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Estimation of various noise types in continuous GPS time series over the Alborz mountain range (in Northern Iran)

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Alborz mountain range is located in northern Iran and is extending from 49 E to 53 E and 34.5 N to 37.5 N, which is a natural barrier between the Caspian Sea and the central plateau of Iran. The range includes a complex and not well understood system of strike-slip and thrust faults accommodates NNE-SSW oriented shortening. Review a historical seismic data shows the Alborz range is the most seismically active region in the Northern Iran, which has experienced an earthquake with magnitude of 7.3 Mw over the past two decade. Therefore, a better understanding of the present tectonics in this region is of fundamental relevance for seismotectonic and seismic hazard assessment studies. Since 2005, a dense continuous GPS network has established in the region by National Cartographic Center (NCC) consist of 26 permanent stations to enable accurate and online monitoring of deformation mechanisms along fault zones. Moreover, it is important to understanding the noise content of GPS position data in order to modeling of the geodynamic events in the region. Daily solutions (horizontal and vertical) of 26 stations, between Jan 2005 to Jan 2012, analyzed for noise content using maximum likelihood estimation (MLE). Furthermore, MLE applied to estimate amplitudes of all types of noises (white noise, flicker noise and random walk noise), simultaneously, over the time series. In order to overcome the problem of obtaining negative variance components, due to the low redundancy of model or an improperly designed stochastic model, nonlinear stochastic model in the presence of almost positive valued function (e.g., exponential function) is used. The results confirm that the contribution of random walk noise in 85% of vertical components and 25% of horizontal components is zero. This means that, in this case, there is not established any contribution of random walk noise in the stochastic model, probably due to deep drilled braced GPS monuments, and assuming the flicker noise plus white noise in the stochastic model is sufficient. Overall, by this method we have determined individual contributions of each type of noises in the continuous GPS time series over the range.