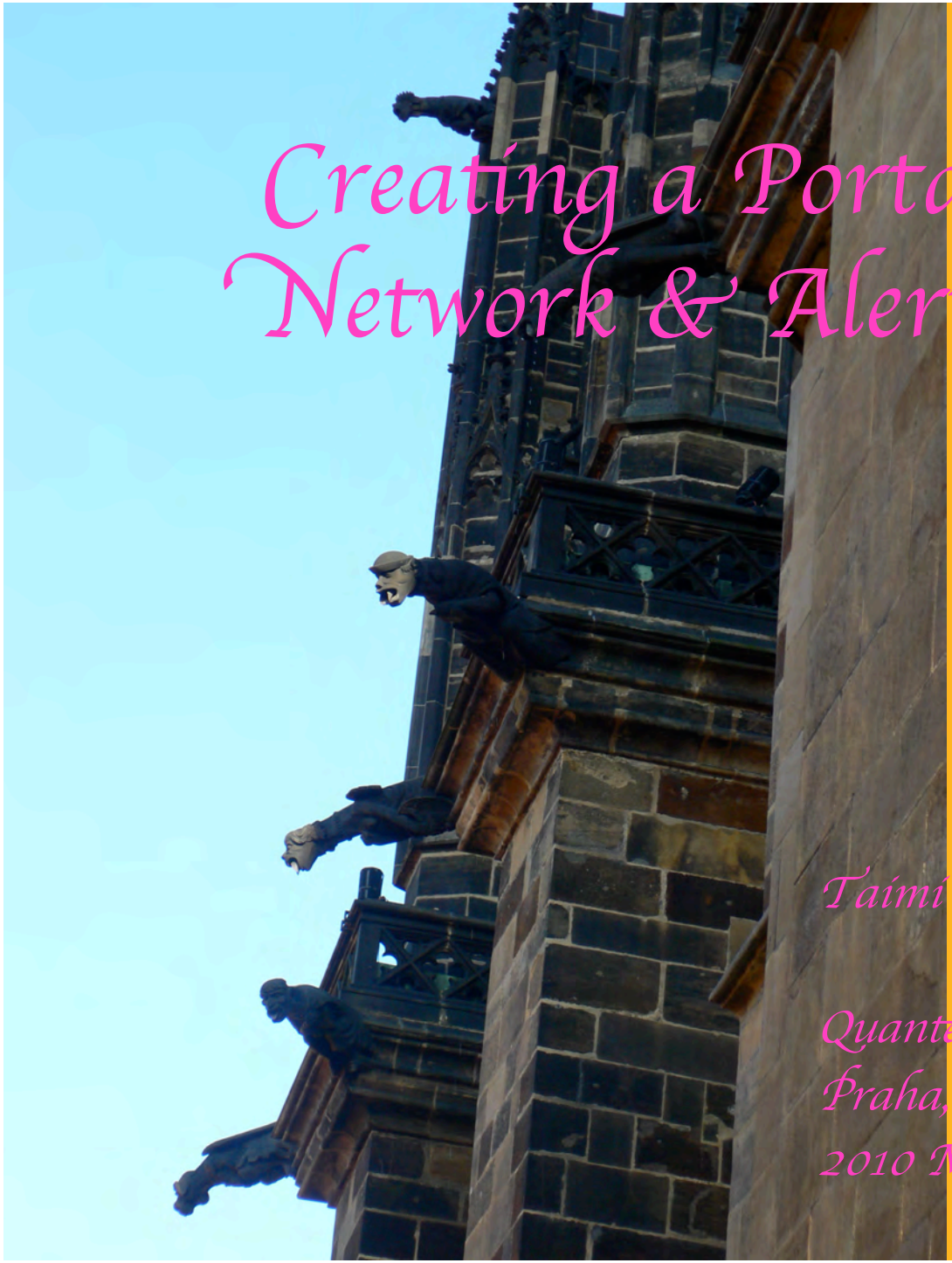

Creating a Portable Seismic Network & Alerting System

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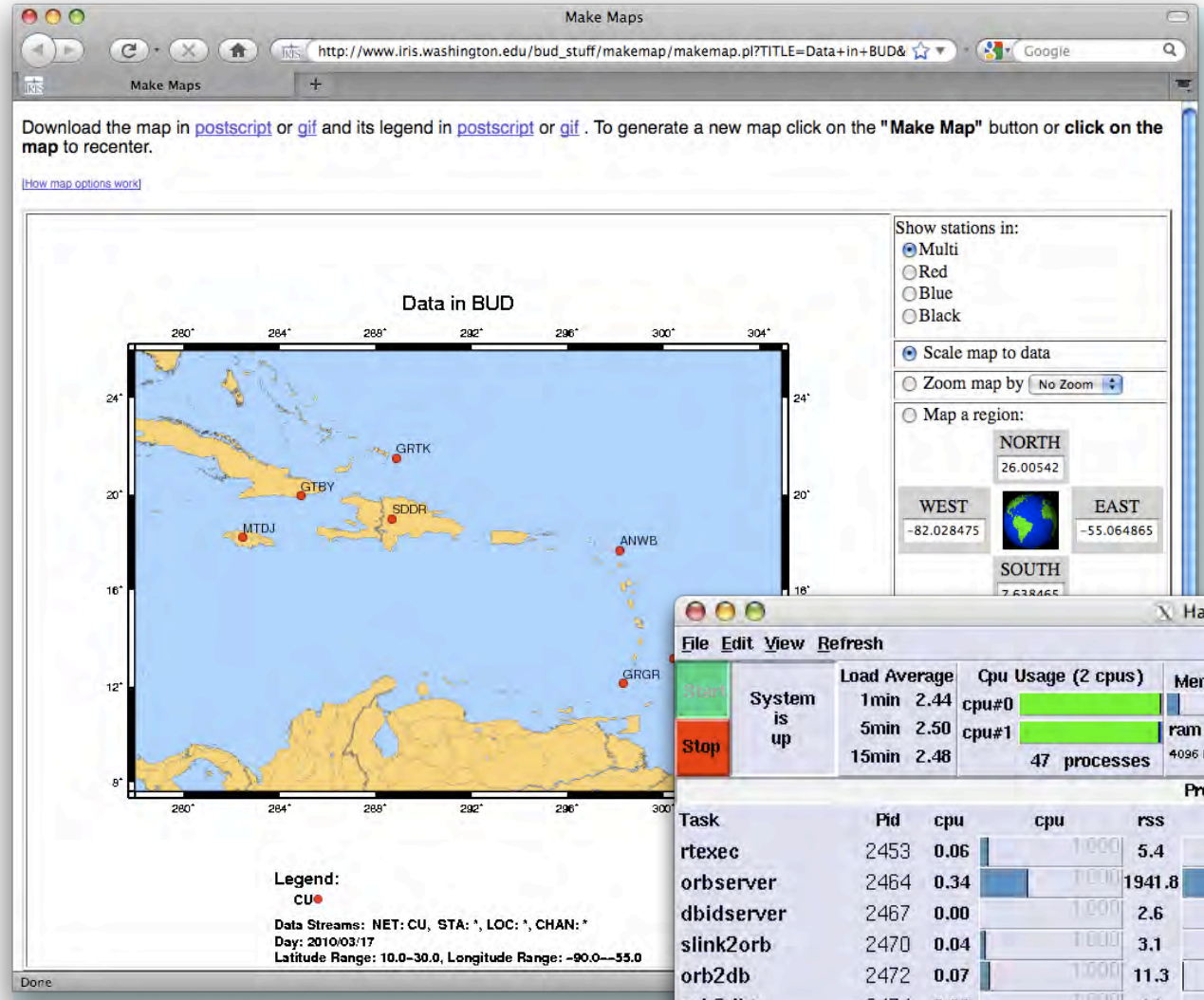
AFTER the stations are installed… A Strategic Approach

I. Dataflow
II. Meta-data (dbmaster)
III. Travel-time grids
IV. Automatic solutions
V. Alerting module
VI. “To Do” List

I. Dataflow

- 3 new stations installed around Port au Prince, Haiti.
- Earthquakes near Port au Prince and also from further away show up on the 3 temporary seismic stations. For locating regional earthquakes, decide which regional stations to bring in – GSN stations.



