

The Antelope Toolbox for Matlab

New Mexico Tech
August 25, 2009

Dr. Kent Lindquist

Lindquist Consulting, Inc.



Established Antelope Interfaces

- Command-line
- C
- Fortran
- Perl
- TCL/Tk
- PHP
- Python

Antelope Toolbox for Matlab

- 12,000+ lines of code
- Publicly available
 - (Antelope contributed code distribution)
- 1997 – 2009
- Representative hierarchy of Antelope Tools
- Datascope Database Interaction in Matlab
 - Notably CSS3.0
- Orb interactions
- parameter-file interactions
- Etc. (Response files, stock functions)

August 25, 2009

Lindquist Consulting, Inc.



ATM History

- Originated 1997 Chicago “FISSURES” meeting
 - Seeking common seismology software framework
- Spurred by comment from Danny Harvey
- Matlab MEX-file connection to Antelope libraries
 - (grassroots approach to software interoperability)
- Four generations
 - Initial foray (two functions, 1 wkend coding)
 - Rough datascope support (2 wks coding; 1 yr light use)
 - Interface solidification (off-hrs coding, used for test projects)
 - Current version (widespread usage)

ATM Availability

● Antelope contributed-code repository

- http://github.com/antelopeusersgroup/antelope_contrib/tree/master
- `Git clone git://github.com/antelopeusersgroup/antelope_contrib.git contrib`
- `src/contrib/data/matlab/antelope`

● Compiled along with Antelope 4.11

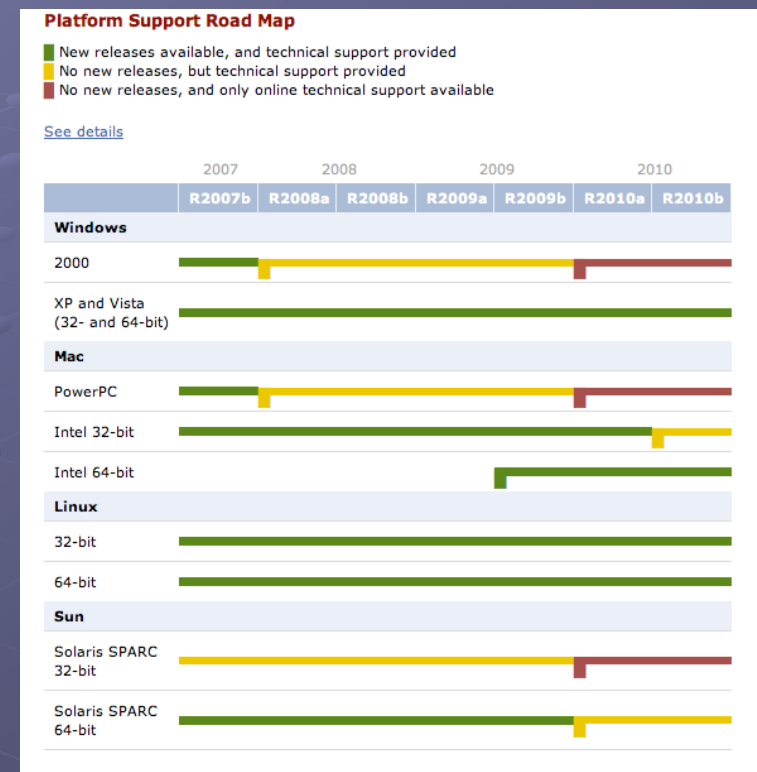
- Version 7.8 (at least on Mac)
- Version skew => need to recompile

ATM Installation

- `cd $ANTELOPE/src/contrib/data/matlab`
- `setenv MATLAB`
- `make`
- `make install`
- Test
 - (instructions coming...)

ATM Platform Compatibility

- Antelope: 32-bit
- OS: 32-bit support
- Matlab: needs 32-bit also



<http://www.mathworks.com/support/sysreq/roadmap.html>

ATM Startup

● Easiest:

- `>> run '/opt/antelope/4.11/data/matlab/antelope/scripts/setup_antelope.m'`

● Basic idea:

- `addpath([getenv('ANTELOPE') , '/data/matlab/antelope/antelope']);`
- `addpath([getenv('ANTELOPE') , '/data/matlab/antelope/scripts']);`
- `addpath([getenv('ANTELOPE') , '/data/matlab/antelope/examples']);`
- `addpath([getenv('ANTELOPE') , '/data/matlab/antelope/user']);`

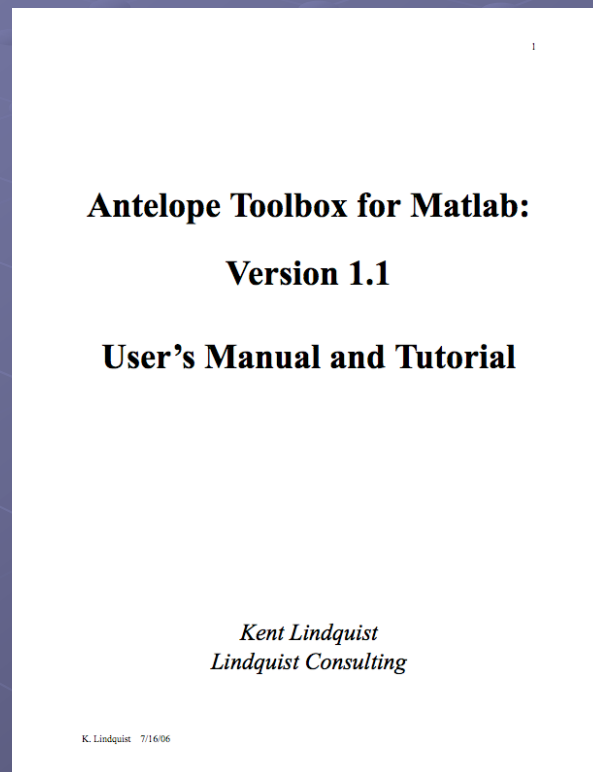
● Requires \$ANTELOPE to be set

● Can use

- `pathdef.m`
- `startup.m`
- See Matlab documentation

ATM Tutorial

- [\\$ANTELOPE/doc/matlab/Antelope_Toolbox_for_Matlab.pdf](#)
- [\\$ANTELOPE/doc/antelope_refguide.pdf](#)



