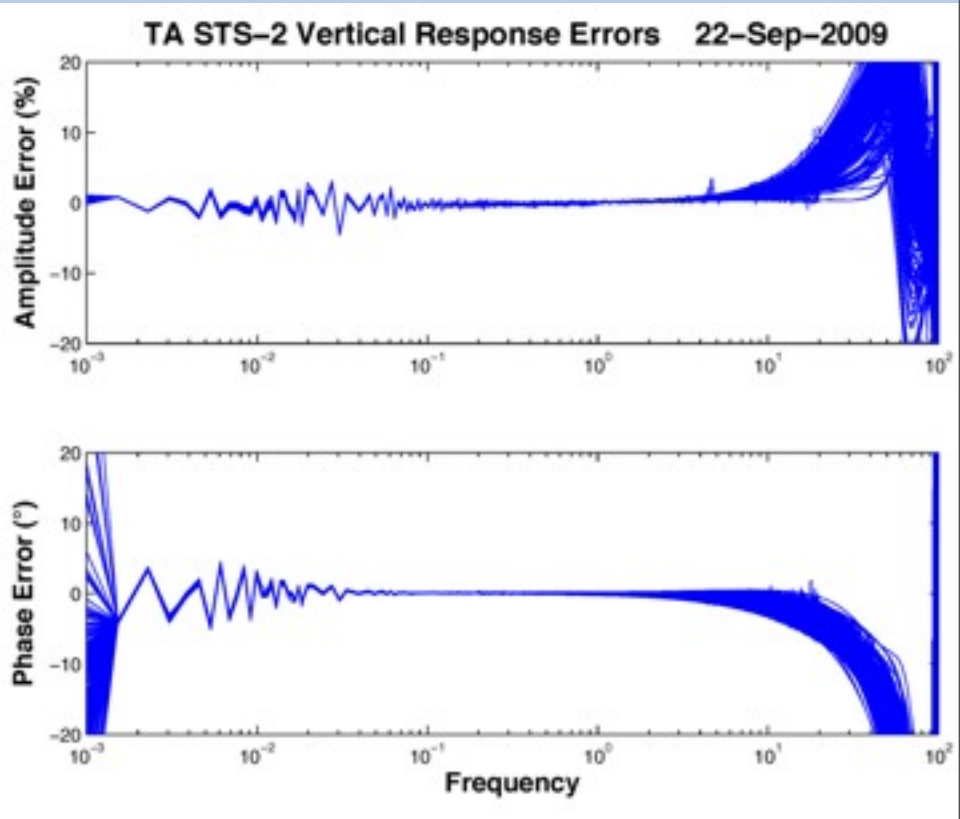
Trillium 240 Z & H gnom



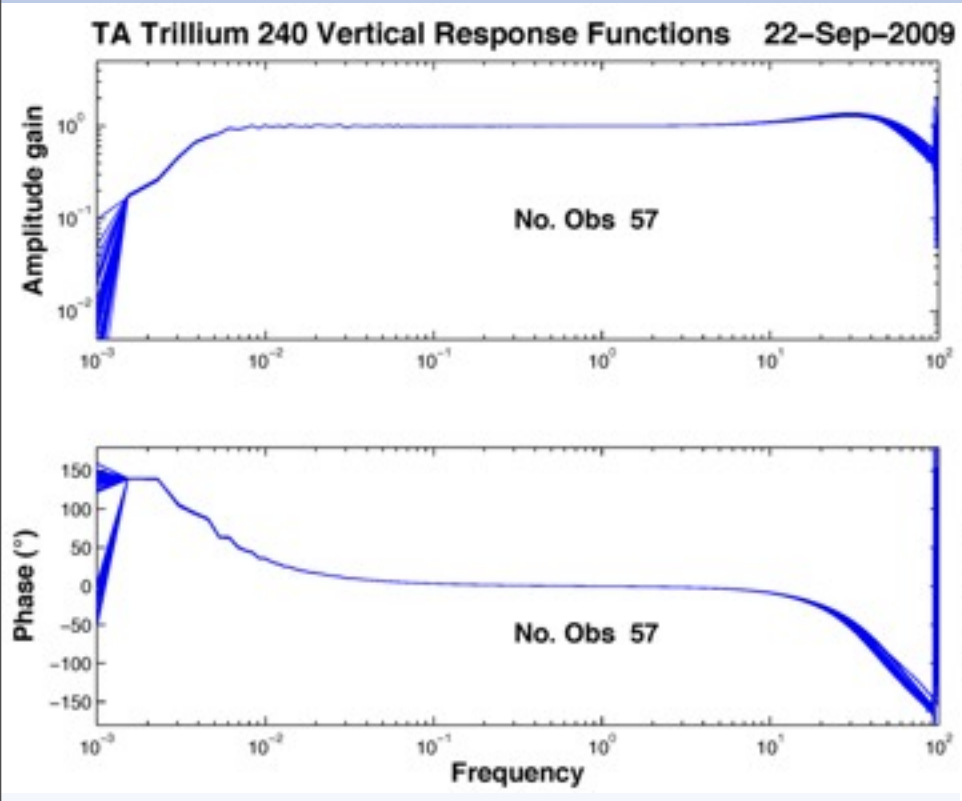


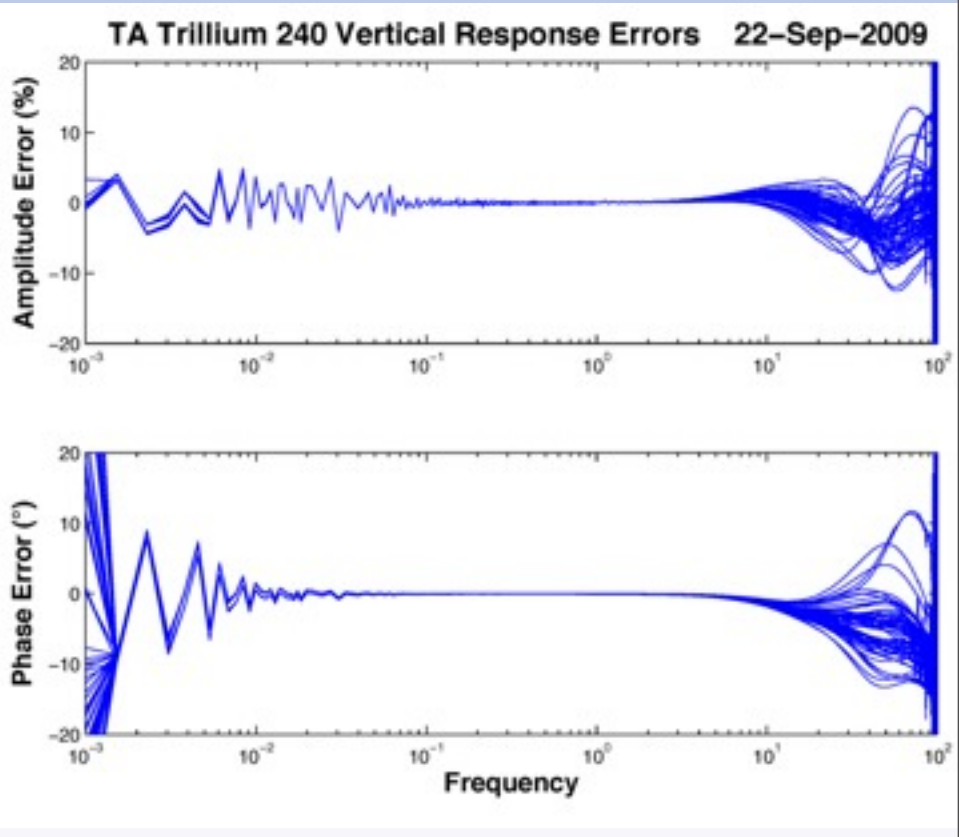
STS-2 Z gnom


TA STS–2 Vertical Response Functions 22–Sep–2009
Amplitude gain
No. Obs 178
Phase (°)
No. Obs 178
Frequency

