

### 3.6.2 Combination Research Centres

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##### Introduction

The CRC works principally in two different directions that would hopefully converge to a single combination method in future. On the one hand, we combine some of the Earth Orientation Parameters using the ‘combined smoothing’ algorithm that we recently proposed, without changing the underlying reference frames (terrestrial, celestial). On the other hand, we follow the direction of combining particular solutions of different techniques for the simultaneous determination of EOP and station coordinates.

##### Combination of EOP only

The algorithm used in 2001 was further improved – GPS observations of length-of-day and celestial pole offset rates proved to suffer from long-periodic (30 days and longer) systematic errors, most probably due to orbit mismodeling. Therefore the calibration of GPS against VLBI becomes necessity on these time scales, prior to their combination. The new algorithm was used to combine Universal time observed by VLBI (IVS) with length-of-day changes observed by GPS (IGS) in the interval 1999.0 – 2002.0, and to combine the celestial pole offsets by VLBI (IVS+ IERS C04) with their rates by GPS (CODE) in the interval 1994.3 – 2000.4 (Vondrák & Ron 2002a). Later on, when more recent celestial pole offset rates from CODE were obtained, the latter study was repeated on a longer time span (1994.3 – 2002.0) and the solution was compared with the new IAU model of precession-nutation (Vondrák et al. 2003). The agreement is on the level of 0.2 mas, the dominant difference between the two series having the period of about 450 days (free core nutation). Finally, when a more recent IVS combined solution appeared (in September), it was used to repeat both combinations (i.e. UT1/LOD and celestial pole offsets/rates) with GPS in the interval 1994.3 – 2002.0 (Vondrák & Ron 2002b). It is demonstrated that the *a priori* and *a posteriori* uncertainties are almost equal for both methods of observation when UT1 is combined with LOD. However, it is not the case of combining celestial pole offsets/rates – in case of GPS the *a posteriori* uncertainties are about two times larger than the *a priori* values.

##### Combination of EOP and station coordinates

We continued in developing a method for combining non-sinex data to obtain simultaneously station coordinates and Earth orientation parameters. The method is based on combining position vectors of the stations as obtained from different techniques, in the celestial reference frame. Input EOP are referred to a single epoch so that celestial pole offset cannot be separated from polar motion. Thus, two auxiliary fictitious “observations” shifted by

$\pm 6$  hours from the basic epoch should be introduced to separate the unknowns.

The tie between EOP at different epochs is realized by introducing constraints (assured by means of special “condition” observation equations) whose weights can control smoothness of the result. The combination was stabilized substantially by deriving transformation parameters of individual input solutions rather than increments to the individual station coordinates, in addition to the constraint of no-net rotation. Sample tests show that dispersion of station coordinates decreases by 40-50% after adjustment (Kostecký & Pešek 2002).

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