



TECHNISCHE UNIVERSITÄT  
BERGAKADEMIE FREIBERG

Die Ressourcenuniversität. Seit 1765.

# The Seismological Observatory Berggießhübel/Saxony and its underground lab



Olaf Hellwig, Anja Zeibig, Stefan Buske

TU Bergakademie Freiberg  
Institute of Geophysics and Geoinformatics



# Overview

- Seismological observatory and underground lab in Berggießhübel
- Historical overview
- Earthquake monitoring in Berggießhübel
  - Local seismicity
  - Teleseismic events

# Seismological observatory and underground lab

- Location SE of Dresden in the eastern part of the Ore Mountains



- Optimal conditions for earthquake monitoring
- Low microseismic noise level caused by the sea, heavy traffic, industry and wind turbines

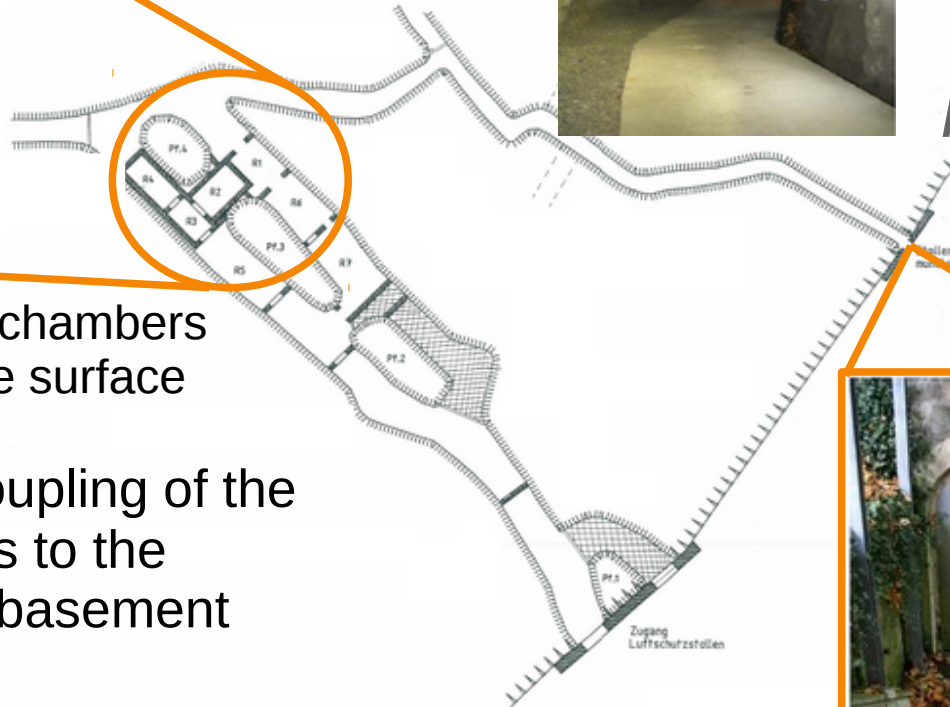
# Seismological observatory and underground lab

Former exploration tunnel  
from iron ore mining  
(today main access)



Measurement chambers  
36 m below the surface

- Excelent coupling of the instruments to the crystalline basement



Station building



# Overview

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# Historical overview

- Construction of the station building and installation of the observatory in 1957 as a contribution of Bergakademie Freiberg to the International Geophysical Year (1957/58)
- Start of tide measurements and geomagnetic measurements in 1960

