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Statistical inference in comparing DInSAR and GPS data in fault areas

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DInSAR and GPS data are nowadays currently used in geophysical investigation, e.g. for estimating slip rate over the fault plane in seismogenic areas. This analysis is usually done by mapping the surface deformation rates as estimated by GPS and DInSAR over the fault plane using suitable geophysical models (e.g. the Okada model). Usually, DInSAR vertical velocities and GPS horizontal velocities are used for getting an integrated slip estimate. However, it is sometimes critical to merge the two kinds of information since they may reflect a common undergoing geophysical signal plus different disturbing signals that are not related to the fault dynamic. In GPS and DInSAR data analysis, these artifacts are mainly connected to signal propagation in the atmosphere and to hydrological phenomena (e.g. variation in the water table). Thus, some coherence test between the two information must be carried out in order to properly merge the GPS and DInSAR velocities in the inversion procedure. To this aim, statistical tests have been studied to check for the compatibility of the two deformation rate estimates coming from GPS and DInSAR data analysis. This has been done according both to standard and Bayesian testing methodology. The effectiveness of the proposed inference methods has been checked with numerical simulations in the case of a normal fault. The fault structure is defined following the Pollino fault model and both GPS and DInSAR data are simulated according to real data acquired in this area.