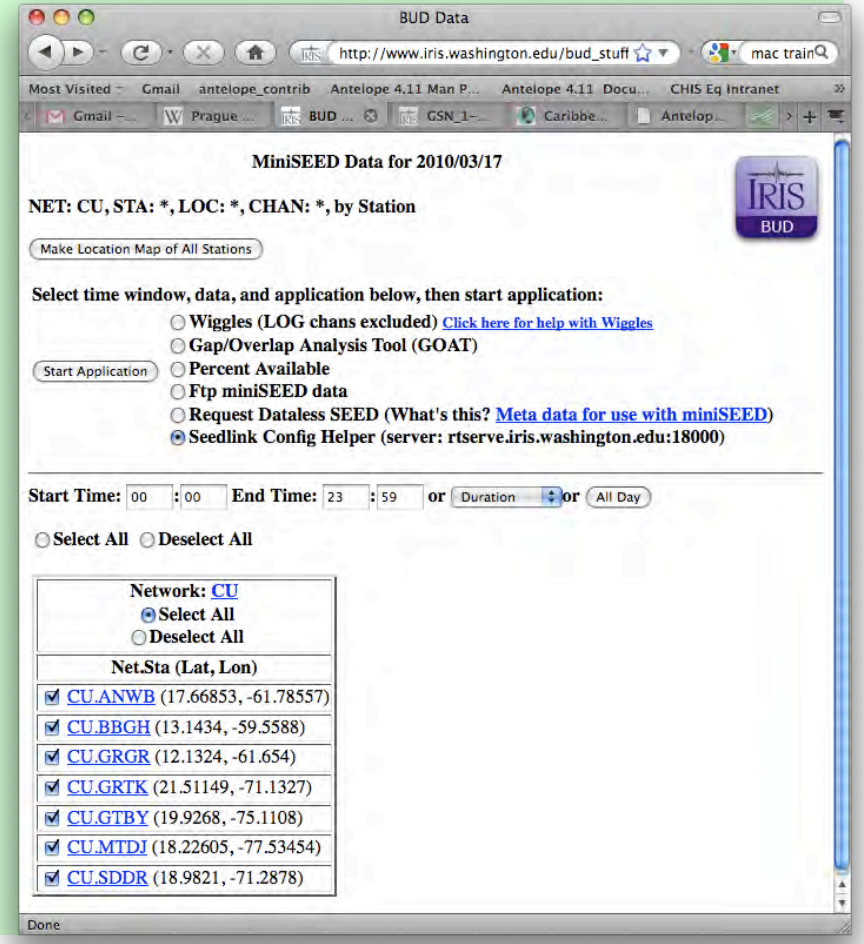
Find GSN stations in the Caribbean and bring them in to real-time system (rtexec.pf) via slink2orb.

II. Metadata (dbmaster)

- Existing dbmaster for 3 installed stations.
  Database: CN_haiti

- Find metadata (dataless SEED) for Caribbean stations.

  Request CU network data from IRIS BUD website and ftp requested file 'CU.dataless' to my computer



- Convert dataless SEED to database.

  % seed2db -v CU.dataless haiti

- Merge databases.

  % dbmerge CN_haiti haiti

sensor table → join → instrument table

View → sort → sta, unique

haiti View98

File Edit View Options Graphics Help

0	sta	chan	time	inid	insname	band	digital	samprate	ncalper	rsptype
	ANWB	BH1_00	2/10/2010 (041) 18:35:00.00000	1	Streckeisen STS-2 Standard-gain	b	d	40.0000000	20.000000	V
	BBGH	BH1_00	2/10/2010 (041) 18:27:42.00000	4	Streckeisen STS-2 Standard-gain	b	d	40.0000000	20.000000	V
	GRGR	BH1_00	2/10/2010 (041) 18:40:00.00000	4	Streckeisen STS-2 Standard-gain	b	d	40.0000000	20.000000	V
	GRTK	BH1_00	2/09/2010 (040) 17:00:00.00000	4	Streckeisen STS-2 Standard-gain	b	d	40.0000000	20.000000	V
	GTBY	BH1_00	2/10/2010 (041) 18:40:00.00000	4	Streckeisen STS-2 Standard-gain	b	d	40.0000000	20.000000	V
	JAKH	HHE	2/16/2010 (047) 13:22:00.00000	490	120p TRD 100s/s, H, ncalper=1.00, ncalib=0.3315728	b	d	100.0000000	1.000000	V
	LGNH	HHE	2/14/2010 (045) 18:20:00.00000	490	120p TRD 100s/s, H, ncalper=1.00, ncalib=0.3315728	b	d	100.0000000	1.000000	V
	MTDJ	BH1_00	2/10/2010 (041) 18:40:00.00000	4	Streckeisen STS-2 Standard-gain	b	d	40.0000000	20.000000	V
	PAPH	HHE	2/11/2010 (042) 21:40:00.00000	490	120p TRD 100s/s, H, ncalper=1.00, ncalib=0.3315728	b	d	100.0000000	1.000000	V
	SDDR	BH1_00	2/10/2010 (041) 18:28:49.00000	4	Streckeisen STS-2 Standard-gain	b	d	40.0000000	20.000000	V