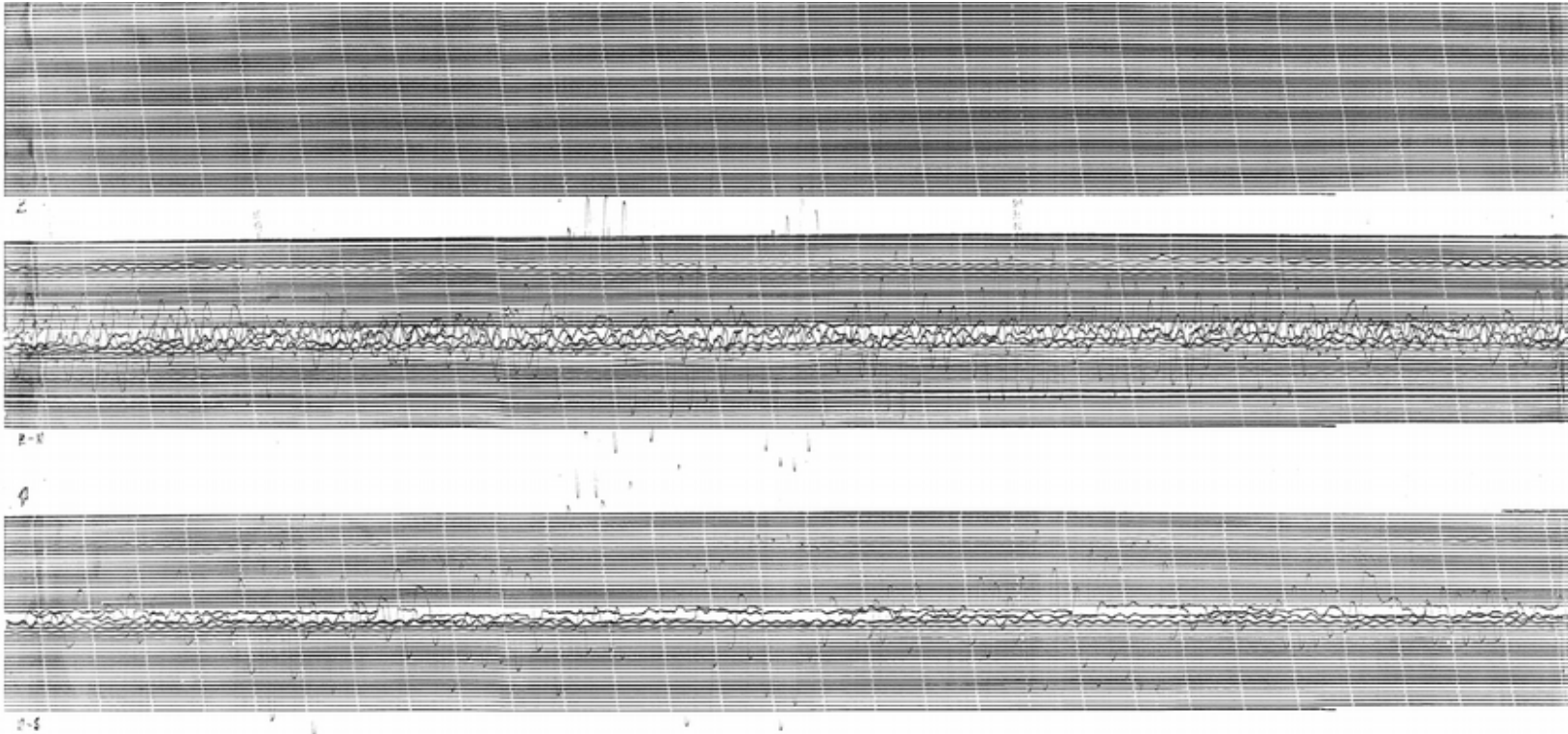


Wolfgang Buchheim



# Historical overview

- 10<sup>th</sup> May 1960 First seismic test recordings
- 22<sup>nd</sup> May 1960 Great Chilean earthquake (Valdivia earthquake) with Mw 9.5



# Historical overview

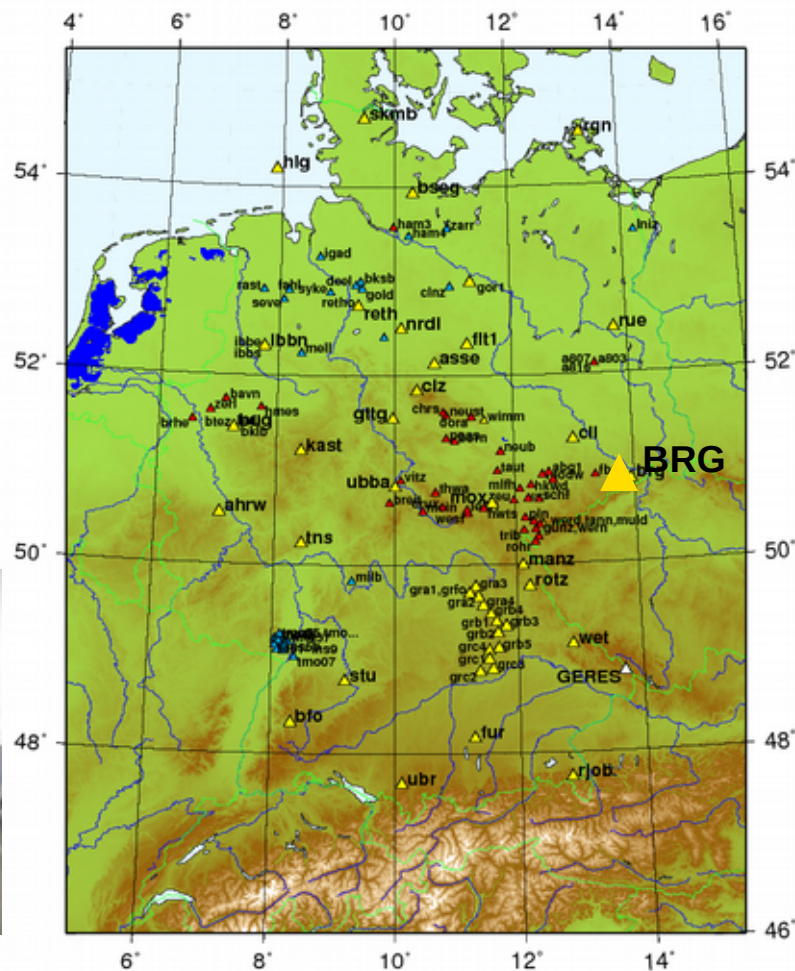
- Continuous seismic recordings since 1966
- 1970 Integration into the Central Institute of Physics of the Earth (ZIPE) in Potsdam
- 1974 Start of routine analysis of seismological data and reporting to seismological data centres (ISC, NEIC, WDC-B)

