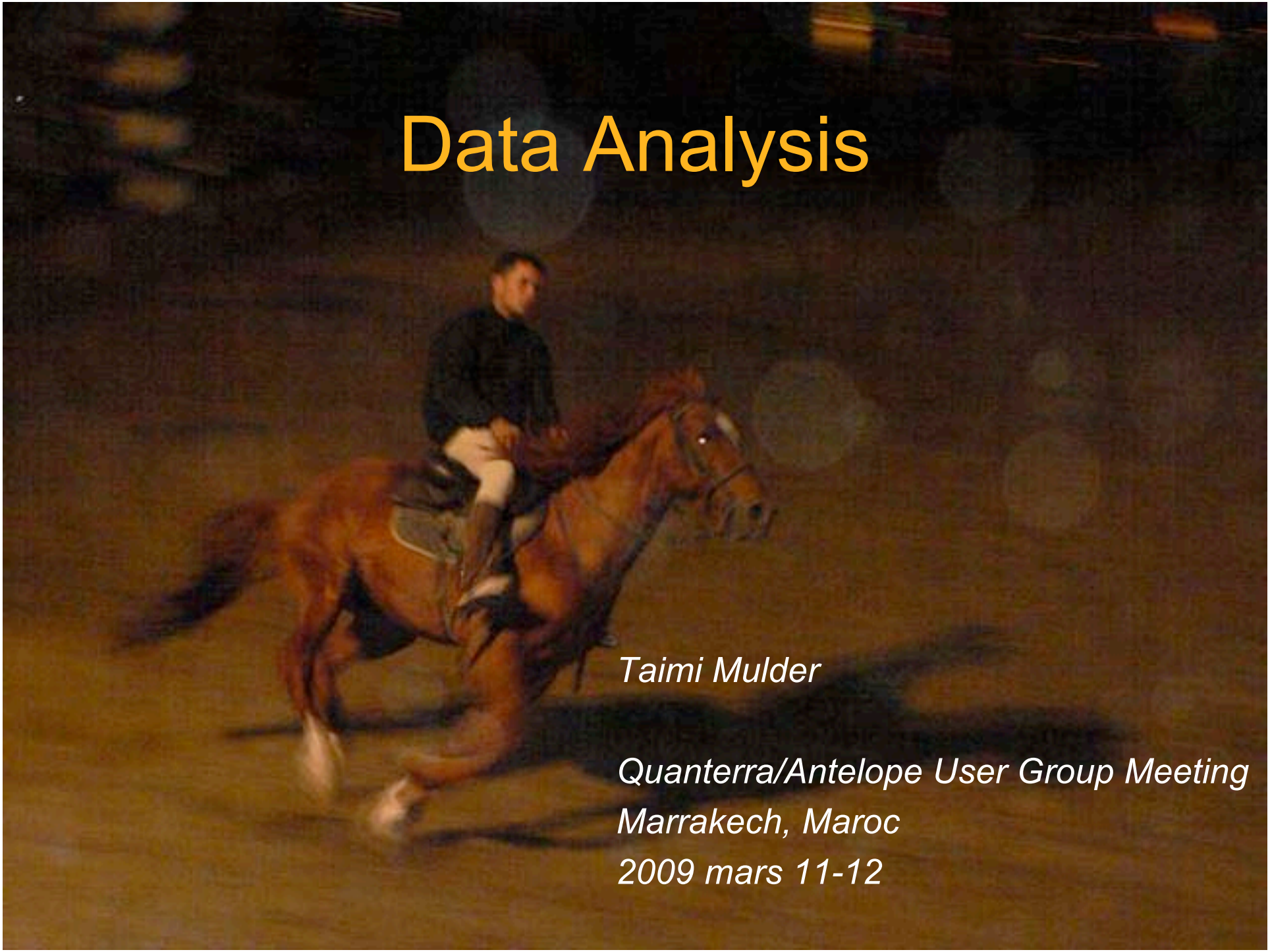
Data Analysis

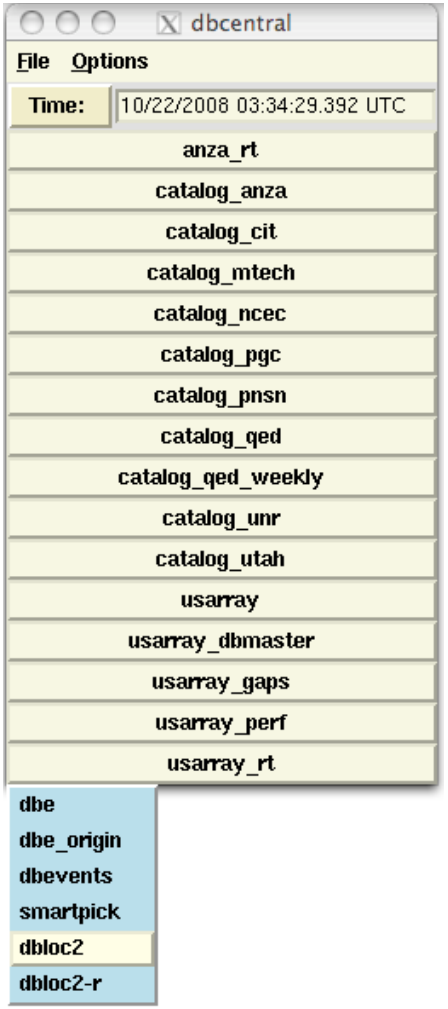


Taimi Mulder

Quanterra/Antelope User Group Meeting
Marrakech, Maroc
2009 mars 11-12

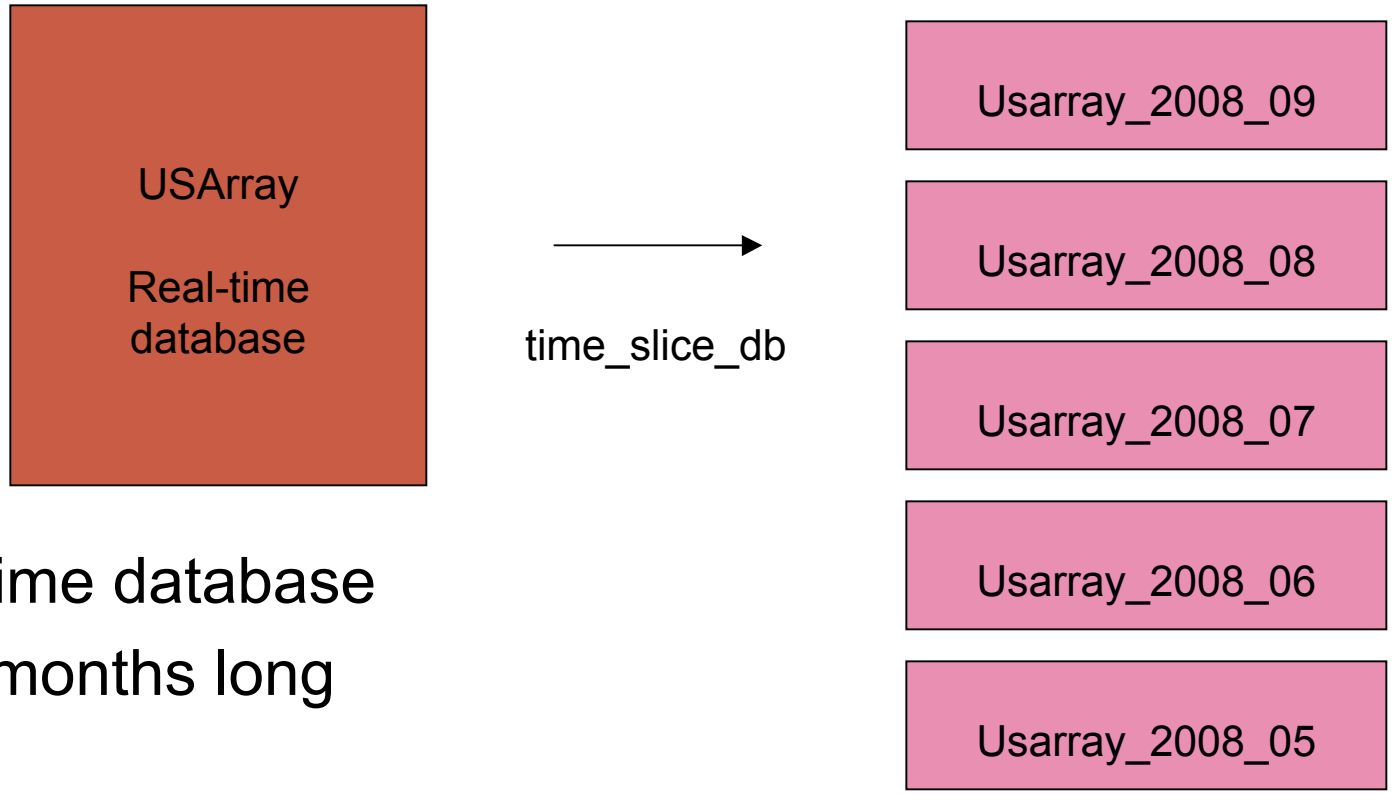
- Database Splitting
- Velocity Models
- Location Procedures