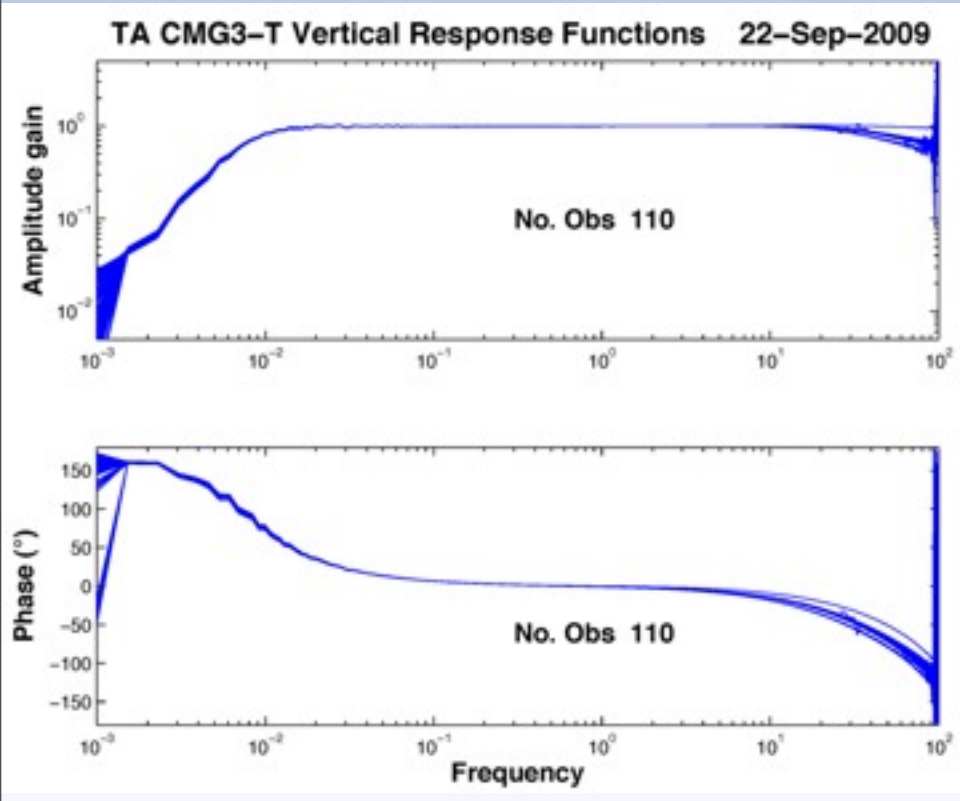

TA STS–2 Vertical Response Errors 22–Sep–2009
Amplitude Error (%)
Phase Error (°)
Frequency

