Reviewed research article

The analog seismogram archives of Iceland: Scanning and preservation for future research

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Abstract — *The history of seismography in Iceland began in 1909 with the installation of one horizontal Mainka seismograph in Reykjavík. Following a period of intermittent operation, regular operation was initiated in 1925 with the establishment of the Icelandic Meteorological Office. The number of stations increased gradually over the following decades, and in the sixties, four stations were in operation. The number of permanent stations proliferated following the Heimaey eruption in 1973 and during most of the eighties the number of stations was 40–50. The first digital seismograph stations were installed in 1990 and the analog seismic network was gradually replaced by digital stations over the next two decades. Between 1910 and 1920 the number of seismograms grew to an estimated 300,000. A four-year project to make this record collection accessible on the internet has been initiated and funded. So far around 175,000 seismograms have been scanned and the results are available and free for download on the open website seismis.hi.is. The seismograms are scanned with a resolution of 300 dpi and presented on the website as jpg-, and png-file. The high-resolution files are on the order of 4–8 Mb each. Digitization of the seismic traces has not been attempted since most of the seismograms are from short-period instruments and the waveforms are already lost. In addition to numerous teleseismic body-wave-phases, the record collection contains primary data from various tectonic and magmatic events in Iceland during the last century. This includes eruptions of Hekla in 1947, 1970, 1980–81, 1991 and 2000, Surtsey in 1963–1967, Heimaey in 1973, Askja in 1961, Grímsvötn in 1934, 1983, 1998, and 2004, Gjálp in 1996, rifting episode at Krafla in 1975–1984, persistent seismic activity of the Bárðarbunga and Katla volcanoes, numerous suspected subglacial magmatic events, earthquake swarms on the Reykjanes Peninsula Oblique Rift and within the Tjörnes Fracture Zone, and earthquake sequences in the transform zones of South and North Iceland and adjacent segments of the Mid-Atlantic Ridge.*

INTRODUCTION

All over the world scientists are waking up to the reality that valuable seismological data are being lost. Because storage is costly, large archives of analog data of various nature are taken to the waste dumps (Richards and Hellweg, 2020). The analog-to-digital revolution and the large increase in storage capacities for digital data has brought many benefits to the scientific community. Digital data are becoming readily available to a large generation of scientists, allowing sophisticated analysis and research, unthinkable before. This brings with it the danger of forgetting and ignoring data sets obtained in the pre-digital era. In several branches of science it is essential to have long term data. This includes many branches of earth sciences. The natural systems under investigation operate on time scales of centuries and millennia, much longer than the time periods of available digital data, including volcanic systems, active seismogenic faults, climatic systems (e.g., Sturkell *et al.*, 2006; Sigmundsson *et al.*, 2018). For research in these fields, it is important to extend the period of observation back in time as far as possible in order to appreciate the time-variability of the systems. In earthquake seismology, this is done by studying and interpreting 1) surface effects of prehistoric and historic earthquakes, 2) old documents