- Location Checks

dbcentral



- Collects all databases in one place
- Desired time entered in “Time:” bar
- Select program to run on database

Db splitting



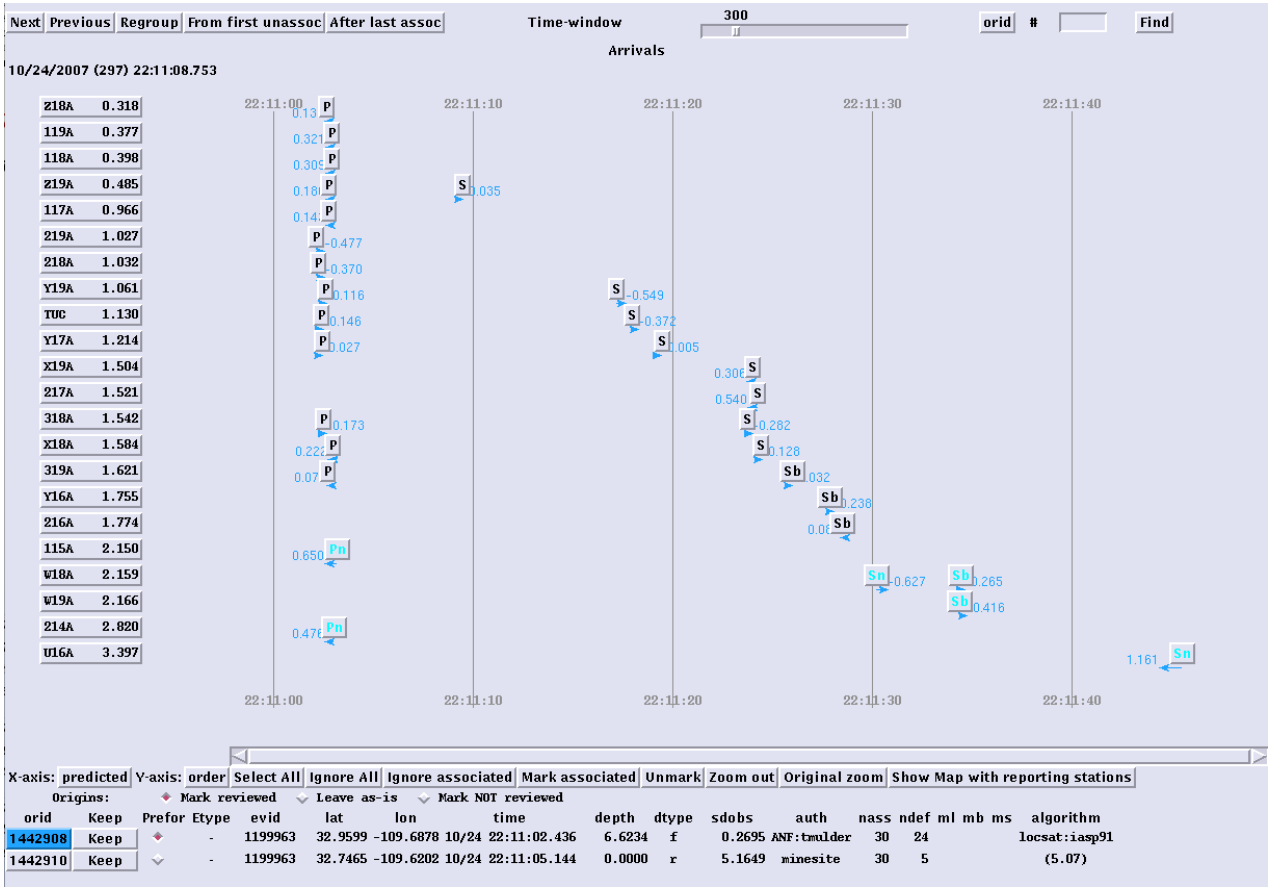
Real-time database

~ 2-3 months long

Monthly archived databases

Etc.

