ICTP DIPLOMA PROGRAMME IN EARTH SYSTEM PHYSICS 2013-14

SYLLABUS

SPACE GEODESY AND OBSERVATIONAL SEISMOLOGY

{12 Lectures = 18 hours} - M. Guidarelli, A. Borghi

Part I Observational Seismology

1. Fundamentals of Seismology

What is seismology? Branches of seismology. Spectrum of seismic waves. Historical development of seismology. Elastic moduli and body waves. P-waves, S-waves and their velocity. Surface waves.Surface wave dispersion.

2. Seismogram interpretation

Origin time, arrival time and travel time. Hypocentre and epicenter. Local, regional and teleseismic earthquakes. Refraction, reflection and conversion of waves at boundaries.

Seismic phases at different distance ranges. Seismogram analysis and travel time curves.

Phase picking and first arrival polarities.

3. Earthquake location

Manual location. Single station location. Multiple station location. Wadati diagram. Earthquake location:general problem and generalize inverse. Relative location methods.

4. Intensity and magnitude measurements

Parameters which characterize size and strength of seismic sources: intensity, magnitude seismic moment. Magnitude determination: local magnitude, body-wave magnitude, surface-wave magnitude.

5. Earthquakes and seismometry

Elastic rebound theory. Fault geometry and basic types of faulting. First motions and body wave radiation patterns. Focal mechanism determination. Focal mechanisms from first motions. Inversion of amplitudes and first arrival polarities. Moment tensor inversion.

6. Earth structure

Inversion of seismic data for determination of Earth structure. Refraction seismology. Reflection seismology. Body waves travel time studies. Surface wave dispersion measurement. Inversion of surface wave dispersion. Seismic tomography. Ambient noise tomography. Other methodologies for the study of Earth structure.

Part II Space Geodesy

1. Fundamentals of Geodesy

Definition of the Earth gravity field. Reference surfaces: geoid and ellipsoid.

2. Fundamentals of Spatial Geodesy

Definitions of Spacial Geodesy. International Terrestrial Reference System and Frame. Satellite techniques: GPS, satellite altimetry, SAR, satellite gravity missions.

3. Global Positioning System (GPS)
Definition of the GPS technique: observables and errors.

4. GPS time-series
Deterministic and stochastic models in GPS time-series analysis.

5. InSAR
Definition of SAR (Synthetic Aperture RADAR). Definition of InSAR. Applications.

6. Satellite Gravity Missions
The anomalous potential and its representation in terms of spherical harmonic. The satellite gravity missions: CHAMP, GRACE and GOCE.