10

Dismiss

Instruments: STS-2, Trillium 50hz-120sec

III. Travel tim

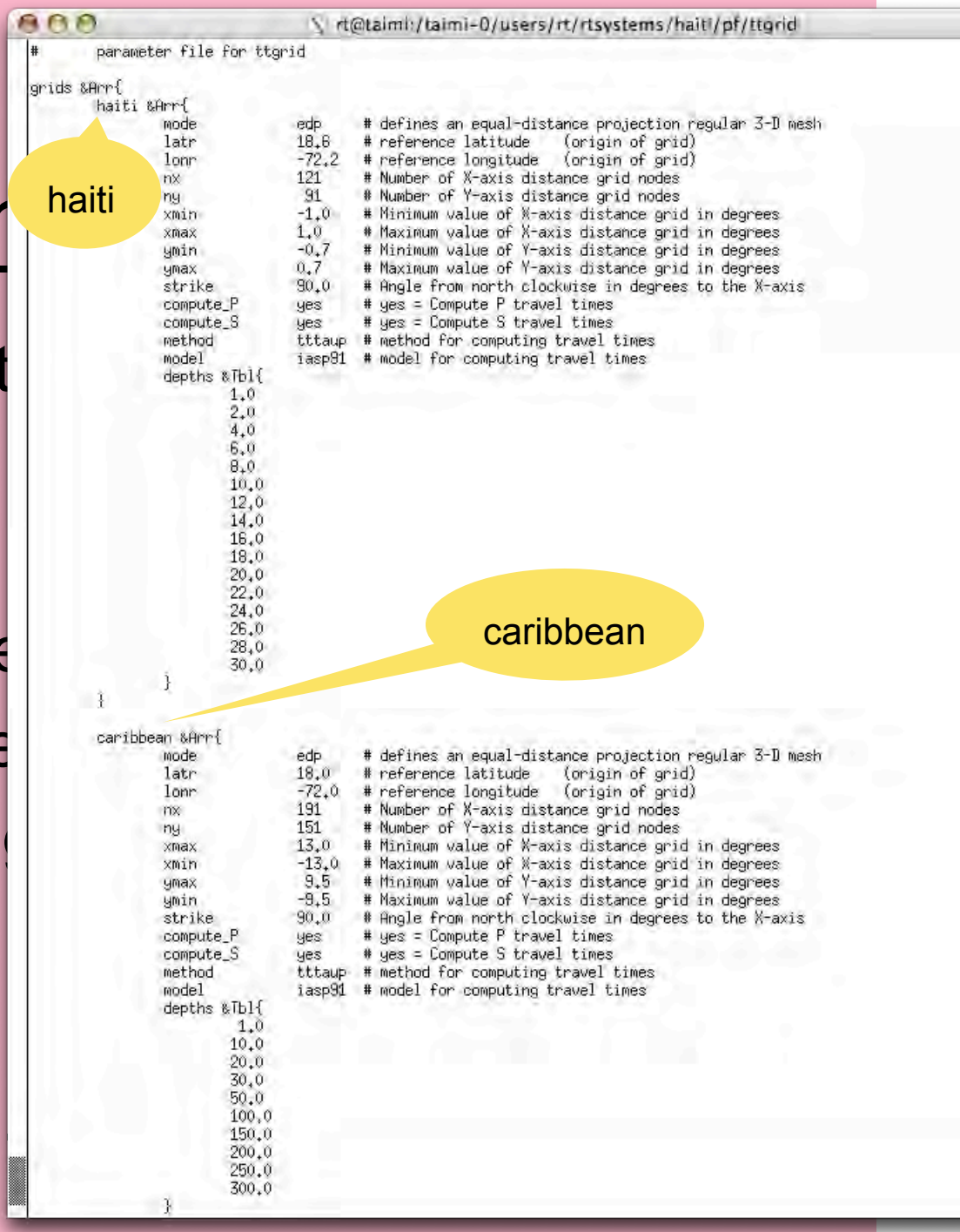
Directory: rtsystem/hait

$ pfcp ttgrid .

