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Ground deformation of the western rift of Corinth observed by means of PSI, SBAS and DInSAR methodologies

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The rift of Corinth has been long identified as a site of major importance in Europe due to its intense tectonic activity. It is one of the world's most rapidly extending continental regions and it has one of the highest seismicity rates in the Euro-Mediterranean region. It produces in average, an earthquake of magnitude 6 per century. The GPS studies conducted since 1990 indicate a north–south extension rate across the rift of ∼1.5 cm year-1 around its western termination. Geological evidences show that the south coast of the rift is uplifting whereas the north part is subsiding.

The western termination of the rift in the Patras broader area presents a major scientific and socio-economic importance, with the Psathopyrgos and the Rion-Patras faults being located very close to the city of Patras.

The first DInSAR studies were carried out using SAR/ERS data after the Ms= 6.2 June 15, 1995 Aigion earthquake and contributed to its characterization.

More recently the ground deformation of the area has been measured using a series of ASAR/ENVISAT, PALSAR/ALOS and RASARSAT-2 acquisitions. All datasets were processed by means of PSI (Persistent Scatterers Interferometry), SBAS (Small Baseline SubSet) and DInSAR (Differential Interferometry with SAR) methodologies. In addition to widely used tools (DIAPASON, ROI-PAC, STAMPS e.t.c.) in-house procedures and tools have been developed in order to exploit of the synergy of multiple characteristics/properties (frequency, viewing angles, sides, etc) of the SAR acquisitions aiming to the minimisation of the noise components.

We verified the agreement between GPS and PSI/SBAS velocities at the location of the five permanent GPS stations operated in the rift since ten years.

Ground deformations are visible at various scales and at various places in the produced PSI/SBAS maps and several known faults exhibit ground deformation around them with no earthquake occurred during the observations period:

(a) On 18th and 22nd of January 2010 two moderated earthquakes (both Mw= 5.1) occurred near Nafpaktos. Despite their low magnitudes those events show a small signature in C-band DInSAR. Modelling of the deformation sources provided constraints on the location, size, azimuth and depth of the activated faults.

(b) Our findings include the active zones inside the city of Patras (striking ENE-WSW, presenting aseismic surface slip rates ranging between ∼1 - ∼6 mm year-1 in the Up-Down component and ∼1 - ∼3 mm year-1 in the East-West component), the Rion-Patras (striking NE-SE, an oblique-slip transfer zone, presenting aseismic surface slip rate of ∼2 - ∼4 mm year-1 in the Up-Down component and ∼4 - ∼6 mm year-1 in the East-West component).

(c) Several normal faults exhibit deformations around them as the Psathopyrgos (striking E-W) Aigion, Eliki, Pyrgaki, Lakka, and Nafpaktos fault zones.

(d) The Ag. Triada zone has been investigated for discrimination of its compaction due to the existence of old riverbed underneath. The Psathopyrgos, Aigio, Selianitika and Mornos zones have been also investigated for discrimination of their compaction due to the existence of deltaic depositions.

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