Abstract. The PLANETS database contains the data of astrometric optical observations of the Sun and seven major planets from Mercury to Neptune, performed with meridian instruments, astrographs and astrolabes from 1960 to the present. The database structure and some problems that were resolved during the first (1980-1985) and second (1988-1995) stages of the 15-year database history are described. The discussion focuses on the present status and future scientific applications of the database.

Key words: databases – astrometry: Sun, planets and satellites

In the early sixties a worldwide campaign of intensive astrometric observations of the Sun and major planets, especially Mercury, Venus and Mars, was initiated. The principal campaign objectives, formulated by the IAU, were twofold: to refine the old Newcomb theory and to improve the orientation of the fundamental catalogs with respect to the dynamical reference frame. These observations continued until the early eighties when new modern numerical ephemerides were developed and more accurate analytical theories were constructed. Only six classical meridian instruments in Kislovodsk, Tashkent, Belgrade, Washington and Black Birch continue routine daytime visual observations of the Sun, Mercury and Venus. The outer planets are observed at night only with new automatic meridian circles at Bordeaux, La Palma and Tokyo.
The underlying idea of the PLANETS database construction was to collect the bulk of the planetary worldwide observations and to apply a more general approach to the solution of the two fundamental problems mentioned above. The database was conceived and its initial version compiled at the Main Astronomical Observatory in Golosiiv, Kiev, from 1980 to 1985 (Kharin et al. 1987). Since 1988 the database has been updated, maintained and analyzed in cooperation with the Institute of Astronomy (INASAN), Moscow. By now it contains more than 56 thousand observations of the Sun and seven planets which were obtained with 26 meridian instruments (50 189), 16 astrographs (4880) and 11 astrolabes (1199) from 1960 to 1995.

The structure of the database which was finally released is simple and convenient for operation. It consists of eight sequential access files, each containing the data for the Sun and seven planets. Each record refers to a separate observation of an object and is represented by the codes of the methods, the instruments, the reference system in which the observation was published, ephemerides (theories) for comparison, the date of observation (year, month, day) and $O-C$ values for both equatorial coordinates. The files are updated by a simple appending of newcomers observations.

During the first stage of existence of the database, the main scientific results, involving its use, were the comparative analysis of the accuracy of observational series obtained with different instruments and methods. Such an approach has evident advantages over the estimates of accuracy published by the observers themselves, which are essentially internal estimates. The point is that external estimates of accuracy can only be obtained by using as a reference the mean instrumental system of a relatively large subset of different instrumental series. At the same time, internal estimates derived for instrumental series appear to be more reliable since they result from the same mathematical procedures applied to all series. Different approaches to accuracy estimates have been suggested at an early stage of the database operation (Kharin 1986). Finally, a more general approach has been developed (Kolesnik 1995, Kharin et al. 1996) making it possible to estimate both systematic and random errors for a given series and assign to it a weight, which is objective in the internal and external sense.

The most important result derived from the PLANETS database is the determination of the equinox and equator corrections for the FK4 (Kharin et al. 1984) and FK5 (Kolesnik 1995, 1996) systems where the secular motion of the equinox had been determined. The
latter was based on an analysis of observations of the Sun, Mercury and Venus. The global approach combining observations of a large number of series has been applied, and fairly consistent corrections for all three objects have been obtained. Many other investigations were performed using the data that had been collected (Kharin 1986, Kharin et al. 1987). In brief, the history of the database operation has had two stages. During the first stage the analysis was based on a limited volume of observational data obtained before 1985. The use of only one reference catalog (FK4) and only one (Newcomb's) ephemeris resulted in $O-C$ values of high homogeneity, and therefore rather simple methods have been used for the analysis of the data. During the second stage, a substantially larger volume of observational data obtained over a 30 year period has been analyzed (Kharin & Kolesnik 1989, Kharin et al. 1996, Kolesnik 1995, 1996). Factors such as a transition to the new astronomical constants, the new reference catalog and more accurate ephemerides had to be taken into account and all the data had to be reduced to a homogeneous system. For this we had to apply a more sophisticated mathematical technique.

A new coordinate system based on 606 extragalactic sources is now introduced in accordance with the resolution of the 22nd General Assembly of the IAU. In the near future the transition of all ephemerides into this fixed coordinate system is also expected. After this is done, the next stage of transition of planetary observations into an extragalactic reference frame can be undertaken, and new results can be expected from the PLANETS database such as orientation parameters of the FK5 with respect to the new fixed reference system.

REFERENCES