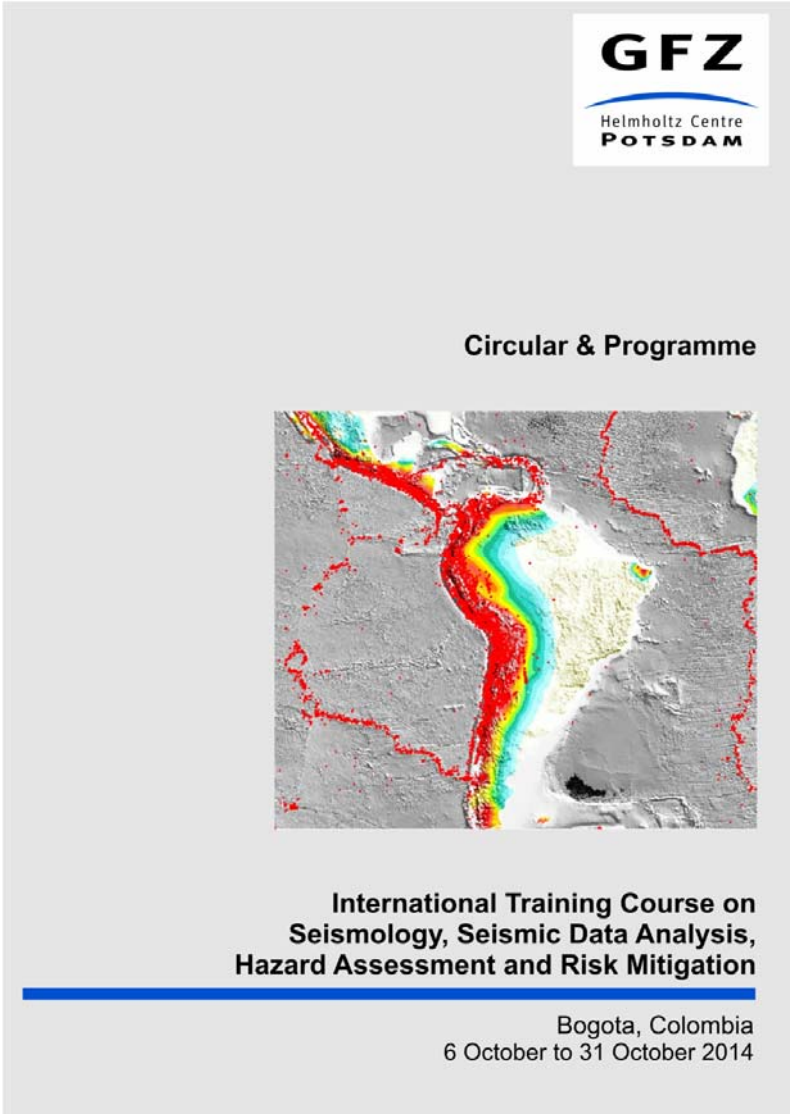
# Scientific Programme

**International Training Course on**

## Seismology, Seismic Data Analysis, Hazard Assessment and Risk Mitigation

Bogota/Colombia, 6 October to 31 October, 2014




## 1. Opening Day

| **Monday, Oct. 6** | **Opening of the Training Course 2014** |
|---|---|
| 08:30 – 9:00 | *Representative of the Universidad Nacional, Bogota (to be confirmed)* |
| | *Representative of the German Embassy (to be confirmed)* |
| | *Representative of the Geological Survey (to be confirmed)* |
| 09:00 – 09:30 | *Prof. Dr. Carlos A. Vargas*<br>Geology and Seismo-Tectonics in South America and the Caribbean |
| 09:30 – 10:00 | *Dr. Marta Calvache*<br>Disaster Risk Management: monitoring and assessment of geohazards |
| 10:00 – 10:30 | *Break for a welcome drink - Group Photo* |
| 10:30 – 11:00 | *Dr. Claus Milkereit*<br>The International Training Courses |
| 11:00 – 11:30 | *Prof. Dr. Torsten Dahm*<br>Human-induced and triggered seismicity: it's role in hazard programs |
| 11:30 – 12:00 | *Dr. Jaime Eraso*<br>Seismic Hazard Program in Colombia |
| 12:00- 13:30 | *Lunch Break* |
| 13:30 – 15:00 | T. DAHM<br>Aims and fundamentals of seismology |
| 15:30 – 16:00 | J. HAVSKOV<br>Introduction to SEISAN |
| 16:00 – 17:00 | J. HAVSKOV<br>Installation of SEISAN |
| **Evening**<br>19:30 – 21:00 | *Dr. C. Milkereit*<br>Informal get-together of participants and lecturers |

