International Training Course on
Seismology, Seismic Data Analysis,
Hazard Assessment
and Risk Mitigation

September 10 to October 5, 2018
Accra, Ghana

Organised and sponsored by
Helmholtz Centre Potsdam
GFZ German Research Centre for Geosciences

and

Geological Survey of Ghana
Accra, Ghana

cosponsored by

Federal Foreign Office (FFO), Berlin, Germany

List of institutions and lecturers contributing to the International Training Course on “Seismology, Hazard Assessment and Risk Mitigation”, September 10 to October 5, 2018 in Accra, Ghana

GFZ German Research Centre for Geosciences, Germany
Dr. Dino Bindi  dino.bindi@gfz-potsdam.de
Dr. Simone Cesca simone.cesca@gfz-potsdam.de
Prof. Fabrice Cotton  fcotton@gfz-potsdam.de
Prof. Dr. Torsten Dahm torsten.dahm@gfz-potsdam.de
Dr. Sebastian Heimann sebastian.heimann@gfz-potsdam.de
Dr. Claus Milkereit claus.milkereit@gfz-potsdam.de
Dr. Marco Pilz  pilz@gfz-potsdam.de
Dr. Eleonora Rivalta eleonora.rivalta@gfz-potsdam.de
Dr. Angelo Strollo angelo.strollo@gfz-potsdam.de
Dr. Anthony Osei Tutu anthony.osei.tutu@gfz-potsdam.de
Dr. Thomas Walter thomas.walter@gfz-potsdam.de
Dr. Graeme Weatherill graeme.weatherill@gfz-potsdam.de
Mr. Thomas Zieke thomas.zieke@gfz-potsdam.de

Geological Survey of Ghana, Accra
Dr. Daniel Boamah boamahkwaku@yahoo.com
Nicholas Opoku nichopoku@yahoo.com
Ms. Saviour Alomatu alorms21@gmail.com

University of Ghana
Prof. Jacob M. Kutu  jkutu@ug.edu.gh, kutujm@yahoo.com

National Data Center (NDC, CTBTO), Ghana Atomic Energy Commission (GAE)
Nii K. Allotey  niallotey@espco-gh.com
Mrs. Paulina Amponsah  pekua2@yahoo.com
Ms. Alberta Blay alblay@yahoo.com

Ghana Institution of Engineers
Ing. (Mrs.) Carlien D. Bou-Chedid  ghiecentre@yahoo.com

University of Bergen, Norway
Prof. Dr. Lars Ottemoller  Lars.Ottemoller@uib.no
Scientific Programme
International Training Course on
Seismology, Seismic Data Analysis,
Hazard Assessment and Risk Mitigation
Accra, Ghana, 10 September to 5 October, 2018

1. Opening Day

Monday, Sept. 10

Opening of the Training Course 2018

08:30 – 09:00
Representative of the Geological Survey of Ghana (to be confirmed)
Representative of the German Embassy (to be confirmed)

09:00 – 09:30
Prof. Kutu (University of Ghana)
Geology and Seismo-Tectonics of Ghana

09:30 – 10:00
Prof. Dr. Torsten Dahm
Human-induced and triggered seismicity: it’s role in hazard programs

10:00 – 10:30
Dr. Anthony Osei Tutu
Looking at Africa from the Modeling Point of View

10:30 – 11:00
Break for a welcome drink - Group Photo

11:00 – 11:30
Nicholas Opoku (Geological Survey of Ghana)
Monitoring and Assessment of Geohazards in Ghana

11:30 – 12:00
Carlien D. Bou-Chedid (Ghana Institute of Engineers)
Risk Assessment in Ghana

12:00 – 12:30
Dr. Claus Milkereit
The International Training Courses

12:30– 13:30
Lunch Break

13:30 – 15:00
T. DAHM
Aims and fundamentals of seismology

15:30 – 17:00
L. OTTEMØLLER
Introduction to SEISAN

Evening

19:30 – 21:00
Dr. C. Milkereit
Informal get-together of participants and lecturers