Stn	Time	Amplitude	Period	Frequency	Phase	Remarks
1	0.0	1.0	0.5	2.0	0.0	
2	0.1	1.2	0.6	1.7	0.1	
3	0.2	1.5	0.7	1.4	0.2	
4	0.3	1.8	0.8	1.3	0.3	
5	0.4	2.0	0.9	1.1	0.4	
6	0.5	2.2	1.0	1.0	0.5	
7	0.6	2.5	1.1	0.9	0.6	
8	0.7	2.8	1.2	0.8	0.7	
9	0.8	3.0	1.3	0.8	0.8	
10	0.9	3.2	1.4	0.7	0.9	
11	1.0	3.5	1.5	0.7	1.0	
12	1.1	3.8	1.6	0.6	1.1	
13	1.2	4.0	1.7	0.6	1.2	
14	1.3	4.2	1.8	0.6	1.3	
15	1.4	4.5	1.9	0.5	1.4	
16	1.5	4.8	2.0	0.5	1.5	
17	1.6	5.0	2.1	0.5	1.6	
18	1.7	5.2	2.2	0.5	1.7	
19	1.8	5.5	2.3	0.4	1.8	
20	1.9	5.8	2.4	0.4	1.9	
21	2.0	6.0	2.5	0.4	2.0	
22	2.1	6.2	2.6	0.4	2.1	
23	2.2	6.5	2.7	0.4	2.2	
24	2.3	6.8	2.8	0.4	2.3	
25	2.4	7.0	2.9	0.4	2.4	
26	2.5	7.2	3.0	0.3	2.5	
27	2.6	7.5	3.1	0.3	2.6	
28	2.7	7.8	3.2	0.3	2.7	
29	2.8	8.0	3.3	0.3	2.8	
30	2.9	8.2	3.4	0.3	2.9	
31	3.0	8.5	3.5	0.3	3.0	
32	3.1	8.8	3.6	0.3	3.1	
33	3.2	9.0	3.7	0.3	3.2	
34	3.3	9.2	3.8	0.3	3.3	
35	3.4	9.5	3.9	0.3	3.4	
36	3.5	9.8	4.0	0.3	3.5	
37	3.6	10.0	4.1	0.3	3.6	
38	3.7	10.2	4.2	0.3	3.7	
39	3.8	10.5	4.3	0.3	3.8	
40	3.9	10.8	4.4	0.3	3.9	
41	4.0	11.0	4.5	0.3	4.0	
42	4.1	11.2	4.6	0.3	4.1	
43	4.2	11.5	4.7	0.3	4.2	
44	4.3	11.8	4.8	0.3	4.3	
45	4.4	12.0	4.9	0.3	4.4	
46	4.5	12.2	5.0	0.3	4.5	
47	4.6	12.5	5.1	0.3	4.6	
48	4.7	12.8	5.2	0.3	4.7	
49	4.8	13.0	5.3	0.3	4.8	
50	4.9	13.2	5.4	0.3	4.9	
51	5.0	13.5	5.5	0.3	5.0	
52	5.1	13.8	5.6	0.3	5.1	
53	5.2	14.0	5.7	0.3	5.2	
54	5.3	14.2	5.8	0.3	5.3	
55	5.4	14.5	5.9	0.3	5.4	
56	5.5	14.8	6.0	0.3	5.5	
57	5.6	15.0	6.1	0.3	5.6	
58	5.7	15.2	6.2	0.3	5.7	
59	5.8	15.5	6.3	0.3	5.8	
60	5.9	15.8	6.4	0.3	5.9	
61	6.0	16.0	6.5	0.3	6.0	
62	6.1	16.2	6.6	0.3	6.1	
63	6.2	16.5	6.7	0.3	6.2	
64	6.3	16.8	6.8	0.3	6.3	
65	6.4	17.0	6.9	0.3	6.4	
66	6.5	17.2	7.0	0.3	6.5	
67	6.6	17.5	7.1	0.3	6.6	
68	6.7	17.8	7.2	0.3	6.7	
69	6.8	18.0	7.3	0.3	6.8	
70	6.9	18.2	7.4	0.3	6.9	
71	7.0	18.5	7.5	0.3	7.0	
72	7.1	18.8	7.6	0.3	7.1	
73	7.2	19.0	7.7	0.3	7.2	
74	7.3	19.2	7.8	0.3	7.3	
75	7.4	19.5	7.9	0.3	7.4	
76	7.5	19.8	8.0	0.3	7.5	
77	7.6	20.0	8.1	0.3	7.6	
78	7.7	20.2	8.2	0.3	7.7	
79	7.8	20.5	8.3	0.3	7.8	
80	7.9	20.8	8.4	0.3	7.9	
81	8.0	21.0	8.5	0.3	8.0	
82	8.1	21.2	8.6	0.3	8.1	
83	8.2	21.5	8.7	0.3	8.2	
84	8.3	21.8	8.8	0.3	8.3	
85	8.4	22.0	8.9	0.3	8.4	
86	8.5	22.2	9.0	0.3	8.5	
87	8.6	22.5	9.1	0.3	8.6	
88	8.7	22.8	9.2	0.3	8.7	
89	8.8	23.0	9.3	0.3	8.8	
90	8.9	23.2	9.4	0.3	8.9	
91	9.0	23.5	9.5	0.3	9.0	
92	9.1	23.8	9.6	0.3	9.1	
93	9.2	24.0	9.7	0.3	9.2	
94	9.3	24.2	9.8	0.3	9.3	
95	9.4	24.5	9.9	0.3	9.4	
96	9.5	24.8	10.0	0.3	9.5	
97	9.6	25.0	10.1	0.3	9.6	
98	9.7	25.2	10.2	0.3	9.7	
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102	10.1	26.2	10.6	0.3	10.1	
103	10.2	26.5	10.7	0.3	10.2	
104	10.3	26.8	10.8	0.3	10.3	
105	10.4	27.0	10.9	0.3	10.4	
106	10.5	27.2	11.0	0.3	10.5	
107	10.6	27.5	11.1	0.3	10.6	
108	10.7	27.8	11.2	0.3	10.7	
