# Interannual variations of degree 2 from geodetic observations and surface processes

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Geodetic observations from space continuously record surface deformation and global mass redistribution with an increasing accuracy. In parallel, surficial processes (oceanic, atmospheric, and hydrological loading) are more and more precisely modeled. We propose a confrontation of the geodetic GPS and gravity-field satellite laser ranging (SLR) observations at decadal and interannual time scales, in terms of resolution, correlation and comparison with surficial loading models. A focus is made on the degree-2 vertical displacement. At interannual periods, its time variations stay below 0.6 mm. This revises downward the magnitude of 6 years changes put forward in previous studies. Our analysis highlights signals of similar amplitude at various periods, in particular around 3 years. We show that a significant part of the associated patterns can be explained by surface layers (in particular hydrological loadings). Relatively large correlations are observed between GPS and SLR deformation signal, as well as with hydrological loading. GPS time-series do not exhibit any major interannual oscillation that could be associated with a specific degree-2 order-2 geometrical pattern. Interannual gravity changes, in terms of degree-2 Stokes coefficients, show an amplitude less than $2\ 10^{-11}$. The confrontation of deformations from SLR and GPS, in both cases for two families of solutions, show the limits of resolution of these techniques. For the degree-2 interannual deformations, the consistency between the two methods is not high enough to reflect a common global process. Given the limitations in the characterization of surface processes, we conclude that at sub-decadal periods one cannot isolate any signal from the core in the observed fluctuations.

**Mots-Clés :** GNSS, Satellite Laser Ranging, surface deformation, gravity field, surficial loading, core dynamics

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