## 2. Fundamentals of Seismology, Instrumentation, Seismogram Analysis, Earthquake Source Parameter

**Tuesday, Oct. 7**

| | | |
|---|---|---|
| 08:30 – 10:00 | | T. DAHM |
| | 2.1 | Seismic sources and source parameters |
| 10:30 – 12:00 | | T. DAHM |
| | 2.2 | Theory of wave propagation: Basics of numerical methods |
| 13:30 – 15:00 | | J. HAVSKOV |
| | 2.3 | **Exercise** on phase picking and localization of teleseismic events based on network records |
| 15:30 – 17:00 | | J. HAVSKOV |
| | 2.4 | **Exercise** on phase picking and localization of teleseismic events based on network records |

**Wednesday, Oct. 8**

| | | |
|---|---|---|
| 08:30 – 10:00 | | C. MILKEREIT |
| | 2.5 | Seismic Sensors and Their Calibration |
| 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 | | J. HAVSKOV |
| | 2.7 | **Exercise** on amplitude picking and magnitude determination |
| 15:30 – 17:00 | | J. HAVSKOV |
| | 2.8 | **Exercise** on spectral source parameter determination |

**Thursday, Oct. 9**

| | | |
|---|---|---|
| 08:30 – 10:00 | | C. MILKEREIT |
| | 2.9 | Demonstration of fault plane solution |
| 10:30 – 12:00 | | S. HEIMANN, S. CESCA |
| | 2.10 | Moment Tensor Inversion |
| 13:30 – 15:00 | | J. HAVSKOV |
| | 2.11 | **Exercise** on determination of fault-plane solutions |
| 15:30 – 17:00 | | J. HAVSKOV |
| | 2.12 | **Exercise** on amplitude spectra calculation and moment magnitude determination |

**Friday, Oct. 10**

| | | |
|---|---|---|
| 08:30 – 10:00 | | S. HEIMANN, S. CESCA |
| | 2.13 | Earthquake Data Agencies and Data Access |
| 10:30 – 12:00 | | S. HEIMANN, S. CESCA |
| | 2.14 | Waveform Data for Earthquake Analysis |
| 13:30 – 15:00 | | J. HAVSKOV |
| | 2.15 | **Exercises** on seismogram analysis based on digital data |
| 15:30 – 17:00 | | J. HAVSKOV |
| | 2.16 | **Exercises** on seismogram analysis based on digital data |

**Evening**

19:30 – 21:00 *Cultural presentations*

**Saturday, Oct. 11** *Visit of the Universidad Nacional, Geological Survey and National Museum*

**Sunday, Oct. 12** *Visit Bogota*

## 3. Computer-assisted seismogram analysis and source parameter determination

**Monday, Oct. 13**

| | | |
|---|---|---|
| 08:30 – 10:00 | | S. CESCA |
| | 3.1 | Moment Tensor Analysis |
| 10:30 – 12:00 | | S. CESCA, S. HEIMANN |
| | 3.2 | Data Visualization and Preparation |
| 13:30 – 15:00 | | S. CESCA, S. HEIMANN |
| | 3.3 | Data Visualization and Preparation |
| 15:30 – 17:00 | | S. CESCA, S. HEIMANN |
| | 3.4 | Data Visualization and Preparation |

