



Crustal deformations using GPS data and the Kalman filter: preliminary results

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Seismicity which marks out Northern Algeria and local geodetic measures shows that the tectonic deformation is still active. This deformation is generally interpreted as the results of Eurasia-Africa plates convergence. This study focuses in the determination of the geodynamical movements of the Earth's crust by GPS measurements and deformations analyzes by using the Kalman filter. It consists to propose a processing strategy based on Kalman technique, and to define all the parameters of GPS processing with the development of an application test on a large scale precise GPS network. A standard processing method was performed to estimate the precise coordinates and velocities of the GPS stations. Also, we obtain then a combined result of the daily solutions as well as the variance-covariance matrix which will be the input data for the developed application. We process a network of 12 permanent GPS stations of the Italian network, located in the Eurasian tectonic plate, which measurement were collected during four GPS campaigns performed between 2000 and 2006; and a network of five (5) GPS stations located in the north of Algeria and observed in 1998 and 2001.

The Single Point Model permit to detect the deformation parameters as a time function and expressed by its position, velocity and acceleration which can be processed with Kalman filter technique using kinematic model. The elements of the Kalman filter were calculated to allow an optimal estimation of the state vector in each measurement period; the innovation vector and its covariance matrix permit also to calculate the Kalman gain. Also, this application has permit to perform a statistical analysis to evaluate the importance of the displacements parameters of the network, the velocities and the acceleration provided by four (4) repeated GPS campaigns. Finally, the results obtained on the Italian and north Algerian networks were analyzed and compared, for validation, with a reference solution provided by the Bernese Software.

Key words: GPS Positioning - Geodynamics - Deformation - Kalman Filter.