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Noise analysis of GPS time series in Taiwan

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Global positioning system (GPS) usually used for researches of plate tectonics and crustal deformation. In most studies, GPS time series considered only time-independent noises (white noise), but time-dependent noises (flicker noise, random walk noise) which were found by nearly twenty years are also important to the precision of data. The rate uncertainties of stations will be underestimated if the GPS time series are assumed only time-independent noise. Therefore studying the noise properties of GPS time series is necessary in order to realize the precision and reliability of velocity estimates. The lengths of our GPS time series are from over 500 stations around Taiwan with time spans longer than 2.5 years up to 20 years. The GPS stations include different monument types such as deep drill braced, roof, metal tripod, and concrete pier, and the most common type in Taiwan is the metal tripod. We investigated the noise properties of continuous GPS time series by using the spectral index and amplitude of the power law noise. During the process we first remove the data outliers, and then estimate linear trend, size of offsets, and seasonal signals, and finally the amplitudes of the power-law and white noise are estimated simultaneously. Our preliminary results show that the noise amplitudes of the north component are smaller than that of the other two components, and the largest amplitudes are in the vertical. We also find that the amplitudes of white noise and power-law noises are positively correlated in three components. Comparisons of noise amplitudes of different monument types in Taiwan reveal that the deep drill braced monuments have smaller data uncertainties and therefore are more stable than other monuments.