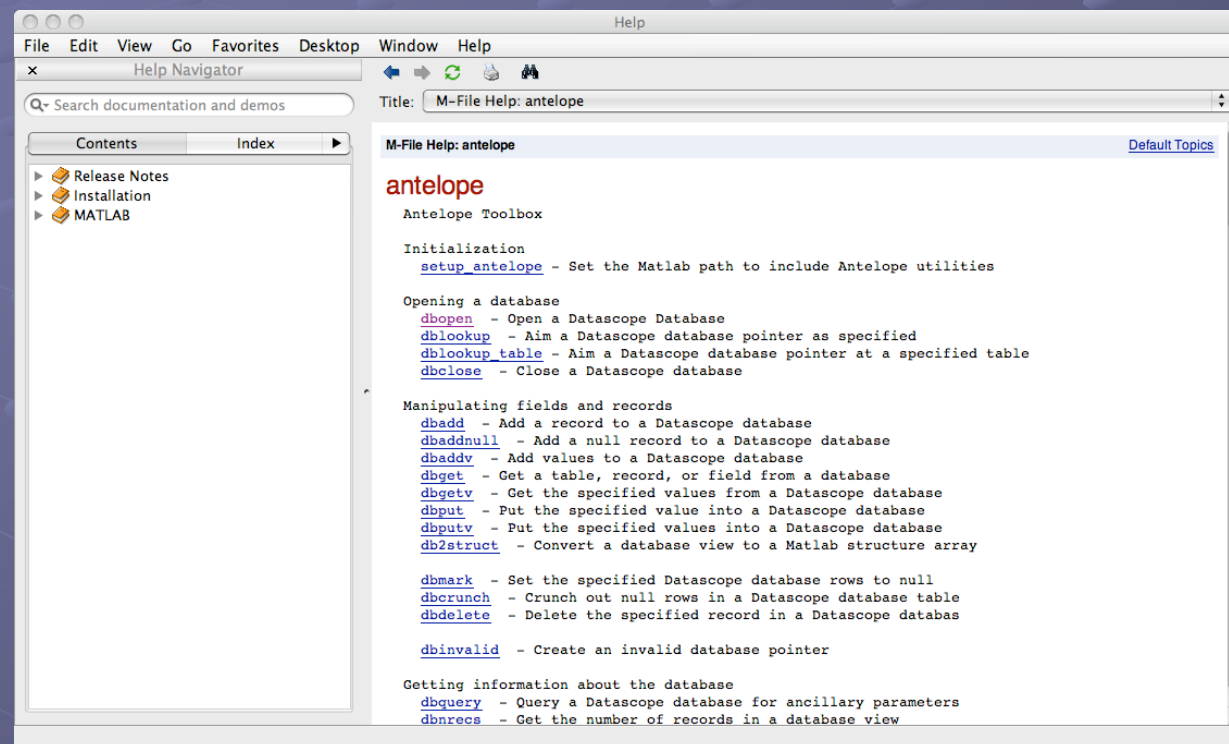
August 25, 2009

Lindquist Consulting, Inc.