dbloc2

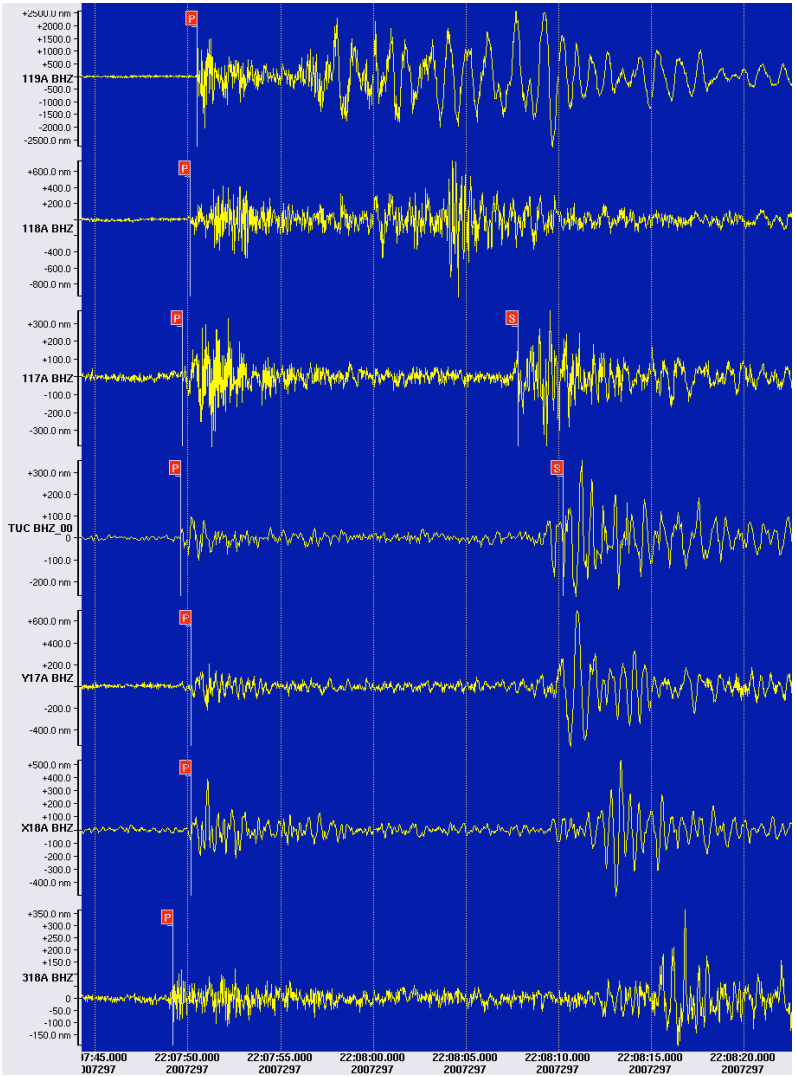


Gui interface for many other programs

In particular…

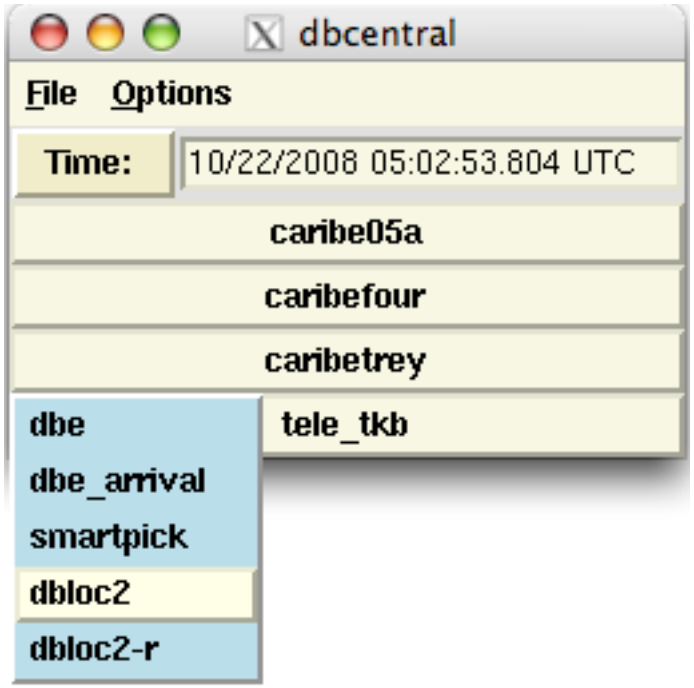
smartpick

dbpick



- Smartpick is gui interface for dbpick

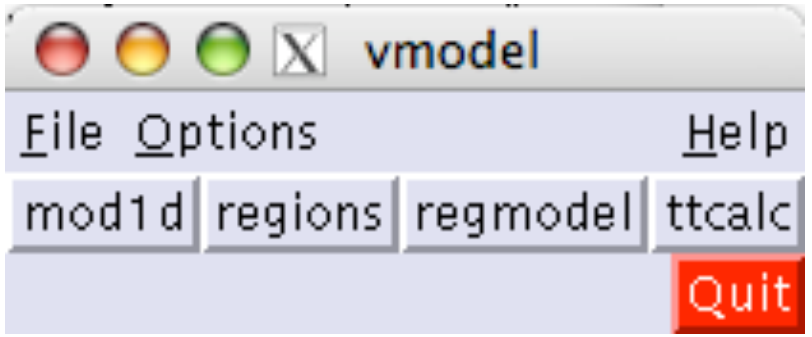
Velocity models



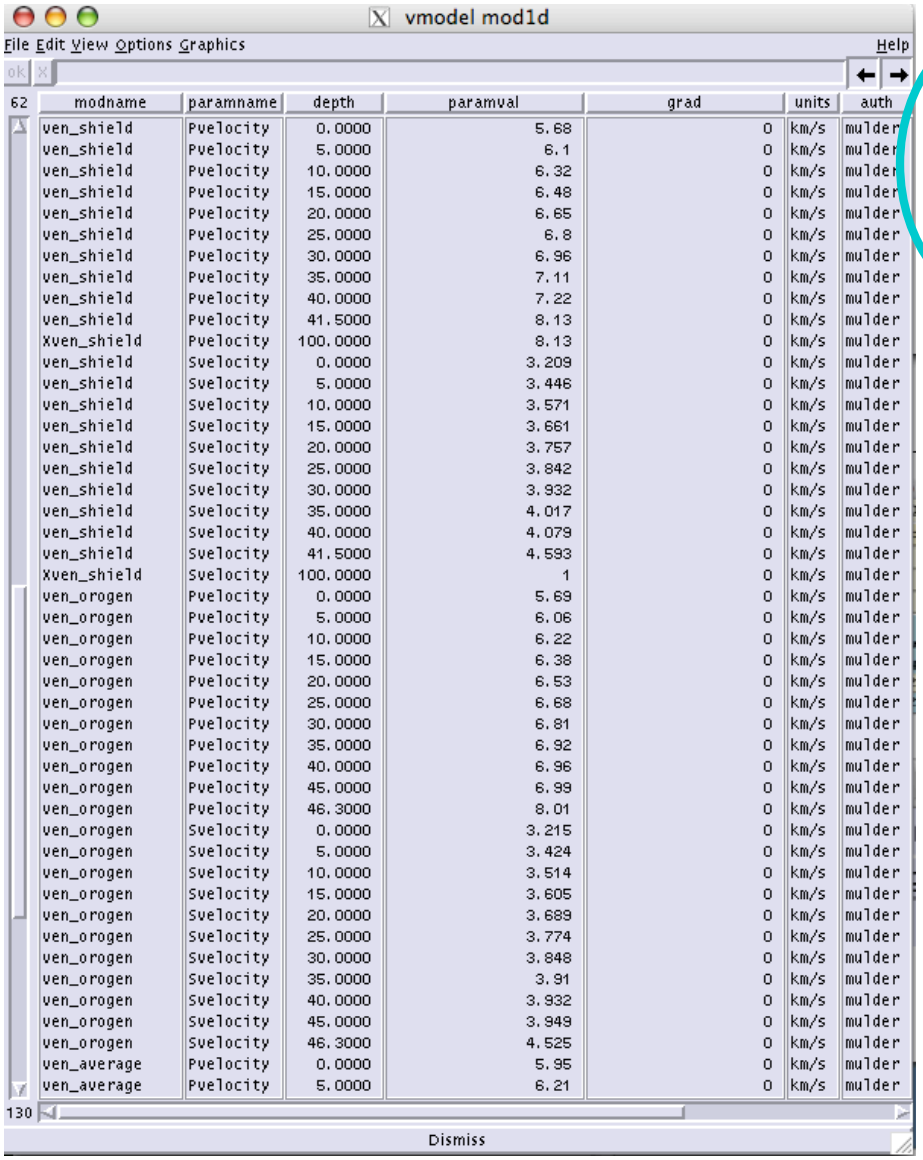
Stand-alone dataset on external drive, Picked arrivals and located events