2. Fundamentals of Seismology, Instrumentation, Earthquake Source Parameter and computer-assisted Seismogram Analysis

Tuesday, Sept. 11

08:30 – 10:00
T. DAHM
2.1 Seismic sources and source parameters

10:30 – 12:00
T. DAHM
2.2 Event Location and Magnitudes

13:30 – 15:00
L. OTTEMØLLER
2.3 Exercise on phase picking and localization of local events based on network records

15:30 – 17:00
L. OTTEMØLLER
2.4 Exercise on phase picking and localization of teleseismic events based on network records

Wednesday, Sept. 12

08:30 – 10:00
T. DAHM
2.5 Theory of wave propagation: Basics of numerical methods

10:30 – 12:00
T. DAHM
2.6 Seismic waves in the real Earth, required seismic records and derived Earth models

13:30 – 15:00
L. OTTEMØLLER
2.7 Exercise on amplitude picking and magnitude determination

15:30 – 17:00
L. OTTEMØLLER
2.8 Exercise on spectral source parameter determination

Thursday, Sept. 13

08:30 – 10:00
C. MILKEREIT
2.9 Seismic Sensors, their calibration and installation

10:30 – 12:00
C. MILKEREIT
2.10 Demonstration, Exercise on Instrumentation

13:30 – 15:00
L. OTTEMØLLER
2.11 Exercise on Response File

15:30 – 17:00
L. OTTEMØLLER
2.12 Exercise on Magnitudes
Friday, Sept. 14

08:30 – 10:00  C. MILKEREIT
               2.13 Fault Plane Solution

10:30 – 12:00  C. MILKEREIT
               2.14 Manual exercise on fault-plane solution

13:30 – 15:00  L. OTTEMØLLER
               Exercise on determination of fault-plane solutions

15:30 – 17:00  Scientific presentations of the participants
               (1-6)

Evening
19:30 – 21:00  Cultural presentations (1-6)

Saturday, Sept. 15  Excursion I

Sunday, Sept. 16  Excursion II

Monday, Sept. 17

08:30 – 10:00  S. CESCA
               2.16 Moment Tensor Inversion Theory

10:30 – 12:00  S. HEIMANN
               2.17 Earthquake Data Agencies and Formats

13:30 – 15:00  S. HEIMANN, S. CESCA
               2.18 Green’s Functions

15:30 – 17:00  S. HEIMANN, S. CESCA
               2.19 Synthetic Seismograms

Tuesday, Sept. 18

08:30 – 10:00  S. CESCA, S. HEIMANN
               Exercise on Moment Tensor Inversion: Case Study
               Strike Slip Earthquake

10:30 – 12:00  S. CESCA, S. HEIMANN
               Exercise on Moment Tensor Inversion: Case Study
               Subduction Earthquake

13:30 – 15:00  S. CESCA, S. HEIMANN
               Exercise on Moment Tensor Inversion

15:30 – 17:00  S. CESCA, S. HEIMANN
               Moment Tensor Inversion with RAPIDINV

3. Engineering Seismology

Wednesday, Sept. 19

08:30 – 10:00  M. PILZ
               3.1 Ground shaking and site effects
               Effects of soft surface layers and surface topography

10:30 – 12:00  M. PILZ
               3.2 Instrumental Microzonation I: Earthquake-based
               methods

13:30 – 15:00  D. BINDI
               3.3 Numerical methods and inversion techniques I

15:30 – 17:00  D. BINDI
               3.4 Numerical methods and inversion techniques II

Evening
19:30 – 21:00  D. BINDI
               3.5 Strong Motion

Thursday, Sept. 20

08:30 – 10:00  M. PILZ
               3.6 Instrumental Microzonation II: Surface waves based
               methods I

10:30 – 12:00  M. PILZ
               3.7 Instrumental Microzonation III: Surface waves based
               methods II