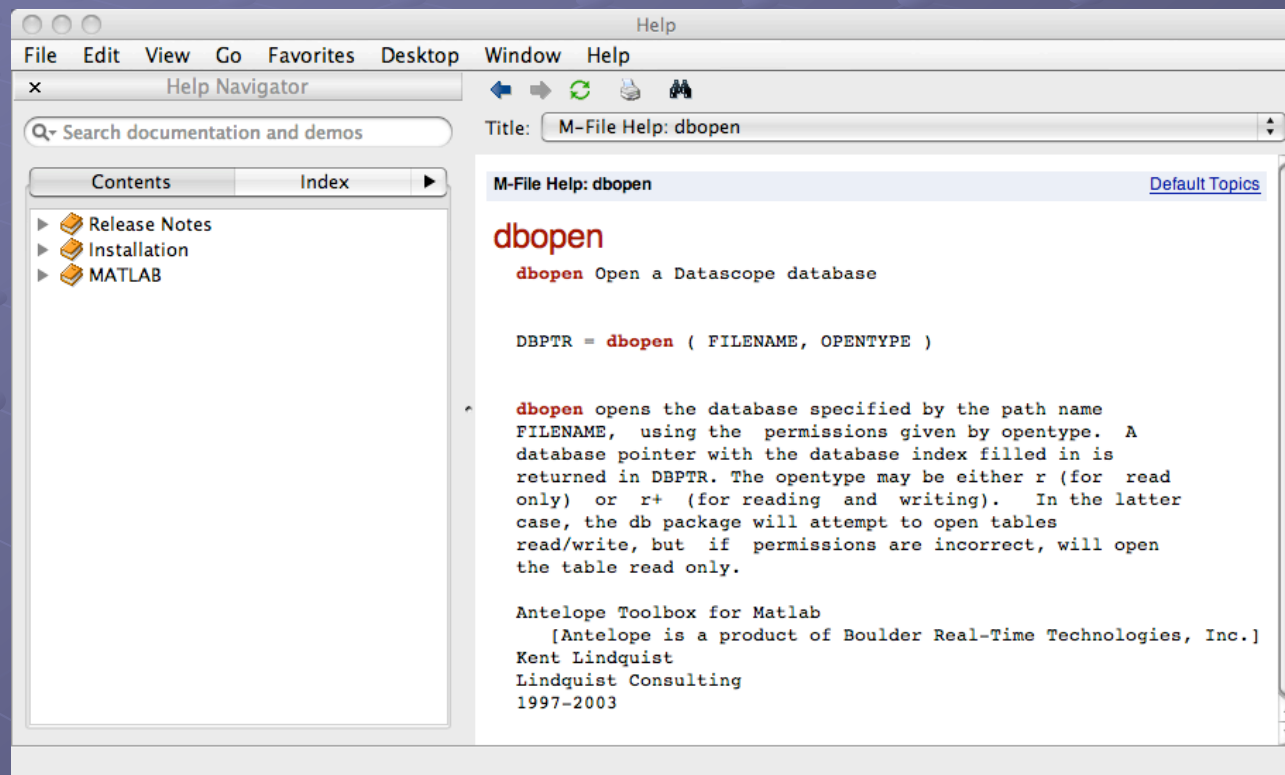
ATM Help

- `>> help antelope`
- `>> helpwin antelope`
- `>> doc antelope`



ATM Help

● >> doc dbopen



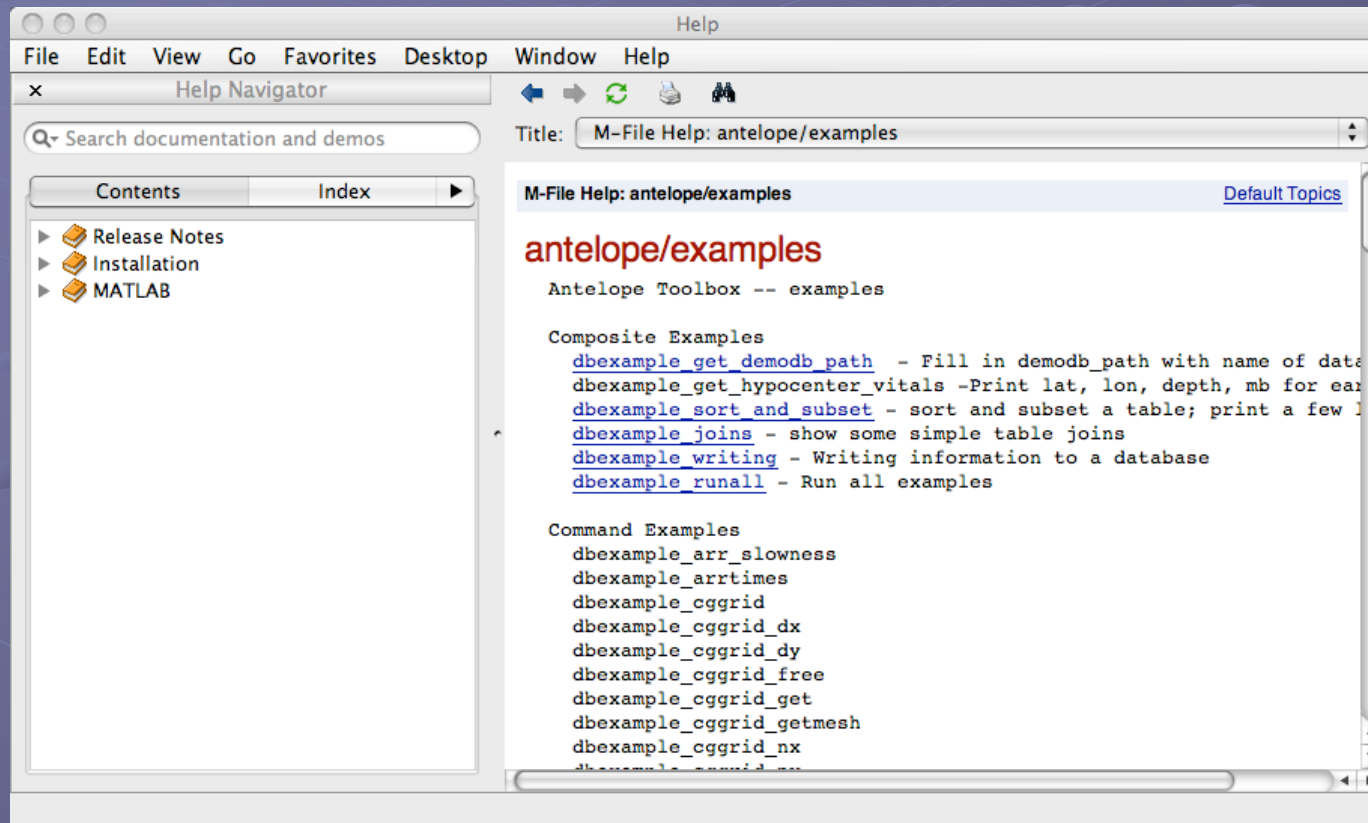
August 25, 2009

Lindquist Consulting, Inc.



ATM Examples

• >> help antelope/examples



ATM Examples

`>> dbexample_runall`

The image shows a MATLAB 7.8.0 (R2009a) window with the Command Window and a 3D plot. The Command Window displays the following code and output:

```
>> dbexample_runall
Running dbexample_runall
Running dbexample_arr_slowness

delta = 20;
depth = 10;

[slowness, phasenames] = arr_slowness( delta, depth );
space(1:length(slowness),1) = ' ';
[num2str(slowness) space char(phasenames)]

ans =
0.097873 P
0.10638 Pn
0.097966 pP
0.097943 sP
0.10668 pPn
0.082873 P
0.1066 sPn
0.082883 pP
0.08288 sP
0.12307 PnPn
0.17998 S
0.21628 Sn
0.2027 S
0.21256 S
0.18023 sS
0.21638 sSn
0.20348 sS
0.21217 sS
0.14975 S
0.14986 pS
0.14981 sS
0.22062 SnSn
0.016438 PcP
0.021013 ScP
0.021017 Pcs
```

The 3D plot, titled 'Figure 1', shows a surface plot of a function with a peak. The axes are labeled with values: the vertical axis ranges from 0 to 1, the horizontal axis from -4 to 2, and the depth axis from -2 to 2. The plot is rendered with a grid and a color gradient from blue at the base to red at the peak. Below the plot, the 'Command History' window shows the following commands:

```
doc antelope
help antelope/examples
helpwin antelope
doc antelope/examples
dbexample_runall
type dbexample_dbsort
dbexample_dbsort
8/14/09 3:38 PM --%
dbexample_runall
setup_antelope
run '/opt/antelope/4.11/
setup_antelope
clear
dbexample_runall
```

Can also use to test your installation

ATM Examples

- >> type dbexample_dbsort
- display('Running dbexample_dbsort')
- dbexample_get_demodb_path;
- echo on
- db = dbopen(demodb_path,'r');
- db=dblookup_table(db,'origin');
- db=dbsubset(db,'mb>6.3');
- db=dbsort(db,'mb')
- dbgetv(db,'mb')
- dbclose(db);
- echo off
- >>

ATM Examples

- `>> dbexample_dbsort`

- `display('Running dbexample_dbsort')`
`Running dbexample_dbsort`

- `dbexample_get_demodb_path;`

- `display('Running dbexample_get_demodb_path')`
`Running dbexample_get_demodb_path`

- `demodb_path = '/opt/antelope/data/db/demo/demo'`

- `demodb_path =`
`/opt/antelope/data/db/demo/demo`

- `echo on`

- `db = dbopen(demodb_path, 'r');`

- `db=dblookup_table(db, 'origin');`

- `db=dbsubset(db, 'mb>6.3');`

- `db=dbsort(db, 'mb')`

- `db =`

- `database: 1`

- `table: 42`

- `field: -501`

- `record: -501`

- `dbgetv(db, 'mb')`

- `ans =`

- `6.3100`

- `6.4000`

- `6.4000`

- `6.4200`

- `6.5000`

- `6.5700`

- `dbclose(db);`

- `echo off`

- `>>`

ATM Special Properties

- Matrix orientation for dbgetv 'column' retrieval:

- `db=dbsort(db,'mb')`

- `db =`

- `database: 1`

- `table: 42`

- `field: -501`

- `record: -501`

- `dbgetv(db,'mb')`

- `ans =`

- `6.3100`

- `6.4000`

- `6.4000`

- `6.4200`

- `6.5000`

- `6.5700`

ATM Special Properties

- **Db2struct:**

- `db = dblookup_table(db, 'origin');`

- `db.record=0;`

- `% Example 1:`

- `db2struct(db)`

- **dbnrecs**

August 25, 2009

Lindquist Consulting, Inc.

