SnT 2025
CTBT: SCIENCE AND TECHNOLOGY CONFERENCE
8 SEPTEMBER ONLINE DAY
9 TO 12 SEPTEMBER AT HOFBURG PALACE, VIENNA & ONLINE

From Paper to Pixels: Lessons Learnt from Creating and Using the NELD Repository

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INTRODUCTION AND MAIN RESULTS

The Nuclear Explosion Legacy Data (NELD) Repository was designed and built to store analog scanned and digitized data in a format consistent with the CTBTO PrepCom database. It presently includes over 2,000 scanned seismic recordings and can be easily extended to a digital waveform repository. Scanned data cover over 300 nuclear explosions detonated in test sites around the world and recorded at over 60 stations in Austria, Bulgaria, Republic of Moldova and Romania.

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Introduction

The **Nuclear Explosion Legacy Data (NELD) Repository** was designed and built to store nuclear explosion analog scanned and digitized data in a format consistent with the CTBTO PrepCom database. It follows and extends the *CSS/IMS formats* for the time series data and station metadata. The repository is supported by a database including information about the event, station, equipment, and analog recording.

Valuable experience was gained on procedures for data selection and scanning, and for collecting, organizing, and storing the metadata information needed for successful usage of legacy data. All scanned data and metadata are stored in the NELD repository designed by Leidos and are ready to be shared with the community.

Leidos (USA) partnered with 4 national institutes in Europe who have large archives of analog seismic recordings that span the most active period of nuclear testing and had previous activities on legacy data rescue: NIEP (Romania), GeoSphere (Austria), NIGGG (Bulgaria), IGS (Republic of Moldova). The paper archives are increasingly in danger of being lost due to physical degradation of the recordings; the expertise required to use them will be lost soon. The first step in analog data rescue is scanning the recordings and collecting the associated metadata.

Methods/Data

Our legacy data rescue project encompasses te following steps:: inventory, identification, scanning, aggregation of metadata and data quality control, followed by collecting the scans and metadata into the common repository.

We developed and applied **uniform** procedures for

- *inventory preparation*
- *scanning* : full seismogram, resolution 1200 dpi, 24 bit color depth, scan notes/stamps on front and back
- *metadata collection* using templates designed for the project: 64 parameters on station, instrument, analog recording, scan files, etc.
- *station database* for “analog era”: similar to IDC one
- *storage* in NELD repository.

Challenges:

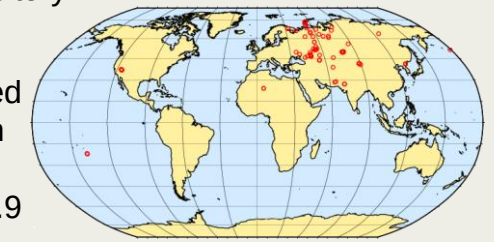
- Recovering old recordings and preparing for scanning the ones not well stored or partially damaged ones.
- Metadata collection for the large variety of instruments and recording systems: publications in archives / libraries / museums, station books, bulletins, etc.




Results/Conclusions

The NELD repository includes over 2,000 scanned seismic recordings and can be easily extended to a digital waveform repository:

- Over 300 nuclear explosions detonated during 1965-2017 in 12 test sites around the world, mb 4.1-6.9



- Recorded at over 60 stations at 5-156 degrees.
- 45 tests at regional distances are included.

Web interface for access to scans, metadata and thumbnails for quick view; click to high-resolution image for inspection.

EVID	DATETIME	LAT	LON	mb	CTRY	STA	CHAN	INSTYPE	QC	FILESIZE	DFILE
1725	1984/07/21 03:10:00	51.391	53.351	5.4	ROU	MLR	EZN	SKM3	GGG	585713170	scan_1723_MLR_EZN_SKM3.tif
1724	1984/07/21 03:05:00	51.371	53.337	5.3	ROU	MLR	EZN	SKM3	GGG	585713170	scan_1723_MLR_EZN_SKM3.tif
1723	1984/07/21 03:00:00	51.358	53.319	5.4	ROU	MLR	EZN	SKM3	GGG	585713170	scan_1723_MLR_EZN_SKM3.tif
1724	1984/07/21 03:05:00	51.371	53.337	5.3	ROU	MLR	Z	S13	GGG	1900182800	scan_1723_MLR_Z_S13.tif
1723	1984/07/21 03:00:00	51.358	53.319	5.4	ROU	MLR	Z	S13	GGG	1900182800	scan_1723_MLR_Z_S13.tif
1725	1984/07/21 03:10:00	51.391	53.351	5.4	ROU	MLR	Z	S13	GGG	1900182800	scan_1723_MLR_Z_S13.tif
1710	1982/10/16 06:00:00	46.759	48.247	5.2	ROU	MLR	NEZ	DD1	GGG	2230430200	scan_1710_MLR_NEZ_DD1.tif
1688	1979/07/14 04:59:58	47.88	48.12	5.7	ROU	MLR	NEZ	DD1	GGG	2230737800	scan_1686_MLR_NEZ_DD1.tif
1712	1982/10/16 06:10:00	46.766	48.288	5.2	ROU	MLR	NEZ	DD1	GGG	2230430200	
1713	1982/10/16 06:15:00	46.76	48.3	5.4	ROU	MLR	NEZ	DD1	GGG	2230430200	
1686	1979/07/14 04:59:58	47.88	48.12	5.7	ROU	MLR	NEZ	DD1	GGG	2230737800	
1687	1979/07/14 04:59:58	47.88	48.12	5.7	ROU	MLR	NEZ	DD1	GGG	2230737800	
1711	1982/10/16 06:05:00	46.752	48.258	5.2	ROU	MLR	NEZ	DD1	GGG	2230430200	
1825	1979/09/24 03:30:00	73.3428	54.6873	5.7	ROU	MLR		DD1	no	2233271000	