Configure ttgrids for the

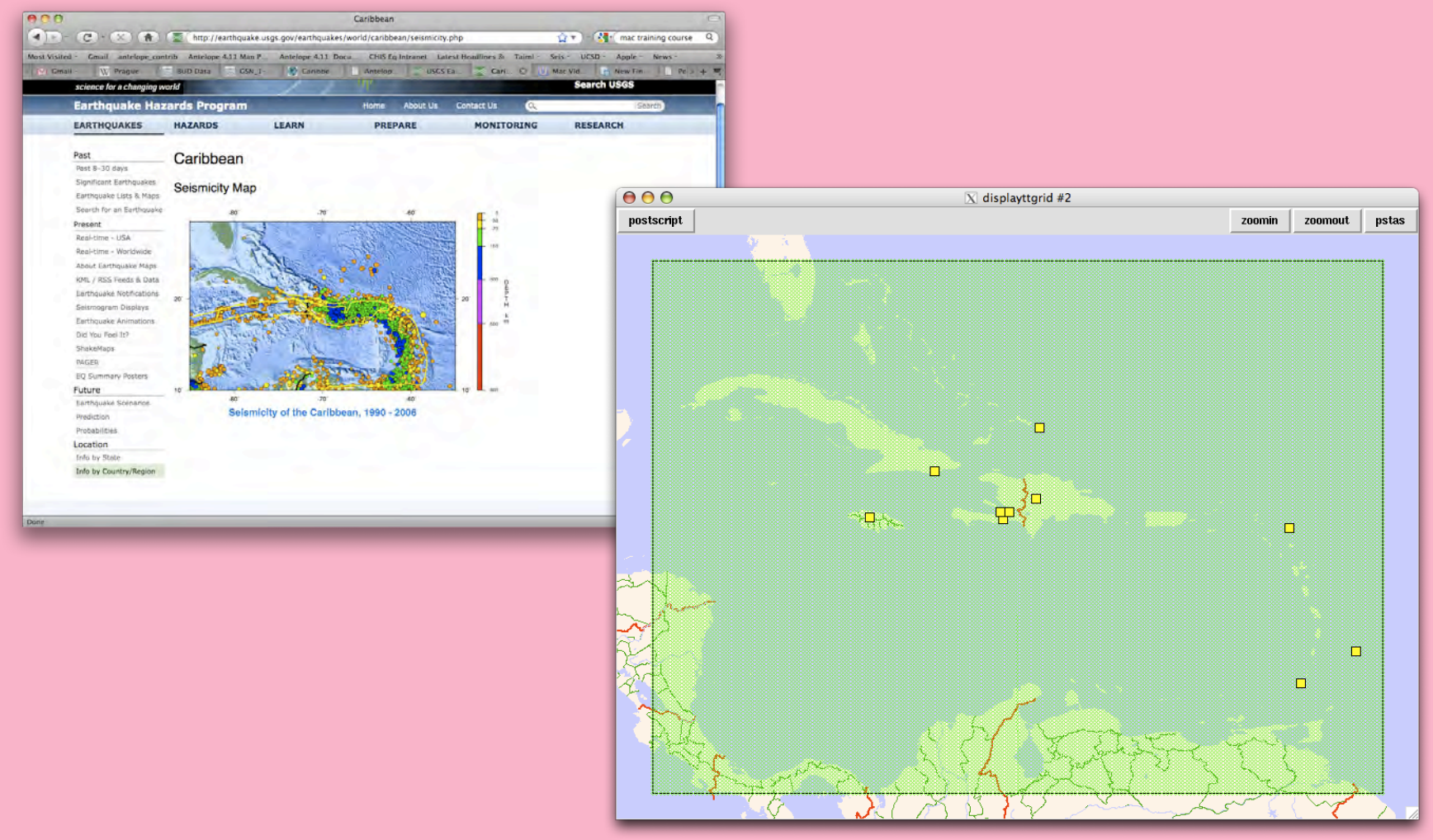
- haiti (Port au Prince
- regional caribbean
- teleseismic grid

% ttgrid –pf ttgrid.pf ../.

