

Worldwide Distribution Of Seismic Stations

R J Willemann

D A Storchak

Readings from well over 2000 seismic stations each year help to ensure reliability of the Bulletin of the International Seismological Centre (ISC). But the density of reporting stations varies widely around the world, partly because the ISC aims to be comprehensive rather than uniform. The effect of station density is important but difficult to quantify. It can be hard to distinguish between true changes in seismicity and artefacts from changes among reporting stations, for example, especially if magnitude is not computed for some events.

A general view of detection capability is provided by the minimum distance beyond which an event must be detected in order to achieve good azimuthal coverage. Within a sufficiently small distance from any point a seismic network includes no more than two stations, with an azimuthal gap of at least 180° . Conversely, when stations at sufficiently large distances are included then azimuthal gap is less than 180° around any point within a network. The coverage of a network at a particular location can be characterised by the distance beyond which one must go to find stations making an azimuthal gap less than 180° .

If arrival times at two or more stations in any semicircle around an event are used to compute a location then no single arrival time controls a trade-off between epicentre and origin time. Thus the distance at which the second azimuthal gap (i.e., azimuthal gap ignoring the most isolated station) falls below 180° is sometimes regarded as a better measure of network coverage. We have compiled maps of this coverage among stations that contributed to the ISC Bulletin in recent years. Since smaller earthquakes usually can be detected only at nearer distances, the maps suggest where the ISC Bulletin is most likely to include only larger earthquakes.

The maps show, unsurprisingly, that detection at teleseismic distances is required to reliably locate events in the oceans. But they also show that a few island stations have been effective and essential to monitor seismicity off shore from some extensive continental networks. Coverage is understandably sparse in parts of some continents where large earthquakes occur only infrequently, such as eastern South America and Saharan Africa. In addition, however, the maps show that reporting stations have sometimes been insufficient for good coverage in parts of western South America, northernmost Africa, and much of central Asia.