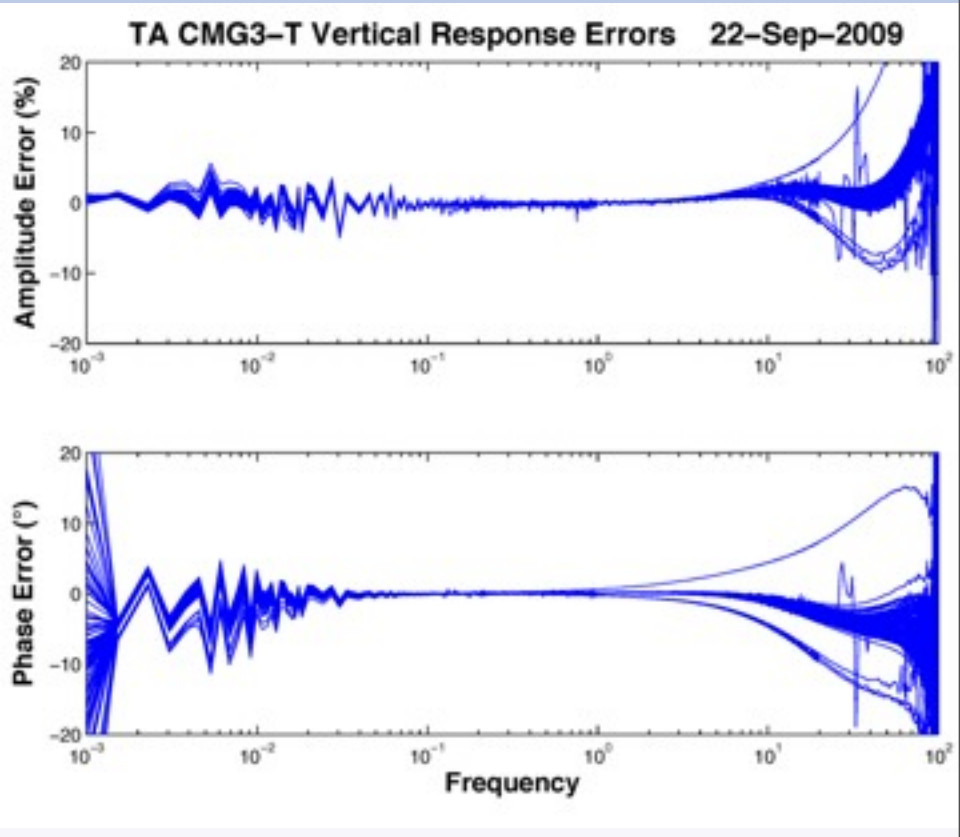
Trillium 240 Z gnom



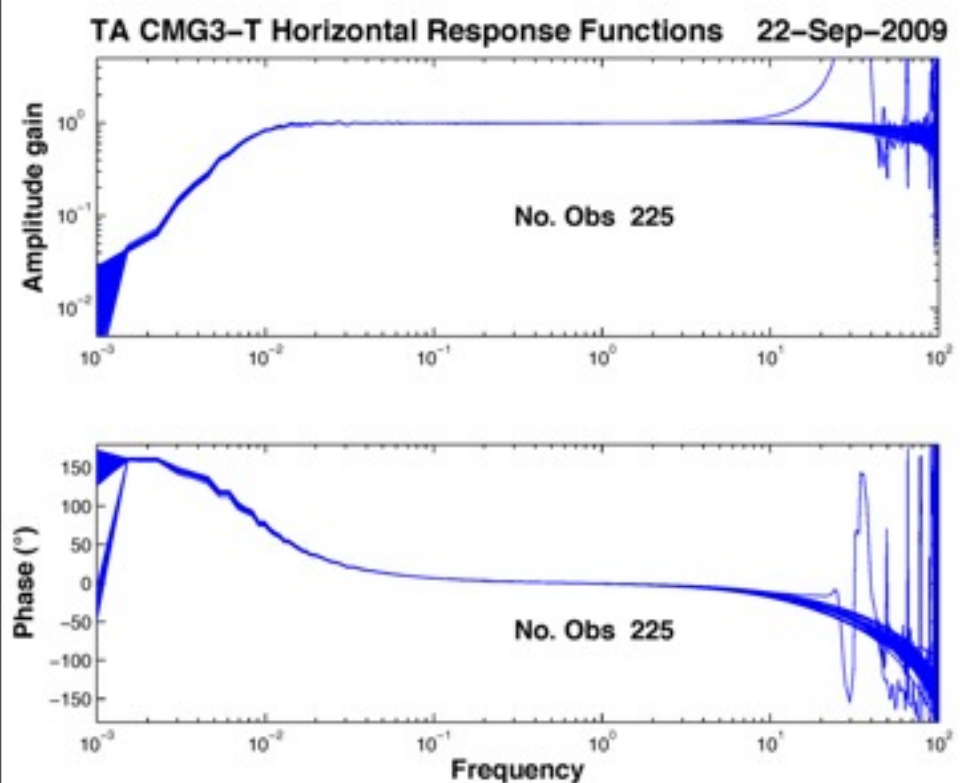


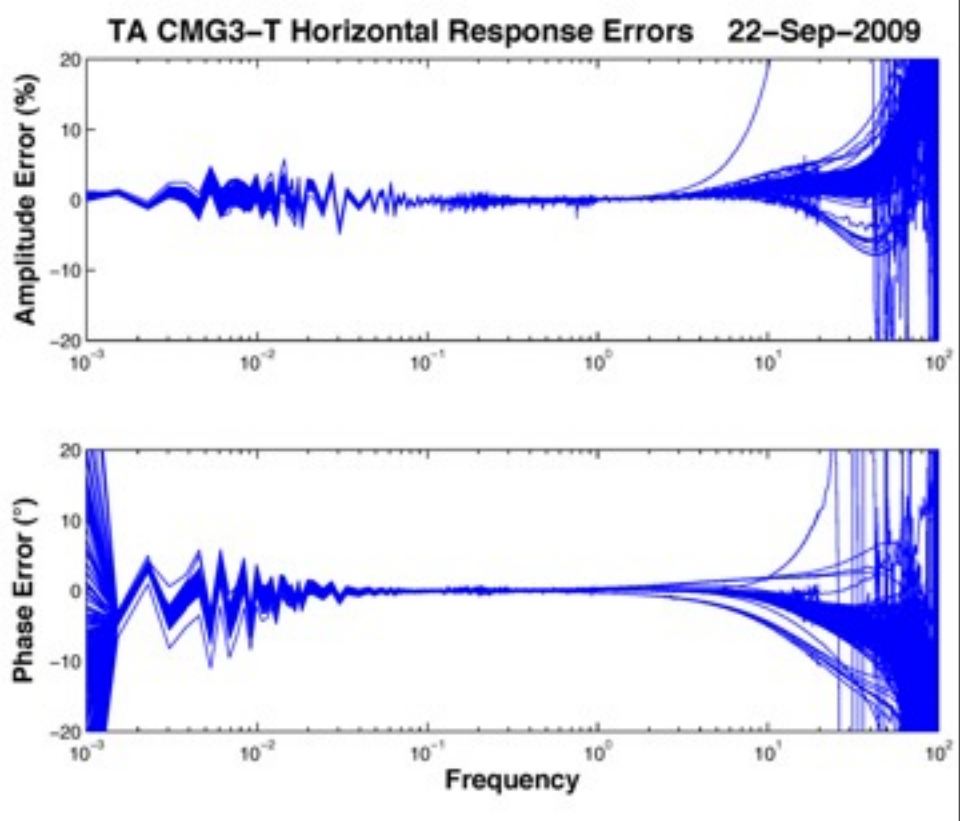
CMG3T Z gnom


TA CMG3–T Vertical Response Functions 22–Sep–2009
Amplitude gain
No. Obs 110
Phase (°)
No. Obs 110
Frequency


TA CMG3–T Vertical Response Errors 22–Sep–2009
Amplitude Error (%)
Phase Error (°)
Frequency

CMG3T H gnom


TA CMG3–T Horizontal Response Functions 22–Sep–2009
Amplitude gain
No. Obs 225
Phase (°)
No. Obs 225
Frequency


TA CMG3–T Horizontal Response Errors 22–Sep–2009
Amplitude Error (%)
Phase Error (°)
Frequency

