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The Corinth Rift Laboratory (CRL) strainmeters: calibration and data analysis

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The Gulf of Corinth (Greece) is one of the most seismic regions in Europe, producing some strong earthquakes in the decades, 1 to 1.5 cm/yr of north-south extension, and frequent seismic swarms. This structure is a 110 km long, N110E oriented graben bounded by systems of very recent normal faults. The Corinth Rift Laboratory (CRL) project is concentrated in the western part of the rift,
around the city of Aigion, where instrumental seismicity and strain rate is highest. The CRL Network is made up about fifteen seismic stations as well as tiltmeters, strainmeters or GPS in order to study the local seismicity, and to observe and model the short and long term mechanics of the normal fault system. The instrumental seismicity in the Aigion zone clearly shows a strong concentration of small earthquakes between 5 and 10 km. In order to study slow transient deformation, two borehole strainmeters have been installed in the area (Trizonia, Monasteraki). The one installed in the Trizonia island, is continuously recording the horizontal strain at 150 m depth with a short term resolution better than 10-9. The dominant signal is the earth and sea tidal effects (few 10-7 strain), this one is modulated by the mechanical effects of the free oscillations of the Gulf with periods between 8 and 40 min. The barometric pressure fluctuations acts in combination with the mean sea level variation at longer periods and both effects are not independant. The comparison between the strain data and the two
forcing signals exhibits a non zero phase delay of the sea-level which is increasing with period. We estimate a transfer function after few correlation iterations for each forcing signal and the physical interpretation of the sea-level function is complex. As the strainmeter is at 150 m depth, below
the shoreline, a sea water percolation on land would increase the effect of sea level fluctuation, and be more efficient at longer periods. The analysis of temperature in the strainmeter argue in favour of a water circulation through the borehole which adds some perturbation on the instrument. The dilatometer response to crustal sources, recorded with the coseismic strain steps of the 2008, M=6.4 Andravida event and some local events, shows a fast pore pressure increase (10-20 s) by a diffusion process, and a slow relaxation (hours). We may interpret this as a defect of cementation around the instrument, the latter is mainly in contact with water on poorly consolidated cementy, and thus reacts to pore pressure changes in the sealed borehole (fast loading by diffusion to the borehole), which leaks at longer periods (slow relaxation by diffusion) out of the borehole. This allow us to adjust some parameters in the whole water and barometric pressure diffusion process. Taking into account the related transfer function, together with the one of the external signals, allows us to study accurately the residual signal in order to find slow transient signatures, especially during the reported seismic swarms. We also present here the first analysis of the Monasteraki strainmeter records after correction of the fast long term drift (10-7/day) and of
the external perturbations.