109	10.8	28.0	11.3	0.3	10.8	
110	10.9	28.2	11.4	0.3	10.9	
111	11.0	28.5	11.5	0.3	11.0	
112	11.1	28.8	11.6	0.3	11.1	
113	11.2	29.0	11.7	0.3	11.2	
114	11.3	29.2	11.8	0.3	11.3	
115	11.4	29.5	11.9	0.3	11.4	
116	11.5	29.8	12.0	0.3	11.5	
117	11.6	30.0	12.1	0.3	11.6	
118	11.7	30.2	12.2	0.3	11.7	
119	11.8	30.5	12.3	0.3	11.8	
120	11.9	30.8	12.4	0.3	11.9	
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122	12.1	31.2	12.6	0.3	12.1	
123	12.2	31.5	12.7	0.3	12.2	
124	12.3	31.8	12.8	0.3	12.3	
125	12.4	32.0	12.9	0.3	12.4	
126	12.5	32.2	13.0	0.3	12.5	
127	12.6	32.5	13.1	0.3	12.6	
128	12.7	32.8	13.2	0.3	12.7	
129	12.8	33.0	13.3	0.3	12.8	
130	12.9	33.2	13.4	0.3	12.9	
131	13.0	33.5	13.5	0.3	13.0	
132	13.1	33.8	13.6	0.3	13.1	
133	13.2	34.0	13.7	0.3	13.2	
134	13.3	34.2	13.8	0.3	13.3	
135	13.4	34.5	13.9	0.3	13.4	
136	13.5	34.8	14.0	0.3	13.5	
137	13.6	35.0	14.1	0.3	13.6	
138	13.7	35.2	14.2	0.3	13.7	
139	13.8	35.5	14.3	0.3	13.8	
140	13.9	35.8	14.4	0.3	13.9	
141	14.0	36.0	14.5	0.3	14.0	
142	14.1	36.2	14.6	0.3	14.1	
143	14.2	36.5	14.7	0.3	14.2	
144	14.3	36.8	14.8	0.3	14.3	
145	14.4	37.0	14.9	0.3	14.4	
146	14.5	37.2	15.0	0.3	14.5	
147	14.6	37.5	15.1	0.3	14.6	
148	14.7	37.8	15.2	0.3	14.7	
149	14.8	38.0	15.3	0.3	14.8	
150	14.9	38.2	15.4	0.3	14.9	
151	15.0	38.5	15.5	0.3	15.0	
152	15.1	38.8	15.6	0.3	15.1	
153	15.2	39.0	15.7	0.3	15.2	
154	15.3	39.2	15.8	0.3	15.3	
155	15.4	39.5	15.9	0.3	15.4	
156	15.5	39.8	16.0	0.3	15.5	
157	15.6	40.0	16.1	0.3	15.6	
158	15.7	40.2	16.2	0.3	15.7	
159	15.8	40.5	16.3	0.3	15.8	
160	15.9	40.8	16.4	0.3	15.9	
161	16.0	41.0	16.5	0.3	16.0	
162	16.1	41.2	16.6	0.3	16.1	
163	16.2	41.5	16.7	0.3	16.2	
164	16.3	41.8	16.8	0.3	16.3	
165	16.4	42.0	16.9	0.3	16.4	
166	16.5	42.2	17.0	0.3	16.5	
167	16.6	42.5	17.1	0.3	16.6	
168	16.7	42.8	17.2	0.3	16.7	
169	16.8	43.0	17.3	0.3	16.8	
170	16.9	43.2	17.4	0.3	16.9	
171	17.0	43.5	17.5	0.3	17.0	
172	17.1	43.8	17.6	0.3	17.1	
173	17.2	44.0	17.7	0.3	17.2	
174	17.3	44.2	17.8	0.3	17.3	
175	17.4	44.5	17.9	0.3	17.4	
176	17.5	44.8	18.0	0.3	17.5	
177	17.6	45.0	18.1	0.3	17.6	
178	17.7	45.2	18.2	0.3	17.7	
179	17.8	45.5	18.3	0.3	17.8	
180	17.9	45.8	18.4	0.3	17.9	
181	18.0	46.0	18.5	0.3	18.0	
182	18.1	46.2	18.6	0.3	18.1	
183	18.2	46.5	18.7	0.3	18.2	
184	18.3	46.8	18.8	0.3	18.3	
185	18.4	47.0	18.9	0.3	18.4	
186	18.5	47.2	19.0	0.3	18.5	
187	18.6	47.5	19.1	0.3	18.6	
188	18.7	47.8	19.2	0.3	18.7	
189	18.8	48.0	19.3	0.3	18.8	
190	18.9	48.2	19.4	0.3	18.9	
191	19.0	48.5	19.5	0.3	19.0	
192	19.1	48.8	19.6	0.3	19.1	
193	19.2	49.0	19.7	0.3	19.2	
194	19.3	49.2	19.8	0.3	19.3	
195	19.4	49.5	19.9	0.3	19.4	
196	19.5	49.8	20.0	0.3	19.5	
197	19.6	50.0	20.1	0.3	19.6	
198	19.7	50.2	20.2	0.3	19.7	
199	19.8	50.5	20.3	0.3	19.8	
200	19.9	50.8	20.4	0.3	19.9	