Experimented with a variety of velocity models

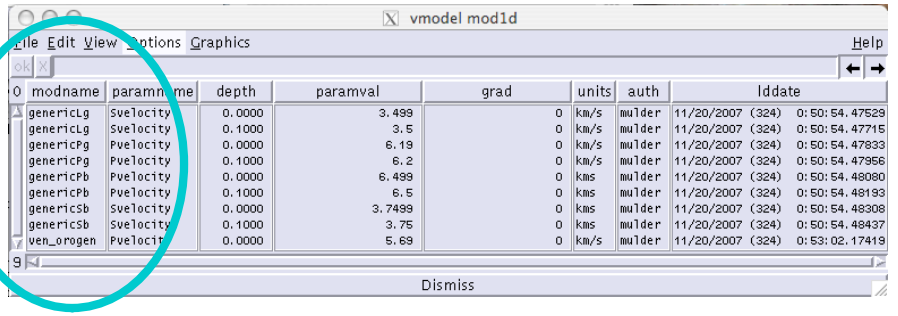
Only genloc uses these velocity models



Velocity model tables



	modname	paramname	depth	paramval	grad	units	auth
62	ven_shield	Pvelocity	0.0000	5.68	0	km/s	mulder
	ven_shield	Pvelocity	5.0000	6.1	0	km/s	mulder
	ven_shield	Pvelocity	10.0000	6.32	0	km/s	mulder
	ven_shield	Pvelocity	15.0000	6.48	0	km/s	mulder
	ven_shield	Pvelocity	20.0000	6.65	0	km/s	mulder
	ven_shield	Pvelocity	25.0000	6.8	0	km/s	mulder
	ven_shield	Pvelocity	30.0000	6.96	0	km/s	mulder
	ven_shield	Pvelocity	35.0000	7.11	0	km/s	mulder
	ven_shield	Pvelocity	40.0000	7.22	0	km/s	mulder
	ven_shield	Pvelocity	41.5000	8.13	0	km/s	mulder
	Xven_shield	Pvelocity	100.0000	8.13	0	km/s	mulder
	ven_shield	Svelocity	0.0000	3.209	0	km/s	mulder
	ven_shield	Svelocity	5.0000	3.446	0	km/s	mulder
	ven_shield	Svelocity	10.0000	3.571	0	km/s	mulder
	ven_shield	Svelocity	15.0000	3.661	0	km/s	mulder
	ven_shield	Svelocity	20.0000	3.757	0	km/s	mulder
	ven_shield	Svelocity	25.0000	3.842	0	km/s	mulder
	ven_shield	Svelocity	30.0000	3.932	0	km/s	mulder
	ven_shield	Svelocity	35.0000	4.017	0	km/s	mulder
	ven_shield	Svelocity	40.0000	4.079	0	km/s	mulder
	ven_shield	Svelocity	41.5000	4.593	0	km/s	mulder
	Xven_shield	Svelocity	100.0000	1	0	km/s	mulder
	ven_orogen	Pvelocity	0.0000	5.69	0	km/s	mulder
	ven_orogen	Pvelocity	5.0000	6.06	0	km/s	mulder
	ven_orogen	Pvelocity	10.0000	6.22	0	km/s	mulder
	ven_orogen	Pvelocity	15.0000	6.38	0	km/s	mulder
	ven_orogen	Pvelocity	20.0000	6.53	0	km/s	mulder
	ven_orogen	Pvelocity	25.0000	6.68	0	km/s	mulder
	ven_orogen	Pvelocity	30.0000	6.81	0	km/s	mulder
	ven_orogen	Pvelocity	35.0000	6.92	0	km/s	mulder
	ven_orogen	Pvelocity	40.0000	6.96	0	km/s	mulder
	ven_orogen	Pvelocity	45.0000	6.99	0	km/s	mulder
	ven_orogen	Pvelocity	46.3000	8.01	0	km/s	mulder
	ven_orogen	Svelocity	0.0000	3.215	0	km/s	mulder
	ven_orogen	Svelocity	5.0000	3.424	0	km/s	mulder
	ven_orogen	Svelocity	10.0000	3.514	0	km/s	mulder
	ven_orogen	Svelocity	15.0000	3.605	0	km/s	mulder
	ven_orogen	Svelocity	20.0000	3.689	0	km/s	mulder
	ven_orogen	Svelocity	25.0000	3.774	0	km/s	mulder
	ven_orogen	Svelocity	30.0000	3.848	0	km/s	mulder
	ven_orogen	Svelocity	35.0000	3.91	0	km/s	mulder
	ven_orogen	Svelocity	40.0000	3.932	0	km/s	mulder
	ven_orogen	Svelocity	45.0000	3.949	0	km/s	mulder
	ven_orogen	Svelocity	46.3000	4.525	0	km/s	mulder
	ven_average	Pvelocity	0.0000	5.95	0	km/s	mulder
130	ven_average	Pvelocity	5.0000	6.21	0	km/s	mulder



0	modname	paramname	depth	paramval	grad	units	auth	lddate
	genericLg	Svelocity	0.0000	3.499	0	km/s	mulder	11/20/2007 (324) 0:50:54.47529
	genericLg	Svelocity	0.1000	3.5	0	km/s	mulder	11/20/2007 (324) 0:50:54.47715
	genericPg	Pvelocity	0.0000	6.19	0	km/s	mulder	11/20/2007 (324) 0:50:54.47833
	genericPg	Pvelocity	0.1000	6.2	0	km/s	mulder	11/20/2007 (324) 0:50:54.47956
	genericPb	Pvelocity	0.0000	6.499	0	kms	mulder	11/20/2007 (324) 0:50:54.48080
	genericPb	Pvelocity	0.1000	6.5	0	kms	mulder	11/20/2007 (324) 0:50:54.48193
	genericSb	Svelocity	0.0000	3.7499	0	kms	mulder	11/20/2007 (324) 0:50:54.48308
	genericSb	Svelocity	0.1000	3.75	0	kms	mulder	11/20/2007 (324) 0:50:54.48437
	ven_orogen	Pvelocit	0.0000	5.69	0	km/s	mulder	11/20/2007 (324) 0:53:02.17419
9								