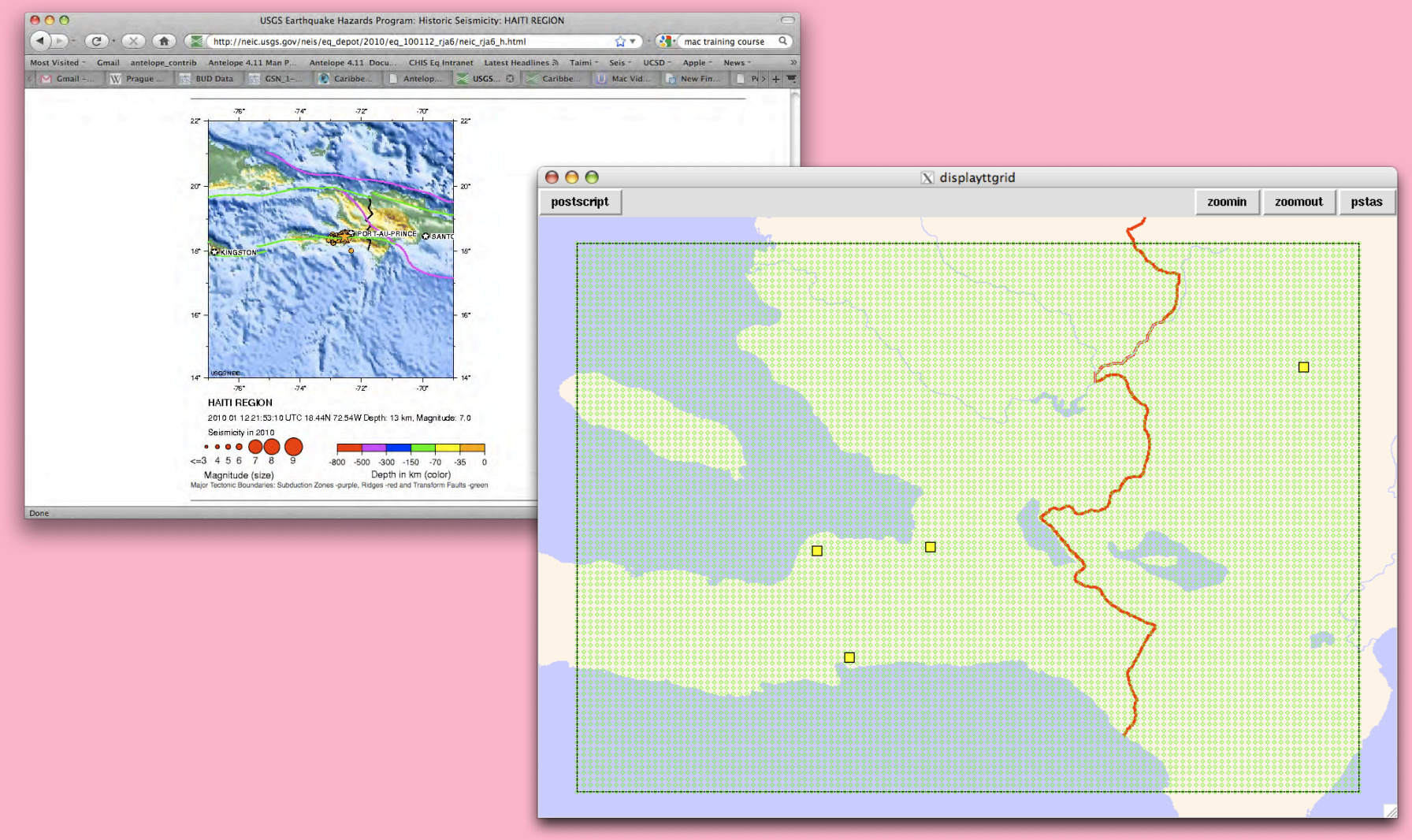



```
#       parameter file for ttgrid

grids &Arr{
        haiti &Arr{
                mode            edp     # defines an equal-distance projection regular 3-D mesh
                latr            18.6    # reference latitude    (origin of grid)
                lonr            -72.2   # reference longitude   (origin of grid)
                nx              121     # Number of X-axis distance grid nodes
                ny               91     # Number of Y-axis distance grid nodes
                xmin            -1.0    # Minimum value of X-axis distance grid in degrees
                xmax            1.0     # Maximum value of X-axis distance grid in degrees
                ymin            -0.7    # Minimum value of Y-axis distance grid in degrees
                ymax            0.7     # Maximum value of Y-axis distance grid in degrees
                strike          90.0    # Angle from north clockwise in degrees to the X-axis
                compute_P       yes     # yes = Compute P travel times
                compute_S       yes     # yes = Compute S travel times
                method          tttaup  # method for computing travel times
                model           iasp91  # model for computing travel times
                depths &Tbl{
                        1.0
                        2.0
                        4.0
                        6.0
                        8.0
                        10.0
                        12.0
                        14.0
                        16.0
                        18.0
                        20.0
                        22.0
                        24.0
                        26.0
                        28.0
                        30.0
                }
        }

        caribbean &Arr{
                mode            edp     # defines an equal-distance projection regular 3-D mesh
                latr            18.0    # reference latitude    (origin of grid)
                lonr            -72.0   # reference longitude   (origin of grid)
                nx              191     # Number of X-axis distance grid nodes
                ny              151     # Number of Y-axis distance grid nodes
                xmax            13.0    # Minimum value of X-axis distance grid in degrees
                xmin            -13.0   # Maximum value of X-axis distance grid in degrees
                ymax             9.5    # Minimum value of Y-axis distance grid in degrees
                ymin            -9.5    # Maximum value of Y-axis distance grid in degrees
                strike          90.0    # Angle from north clockwise in degrees to the X-axis
                compute_P       yes     # yes = Compute P travel times
                compute_S       yes     # yes = Compute S travel times
                method          tttaup  # method for computing travel times
                model           iasp91  # model for computing travel times
                depths &Tbl{
                        1.0
                        10.0
                        20.0
                        30.0
                        50.0
                        100.0
                        150.0
                        200.0
                        250.0
                        300.0
                }
```

