Documentation of Kate’s Repeating Earthquake Detector (RED)

Matlab packages required:

Coral

GISMO

IRIS webservices matlab code

Code to access data from Winston waveservers

Schematic of program flow:

Description of Codes

Databases:

**familyTank** – Tank of all current families that have been active within the past 2 months

**orphanTank** – Tank of all events that have not been clustered into families. The life of an orphan depends on its psuedoenergy. Smaller events are kicked out sooner than larger amplitude events.

**Save in a separate Winston**??

Codes:

**redOptions.m** – Script to define options for all programs and designate which stations to include in the analysis. Description of all options can be found inside the program. Outputs a structure (typically called “opt”) containing info on all options chosen.

**redMain.m** – main script to run RED – accesses all the other programs, detailed below. Look at comments inside script for more details.

**redPicker.m** – uses STA/LTA picker to find all events in detection period. Uses the (unbiased) kurtosis of a time around the pick times to eliminate calibration pulses, spikes, and some particularly rumbly signals. Recommended opt.Kmin = 3.2 (3 is Gaussian), opt.Kmax = 200.

**redCluster.m** – First clusters events from detection period into families in current familyTank with cross correlation higher than opt.XCthresh (0.6 default). Throws unmatched detections into the orphanTank. To be together in a family, every event must have cross correlation of opt.XCthresh or greater with every other event.

**redOrphan.m** This code compares events without an existing family against each other and all over events in orphanTank, but to save time, waveforms are lowpass filtered and then downsampled and not crosscorrelated against each other if they already have been compared against each other and didn’t match up. i.e. it only cross correlates new orphans with each other and with existing orphans

**redPostprocess.m** family postprocessing including subdividing families into branches that share different xcorr coefficients (redTree.m) and building stacks for all large families and subfamilies (redStack.m) and computing statistics about individual events

**redCombine.m**  combines detections from individual stations into network-wide repeating earthquake detections.

**Conventions:**

Naming of events – families are named by the time of the earliest detection like YYMM-DDhhmmss. This is the name of the largest subfamily (XCthresh>0.6 typically) is just named this. Subfamilies naming goes like YYMM-DDhhmmss.A for >0.7 YYMM-DDhhmmss.A1 for >0.7, YYMM-DDhhmmss.A1a for >0.8 and YYMM-DDhhmmss.A1a1 for >0.9.

**Coral structure, new metadata fields:**

D.picktime – the datenum of the picktime this event was detected by, should be aligned with the

D.pickend – the time the signal falls below the specified noise level

D.family – the family name

D.subfamily – the subfamily name for the specific event

D.xcorr – the cross correlation between this event and the stack of all events in the family

D.domfreq

D.kurtosis