INTRODUCTION

This presentation focuses on the performance of the operational IVS-R1 and IVS-R4 sessions from 2002 through 2017. The formal uncertainties of the R1 and R4 EOPs improved over the period of 2002 through 2017. What contributed to the improvements: Number of stations; Improved frequency sequence; Increased data rates; SNRs; SEFDs?

The chart to the left shows the formal uncertainties of X pole position, Y pole position, and UT1 for the R1 sessions. The uncertainty of UT1 has improved by a factor of 2. UT1 improves by a factor of 2.

The standard VLBI solutions assume that you are doing a global estimate of station position and velocity, and are estimating EOP as an arc-by-arc basis. Because of this, the uncertainties in the reference frame propagate into the EOP uncertainties. The reference frame has the largest uncertainty in the middle of the data span, and increases towards the end. Because of this, even the network and observing sessions remains the same, the UT1 estimates would be more accurate at one end of the observing span. An alternative way of estimating the EOP estimates is to turn off reference frame estimation by turning off velocity estimation. The resulting EOPs are only influenced by the observing schedule, and allow a true comparison of EOP uncertainty at different epochs.

The EOP goal of the IVS program is 3.5 µs for UT1 and 100 µas for pole position. As shown in Figure 1, the formal uncertainties have improved over time for most of the components. The moving average (1 year) trend line for R1 pole position goes from 80 µas in early 2002 to 40 µas in late 2017. Whereas there is no change in the moving average (1 year) trend line for R4 UT1. There is a more significant improvement over time in all formal uncertainty components for the R4 session (Figure 2). The moving average (1 year) trend line for R4 pole position goes from 90 µas in early 2002 to 40 µas in late 2017 for X pole, and from 70 µas in early 2002 to 40 µas in late 2017 for Y pole. The UT1 decreases slightly from 3 µas to 2.5 µas over the 16 year period.

Figure 3 and Figure 4 show the obtained EOP formal uncertainties without velocity estimation improved from 2002 through 2017. The X pole and Y pole uncertainties for the R1 improved by a factor of 2 and the UT1 goes from slightly above 1 µas slightly below 1 µas over the 16-year period. There is a large change with the R4 sessions where X pole improves by a factor of 5 and Y pole improves by a factor of 2.

The EOP formal uncertainties improved for both the R1 and R4 sessions since 2002. There are many interesting issues that still need to be studied regarding these data sets. Simulations are being used to design future experiments and are based on scheduled data; it is possible that simulation procedures should be improved. We need to resolve the reasons for the large difference between scheduled and used observations. Clearly the formal uncertainties of estimated EOP will be improved with more successful observations resulting from reducing the gap between scheduled and used observations. We also intend to further study the sessions where the performance of R1 and R4 were best and specifically the R1 sessions before and after CONT14.