IGS Rapid Orbits: Systematic Error at Day Boundaries

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When one fits a GPS spacecraft trajectory through several days of orbit positions from IGS Rapid orbit SP3 files, the orbit position residuals show discontinuities at the day boundaries between SP3 files.

The discontinuities can be of order 10 cm, especially the component in the along-track direction. The discontinuity component values for a specific spacecraft usually have the same sign for several months, that is, the variation from day to day is not random. SVN 44 (PRN 28) during the year 2005 showed an along-track discontinuity that slowly varied over the range +2 to +13 cm. IGS Final orbits show similar discontinuities at each 00 hr GPS. The biased residual discontinuities reflect a discontinuity in Rapid orbit systematic position error across day boundaries; this error is much larger than the 2 cm RMS difference between orbits from different Analysis Centers. To indicate the magnitude of systematic orbit error, the IGS should include day boundary discontinuity values in the Rapid orbit combination reports.