

Optimizing the frequency of GNSS campaigns for cost effective and reliable site velocity estimation

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Installing GNSS permanent stations requires high costs. Besides, the installation is not possible in all types of deformation monitoring. On the other hand, the continuous data is the standard for reliable accuracy and velocity estimation. How can one achieve comparable accuracies with less cost and similar accuracy in studies such as deformation monitoring? One way to reduce the cost is to perform data collection in episodic campaign measurements. In fact GNSS campaigns are a necessity for studies such as landslide monitoring in which the deformation would harm permanent installations. The repetition interval (i.e. the frequency) and observation duration of campaign observations need to be studied for reliable velocity estimation.

Previously, GNSS continuous time series were decimated into monthly sampled campaigns (i.e. one campaign per month), and velocity estimation was performed from those campaigns. The data archives of the International GNSS service (IGS) and the time series of the Jet Propulsion Laboratory (JPL) were used for the purpose. Although the spectral character (i.e. amplitude and phase of common periodicities) slightly changed, the velocity estimated from those campaigns produced comparable accuracies to those of the GNSS continuous data. In this study, we reduced the data of the time series forming the GNSS campaigns 3 campaigns per year. This would be a trade-off between the traditional 1 campaign per year procedure in which horizontal velocities are estimated only with about 80% confidence level and the recent procedure 12 campaigns per year producing comparable velocity estimation to the continuous GNSS. Decimating GNSS campaigns as sparse as 4 months more or less eliminates the time correlation between the successive measurements. On the other hand the procedure produces almost equivalent results to the continuous data.