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AN EARTHQUAKE LOCATION IS NOT A POINT

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Though rupture on a fault during an earthquake is not a point process, it is convenient and important to estimate a point location for the initiation of rupture. For simplicity, by necessity or through laziness, such earthquake locations themselves are often represented by a simple point in space-time. But, as in all scientific inference, the information used to determine the location has uncertainty and error, and may be insufficient. Thus an earthquake location is necessarily a blurry cloud of probability in space-time, and this cloud may be extensive, irregular or discontinuous.

Global-search methods for seismic event location produce comprehensive uncertainty information that takes into account the uncertainty, error and incompleteness of the location problem. Using the global-search, NonLinLoc software package (http://alomax.net/nlloc) I will show and discuss a variety of probabilistic earthquake locations produced by realistic (uncertain, error prone and insufficient) data sets. We will see that many well-constrained events location have a compact, ellipsoidal probability density clouds, and thus for some purposes are adequately represented by a point. But other locations may have irregular and extensive probability clouds that can be sheet-like, discontinuous, or otherwise irregular and non-point like. Such locations cannot be meaningfully used or interpreted if they are represented by a simple point. Consequently, it is desirable to determine and use all earthquake locations in the form of a probability distribution. And if a later analysis procedure requires point locations, these should be selected carefully from the set of probabilistic locations.