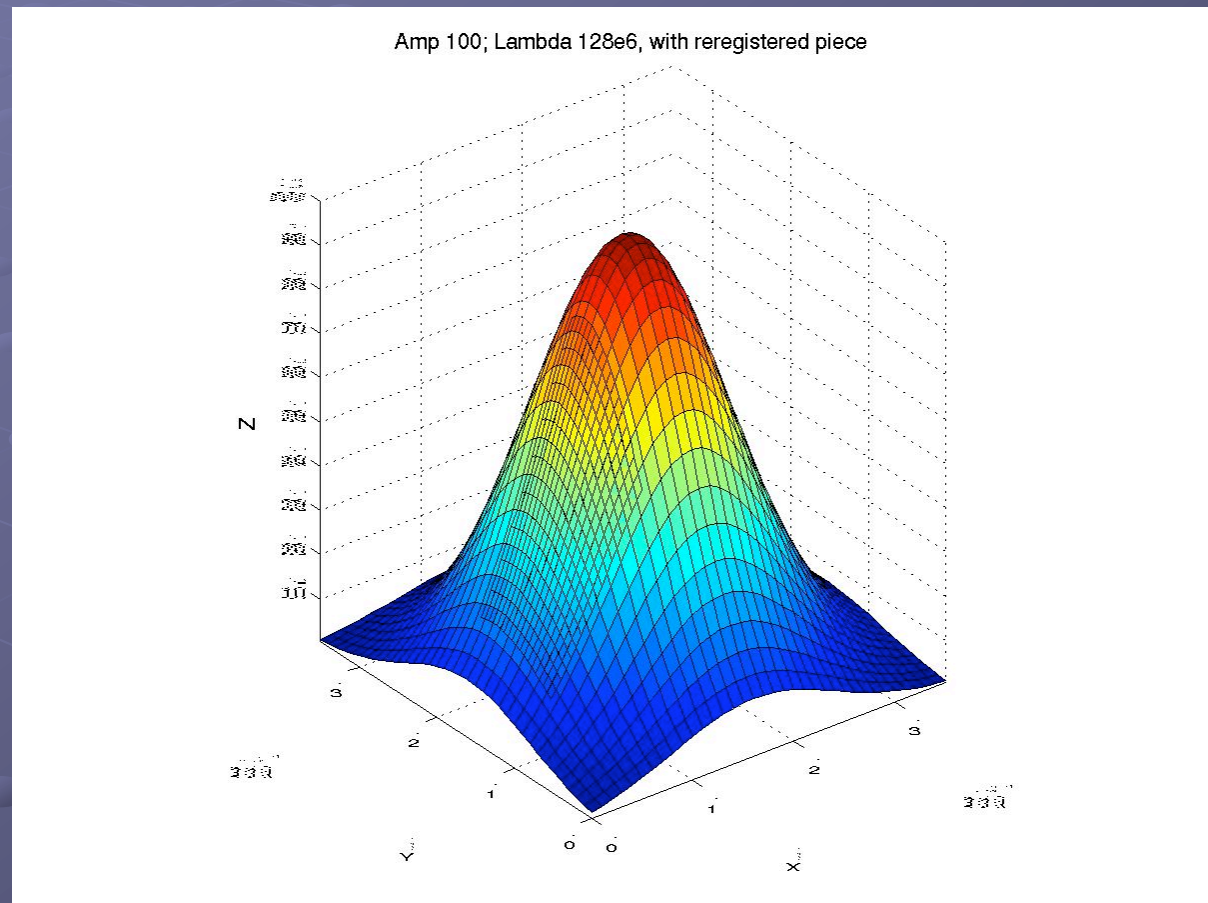
- `ans =`
- `lat: 40.0740`
- `lon: 69.1640`
- `depth: 155.1660`
- `time: 7.0437e+08`
- `orid: 1`
- `evid: -1`
- `jdate: 1992118`
- `nass: 7`
- `ndef: 7`
- `ndp: -1`
- `grn: 715`
- `srn: 48`
- `etype: '-'`
- `review: "`
- `depdp: -999`
- `dtype: 'f'`
- `mb: 2.6200`
- `mbid: 1`
- `ms: -999`
- `msid: -1`
- `ml: -999`
- `mlid: -1`
- `algorithm: 'locsat:kyrgyz'`
- `auth: 'JSPC'`
- `commid: -1`
- `lddate: 790466871`

ATM Types of routines

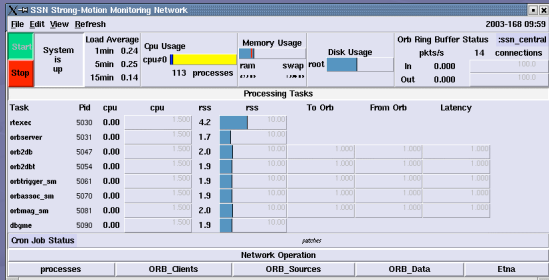
- Datascope database interaction
- Basic orbserver interaction
- Instrument response routines
- Parameter files
- Error handling
- Special functions (travel times, time conversion, misc)
- Computational Geometry routines

