Geophysical and Geodetic Studies in the Atlas Mountains of Morocco: Past, Present and Future Perspectives

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The Atlas Mountains of Morocco have been the target of several geophysical studies: gravity (Hildenbrand et al., 1988), refraction (Makris et al., 1985; Tadili et al., 1986; Wigger et al., 1992) and MT (Schwarz et al., 1992) surveys have been carried out during the 80's and 90's and have helped to establish some of the main characteristics of this intracontinental orogen, such as its overall structure and modest crustal thickness. Later studies, based on structural geology (Teixell et al., 2003; Arboleya et al., 2004), higher resolution gravity surveying (Ayarza et al., 2005) and multidisciplinary potential field modeling (Zeyen et al., 2005; Teixell et al., 2005; Missenard et al., 2006), indicated that the High Atlas crust is too thin to support its topography and that a mantle contribution is required. An astenospheric upwelling, which triggered the Eocene-to-recent Atlas magmatic activity was then proposed as the main cause of its topography. Despite of the advances in the knowledge of the Atlas crustal and lithospheric structure and in the origin of its topography, some questions remain. One of the most important is related with the precise Atlas crustal thickness, which has been deduced from low resolution wide-angle and refraction data, local receiver functions information and gravity modeling. Crustal thickness happens to be the key to establish the position of the lithosphere-astenosphere boundary and therefore, to asses the real contribution of the mantle to the topography and accordingly the actual uplift. With this target, two projects have been launched. Firstly, a high-resolution wide-angle and refraction experiment across two 300 km-long transects has been planned across the Middle Atlas-High Atlas and Anti-Atlas. The station spacing designed for this experiment is between 300-500 m, and should give detailed vertical-incidence and wide-angle information of the main velocity boundaries down to a depth of almost 100 km. Secondly, a non-permanent network of GPS stations has been settled around the Ouarzazate Basin. This network is aimed to control the recent vertical and horizontal movements that affect the area in an attempt to constrain the current deformation rates in the Atlas system.