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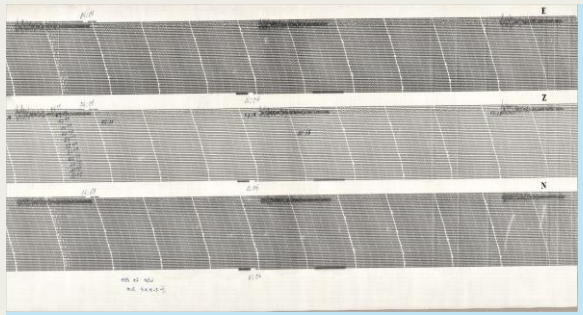
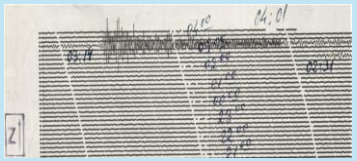
Variety of seismic instruments and recording systems

Most of the instruments are now in museums and their metadata in archives.

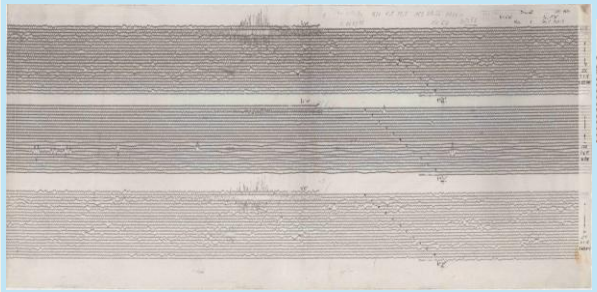
Clockwise from up left: Sprengnether 5007 and Stuttgarter Satz (VKA, Austria), Wiechert (SOF, Bulgaria), Mainka-Curea (TIM, Romania), SKM3 (KIS, Republic of Moldova)

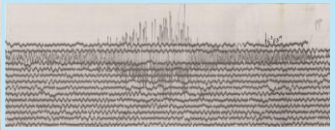
Variety of scanned seismograms



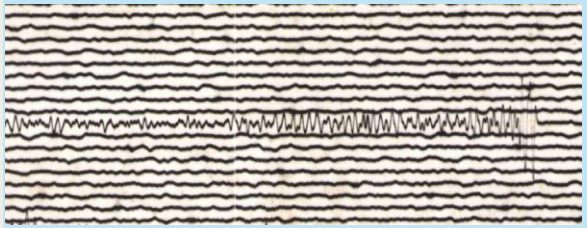


MLR, Romania: Soviet peaceful nuclear tests, 1984/07/21, SKM-3,19 deg.

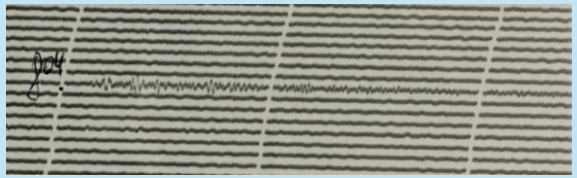




KIS, Moldova: Western Soviet Union 1969/09/26, SK, 9 deg.

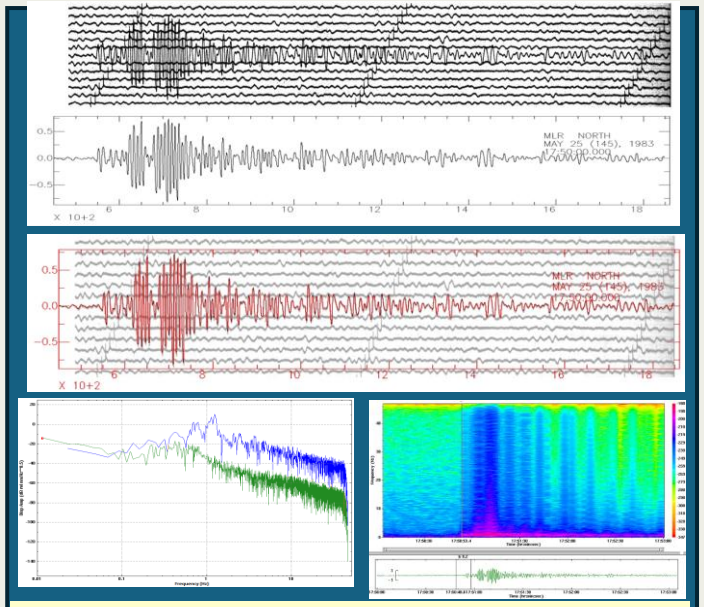


MMB, Bulgaria: Semipalatinsk 1985/04/25, SKM-3, 39 deg.

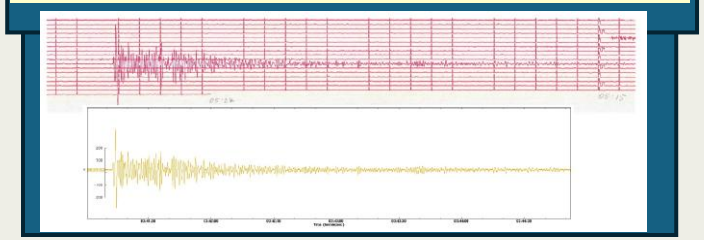


VKA, Austria: Western Soviet Union 1969/ 09/26, Stuttgarter Satz, 18 deg.

One step further



MLR, Romania: Scanned (up) and digitized recording (middle), overlap (low), French Polynesia, 1983/05/25 DD1 NS.



MLR, Romania: comparison of analog scanned and digital recordings of the 2017 DPRK test, S-13 Z