13:30 – 15:00  M. PILZ, D. BINDI
               3.8 Surface wave data acquisition and analysis I

15:30 – 17:00  M. PILZ, D. BINDI
               3.9 Surface wave data acquisition and analysis II

Evening
19:30 – 21:00  Cultural presentations (7-12)

Friday, Sept. 21

08:30 – 10:00  D. BINDI, M. PILZ
               3.10 Data acquisition and analysis, urban seismology I

10:30 – 12:00  M. PILZ, D. BINDI
               3.11 Data acquisition and analysis, urban seismology II

13:30 – 15:00  Scientific presentations of the participants
               (7-12)

15:30
               Excursion III
4. Strong Ground Motion and Hazard Assessment

Monday, Sept. 24
08:30 – 10:00  F. COTTON  Introduction into Seismic Hazard Assessment
10:30 – 12:00  F. COTTON  The basic principles of probabilistic seismic hazard analysis (PSHA): probability distributions
13:30 – 15:00  G. WEATHERILL  Earthquakes catalogues
15:30 – 17:00  G. WEATHERILL  Earthquakes catalogue analysis

Tuesday, Sept. 25
08:30 – 10:00  G. WEATHERILL  Seismicity models for probabilistic seismic hazard analysis
10:30 – 12:00  F. COTTON  The basic principles of probabilistic seismic hazard analysis (PSHA): hazard curves and PSHA maps
13:30 – 15:00  G. WEATHERILL  Introduction to Openquake
15:30 – 17:00  F. COTTON  Capturing epistemic uncertainties: introduction to logic trees (exercise)

Wednesday, Sept. 26
08:30 – 10:00  F. COTTON, G. WEATHERILL  Ground-Motion data
10:30 – 12:00  F. COTTON, G. WEATHERILL  Ground-Motion models
13:30 – 15:00  F. COTTON, G. G. WEATHERILL  Ground-motion model (exercise)
15:30 – 17:15  Scientific presentations of the participants (13-19)

Thursday, Sept. 27
‘Site Specific Hazard Assessment of Critical Infrastructure’
08:30 – 09:30  F. COTTON  Site specific hazard studies. Expert guidance and uncertainty analysis according to SSHAC level 3 and 4
09:30 – 10:30  F. COTTON  Site specific ground shaking prediction. Methods and lessons learned from SSHAC level 3 and 4
11:00 – 12:00  F. COTTON, D. BINDI  Challenges of PSHA (case studies, discussion)
13:30 – 14:15  N. K. ALLOTEY  International safety requirements for an atomic critical infrastructure
14:15 – 15:00  A. BLAY  Site Investigations for a critical infrastructure
16:15 – 17:00  F. COTTON  Seismic Monitoring of Critical Infrastructure – Seismic Early Warning

5. Geodynamic Modelling

Friday, Sept. 28
08:30 – 10:00  E. RIVALTA  Introduction to Geodynamic Modeling I
10:30 – 12:00  E. RIVALTA  Introduction to Geodynamic Modeling II
13:30 – 15:00  E. RIVALTA  Geodynamic Modeling III
15:30 – 17:00  E. RIVALTA  Geodynamic Modeling IV