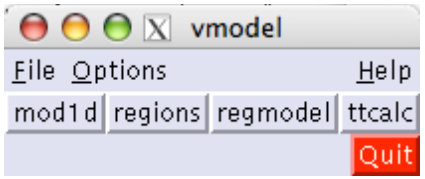
Special phase designations:

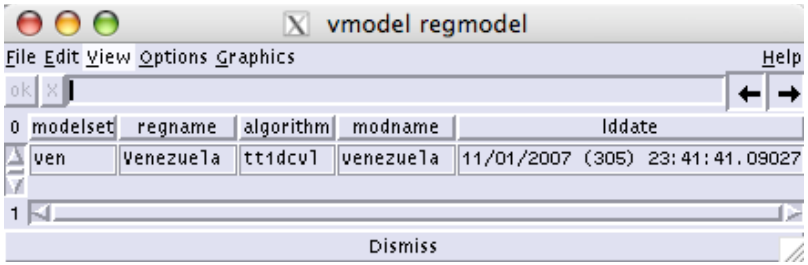
genericPg

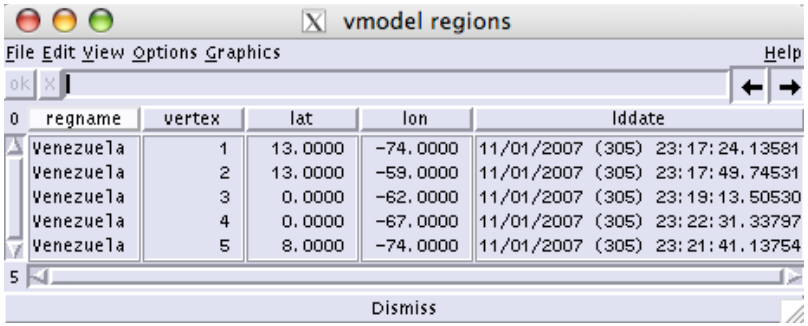
genericLg

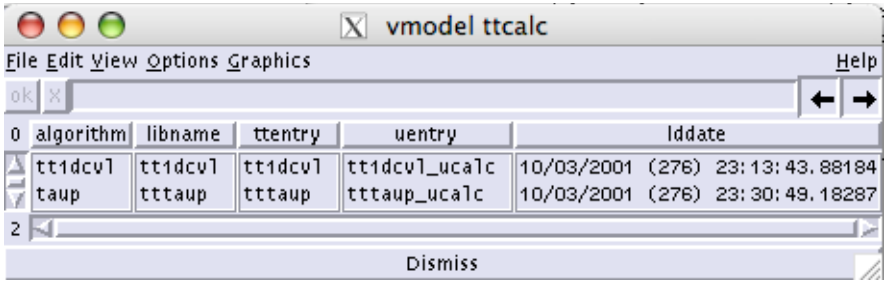
modname	paramname	depth	paramval
genericLg	Svelocity	0.0000	3.499
genericLg	Svelocity	0.1000	3.5
genericPg	Pvelocity	0.0000	6.19
genericPg	Pvelocity	0.1000	6.2
genericPb	Pvelocity	0.0000	6.499
genericPb	Pvelocity	0.1000	6.5
genericSb	Svelocity	0.0000	3.7499
genericSb	Svelocity	0.1000	3.75

Velocity model tables







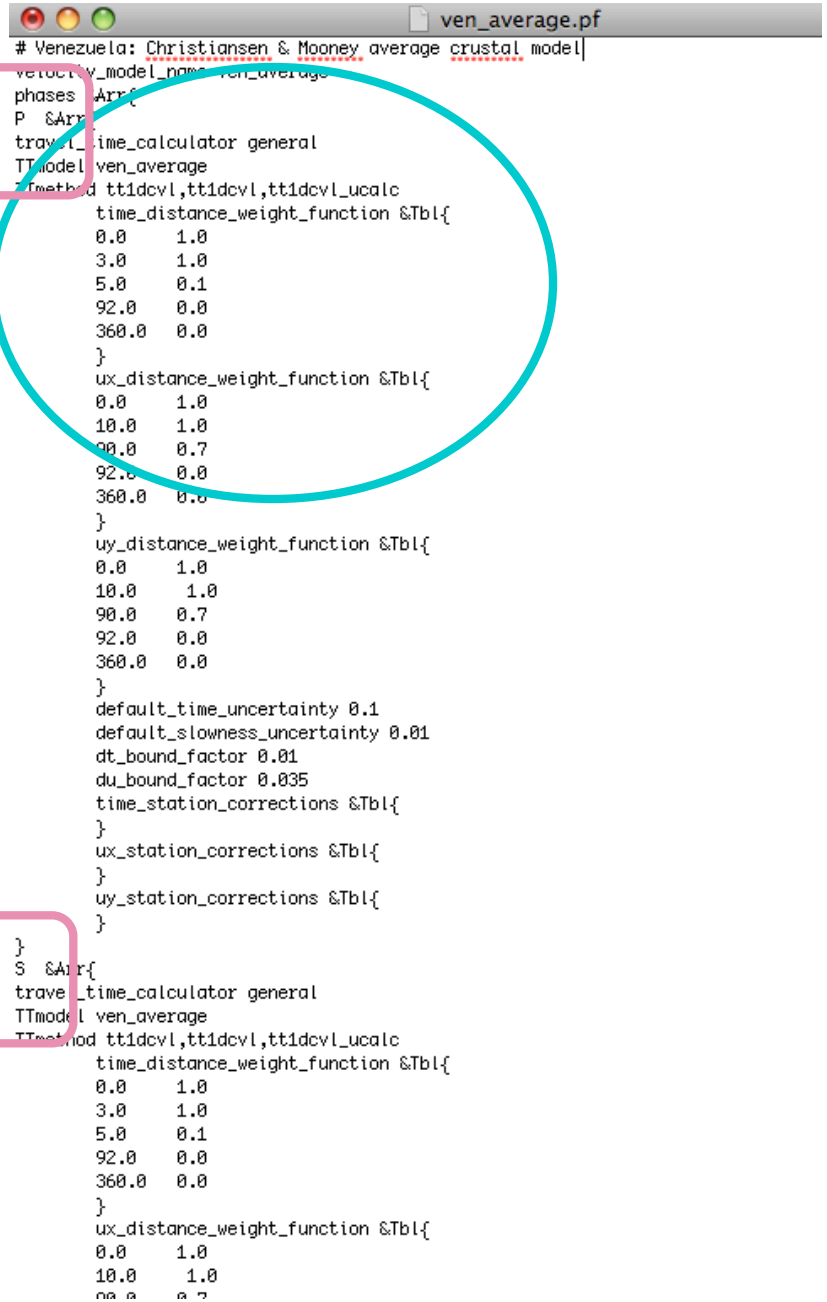


Files are in $ANTELOPE distribution

- % ls $ANTELOPE/data/tables/genloc
  1dcvl/ db/ taup/ ttlvz/ uniform/

- db/ - velocity model tables
  vmodel vmodel.regmodel vmodel_example.mod1d
  vmodel.mod1d vmodel.ttcalc vmodel_example.ttcalc
  vmodel.regions vmodel_example