Libcgeom: various utilities

for example:
re-registration
of grids,
Interpolation,
Generic
functions



Ground-motion monitoring tools



Orbserver

orbwfmeas

wfmgme table

orbdetect
orbtrigger
orbassoc
orbmag

dbgme

gme1.0: qgrid table

origin table

id	sta	chan	measType	filter	timeas	evnt1	evnt2	units1	units2
50810	HCZ	pendv	00	1.0 4.0 10.0 4	INT	5/02/2003 13:22	0:10:58.380	-3732.520	-790.935
50810	HCZ	pendv	00	1.0 4.0 10.0 4	INT	5/02/2003 13:22	0:11:02.760	-2008.770	-1074.001
50810	HCZ	pendv	00	1.0 4.0 10.0 4	INT	5/02/2003 13:22	0:11:06.780	8129.185	-729.442
50810	HCZ	pendv	00	1.0 4.0 10.0 4	INT	5/02/2003 13:22	0:11:09.400	29.131	4.300
50810	HCZ	pendv	00	1.0 4.0 10.0 4	INT	5/02/2003 13:22	0:11:12.760	80.222	-7.315
50810	HCZ	pendv	00	1.0 4.0 10.0 4	INT	5/02/2003 13:22	0:11:16.140	-23.336	3.366
50810	HCZ	pendv	00	1.0 4.0 10.0 4	INT	5/02/2003 13:22	0:11:19.500	0.106	0.809
50810	HCZ	pendv	00	1.0 4.0 10.0 4	INT	5/02/2003 13:22	0:11:22.860	-0.105	0.099
50810	HCZ	pendv	00	1.0 4.0 10.0 4	INT	5/02/2003 13:22	0:11:26.220	-0.089	-0.089
50811	HCZ	pendv	00	1.0 4.0 10.0 4	INT	5/02/2003 13:22	0:15:15.890	-340.181	-216.249
50811	HCZ	pendv	00	1.0 4.0 10.0 4	INT	5/02/2003 13:22	0:15:19.480	-587.812	-6.089
50811	HCZ	pendv	00	1.0 4.0 10.0 4	INT	5/02/2003 13:22	0:15:23.060	-275.063	-164.828
50811	HCZ	pendv	00	1.0 4.0 10.0 4	INT	5/02/2003 13:22	0:15:26.640	-1.564	-0.271
50811	HCZ	pendv	00	1.0 4.0 10.0 4	INT	5/02/2003 13:22	0:15:30.220	-7.817	3.888
50811	HCZ	pendv	00	1.0 4.0 10.0 4	INT	5/02/2003 13:22	0:15:33.800	-1.536	-0.433
50811	HCZ	pendv	00	1.0 4.0 10.0 4	INT	5/02/2003 13:22	0:15:37.380	0.015	0.825
50811	HCZ	pendv	00	1.0 4.0 10.0 4	INT	5/02/2003 13:22	0:15:40.960	-0.763	-0.825
50811	HCZ	pendv	00	1.0 4.0 10.0 4	INT	5/02/2003 13:22	0:15:44.540	-0.024	0.025
50811	HCZ	pendv	00	1.0 4.0 10.0 4	INT	5/02/2003 13:22	0:15:48.120	-554.421	802.921
50810	HCZ	pendv	00	1.0 4.0 10.0 4	INT	5/02/2003 13:22	0:21:40.360	-2430.644	-1010.829
50810	HCZ	pendv	00	1.0 4.0 10.0 4	INT	5/02/2003 13:22	0:21:43.940	-3700.364	-730.426
50810	HCZ	pendv	00	1.0 4.0 10.0 4	INT	5/02/2003 13:22	0:21:47.520	15.205	-6.863
50810	HCZ	pendv	00	1.0 4.0 10.0 4	INT	5/02/2003 13:22	0:21:51.100	16.745	6.878
50810	HCZ	pendv	00	1.0 4.0 10.0 4	INT	5/02/2003 13:22	0:21:54.680	22.063	4.115

id	lat	lon	depth	time	evnt1	evnt2	date	hazs	ndst	dypp	ml	mltd
33.4771	-116.4554	16.0000	5/02/2003 13:22	0:15:37.832	1	1	2003132	6	5	F		
33.7620	-117.6823	8.0000	5/02/2003 13:22	0:07:05.286	2	2	2003132	4	4	F		
33.8261	-117.4216	12.0000	5/02/2003 13:22	0:08:11.618	3	3	2003132	11	11	F		
33.8916	-116.3912	24.0000	5/02/2003 13:22	0:07:29.432	4	4	2003132	5	5	F		
34.0096	-117.1111	16.0000	5/02/2003 13:22	0:14:51.386	5	5	2003132	11	11	F		
32.8112	-116.1825	16.0000	5/02/2003 13:22	0:14:54.398	6	6	2003132	11	11	F		
32.9479	-115.8652	12.0000	5/02/2003 13:22	0:14:56.794	7	7	2003134	6	6	F	2.38	2
32.9479	-115.8652	12.0000	5/02/2003 13:22	0:14:56.794	7	7	2003134	6	6	F	2.38	3
32.9479	-115.8652	12.0000	5/02/2003 13:22	0:14:56.794	7	7	2003134	6	6	F	1.86	4
33.4771	-116.4554	6.0000	5/02/2003 13:22	0:15:38.337	10	10	2003134	8	8	F	1.26	5
33.0374	-116.7629	20.0000	5/02/2003 13:22	0:16:01.562	11	11	2003134	6	6	F	1.86	6
33.3516	-116.3207	14.0000	5/02/2003 13:22	0:14:01.467	12	12	2003134	5	5	F	1.63	7
33.0374	-116.7629	20.0000	5/02/2003 13:22	0:16:01.562	13	13	2003135	7	7	F	2.52	8
32.8711	-116.4973	12.0000	5/02/2003 13:22	0:14:03.024	14	14	2003135	4	4	F	2.87	9
33.7714	-116.8209	24.0000	5/02/2003 13:22	0:14:01.554	15	15	2003135	8	8	F	1.48	10
33.8112	-116.7964	6.0000	5/02/2003 13:22	0:17:16.139	16	16	2003136	5	5	F	0.31	11
33.0374	-116.7629	20.0000	5/02/2003 13:22	0:16:01.562	17	17	2003136	8	8	F	2.52	12
34.2162	-117.6840	12.0000	5/02/2003 13:22	0:13:21.170	18	18	2003137	11	11	F	2.62	13
33.3516	-116.3207	14.0000	5/02/2003 13:22	0:14:01.467	19	19	2003137	8	8	F	2.51	14
41.6651	-115.8841	30.0000	5/02/2003 13:30	0:14:11.082	20	20	2003138	10	10	F	1.71	15
33.8112	-116.7964	6.0000	5/02/2003 13:30	0:17:16.139	21	21	2003139	7	7	F	2.71	16
33.4771	-116.4554	16.0000	5/02/2003 13:30	0:15:38.337	22	22	2003139	11	11	F	1.79	16
34.0274	-117.4071	10.0000	5/12/2003 13:30	0:14:30.253	23	23	2003139	7	7	F	2.71	17
33.2710	-116.6527	2.0000	5/12/2003 13:32	0:21:14.531	24	24	2003132	8	8	F	2.35	18
33.2710	-116.6527	2.0000	5/12/2003 13:32	0:21:14.531	24	24	2003132	8	8	F	2.35	18
33.2710	-116.6527	2.0000	5/12/2003 13:32	0:21:14.531	24	24	2003132	8	8	F	2.35	18

