European Seismological Commission
36th General Assembly
2-7 September 2018
Valletta - Malta
ESC2018-S8 - 392

ON THE CORRELATION BETWEEN THE CRUSTAL DEFORMATION AND THE UPPER MANTLE STRUCTURE OF THE HELLENIC LITHOSPHERIC PLATE DEDUCED FROM SEISMOLOGICAL AND GPS OBSERVATIONS. PRELIMINARY RESULTS.

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The tectonic regime in the broader area of Greece is complex, involving the subduction along the Hellenic Arc, the collision between Adria and northwestern continental Greece, and the westward intrusion of the Turkish plate in North Aegean. As a result, the Aegean region has been shaped by compression, extension and rotation of different lithospheric blocks.

As it is well established, the kinematics at a specific location on the Earthâ€™s surface is controlled by plate-scale tectonic processes as well as by stresses acting at local scales (Zoback, 1992). In other words, strain-rates not only represent plate interaction with mantle dynamics, but are also due to second and third order stress sources, related to crustal structure, faults and topography (Petricca et al., 2013). However, very few observations sample the deformation of the Hellenic lithosphere as a whole (Hatzfeld et al., 2001) with most of them based on input regarding the deformation of the shallow crust. Whether the whole continental lithosphere deforms in the same manner as the crust remains a challenging question.

The issue of the relation of contemporary and/or inherited shallow tectonics with mantle dynamics is investigated in the present study by exploiting available geophysical data. These observations consist of: Seismicity; GPS strain-rates; directions of maximum horizontal compression, SHmax, deduced from the inversion of a massive dataset of over 2000 focal mechanisms of Mw>=3.5 earthquakes at crustal depths (Kassaras and Kapetanidis, 2018); Fast polarization directions from local shear-wave splitting analysis; Regional and teleseismic fundamental mode Rayleigh-wave recordings from the Hellenic Unified Seismological Network; SKS-wave fast polarization directions.

Path average group- and two-station phase-velocity dispersion curves were derived using a waveform multiple filtering and a slant stacking technique, respectively. The multiple filtering technique was also applied to extract Rayleigh wave attenuation coefficients over pairs of stations. The Rayleigh-wave dispersion measurements were then inverted using a least-squares algorithm and 1D path-average models of shear velocity and Qs factor, were obtained for depths down to 200 km. In addition to this, data from a teleseismic survey (Kassaras et al., 2009) were employed. All 1D models were then combined in a continuous regionalization scheme, producing elastic-anelastic tomograms of the upper mantle of the Greek region for various depths. Thereafter, seismicity, GPS strain-rates, SHmax orientations and axes of fast shear-wave polarization directions are superimposed on the inferred upper mantle structure and common features at shallow and larger depths are examined.

The most predominant characteristic of the upper mantle, resolved with sufficient resolution, is the velocity and attenuation contrast between North and South Aegean, with low velocities/high attenuation, and high velocities/low attenuation, respectively. This transition occurs roughly along the South Aegean Active Volcanic Arc (SAAVA) that overlies the northernmost part of the Hellenic Subduction Zone.

The SAAVA also marks a transition of SHmax and eH1 maximum compressional strain-rate directions from roughly E-W in the north to almost N-S in the south, a pattern consistent with fast SKS-wave polarization directions, while a strong contrast of the stress-shape from uniaxial extension to uniaxial compression along SAAVA is also evidenced. The above imply a linkage between the deep mantle dynamics and the deformation within the continental crust of the Hellenic lithosphere, while inferred inherited structures, possibly related to past processes, need to be further investigated since they can significantly affect the seismic hazard of the Greek region.

Acknowledgments
We acknowledge support of this study by the project â€œHELPOS - Hellenic Plate Observing Systemâ€• (MIS 5002697) which is implemented under the Action â€œReinforcement of the Research and Innovation Infrastructureâ€•, funded by the Operational Programme "Competitiveness, Entrepreneurship and Innovation" (NSRF 2014-2020) and co-financed by Greece and the European Union (European Regional Development Fund).

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