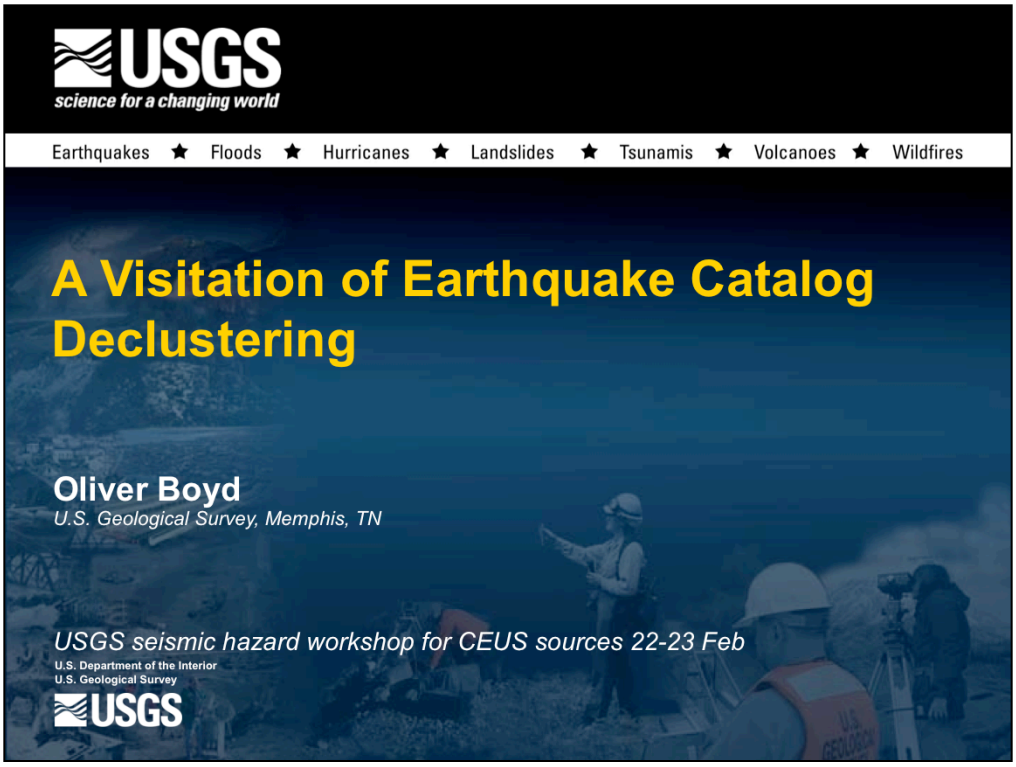
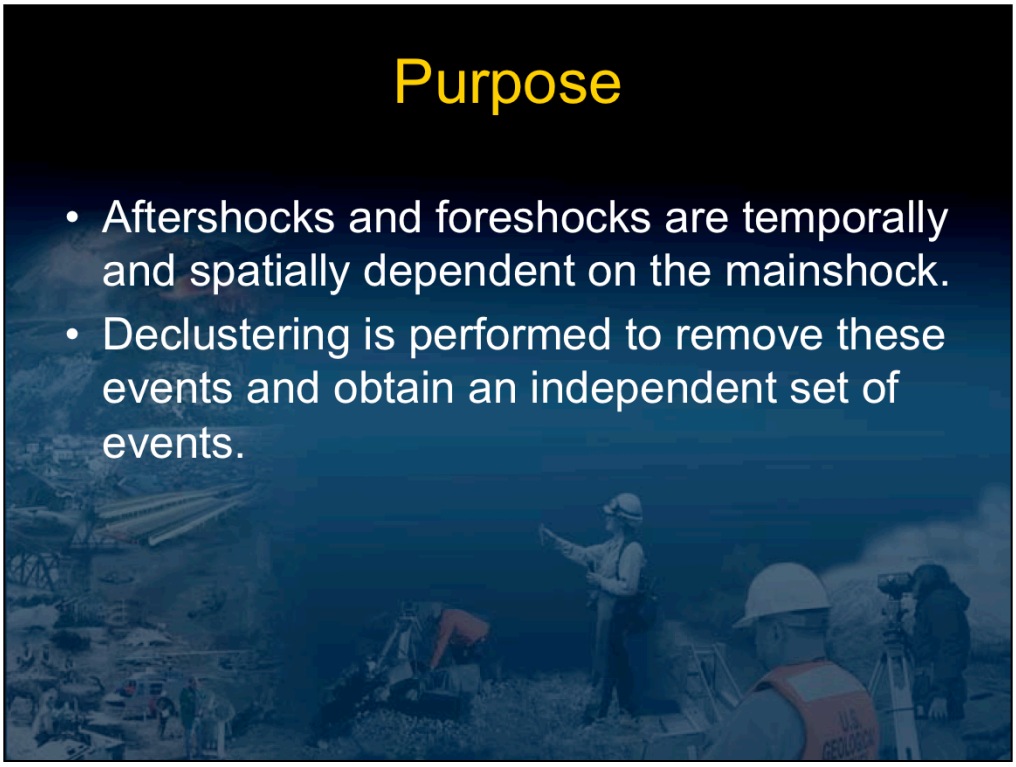
