Improving Monitoring, Hazard Assessment and Public Information for Ongoing Seismicity with Calibrated, Absolute Earthquake Location: The 2020 Indios, Puerto Rico Earthquake Sequence

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Abstract

Absolute earthquake location forms a foundation and framework for earthquake response, including early warning, public information, mapping shaking intensity, and forecasting aftershock likelihoods, and for basic seismological study, including seismicity, relative earthquake locations, large-scale faulting structures, earthquake rupture physics, earthquake hazard, and human-induced seismicity. Calibrated earthquake location incorporates source-specific station corrections, local/regional 1D or 3D seismic velocity models, robust location (e.g. probabilistic global-searching, L1-norm, intelligent phase re-weighting, or other robust algorithm), and high-quality, reviewed picks with realistic uncertainties.

In the context of the 2019-2020 Indios, Puerto Rico sequence seismicity, we discuss the use, importance and performance of calibrated, absolute event locations for monitoring, analysis, hazard assessment, and public information, while a sequence is progressing, as well as for later seismological study.

We present calibrated, absolute relocation of 2019-2020 Indios, Puerto Rico seismicity using reviewed PRSN arrival data, different 1D and 3D velocity models, station corrections and a probabilistic, global-search, location algorithm (NonLinLoc-EDT) that is very robust to errors in the velocity model and in arrival-times. We show the space-time evolution of the seismicity and how it defines likely faulting structures, and we relate this seismicity and inferred faulting to earthquake mechanisms and local geology and tectonics. For example, early in the sequence the relocated seismicity resolved a complex, 3D, multi-level set of likely fault planes. These include a shallow, offshore, near-vertical, WNW-ESE striking structure which adjoins and aligns with the onshore, left-lateral Punta Montalva fault; moreover, the largest events defining this structure have mechanisms with left-lateral fault planes which align with the fault.

3D visualizations of absolute relocation of M≥1.0 2020 Puerto Rico seismicity:
http://alomax.net/projects/PuertoRico_2020