id	griidname	recipc	time	griidref	units	maxval	dir	dtile
014.7	Trfmeas_ssm9	5/04/2003 13:20	0:14:06.798	as	0	0.065	2003/05/04/134	0:14.7.Trfmeas_ssm9.as
014.8	Trfmeas_ssm9	5/04/2003 13:20	0:14:06.798	as	0	0.065	2003/05/04/134	0:14.8.Trfmeas_ssm9.as
014.9	Trfmeas_ssm9	5/04/2003 13:20	0:14:06.798	as	0	0.075	2003/05/04/134	0:14.9.Trfmeas_ssm9.as
014.10	Trfmeas_ssm9	5/04/2003 13:20	0:14:06.798	as	0	0.084	2003/05/04/134	0:14.10.Trfmeas_ssm9.as
014.11	Trfmeas_ssm9	5/04/2003 13:20	0:14:06.798	as	0	0.093	2003/05/04/134	0:14.11.Trfmeas_ssm9.as
014.12	Trfmeas_ssm9	5/04/2003 13:20	0:14:06.798	as	0	0.102	2003/05/04/134	0:14.12.Trfmeas_ssm9.as
014.13	Trfmeas_ssm9	5/04/2003 13:20	0:14:06.798	as	0	0.111	2003/05/04/134	0:14.13.Trfmeas_ssm9.as
014.14	Trfmeas_ssm9	5/04/2003 13:20	0:14:06.798	as	0	0.120	2003/05/04/134	0:14.14.Trfmeas_ssm9.as
014.15	Trfmeas_ssm9	5/04/2003 13:20	0:14:06.798	as	0	0.129	2003/05/04/134	0:14.15.Trfmeas_ssm9.as
014.16	Trfmeas_ssm9	5/04/2003 13:20	0:14:06.798	as	0	0.138	2003/05/04/134	0:14.16.Trfmeas_ssm9.as
014.17	Trfmeas_ssm9	5/04/2003 13:20	0:14:06.798	as	0	0.147	2003/05/04/134	0:14.17.Trfmeas_ssm9.as
014.18	Trfmeas_ssm9	5/04/2003 13:20	0:14:06.798	as	0	0.156	2003/05/04/134	0:14.18.Trfmeas_ssm9.as
014.19	Trfmeas_ssm9	5/04/2003 13:20	0:14:06.798	as	0	0.165	2003/05/04/134	0:14.19.Trfmeas_ssm9.as
014.20	Trfmeas_ssm9	5/04/2003 13:20	0:14:06.798	as	0	0.174	2003/05/04/134	0:14.20.Trfmeas_ssm9.as
014.21	Trfmeas_ssm9	5/04/2003 13:20	0:14:06.798	as	0	0.183	2003/05/04/134	0:14.21.Trfmeas_ssm9.as
014.22	Trfmeas_ssm9	5/04/2003 13:20	0:14:06.798	as	0	0.192	2003/05/04/134	0:14.22.Trfmeas_ssm9.as
014.23	Trfmeas_ssm9	5/04/2003 13:20	0:14:06.798	as	0	0.201	2003/05/04/134	0:14.23.Trfmeas_ssm9.as
014.24	Trfmeas_ssm9	5/04/2003 13:20	0:14:06.798	as	0	0.210	2003/05/04/134	0:14.24.Trfmeas_ssm9.as
014.25	Trfmeas_ssm9	5/04/2003 13:20	0:14:06.798	as	0	0.219	2003/05/04/134	0:14.25.Trfmeas_ssm9.as
014.26	Trfmeas_ssm9	5/04/2003 13:20	0:14:06.798	as	0	0.228	2003/05/04/134	0:14.26.Trfmeas_ssm9.as
014.27	Trfmeas_ssm9	5/04/2003 13:20	0:14:06.798	as	0	0.237	2003/05/04/134	0:14.27.Trfmeas_ssm9.as
014.28	Trfmeas_ssm9	5/04/2003 13:20	0:14:06.798	as	0	0.246	2003/05/04/134	0:14.28.Trfmeas_ssm9.as
014.29	Trfmeas_ssm9	5/04/2003 13:20	0:14:06.798	as	0	0.255	2003/05/04/134	0:14.29.Trfmeas_ssm9.as
014.30	Trfmeas_ssm9	5/04/2003 13:20	0:14:06.798	as	0	0.264	2003/05/04/134	0:14.30.Trfmeas_ssm9.as
014.31	Trfmeas_ssm9	5/04/2003 13:20	0:14:06.798	as	0	0.273	2003/05/04/134	0:14.31.Trfmeas_ssm9.as
014.32	Trfmeas_ssm9	5/04/2003 13:20	0:14:06.798	as	0	0.282	2003/05/04/134	0:14.32.Trfmeas_ssm9.as

