The impact of temporal correlations in GPS permanent network solutions

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Abstract
The correct estimation of GPS-derived coordinate and velocity precisions is of fundamental importance when GPS permanent stations are used to realize and maintain a reference system and to infer geodynamical interpretations.
Despite of the fact that several authors evidenced temporal correlations in the GPS coordinate time series of the daily solutions, in the standard processing procedures for GPS permanent networks weekly solutions and site velocities are estimated by adjusting daily solutions without taking into account the temporal correlations themselves. This fact leads to an overestimation of parameter precisions when daily solutions are least squares adjusted in order to estimate "public" weekly solutions and site velocities.
In the present work, analyzing the time series of 4 Italian GPS permanent stations belonging to the IGS global network, we found, as expected, that temporal correlations are not negligible at all.
Without analyzing, for the moment, their causes, we just tried to introduce these correlations (in terms of both autocovariances and cross-covariances) in the solution of our small "pilot" GPS network with the aim of discovering how weekly solution and velocity precisions change when a more correct stochastic model is used. In this respect we implemented a new software in C language (KINADGPS) for velocity and weekly solution estimations taking into account temporal covariances; to evaluate the impact of such covariances, the software also performs the standard adjustment, where daily solutions are assumed as temporally uncorrelated and the stochastic model is represented by a block diagonal covariance matrix (each block representing the covariance matrix of one daily solution).