# Historical overview

- Since 1993 station of the newly established German Regional Seismic Network (GRSN)
- Installation of a modern STS-2 broadband seismometer (evaluatable ground displacements down to 1 nm)
- Reintegration into the Institute of Geophysics (TU Bergakademie Freiberg) in 1994
- Since 2001 online provision of waveform data for the automatic localization of earthquakes by other agencies (EMSC, SXNET)

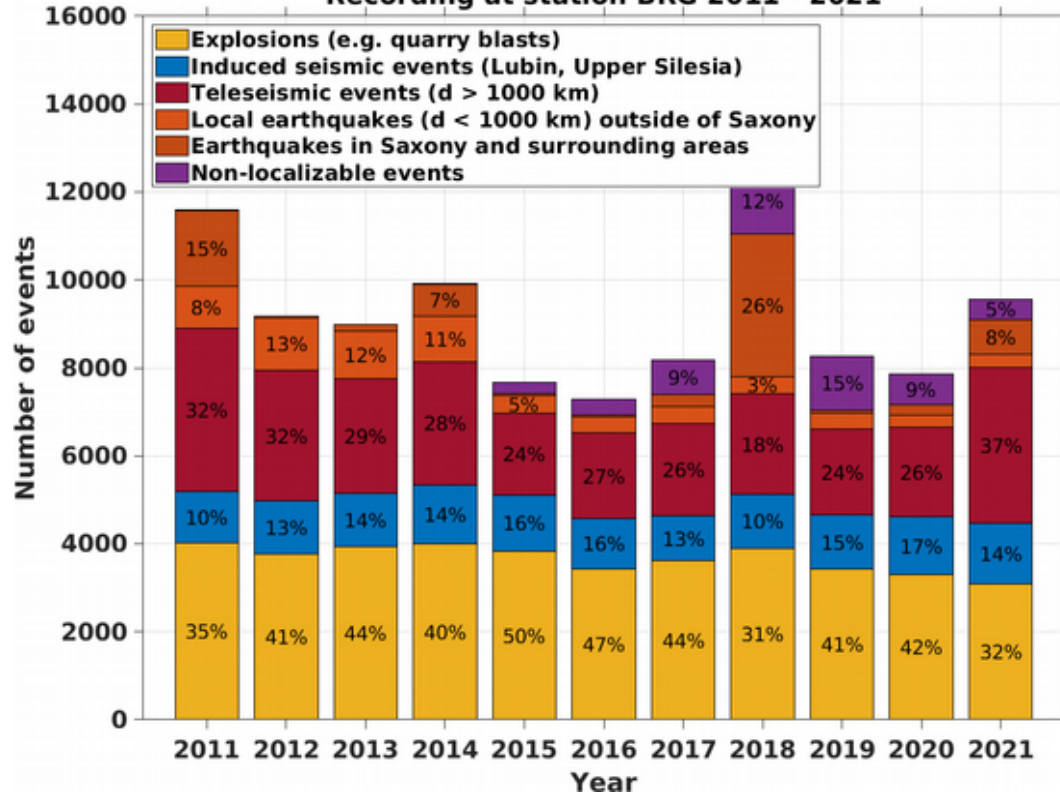


# Overview

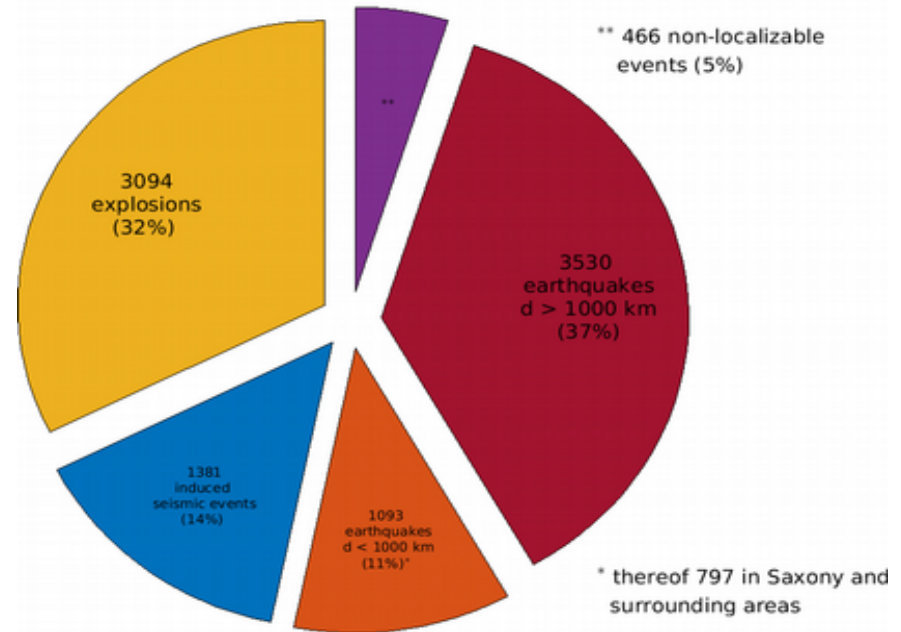
- Seismological observatory and underground lab in Berggießhübel
- Historical overview
- Earthquake monitoring in Berggießhübel
  - Local seismicity
  - Teleseismic events

# Earthquake monitoring in Berggießhübel

Recording at station BRG 2011 - 2021

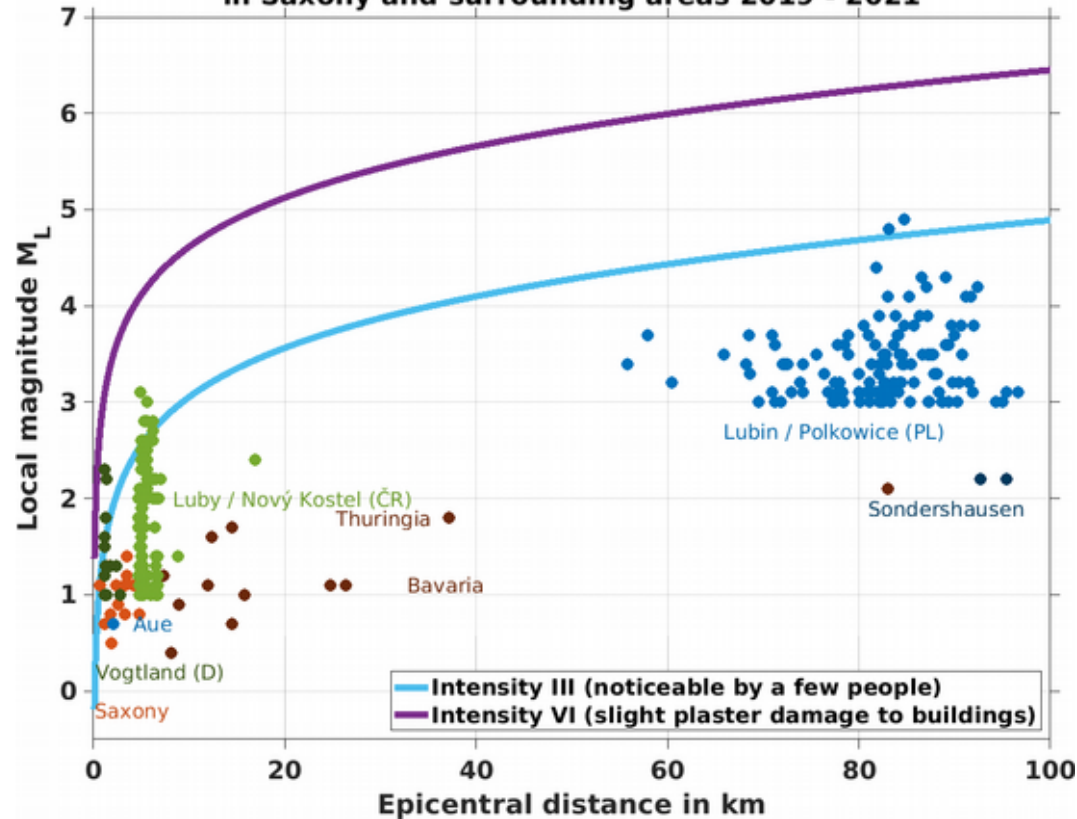


2021: 9564 seismic events  
(Recording at GRNS station BRG)

