



## **Impact of Seasonal Changes on Noise and Velocity Estimation**

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Each of the GPS-derived time series consists of the deterministic and stochastic part. We propose that the deterministic part includes all harmonics of periodicities from 1st to 9th of residual Chandler, tropical and draconitic periods and compare it with commonly used calculations of the annual and semi-annual tropical curve. Then, we address the issues of whether all residual periodicities, as proposed here, need to be taken into consideration when performing noise analysis. We use the position time series from 180 International GNSS Service stations obtained at the Jet Propulsion Laboratory using the GIPSY-OASIS software in a Precise Point Positioning mode. The longest series has 22.1 years of GPS daily solutions. The spectral indices range from  $-0.12$  to  $-0.92$ , while the median values of „global” spectral indices are equal to:  $-0.41 \pm 0.15$ ,  $-0.38 \pm 0.12$  and  $-0.33 \pm 0.18$  for North, East and Up components, respectively. All non-modelled geophysical processes or non-included artificial effects in time series lead to an underestimation of errors of velocities, but also to changes in the velocity values themselves. The proposed assumption of seasonal oscillations subtraction caused the Akaike information criterion values to show a decrease in the median value of 30 %, which in fact means that all the seasonals mentioned here must be taken into account when analyzing noises. Finally, we noticed that there are some of the GPS stations that improved their velocity uncertainty even of 56 %.