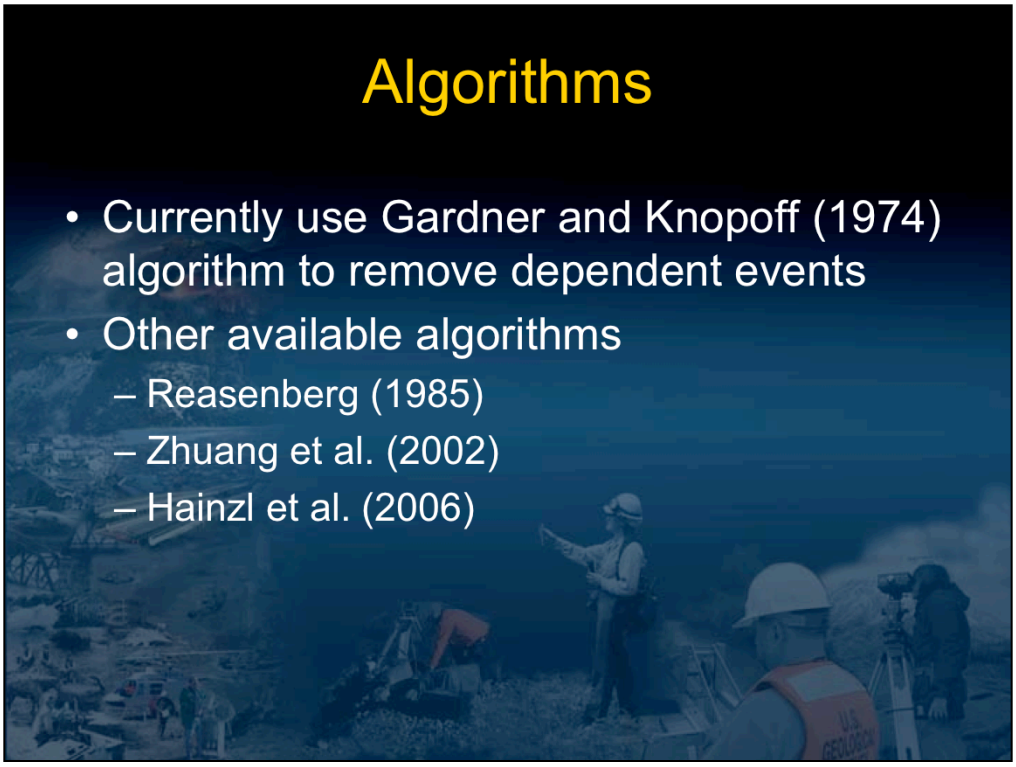