August 25, 2009

Ground-motion Estimation

Peak Ground Acceleration

Trinetsm_es99 delegate

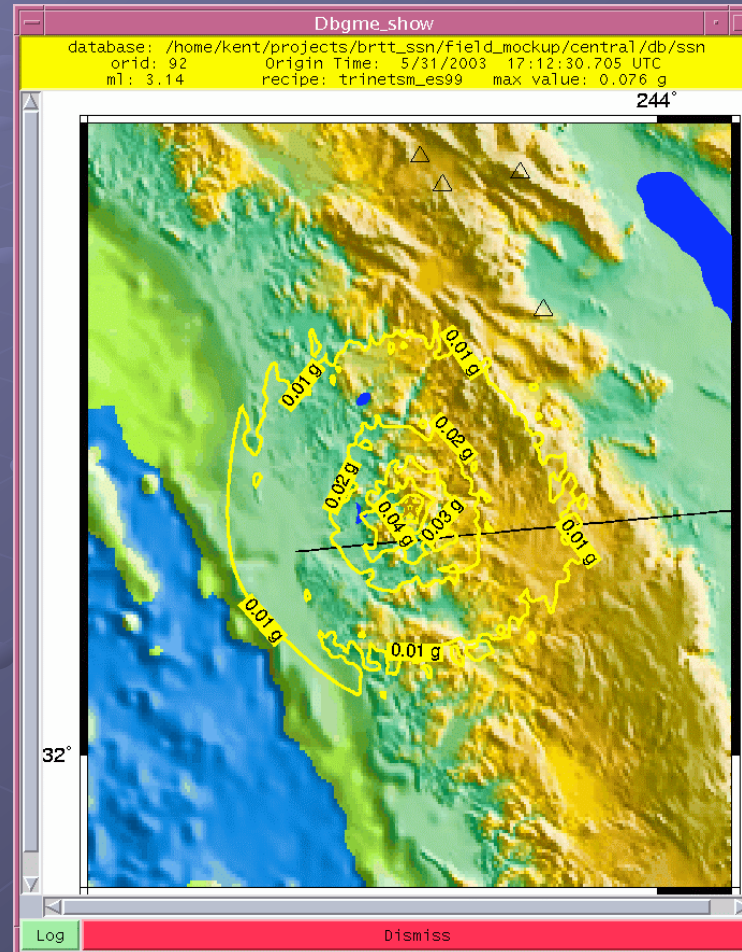
May 31, 2003
17:12 GMT

ML 3.14

Max 0.076 g

Lat 32.6513

Lon -116.7682



August 25, 2009

Lindquist Consulting, Inc.



Ground-motion from an Earthquake Empirical/Theoretical Hybrid

May 12, 2003

22:35 GMT

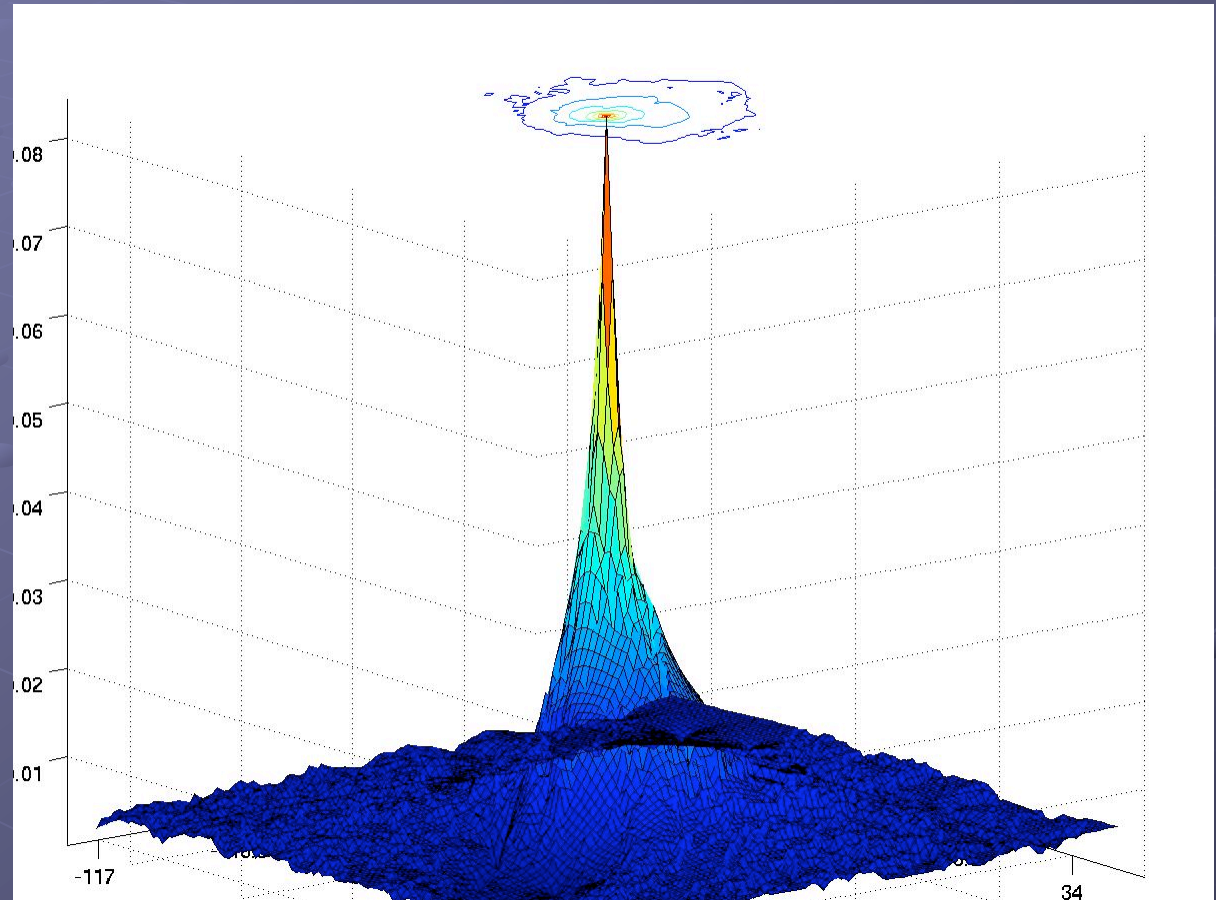
ML 2.95

Max 0.084 g

Lat 33.2710

Lon -116.0527

```
db=dbopen('ssn','r');  
db=dblookup(db,"'qgrid','orid','24');  
cgg=cggrid(dbfilename(db));  
[x,y,z]=cggrid_getmesh(cgg);  
mysurfc(x,y,z)
```