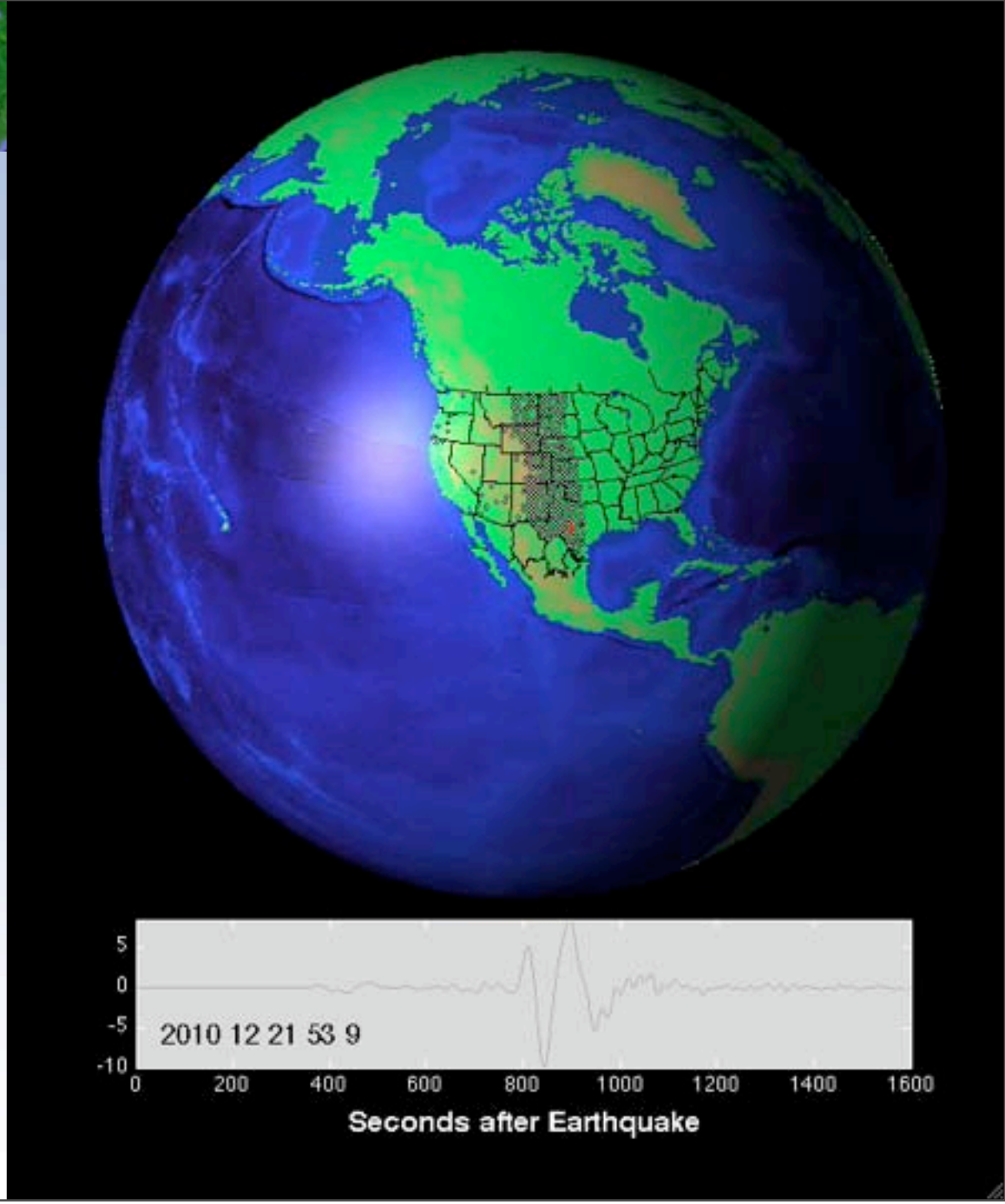
Results

- All seismometer types performed well
- Can isolate anomalous stations
- Most problems appear to be in sensor calibration circuits

Magnitude 7.0
Haiti

January 12, 2010
(21:53:10 UTC)

http://www.iris.edu/hq/files/programs/education_and_outreach/seismographs_in_schools/docs/haiti_visual/movie_Haiti_sphere.mov