Here I will briefly discuss the declustering of the earthquake catalog, which is an essential part of determining the hazard from the background rate of seismicity.

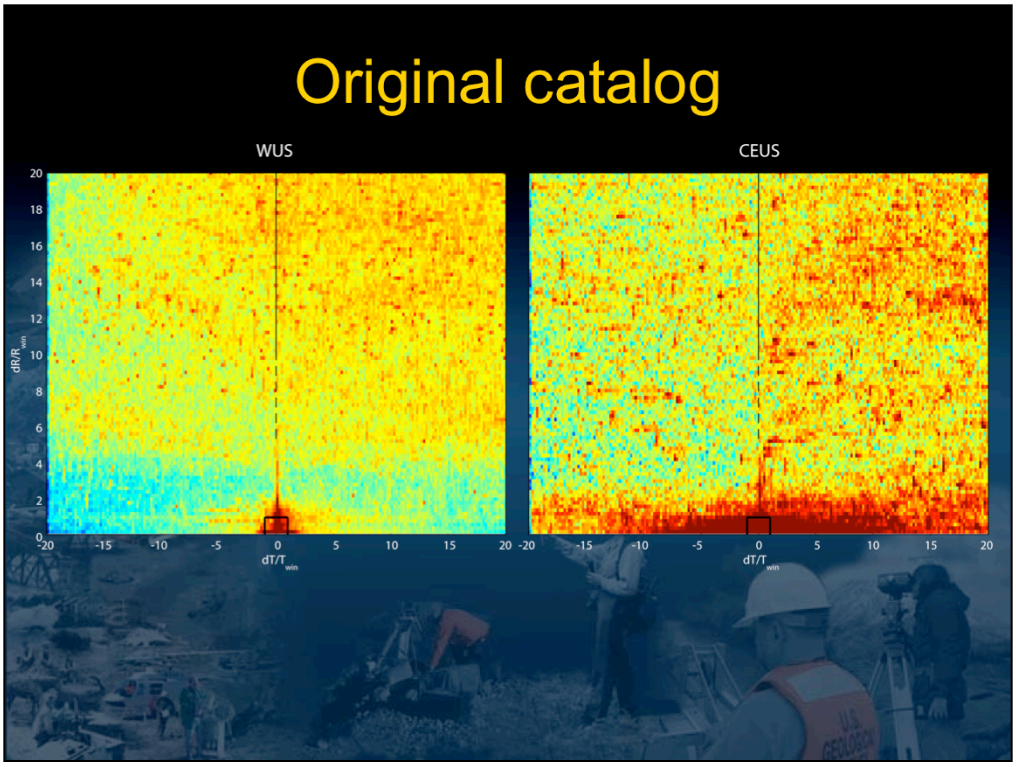


Why do we decluster earthquake catalogs? In our hazard analyses, we are interested in modeling a process where each possible event is independent of any other. Foreshocks and aftershocks are both temporally and spatially dependent on the mainshock. When we speak of declustering, we mean removing these dependent events. Declustering an earthquake catalog results in a catalog composed of independent events.

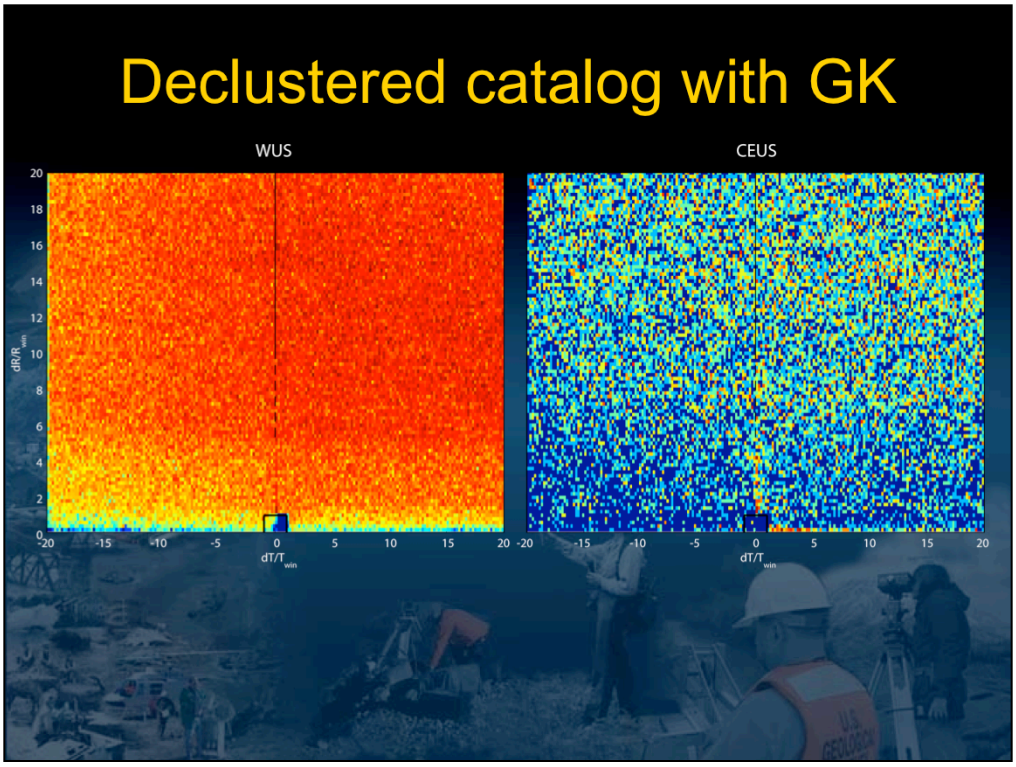


We currently use the declustering algorithm of Gardner and Knopoff in which earthquakes within certain time and distance windows of the mainshock, the size of which are defined by the mainshock magnitude, are considered dependent events and removed from the catalog. These windows are dependent only on the magnitude of the event and were derived for California earthquake sequences.

