



## Station Set Residual: Event Classification Using Historical Distribution of Observing Stations

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Analysts working at the International Data Centre in support of treaty monitoring through the Comprehensive Nuclear-Test-Ban Treaty Organization spend a significant amount of time reviewing hypothesized seismic events produced by an automatic processing system. When reviewing these events to determine their legitimacy, analysts take a variety of approaches that rely heavily on training and past experience.

One method used by analysts to gauge the validity of an event involves examining the set of stations involved in the detection of an event. In particular, leveraging past experience, an analyst can say that an event located in a certain part of the world is expected to be detected by Stations A, B, and C. Implicit in this statement is that such an event would usually not be detected by Stations X, Y, or Z. For some well understood parts of the world, the absence of one or more “expected” stations—or the presence of one or more “unexpected” stations—is correlated with a hypothesized event’s legitimacy and to its survival to the event bulletin.

The primary objective of this research is to formalize and quantify the difference between the observed set of stations detecting some hypothesized event, versus the expected set of stations historically associated with detecting similar nearby events close in magnitude. This Station Set Residual can be quantified in many ways, some of which are correlated with the analysts’ determination of whether or not the event is valid. We propose that this Station Set Residual score can be used to screen out certain classes of “false” events produced by automatic processing with a high degree of confidence, reducing the analyst burden. Moreover, we propose that the visualization of the historically expected distribution of detecting stations can be immediately useful as an analyst aid during their review process.