Evening
19:30 – 21:00  Cultural presentations (13-19)
<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Session</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saturday, Sept. 29</td>
<td>Leisure Time</td>
<td></td>
</tr>
<tr>
<td>Sunday, Sept. 30</td>
<td>Leisure Time</td>
<td></td>
</tr>
<tr>
<td><strong>6. InSAR and Remote Sensing in Monitoring Geological Changes</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monday, Oct. 1</td>
<td>08:30 – 10:00</td>
<td>6.1 T. WALTER Examples of Remote sensing of Volcano- and seismo-tectonic processes</td>
</tr>
<tr>
<td></td>
<td>10:30 – 12:00</td>
<td>6.2 T. WALTER Examples of Remote sensing of Volcano- and seismo-tectonic processes</td>
</tr>
<tr>
<td></td>
<td>13:30 – 15:00</td>
<td>6.3 T. WALTER Examples of Remote sensing of Volcano- and seismo-tectonic processes</td>
</tr>
<tr>
<td></td>
<td>15:30 – 17:00</td>
<td>6.4 T. WALTER Examples of Remote sensing of Volcano- and seismo-tectonic processes</td>
</tr>
<tr>
<td>Tuesday, Oct. 2</td>
<td>08:30 – 10:00</td>
<td>6.5 T. WALTER Examples of Remote sensing of Volcano- and seismo-tectonic processes</td>
</tr>
<tr>
<td></td>
<td>10:30 – 12:00</td>
<td>6.6 T. WALTER Examples of Remote sensing of Volcano- and seismo-tectonic processes</td>
</tr>
<tr>
<td></td>
<td>13:30 – 15:00</td>
<td>6.7 T. WALTER <strong>Exercises</strong> on InSAR data analysis</td>
</tr>
<tr>
<td></td>
<td>15:30 – 17:00</td>
<td>6.8 T. WALTER <strong>Exercises</strong> on InSAR data analysis</td>
</tr>
<tr>
<td><strong>Evening</strong></td>
<td>19:30 – 21:00</td>
<td><em>Cultural presentations (20-26)</em></td>
</tr>
<tr>
<td>Thursday, Oct. 4</td>
<td>08:30 – 10:00</td>
<td>7.1 A. STROLLO, T. ZIEKE Waveform analysis with SeisComp3</td>
</tr>
<tr>
<td></td>
<td>10:30 – 12:00</td>
<td>7.2 A. STROLLO, T. ZIEKE Waveform analysis with SeisComp3</td>
</tr>
<tr>
<td></td>
<td>13:30 – 15:00</td>
<td>7.3 A. STROLLO, T. ZIEKE Seismic station integration into SeisComp3</td>
</tr>
<tr>
<td></td>
<td>15:30 – 17:15</td>
<td>7.4 A. STROLLO, T. ZIEKE Seismic station integration into SeisComp3</td>
</tr>
<tr>
<td><strong>Evening</strong></td>
<td>19:30 – 21:00</td>
<td><em>Closing of the Training Course 2018</em></td>
</tr>
<tr>
<td>Friday, Oct. 5</td>
<td>08:30 – 10:00</td>
<td>7.5 A. STROLLO, T. ZIEKE Waveform analysis with SeisComp3</td>
</tr>
<tr>
<td></td>
<td>10:30 – 12:00</td>
<td>7.6 A. STROLLO, T. ZIEKE Waveform analysis with SeisComp3</td>
</tr>
<tr>
<td></td>
<td>13:30 – 15:00</td>
<td>7.7 A. STROLLO, T. ZIEKE Waveform analysis with SeisComp3</td>
</tr>
<tr>
<td></td>
<td>15:30 – 16:00</td>
<td>7.8 A. STROLLO, T. ZIEKE Waveform analysis with SeisComp3</td>
</tr>
<tr>
<td></td>
<td>19:30 – 21:00</td>
<td>7.9 A. STROLLO, T. ZIEKE Waveform analysis with SeisComp3</td>
</tr>
<tr>
<td><strong>Final Discussion</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Saturday, Oct. 6</strong></td>
<td></td>
<td><em>Departure of Participants</em></td>
</tr>
<tr>
<td><strong>7. Waveform Analysis with SeisComp3</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wednesday, Oct. 3</td>
<td>08:30 – 10:00</td>
<td>7.1 A. STROLLO The GEOFON Project and SeisComp3</td>
</tr>
<tr>
<td></td>
<td>10:30 – 12:00</td>
<td>7.2 A. STROLLO, T. ZIEKE Seismic station integration into SeisComp3</td>
</tr>
</tbody>
</table>