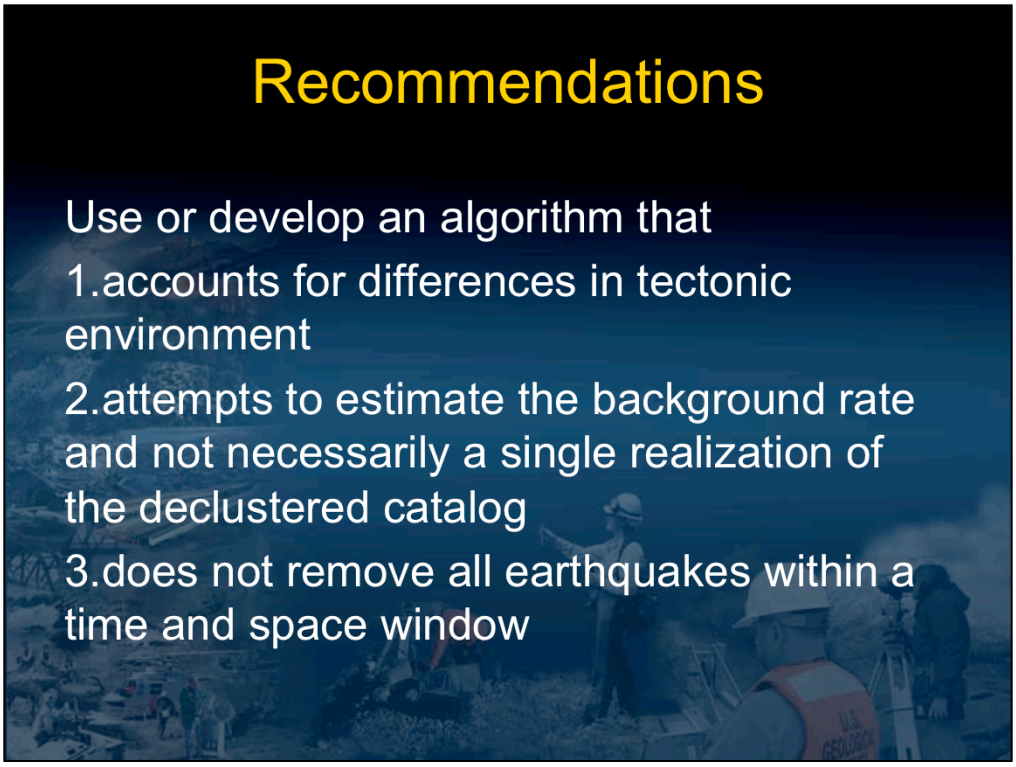
Other methods include that of Reasenberg in which events within time and distance windows are associated to form clusters and the cluster is replaced with an equivalent earthquake. Zhuang et al. use an epidmic-type aftershock sequence (ETAS) model and maximum likelihood to estimate contributions to the total seismicity from the background rate and branching structure. Hainzl et al. use the distribution of interevent times to derive a nonparametric estimate of the rate of mainshocks.



When we look at the time and distance between events normalized by the Gardner and Knopoff windows, we find that for both the WUS and CEUS catalogs containing dependent events, there is a prevalence for earthquakes to occur near to others in both space and time. It appears that in the CEUS, there is a greater proportion of these events. The black box near the origin represents the Gardner and Knopoff window. One thing we see is that dependent events occur outside of this window. We also see that dependent events appear at large distances at small times, perhaps caused by dynamic triggering. It also appears, at least in the CEUS catalog, that these events lead to increased activity at large distances.



When we decluster these catalogs with Gardner and Knopoff, we see catalogs that have much less structure. Many of the dependent events have been removed. Most of the events within the Gardner and Knopoff windows have been removed, but some of the dependent events have not. This is much more apparent for the CEUS catalog.



I therefor recommend using or developing an algorithm that

1) accounts for tectonic differences.
2) attempts to estimate the background rate and not remove all earthquakes within a time and space window.
3) does not remove all earthquakes within a time and space window

The algorithms of Zhuang et al. and Hainzl et al. and others may do this. We can then provide the original catalog, algorithm and background rate to users of the national maps.