Differences between Independent Arrival Time Picks

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Rapid exchange of seismic waveform data is becoming more practicable and affordable, as evidenced partly by the growing number of "open" stations. A side-effect of wider access is that station operators are no longer the only source of arrival picks that might be used in compiling seismic bulletins. The situation may have been widely noticed first during GSETT-3 in 1995, when the IDC became the most readily available source of readings from stations that participated in the experiment. These stations include those that were already among the most prolific contributors to global compilations, such as the Yellowknife and Warramunga Arrrays. Independent arrival picks from the same records may create uncertainty about the "best" sources of readings and increase the responsibility of agencies preparing composite bulletins to choose preferred readings well.

But independent arrival picks also present new opportunities. Systematic differences between body wave magnitudes, for example, have widened recognition of differences around the world in how amplitudes are actually measured. We use our database of duplicate readings to investigate onset time differences as picked by the IDC and other agencies. We find scatters of one second or more in the time differences, with no evidence that this scatter is less for larger amplitude arrivals. Generally, onset time differences are more narrowly distributed for initial phases than for later phases. For each station examined and for each phase with a reasonably compact distribution of differences, the median and mode of IDC picks are early compared with operator picks. The systematic differences are small compared with the scatter but statistically very significant.

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Abstract

Contents

Summary

- I consider differences between arrivals times where the IDC and the station operator made the same phase identification, and the ISC associated both picks with the same earthquake.
- Means are computed from differences smaller than ±2 seconds, to exclude outliers resulting from misidentification.
- "Uncertainty" of each mean is the standard deviation divided by the square root of the number of differences.


Top of Page

Among Regional Phase Picks

- The IDC pick is early, on average, at each of Arcess, Noress, Finess and Geress.
- Initial phase pick (Pn, Pg) differences have a clear mode, with rather skewed distribution.
- Differences between picks of later phases (*e.g.*, Lg) show, at best, a much weaker mode.
- At some stations, Sn time pick differences within ±2 seconds are almost uniformly distributed.


Top of Page

Among Teleseismic Phase Picks

- The IDC pick is early, on average, at each of Geress, Matsushiro and Alice Springs.
- Initial phase pick (P, PKP) differences have a clear mode, with an approximately Gaussian distribution.
- Differences between picks of later P-type phases (PcP, ScP) probably have an equally strong mode, with a similar mean.
- S time pick differences also have a strong mode but are significantly more widely distributed.


Top of Page

There are large differences with azimuth

- Density distribution functions can be used to demonstrate clear differences between sectors, where they are known.

- Cumulative distribution functions can be used more easily to compare several sectors, to discover azimuthal patterns.
- The mean difference does not vary too much with azimuth.
- The width of the distribution of Pn differences varies systematically with azimuth at several stations.

Top of Page