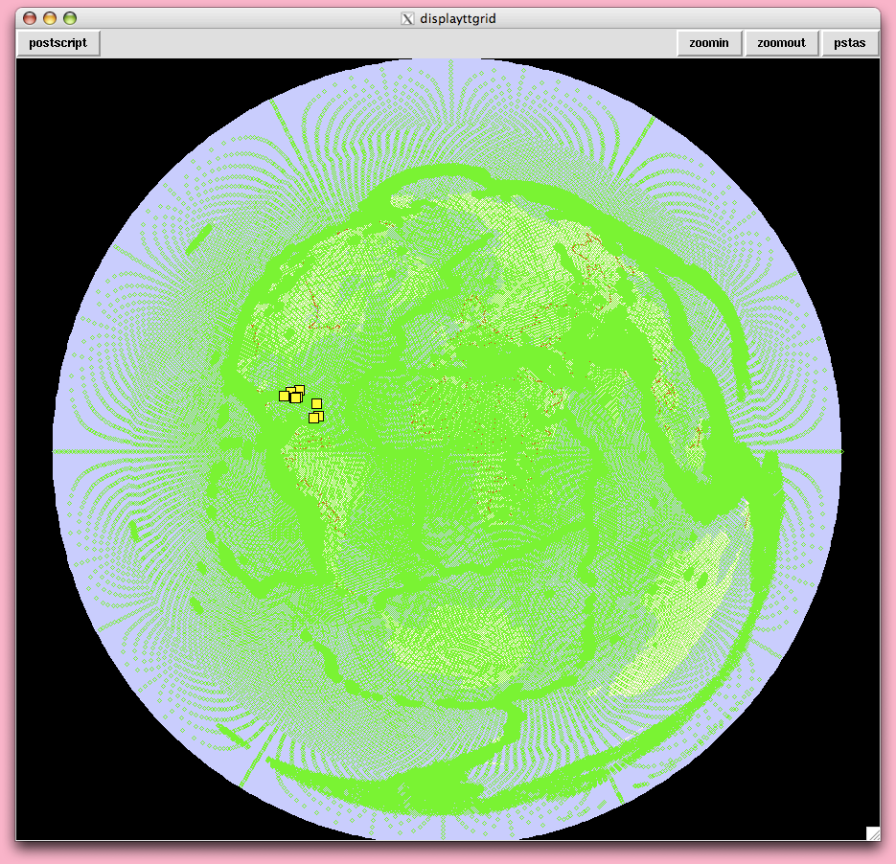
regional “caribbean” grid



local “haiti” grid



teleseismic “tele_uni” grid



IV. Automatic Solutions

- In rtexec run

```
orbdetect      orbdetect -out $ORB $ORB $DB
orbassoc       orbassoc -v -select 'db/detection.*' -start 2010074:00:00
                  $ORB $ORB pf/ttgrid/ttgrid_haiti.out
orbevproc      orbevproc -v -start OLDEST $ORB $ORB $DB
```

Tune orbdetect by examining detection table and filtered waveforms.

Copy detection and site table to another directory and run dbgrassoc over this database – find out why expected solutions do not appear and modify dbdetect.pf & dbgrassoc.pf/orbassoc.pf accordingly.

V. Alerting module

In rtexec add orb_quake_alarm:

```
orb_quake_alarm orb_quake_alarm -S state/orb_quake_alarm
    -d db/quakes -V $ORB
```

Configure orb_quake_alarm.pf to

- Send msg to cell phones.
- Send email notice to distribution list.

when desired conditions are met.

VI. "To Do" List

- Change orb2db to cdorb2db
- Remove "haiti" grid, use regional "caribbean" and "tele-uni" instead.
- Add Mwp to orbevproc.
- Collect bulletins

V. Tutorial

(with Danny Harvey)

Set up a new directory “tune” in which the automatic locations will be tuned (make this into a script), include a local db descriptor file.

- mkdir tune
- cp –r dbmaster/haiti.* tune/.
- cp db/haiti.wfdisc tune/.
- cp –r pf/ttgrid/* .
- cd tune
- ln –s ../dbmaster/response .
- ln –s ../db/2010 .

1. Run dbdetect on db and examine output in dbpick

% dbpick haiti

> sc .*:[BH]HZ.*

Try out several different filters, such as:

1 Hz HP

5 Hz HP

0.3-10 BP

1-5 BP

0.8-3 # For teleseisms

And one lower LP for detecting very large events.

put these in .dbpickrc, show example here.

Pick the filter that emphasis the local/regional P arrivals on several (10-ish) events. Omit teleseisms from this exercise, at this time.

Edit dbdetect.pf to duplicate these filters, assign each filter its own iphase (e.g. l, t)

Edit dbgrassoc.pf and ttgrid/ttgrid.pf to have the same iphase and grids as orbassoc.pf

Rerun ttgrid, if necessary.

Now run dbdetect and after this, examine wf picks in dbpick.

% dbdetect -v -tstart 2010081:00:00 -twin 86400 -onlypicks haiti haiti

% dbpick haiti

> y

> sd on # show detections

> sw off # show waveforms off

> swd # show only all traces with detections

2. Fit all wf traces to window: put cursor over vertical wf plot scroll bar, right click, select fit.

3. Fit all time to window (both axis):put cursor over wfs and on keyboard select

4. Find an area with “too many” picks and zoom in on it (1-3 min window)

> sw on

In this example the station data had an excess of data spikes and will need to be removed from the rtprocessing stream.

> quit

Remove bad station by adding bad station into reject table in dbdetect.pf

Rerun dbdetect on db
dbdetect -v -tstart 2010081:00:00 -twin 86400 -onlypicks haiti haiti
Dbgrassoc …..

If you get events, the look at results in dbevents.
Goto event map, place cursor over largest event, press keyboard “I”, repeatedly the event to zoom in. Show waveforms to see how good the arrivals are.