- 1dcvl/ - phase parameter files
  ven3.pf ven_average.pf ven_shield.pf ven_orogen.pf wabash.pf


ven_average.pf
# Venezuela: Christiansen & Mooney average crustal model
phases &Arr{
P &Arr{
time_calculator general
TTmodel ven_average
tt1dcvl,tt1dcvl,tt1dcvl_ucalc
time_distance_weight_function &Tbl{
0.0 1.0
3.0 1.0
5.0 0.1
92.0 0.0
360.0 0.0
}
ux_distance_weight_function &Tbl{
0.0 1.0
10.0 1.0
90.0 0.7
92.0 0.0
360.0 0.0
}
uy_distance_weight_function &Tbl{
0.0 1.0
10.0 1.0
90.0 0.7
92.0 0.0
360.0 0.0
}
default_time_uncertainty 0.1
default_slowness_uncertainty 0.01
dt_bound_factor 0.01
du_bound_factor 0.035
time_station_corrections &Tbl{
}
ux_station_corrections &Tbl{
}
uy_station_corrections &Tbl{
}
}
S &Arr{
time_calculator general
TTmodel ven_average
tt1dcvl,tt1dcvl,tt1dcvl_ucalc
time_distance_weight_function &Tbl{
0.0 1.0
3.0 1.0
5.0 0.1
92.0 0.0
360.0 0.0
}
ux_distance_weight_function &Tbl{
0.0 1.0
10.0 1.0

$ANTELOPE/data/tables/genloc/1dcvl/en_average.pf

```
# Venezuela: Christiansen & Mooney average crustal model
velocity_model_name ven_average
phases &Arr{
P &Arr{
travel_time_calculator general
TTmodel ven_average
TTmethod tt1dcvl,tt1dcvl,tt1dcvl_ucalc
        time_distance_weight_function &Tbl{
        0.0     1.0
        3.0     1.0
        5.0     0.1
        92.0    0.0
        360.0   0.0
        }
```

```
S &Arr{
travel_time_calcu
TTmodel ven_avera
TTmethod tt1dcvl,
        time_dist
        0.0     1
        3.0     1
        5.0     0
        92.0    0
        360.0   0
        }
Sg  &Arr{
travel_time_calculator general
TTmodel ven_average_Lg
TTmethod tt1dcvl tt1dcvl tt1dcvl_ucalc
        time_distance_weight_function &Tbl
        0.0     0.0
        1.0     1.0
        15.0    1.0
        92.0    0.0
        360.0   0.0
        }
```

```
Pn &Arr{
travel_time_calculator general
TTmodel ven_average
TTmethod tt1dcvl,tt1dcvl,tt1dcvl_ucalc
        time_distance_weight_function &Tbl{
        0.0     0.0
        1.0     0.0
        2.0     1.0
        30.0    1.0
        92.0    0.1
        360.0   0.0
        }
```

```
Lg &Arr{
travel_time_calculator general
TTmodel ven_average_Lg
TTmethod tt1dcvl tt1dcvl tt1dcvl_ucalc
        time_distance_weight_function &Tbl{
        0.0     0.0
        1.0     1.0
        15.0    1.0
        92.0    0.0
        360.0   0.0
        }
        ux_distance_weight_function &Tbl{
        0.0     1.0
        10.0     1.0
        90.0    0.7
```

IMPORTANT!

- Backup velocity db (vmodel) and pf files outside distribution.
- Otherwise, if you re-install the antelope distribution, you WILL lose all your work.

Daily tasks

- Review and locate earthquakes produced from rtsystem automatic locations (orbdetect, orbassoc, orbevproc/orbmag/orbampmag).
- Scan for missed events.
- Associate with external catalogues
  - NEIC (QED)
  - Neighbouring networks
- Assign preferred origin

For each event:

- Review & adjust arrivals as necessary (dbpick).
  - Remove unwanted arrivals (S on vertical channels).
  - Add arrivals as necessary.
  - Arrival should be places as close to the beginning of the phase as possible.
  - Add error bar for each arrival (automatic arrivals and analyst added arrivals).
  - P-phase on vertical (Z) component.
  - S-phase on horizontal components.
- Locate event (dbloc2).
- Associate with external catalogues (dbloc2).
  - NEIC (QED)
  - Neighbouring networks
- Assign preferred origin (dbloc2).