**Tuesday, Oct. 14**

| | | |
|---|---|---|
| 08:30 – 10:00 | | S. CESCA, S. HEIMANN |
| | 3.5 | **Exercise** on Moment Tensor Inversion I |
| 10:30 – 12:00 | | S. CESCA, S. HEIMANN |
| | 3.6 | **Exercise** on Moment Tensor Inversion II |
| 13:30 – 15:00 | | A. ZANG |
| | 3.7 | Stress field if the Earth Crust |
| 15:30 – 17:00 | | A. ZANG |
| | 3.8 | Rock Fracture Criteria |

## 4. Direct and induced effects of strong earthquake ground motion

**Wednesday, Oct. 15**

| | | |
|---|---|---|
| 08:30 – 10:00 | | S. PAROLAI |
| | 4.1 | Ground shaking site effects.<br>Introduction: Effects of surface topography |
| 10:30 – 12:00 | | S. PAROLAI |
| | 4.2 | Effects of soft surface layers |
| 13:30 – 15:00 | | S. PAROLAI, M. PILZ |
| | 4.3 | Instrumental Microzonation: Surface waves based methods I |
| 15:30 – 17:00 | | S. PAROLAI, M. PILZ |
| | 4.4 | Instrumental Microzonation: Surface waves based methods II |

**Thursday, Oct. 16**

| | | |
|---|---|---|
| 08:30 – 10:00 | | S. PAROLAI |
| | 4.5 | Estimation of site effects: Instrumental, numerical, empirical |
| 10:30 – 12:00 | | S. PAROLAI |
| | 4.6 | Use of microtremor recordings for estimating site effects |
| 13:30 – 15:00 | | S. PAROLAI, M. PILZ |
| | 4.7 | Surface wave data acquisition III |
| 15:30 – 17:00 | | S. PAROLAI, M. PILZ |
| | 4.8 | Surface wave data acquisition IV |

**Evening**

19:30 – 21:00 *Cultural presentations*

**Friday, Oct. 17**

| | | |
|---|---|---|
| 08:30 – 10:00 | | S. PAROLAI, M. PILZ |
| | 4.9 | Array Techniques |
| 10:30 – 12:00 | | S. PAROLAI, M. PILZ |
| | 4.10 | Array Techniques |

13:30 Excursion - Travel to Manizales by bus

**Saturday, Oct. 18** Excursion

**Sunday, Oct. 19** Excursion

## 5. Strong Motion Data Analysis

**Monday, Oct. 20**

| | | |
|---|---|---|
| 08:30 – 10:00 | | D. BINDI |
| | 5.1 | Introduction to Strong Motion Seismology |
| 10:30 – 12:00 | | D. BINDI |
| | 5.2 | Strong Motion data processing |
| 13:30 – 15:00 | | D. BINDI, M. PILZ |
| | 5.3 | **Exercise** on Strong Motion data processing |
| 15:30 – 17:00 | | D. BINDI, M. PILZ |
| | 5.4 | **Exercise** on Strong Motion data processing |

**Tuesday, Oct. 21**

| | | |
|---|---|---|
| 08:30 – 10:00 | | D. BINDI |
| | 5.5 | Introduction to Ground Motion Prediction Equation (GMPE) |
| 10:30 – 12:00 | | D. BINDI |
| | 5.6 | Ground Motion Prediction Equation |
| 13:30 – 15:00 | | D. BINDI |
| | 5.7 | **Exercise** on Ground Motion Prediction Equation |
| 15:30 – 17:00 | | D. BINDI |
| | 5.8 | **Exercise** on Ground Motion Prediction Equation |

## 6. Seismic Hazard Assessment

**Wednesday, Oct. 22**

| | | |
|---|---|---|
| 08:30 – 10:00 | | F. COTTON |
| | 6.1 | Introduction to probability theory, **Exercises** |
| 10:30 – 12:00 | | F. COTTON |
| | 6.2 | The basic principles of probabilistic seismic hazard analysis (PSHA) |
| 13:30 – 15:00 | | F. COTTON |
| | 6.3 | **Exercises:** Building hazard curves |
| 15:30 – 17:00 | | F. COTTON |
| | 6.4 | Opensource tools and the Global Earthquake Model initiative |

