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# Controlling seasonal effects on the weekly realization of the SIRGAS Reference Frame

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Regional and national reference frames supporting GNSS positioning must be consistent with the reference frame in which the GNSS orbits are determined, i.e. the ITRF. Usually, epoch solutions (daily, weekly, multi-annual) of regional reference frames are aligned to the ITRF using a set of fiducial stations, positions of which are at present given with constant velocities; i.e. they consider linear coordinate changes only. However, GNSS stations show significant seasonal position variations (mainly in the up component) resulting from a combination of geophysical loading and systematic errors. Ignoring these seasonal variations at reference stations can introduce systematic errors in the datum realization and the reference networks can be significantly deformed. These effects are larger in regional networks than in global ones, especially in zones with strong seasonal variations as the SIRGAS region. In this way, with the objective of minimizing the influence of seasonal variations in the weekly realization of the SIRGAS-CON frame (SIRGAS Continuously Operating Network), different strategies for the datum definition are analyzed taken into account the minimal network deformation, the weekly repeatability of station positions, and the consistency with the IGS weekly solutions for the global network. This analysis basically consisted of solving the same free normal equations applying three different strategies for the datum realization: 1) Fixing the IGS05 station positions, 2) Constraining the IGS05 station positions by means of a weight inversely proportional to the internal precision of the GPS measurements, and 3) NNR and NNT conditions with respect to IGS05 station positions. These three strategies are numerically evaluated applying two different sets of reference coordinates for the fiducial stations: the first one corresponds to the IGS05 positions at epoch 2000.0 extrapolated to the observation epoch using the ITRF2005 lineal velocities. The second set corresponds to the weekly positions determined for the IGS05 reference stations within the IGS weekly combination (igsyyPwwww.snx). After comparing the loosely constrained solutions (in which the network is not deformed) with the constrained ones, the main conclusion shows that applying linear velocities to the reference coordinates introduces the largest distortions into the station positions, mainly at the fiducial points. This is a consequence of constraining a seasonal signal to be a linear trend. This study presents numerical results after applying the described strategies to the SIRGAS-CON weekly solutions for a period larger than 2 years (to better identify seasonal effects). Obtained conclusions can be generalized for the datum realization within regional reference frames.