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Long-term variations of the cGNSS data in the slow deforming N-Adria plate edge and relation with fault induced fluid mobilization.

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We analyze the GPS data from the cGNSS networks active at the northern tip of the Adria microplate, the low strain-rate region where the collision with Eurasia occurs. The 15 sites of the Friuli Regional Deformation Network (FReDNet) of OGS (Istituto Nazionale di Oceanografia e di Geofisica Sperimentale), the ten sites of the Marussi network of the Council of the Friuli-Venezia Giulia Region, and the EUREF station GSR1, in Slovenia, provides continuous observations since 2002. With time-series more than ten-year long, we can reliably evaluate not only the plate motion direction and velocity but also the possible plate acceleration, due to the superposition of other terms of the strain field time-space variations.
With this aim, we considered the longest time series available. We corrected the data for the influence of surface and underground hydrological load effects at seasonal, annual, and multi-year scale. The resulting time-series of the two horizontal components show a dominant linear trend, whereas it is slight, or absent, in the case of the vertical component, related to the Adria plate movement about Eurasia. Marked oscillations of some years of duration are superimposed on it for all the three components, with the same frequency content, showing a striking similarity between couples of station tens of km apart. In particular, we focussed on an apparent transient signal of about 2-year period, apparently slowly propagating in a region about 150 km wide. The movement is initially upward, except one case, with a slight tilting parallel to the direction of the main tectonic structures with small time delays between the different sites. Later, the opposite behavior is observed. Having excluded hydrological loading factors, we formulated the hypothesis of a porosity wave, originated by fluid mobilization due to tectonic processes in the region. We tested such hypothesis, with an original tomographic approach that located the source of the disturbance near in space and time to the last moderate magnitude event of Bovec (Slovenia) in 2004. In the same time, we calculated the propagation velocity and the hydraulic diffusivity, obtaining values compatible with the lithotypes present in the area. Through the solitary/porosity wave equation and with these values, we infer an initial effective stress of approximately 0.23 bar, enough to alter the equilibrium of some fault segments and influence the subsequent seismicity.