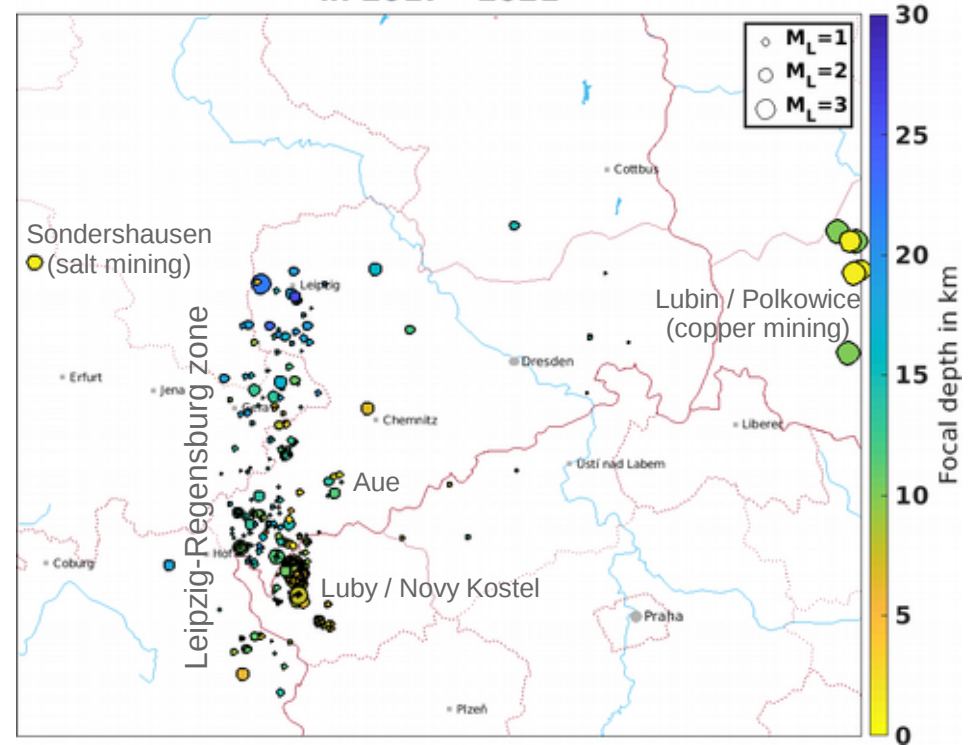


# Local seismicity

Observableness of earthquakes with epicentre in Saxony and surrounding areas 2019 - 2021



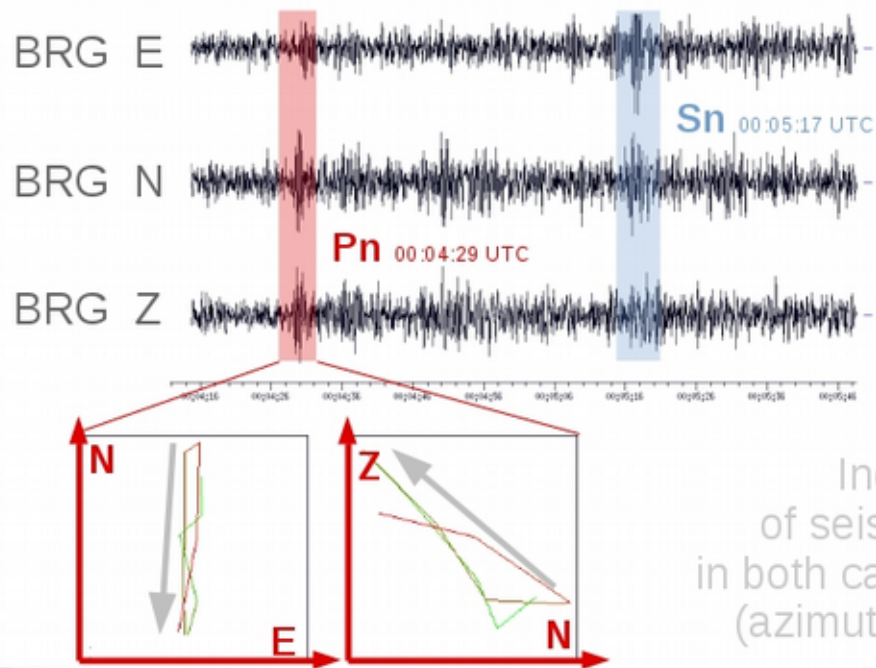
Earthquakes in Saxony and surrounding areas in 2017 - 2021



