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Dottorato di Ricerca “ Matematica, Fisica e Applicazioni”
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Curriculum Sistemi complessi

Sintesi della Tesi di dottorato

Seismic Tomography of Italy (with special regard to Southern Tyrrhenian) by means of teleseismic data

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The topic of my PhD thesis is a seismic tomography which has as object of investigation Italy, particularly Southern Italy and Southern Tyrrhenian. This tomography has been obtained by means of inversion of teleseismic data. Seismic tomography is a method of investigation which is considerably stabilized in the field of Geophysics. Its goal is the achievement of a tridimensional velocity model of a subsoil of a determined area. For reaching this aim, it is necessary to gather arrival times of seismic events registered by seismic stations that are distributed in an opportune way on the area subject to process of investigation and an one-dimensional velocity model (that is, velocity only in function of depth). Through this last one, there is the computation of theoretical travel times for each pair seismic event – seismic station. This particular phase of method is called ***forward problem***. Then, there is the computation of the difference between observed travel times and these theoretical travel times, a difference named ***residual***. This is the description of so-called ***inverse problem***. The computation happens in an iterative way and it stops when the residual is minimum. Obtained tridimensional velocity model corresponds with the model where residual is minimum. The entire process of operation of a seismic tomography is completely described in first chapter of this thesis. The second chapter describes the phenomen of subduction, that is of a particular process which happens, under determined conditions, at convergent boundaries of plates. I have dedicated a chapter to this phenomen because the area subject to this research, the basin of Southern Tyrrhenian, is a result of a roll-back subducting Ionian slab. After a paragraph dedicated to a general description of tectonic plates theory, other paragraphs describe the kinematics and the dynamics of subduction processes. This seismic tomography has been obtained by inversion of teleseismic travel times. This particular kind of choice has been made because teleseismic ray travel in upper mantle at high depths, so

their inversion could supply us a good resolution of an area that we want to investigate until depth of 500-600 km. The third chapter of my PhD thesis is dedicated to teleseisms. In particular, there is a description of classification of seismic events according to their epicentral distance and how we can interpretate various seismic phases on a teleseismic seismogram. A paragraph is about the nomenclature of same seismic phases deriving from the reflection and the refraction of the waves on the discontinuity surfaces present in Earth's inner. The fourth and last chapter of my PhD thesis contains the results of research and their interpretation. First paragraph is dedicated to a brief summary of geological history of Southern Tyrrhenian. Second paragraph is dedicated to a description of software used for the research, that is **FMTT** (***Fast Marching Teleseismic Transform***), created by Nick Rawlinson in 2008. Third paragraph is dedicated to description of my data. I have utilised 1929 teleseisms (only P phases) recorded in period 1990-2012 by 122 southern Italian seismic station directly connected to ***ISC*** (***International Seismological Centre***). I have obtained several sections at various level of depth, from 25 km to 500 km and I have obtained several profiles NS and EW at fixed values of longitude from 14° to 16° and latitude, from 37° to 40° respectively. Results, compared with previous works in that area, confirm the presence of a subducting slab in Southern Tyrrhenian. Finally, my PhD thesis is enriched by various appendixes, which describe in a particular way mathematical techniques and geophysical definitions which I have used.