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Reference frame related uncertainties in secular velocities determined from CGPS coordinate time series

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Global scale studies of changes in the Earth’s geometry due to geodynamics and surface loading, including the global pattern of secular trends require access to a highly accurate global reference frame with spatially homogeneous accuracy. Today, such access is easily available through GPS, which allows to determine point coordinates relative to the International Terrestrial Reference Frame (ITRF). The International GNSS Service (IGS) provides global products (satellite orbits and clocks, SOC) as well as time series of the reference coordinates for the IGS tracking stations that can be used to determine coordinates of new points either through single point positioning relative to the SOCs or by using additional information from nearby reference sites. However, the accuracy of the coordinates with respect to ITRF depends crucially on the long-term stability of the reference network and the SOCs. Therefore, we have study the quality of the IGS products in terms of long-term stability and accuracy relative to ITRF.

IGS precise products are found to have a temporal inhomogeneity of the order of 10 mm associated with the transition from ITRF97 to ITRF2000 (at date 2001-12-02) and can thus not directly be used to determine highly accurate trends for time series including the transition date. The IGS precise SOC are given in a specific ’SOC’ frame, which is not identical to ITRF2000 or IGb00. Station velocities determined on the basis of IGS precise products for ITRF reference sites (corrected for the effect of the transition jump) do not agree well with their ITRF2000 velocities, with the differences being as large as ± 3 mm/yr. Thus, errors in station coordinates with respect

to ITRF2000 can be as large as 3 cm over a time span of ten years. This discrepancy can be explained by a motion of the origin of the IGS SOC frame, which is fixed to the geocentre as seen by GPS, with respect to ITRF2000, for which the origin is tied to a geocentre observed by a combination of techniques. This poses the question which of the two frames is better tied to the (physical) geocentre and consequently would provide a more accurate global secular velocity field.