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Maps of coherence of GPS noise in the USA, 2013-2017

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The dense GPS network in the USA (4845 stations within rectangular domain (30N-50N)x(65W-127W)) provides the data for detail investigation of the Earth surface tremor in this region. We used 3-components GPS data with sampling time step 5 minutes which were downloaded from the site of Nevada Geodetic Laboratory since 2013.03.28 up to the current time. Maps of kernel estimates of probability density functions are presented for nodes of the regular grid sized 125x50, which are realized the spatial maximum of the frequency-dependent maximal values of the multiple spectral function of coherence of GPS time series from the nearest 10 workable stations for all 3 components of GPS time-series within moving time window of the length 5 days. The GPS station is considered workable in the time window if its registration interval includes the considered time window and the number of missing values does not exceed a predetermined maximum allowable proportion of the total length equal to 0.1. The missed values are filled using information about records from neighbor time interval of the same length as the length of gaps. Before calculating the correlation coefficients in each window the trend is removed by polynomial of 4th order and 3-sigma winsorizing was performed.

The map of most frequent positions of frequency-dependent maximum of multiple coherence of GPS noise extracts several “spots of noise coherence” among which there are regions in California, New Madrid seismic zone, Bakken shale oilfields, Denver zone of induced seismicity. Time-dependent analysis of multiple correlations between coherence measures from the vicinity of 16 reference points extracts essential maximum during time interval from mid-2015 up to mid-2016. Maps of logarithm of periods providing maximum to multiple coherence measure from 10 nearest operable GPS stations give additional information about spatial peculiarities of coherence distribution. In particular such map for logarithm of periods reflects differences between mountain and plain parts of the region.

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