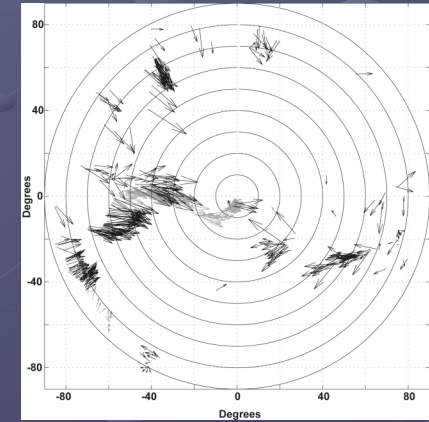
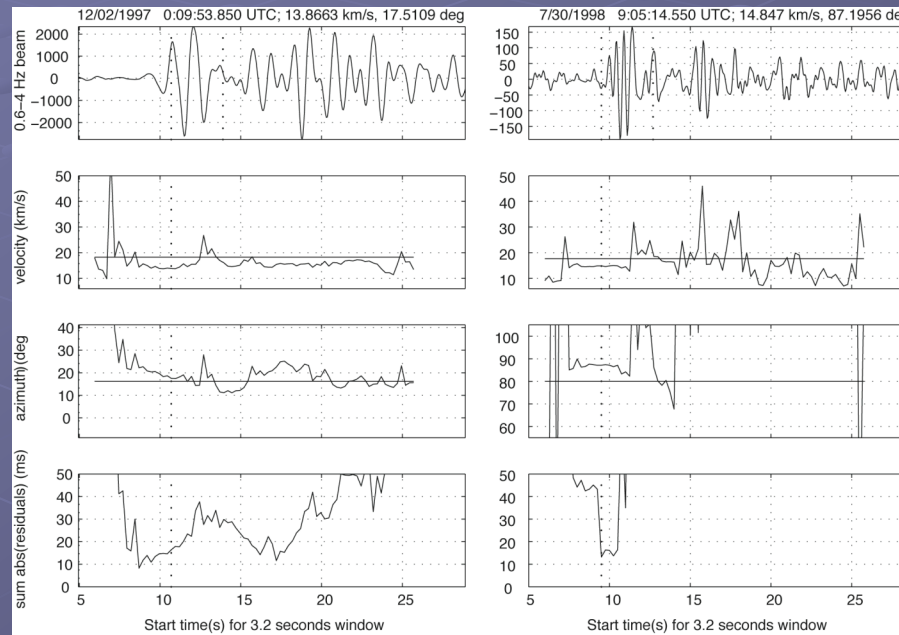
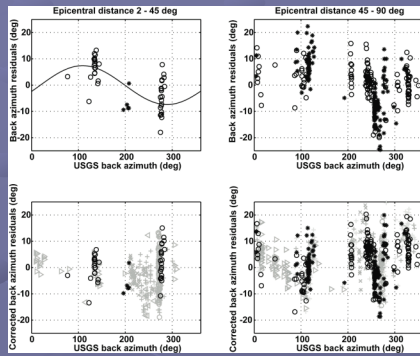
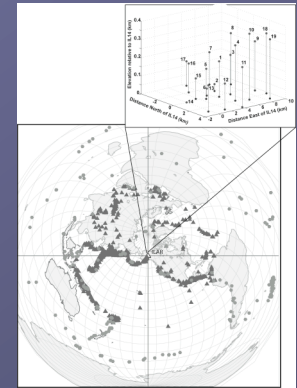


August 25, 2009

Lindquist Consulting, Inc.



Research with ATM



● *Lindquist, Tibuleac, Hansen BSSA 2007*

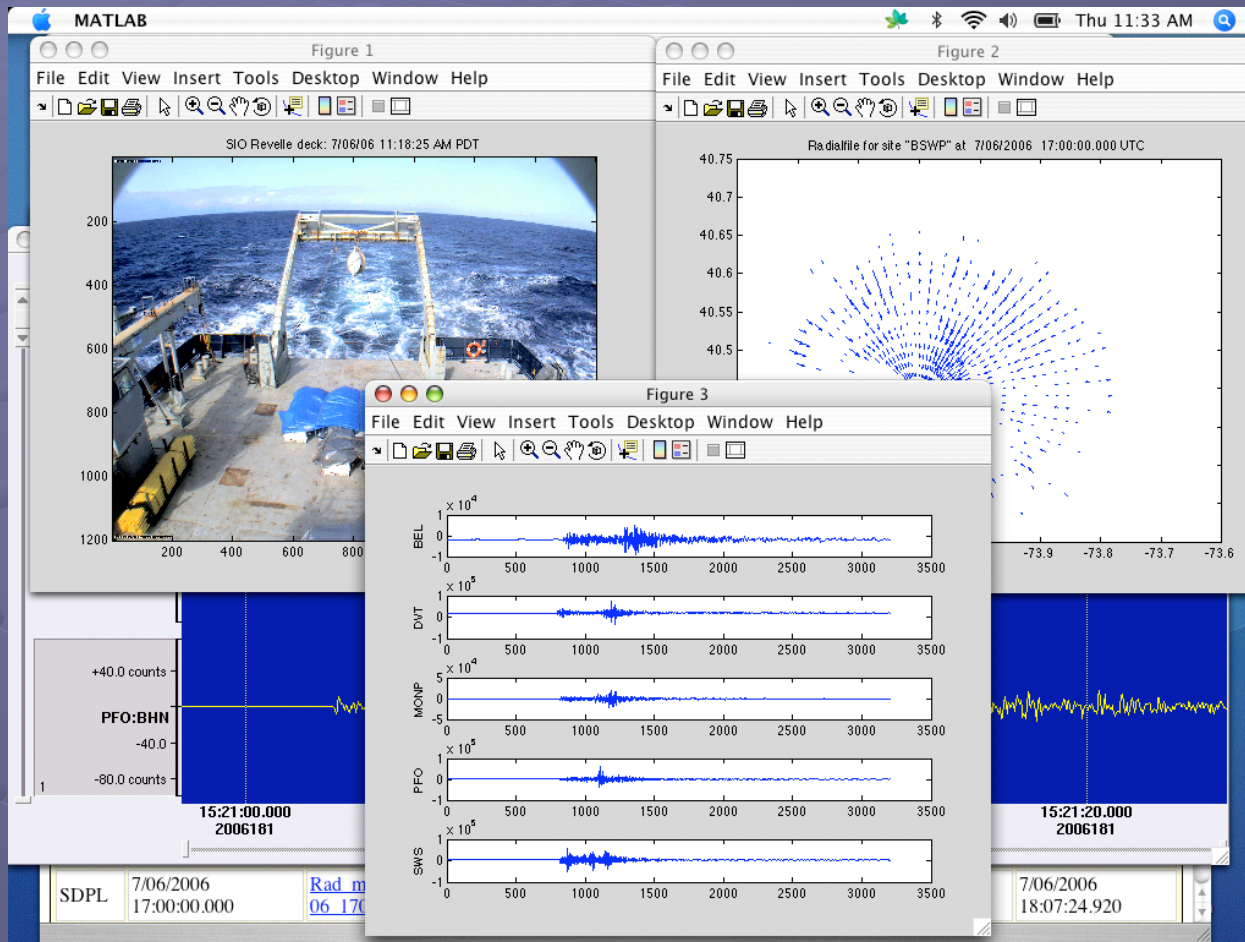
August 25, 2009

Lindquist Consulting, Inc.



LOOKING (UCSD) 2006 multidisciplinary demo

Antelope
acquired
Image data



Antelope
acquired
HFRadar data

Datascope
Seismic
Data

August 25, 2009

Lindquist Consulting, Inc.



Future Directions

- Mature interface
- Low-level support as public service by LCI

Exercises

- Explore capabilities of toolkit
- *All questions welcome ! ...*
- Caveat:
 - No promises to solve all programming problems...
 - No promises to solve all *Antelope* programming problems...
 - Focus is on what's in the toolkits