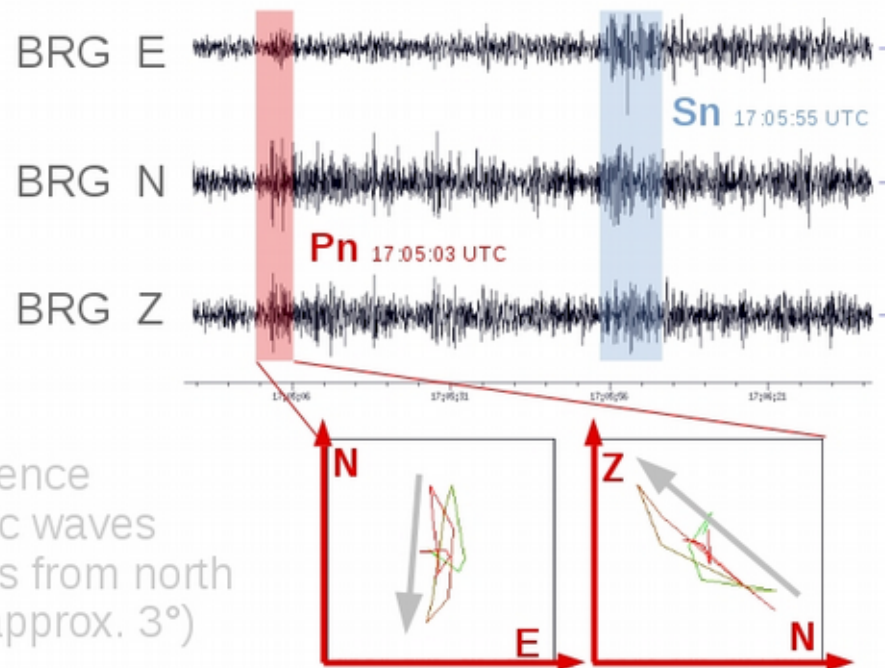


# Explosions on pipelines Nord Stream 1 and 2 on 26<sup>th</sup> Sep. 2022

Focus time approx. 00:03 UTC (02:03 CEST)  
Distance from station BRG approx. 470 km



Focus time approx. 17:04 UTC (19:04 CEST)  
Distance from station BRG approx. 530 km



Incidence  
of seismic waves  
in both cases from north  
(azimuth approx. 3°)

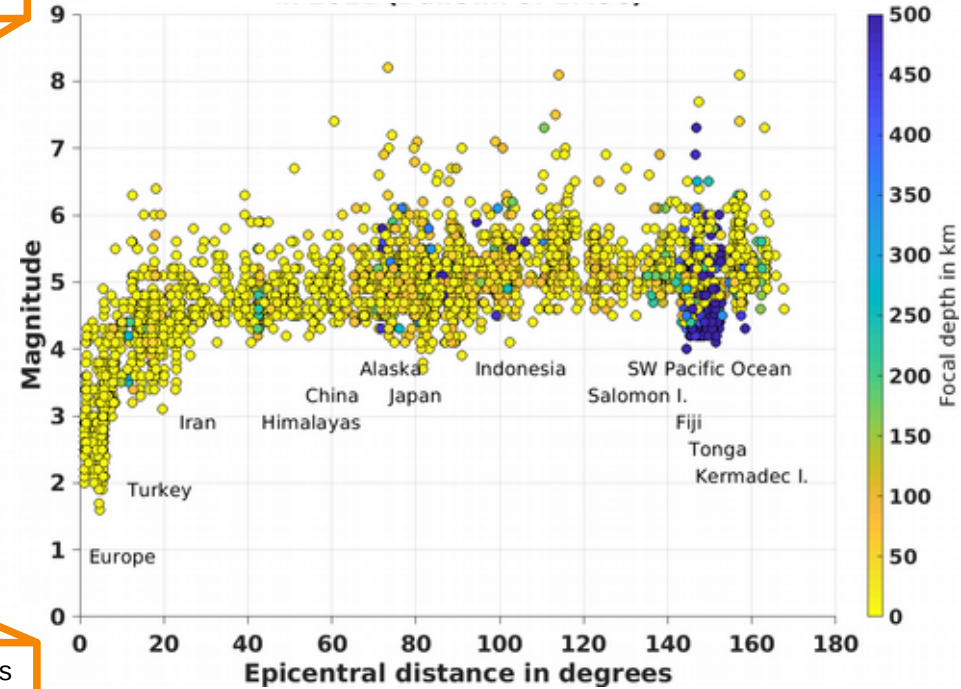
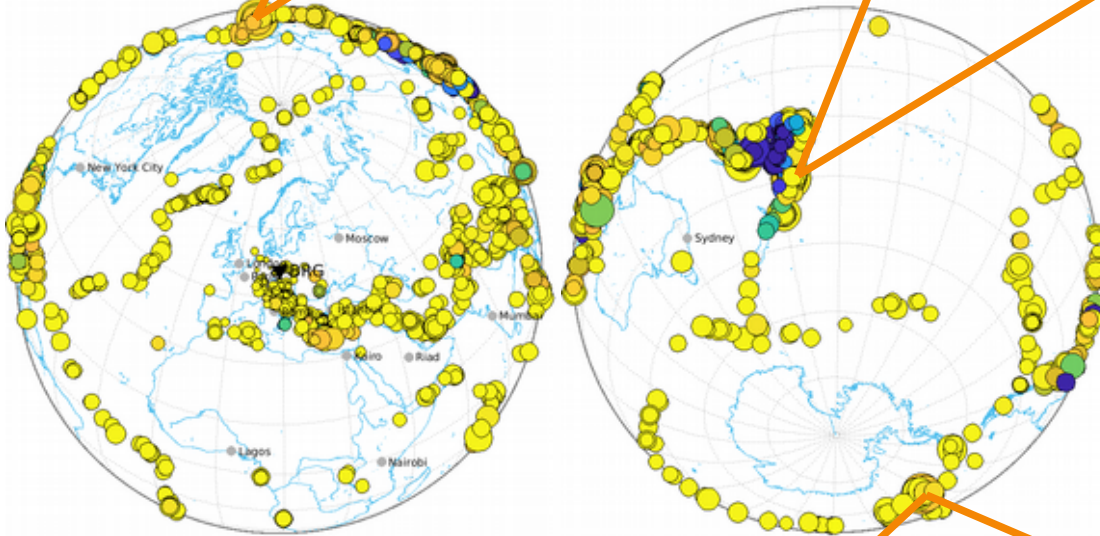
# Teleseismic events

Events recorded at the GRNS station BRG in 2021 (Bulletin of the EMSC)

