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Analysis of GNSS data along the Southern Gas Corridor and estimate of the expected slowly-cumulating tectonic displacements

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Coseismic surface displacements, soil liquefaction effects, and induced landslides are among the most critical issues to be accounted for evaluating the exposure and vulnerability of pipelines. However, tectonic plates and crustal blocks are in an almost continuous relative movement, most pronounced in the narrow zones between tectonic plates, where we observe differential velocities from a few mm to some cm per year. Hence, even without the occurrence of strong earthquakes, a pipeline crossing active tectonic plate boundaries must cope during its lifetime, with remarkable differential motions along its length, due to the interseismic elastic strain-accumulation within the upper crust. Such movements, leading to permanent ground deformation, can distress the pipe and cause operation interruptions, while the anchor points can result in local stress concentrations.

Here, we analyze the Southern Gas Corridor's final part, a route highlighted in the European Energy Security and Energy Union Strategies. This route, which will be occupied by the TransAdriatic pipeline, crosses one of the world's most seismically active zones. Our study aims to identify areas where critical differential motions could be expected along the route over the nominal 50-years pipeline-lifespan. We analyzed the available GNSS data and interpolated the sparsely available velocity vectors to have regular information along the pipeline path in two ways. In the first, we considered the region as a continuum; in the second, we applied an original blocky approach. We subdivided the path into segments, characterized by a relatively homogenous deformational behavior, or a specific tectonic setting, independently upon the neighboring ones. We compared the results of the two methods with the input observation. We calculated the maximum displacement that would cumulate in the next 50 years and the differential displacements that could cause possible critical bending to the pipeline structure. The approach followed in this research could be applied to other infrastructures to identify the segments prone to localized deformation because of interseismic tectonic loading.

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