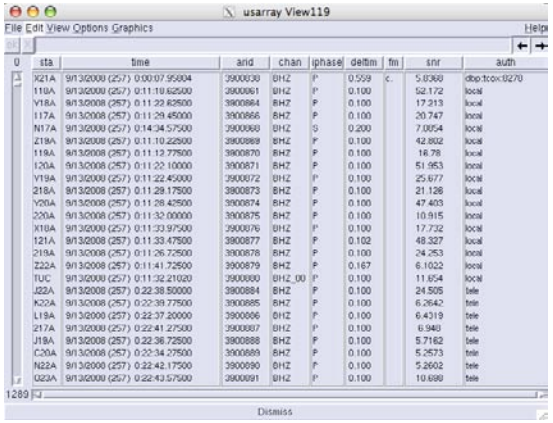
Weekly tasks

- Database health checks of arrival and assoc tables

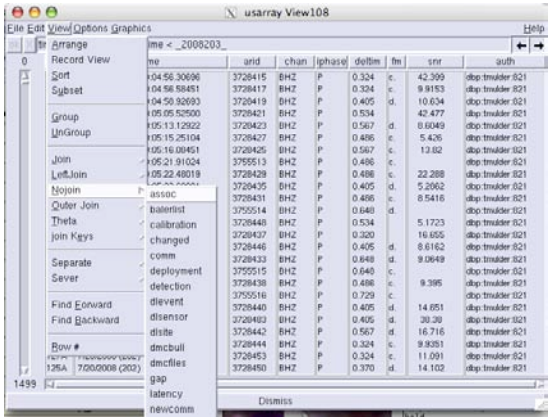
Db health checks - overview

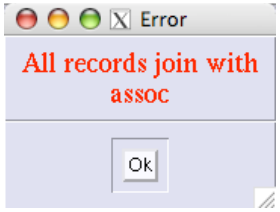
Dbe

Arrival table - rt data

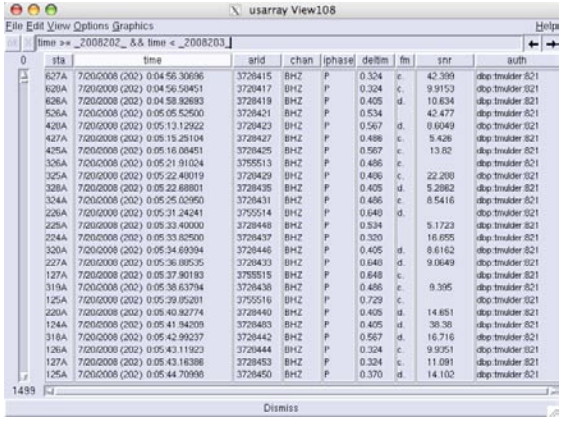


Nojoin with assoc table



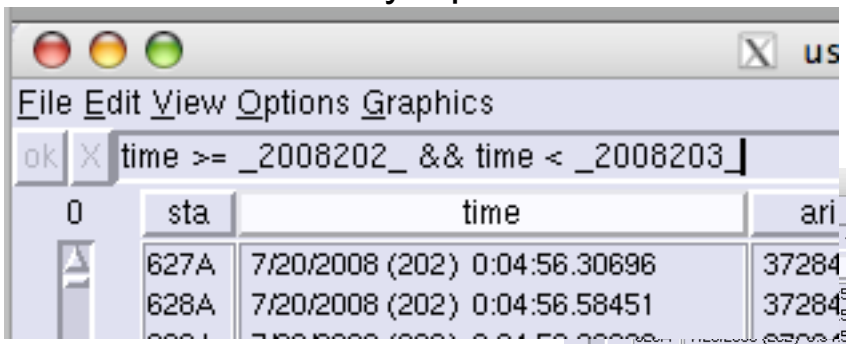


Arrival table - analyst processed data

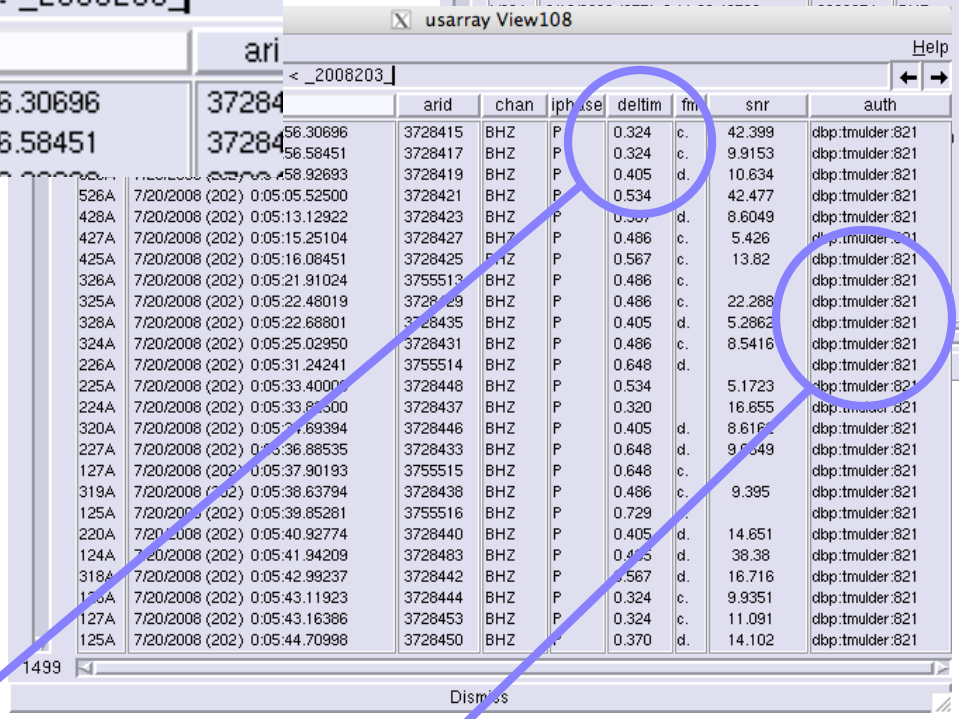


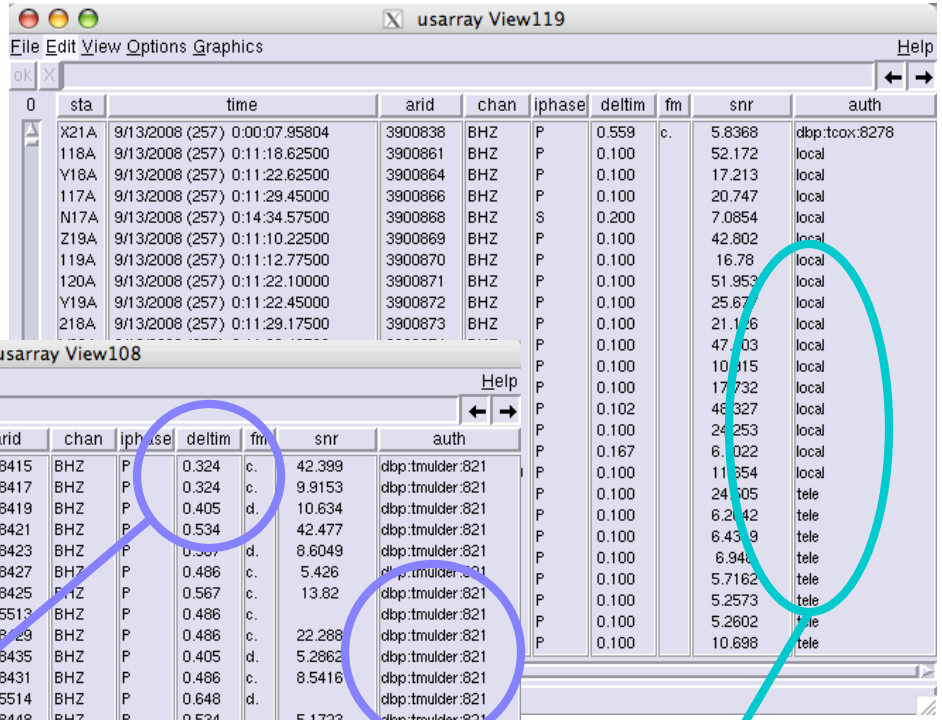
Db health checks

Arrival table - analyst processed data

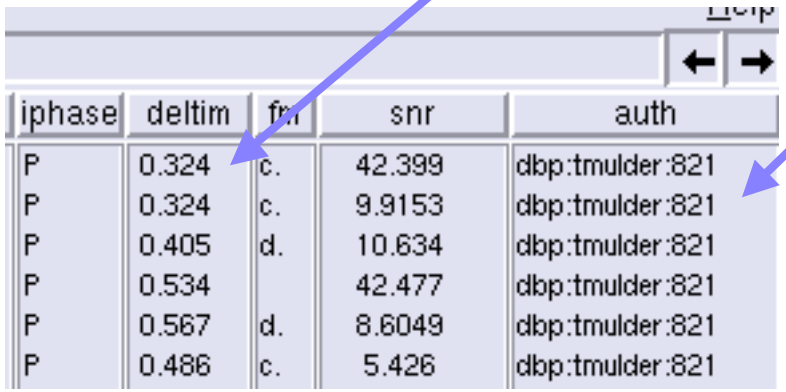


1) Subset for day of interest
View --> subset





Arrival table - rt data (before analyst event review)

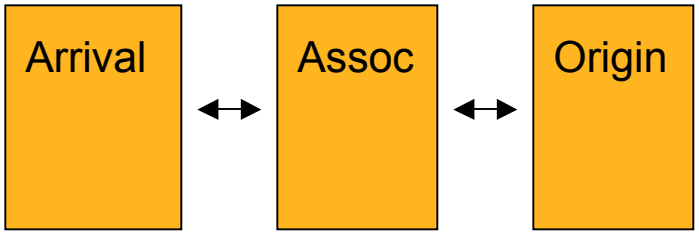


2) Check:

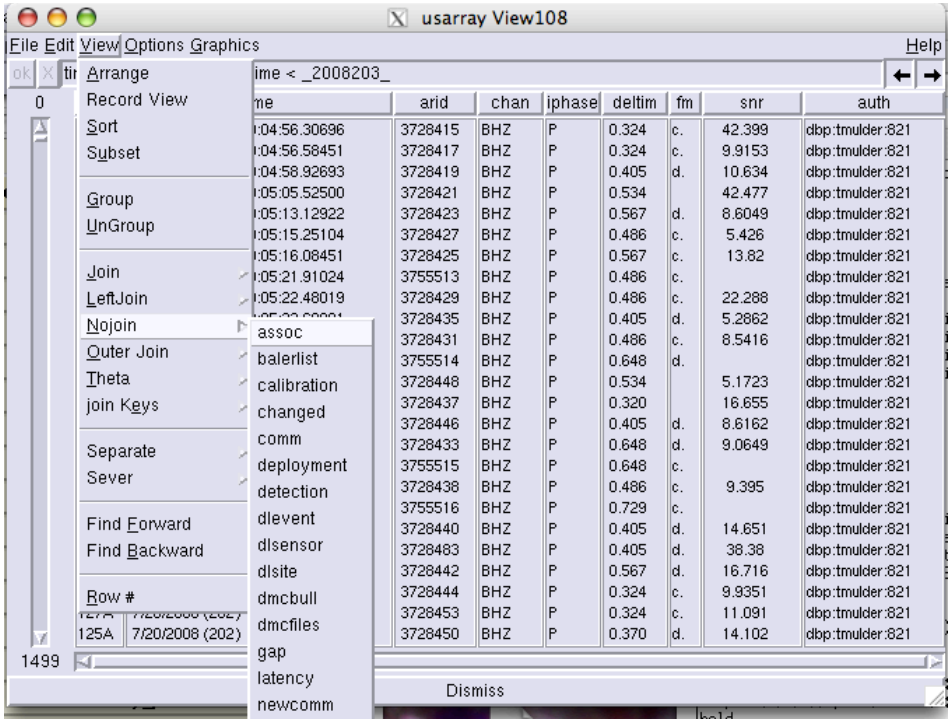
deltim (phase error bar) - filled in & reasonable value (local < 1s, ~1< tele < 10 s)

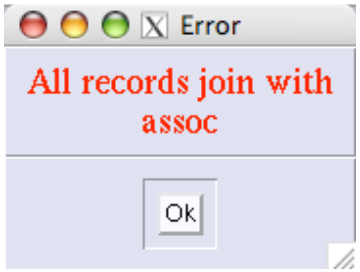
auth = analyst (not rtsystem system: orbassoc/local/regional/teleseismic)

Db health checks

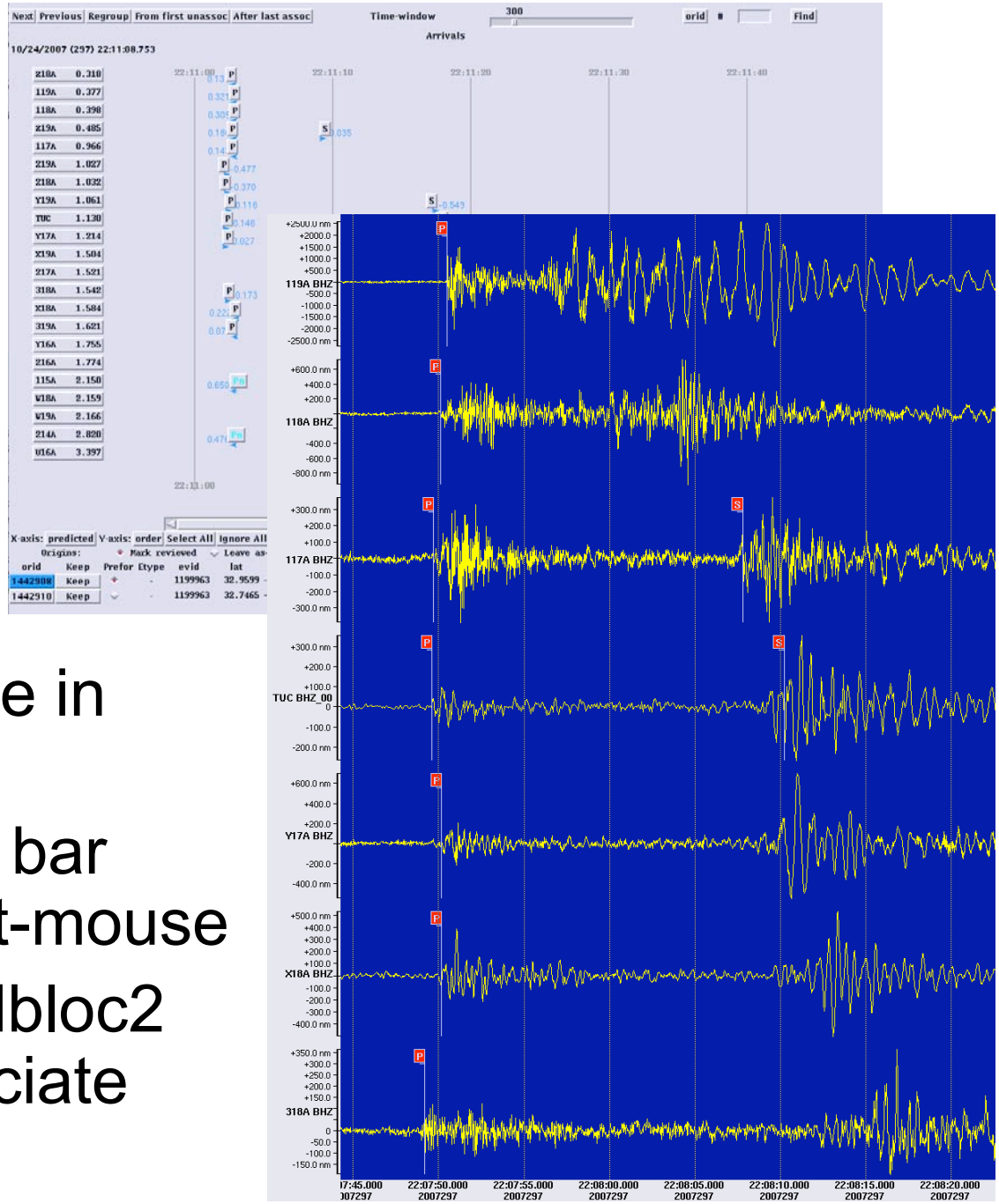


Nojoin with assoc table





Fix problems in dbloc2



- Find event & phase in dbloc2
- In dbpick, fix error bar (deltim): shift + left-mouse
- Select phases in dbloc2 and relocate/associate