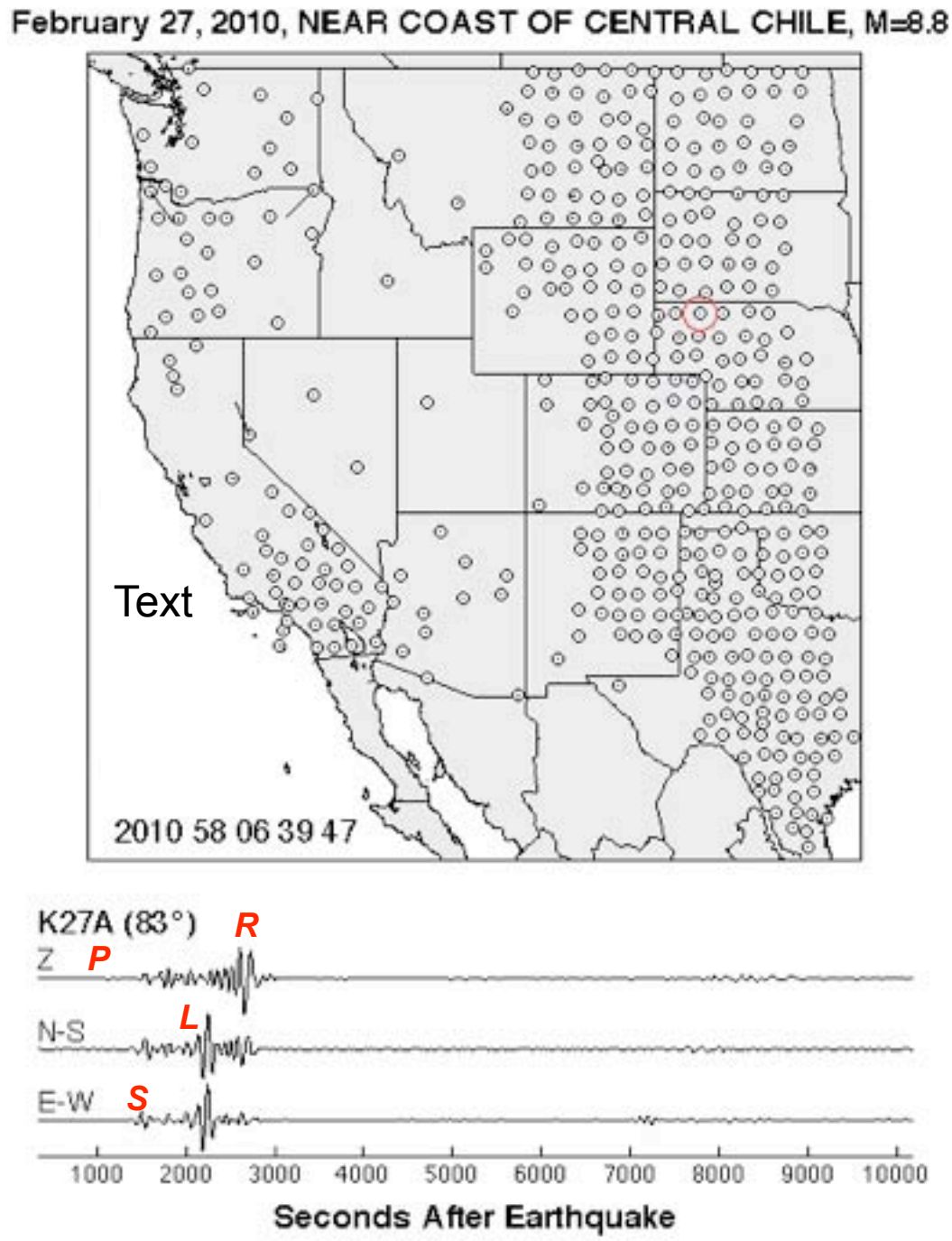


Magnitude 8.8 Chile

February 27, 2010 (06:34:17 UTC)

http://www.youtube.com/enoquakes#p/c/0391BC6FE3A28482/0/QOJ7XsdoDHg

P Wave
S Wave
Love Wave
Rayleigh Wave



Magnitude Calculation

- TA uses M_L as defined in Richter
  - No station corrections
  - ~70 km grid
- SCSN magnitudes from www.data.scec.org
- NCDEC magnitudes from www.ncedc.org

TA stations - 2007

Magnitude results