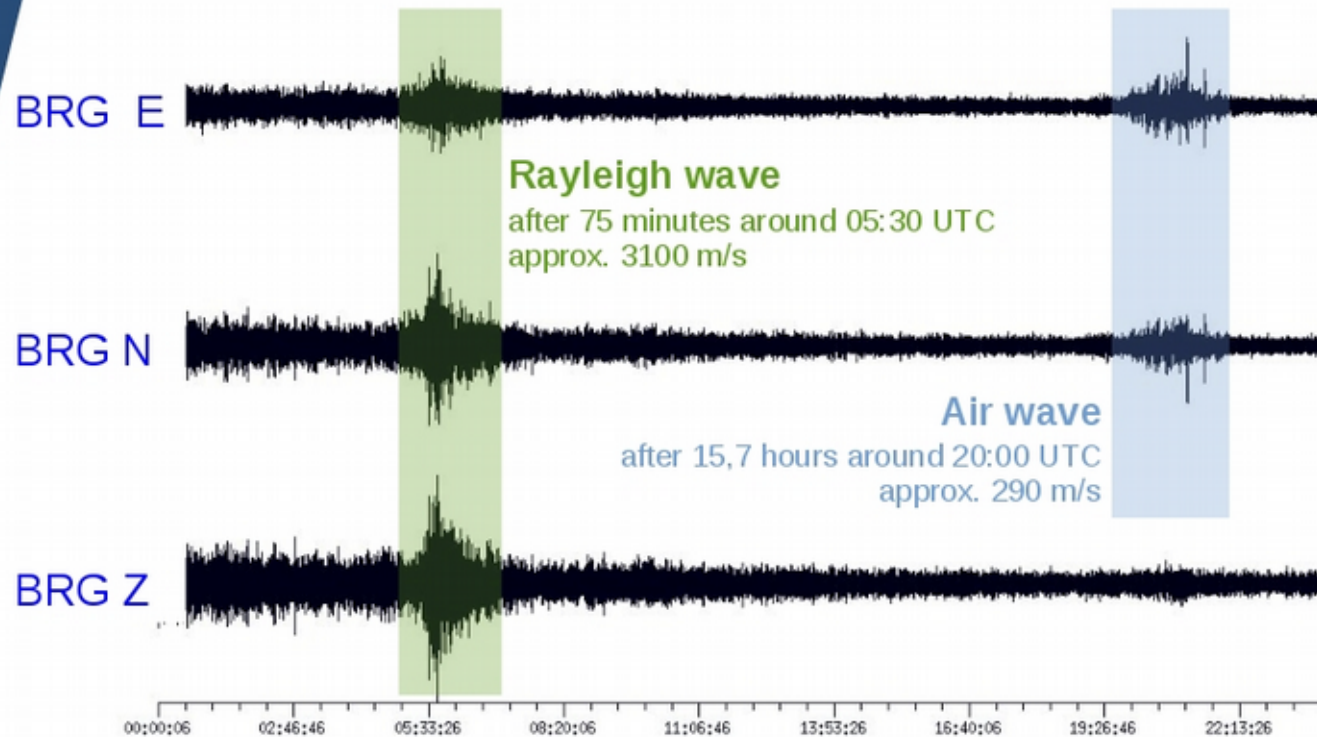
Alaska Peninsula  
29<sup>th</sup> July 2021  
Mw 8.2

Kermadec Islands  
4<sup>th</sup> March 2021  
Mw 8.1

South Sandwich Islands  
12<sup>th</sup> August 2021  
Mw 8.1



# Explosion of Hunga Tonga-Hunga Ha'apai on 15<sup>th</sup> Jan. 2022



Focus 22.6°S / 175.4°W

Focus time 04:14:55 UTC  
(05:14:55 CET)

Magnitude Mw 5.8

Distance from  
station BRG: 148.8°



# Earthquake monitoring in Berggießhübel

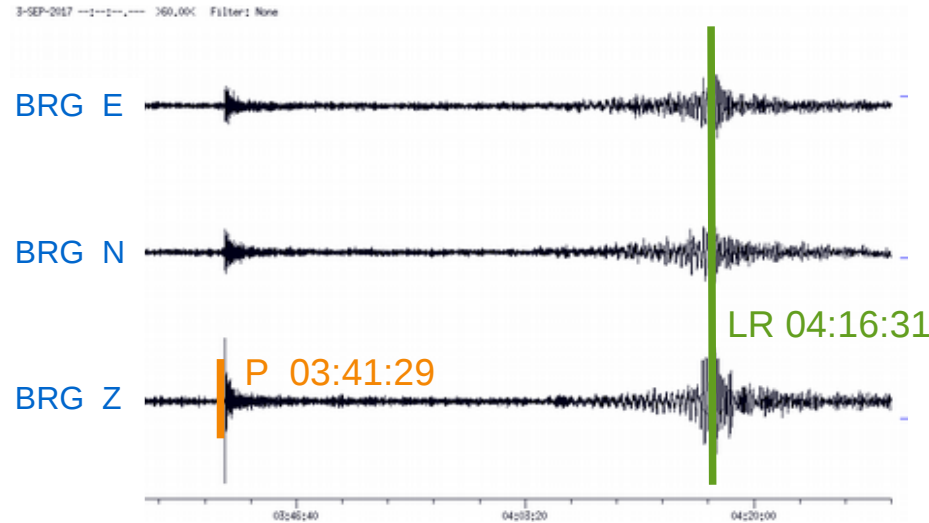
- Differentiation between **artificial sources** and **natural earthquakes**

## Nuclear explosion in North Korea

Focus time 3<sup>rd</sup> Sep. 2017 (03:30:01 UTC)

Magnitude Mw 6.3

Distance from BRG 71.8°



## Earthquake in Japan (Honshu)

Focus time 11<sup>th</sup> Apr. 2019 (08:18:20 UTC)

Magnitude Mw 6.1

Distance from BRG 78.6°