**Thursday, Oct. 23**

| | | |
|---|---|---|
| 08:30 – 10:00 | | F. COTTON |
| | 6.5 | Seismicity models for PSHA |
| 10:30 – 12:00 | | F. COTTON |
| | 6.6 | The Gutenberg-Richter relationship and catalogue completeness, **Exercises** |
| 13:30 – 15:00 | | F. COTTON |
| | 6.7 | Ground-motions models for PSHA, **Exercises** |
| 15:30 – 17:00 | | F. COTTON |
| | 6.8 | Discussion: How do we take into account uncertainties? |

**Friday, Oct. 24**

| | | |
|---|---|---|
| 08:30 – 10:00 | | F. COTTON |
| | 6.9 | Hazard curves, uniform hazard spectrum and disaggregation |
| 10:30 – 12:00 | | F. COTTON |
| | 6.10 | Case studies<br>a. Example of a regional seismic hazard map<br>b. Example of a site specific (critical facility) PSHA |
| 13:30 – 15:00 | | F. COTTON |
| | 6.11 | Discussion: Strengths and weaknesses of PSHA |
| 15:30 – 17:00 | | Scientific presentations of the participants (1-6) |

**Evening**

19:30 – 21:00 *Cultural presentations*

**Saturday, Oct. 25** Leisure Time

**Sunday, Oct. 26** Leisure Time

## 7. Seismic Risk Estimation

**Monday, Oct. 27**

| | | |
|---|---|---|
| 08:30 – 10:00 | | M. PITTORE |
| | 7.1 | Introduction to Risk Assessment |
| 10:30 – 12:00 | | M. PITTORE, M. WIELAND |
| | 7.2 | Risk: Exposure Modeling |
| 13:30 – 15:00 | | M. PITTORE, M. WIELAND |
| | 7.3 | Risk: Exposure Modeling |
| 15:30 – 17:00 | | Scientific presentations of the participants (7-12) |

**Tuesday, Oct. 28**

| | | |
|---|---|---|
| 08:30 – 10:00 | | M. PITTORE, M. WIELAND |
| | 7.4 | Estimating Exposure |
| 10:30 – 12:00 | | M. PITTORE, M. WIELAND |
| | 7.5 | Estimating Vulnerability |
| 13:30 – 15:00 | | M. PITTORE, M. WIELAND |
| | 7.6 | Estimating Risk |
| 15:30 – 17:00 | | M. PITTORE, M. WIELAND |
| | 7.7 | Managing Risk: Open Challenges |

## 8. InSAR Methods

**Wednesday, Oct. 29**

| | | |
|---|---|---|
| 08:30 – 10:00 | | T. WALTER |
| | 8.1 | InSAR Principles and Theory of Radar Interferometry |
| 10:30 – 12:00 | | T. WALTER |
| | 8.2 | InSAR Practical Considerations |
| 13:30 – 15:00 | | T. WALTER |
| | 8.3 | Pixel Tracking |
| 15:30 – 17:00 | | T. WALTER |
| | 8.4 | Installation and Example Processing |

**Evening**

19:30 – 21:00 *Cultural presentations*

**Thursday, Oct. 30**

| | | |
|---|---|---|
| 08:30 – 10:00 | | T. WALTER |
| | 8.5 | **Exercise** on InSAR Data processing |
| 10:30 – 12:00 | | T. WALTER |
| | 8.6 | **Exercise** on InSAR Data processing |
| 13:30 – 15:00 | | Scientific presentations of the participants (13-18) |
| 15:30 – 17:00 | | Scientific presentations of the participants (19-24) |

**Friday, Oct. 31**

| | | |
|---|---|---|
| 08:30 – 10:00 | | T. WALTER, M. CALVACHE |
| | 8.7 | Volcano Monitoring |
| 10:30 – 12:00 | | T. WALTER, M. CALVACHE |
| | 8.8 | Volcano Monitoring |
| 13:30 – 15:00 | | Scientific presentations of the participants (25-28) |
| 15:30 – 16:00 | | Final Discussion |
| **Evening** | | **Closing of the Training Course 2014** |
| 19:30 - | | Handing out of the course certificates |

**Saturday, Nov. 1** Departure of Participants

**Sunday, Nov. 2** Departure of Participants