

INTERNATIONAL CATALOG PROJECTS

Working Group of Commission 24

Chairpersons and Editors: **CH. DE VEGT & L.V. MORRISON**

WGM 3 International Catalog Projects

Saturday, 20 August 1994

Chairmen: Chr. de Veegt & L V Morrison

1 Short reports on recent/current observational programs

1.1 USNO Pole-to-pole catalog program (Rafferty & Corbin)

The US Naval Observatory has nearly completed the observations for an all-sky, absolute catalog. The observations are being made with the Six-inch Transit Circle, located in Washington DC, USA (+39° latitude), and with the Seven-inch Transit Circle, located beside Blenheim, New Zealand (−41° latitude). The locations of the two telescopes allow for a 60° overlap in their zones of coverage of the sky. This includes all of the ecliptic zone. This overlap will allow comparisons between the two instrument and will play a major role in linking the observations.

The program includes Solar System objects, FK5 stars, the International Reference Stars (IRS), radio stars, and other stars down to mag 9.5. All observations will be reduced to the absolute instrumental systems, with the IRS also being reduced differentially. Another important part of this process involves daytime observations of Mars. These observations will provide an excellent test of the link between the daytime observations of the Sun, Mercury and Venus and the nighttime observations of the stars. The daytime Mars observations will also increase the contribution of Mars to the orientation of the catalog to the zero points of the dynamical system.

Observations with the Six-inch Transit Circle should be completed in the spring of 1995 and with the Seven-inch Transit Circle in the spring of 1996. The final catalog is expected to be available in 1997.

1.2 Extension of optical frame to $11 < V < 12$ (Morrison)

I report on the progress of the Carlsberg Automatic Meridian Circle programme to extend the optical reference frame to the magnitude range $11 < V < 12$ with a density of ~ 1 star/square deg.

The stars were chosen at Copenhagen University Observatory and the Real Instituto y Observatorio de la Armada, San Fernando from the Astrographic Catalogue in the declination range +90° to −40°. The list includes ~ 2000 stars with $V > 11$ mag in the HIPPARCOS programme and the 1143 stars with $11 < V < 13$ in the Faint Fundamental Extension to the IRS drawn up recently by the WG on Star Lists.

There is a total of 35 000 stars in the programme and observations began in 1988. To-date 28 200 stars have been completed with 6 observations each. The programme is thus 75% towards completion. The positions are published in Carlsberg Meridian Catalogue No. 5 onwards.

A check on possible systematic errors was made by comparing with about 800 stars in the declination ranges $+10 < \delta < +25$ and $+50 < \delta < +75$ observed by the Bordeaux Meridian Circle as part of a collaborative programme. This comparison showed that all the systematic differences are less than $0''.05$, and, in particular, there is no indication of a magnitude equation. The standard deviations of the differences are $0''.10$ in RA and $0''.12$ in Dec which are consistent with the combined estimates of the external errors in the Carlsberg and Bordeaux catalogues.

1.3 Tokyo PMC (Yoshizawa)

The Tokyo Photoelectric Meridian Circle (Tokyo PMC) was erected in 1982 at the Tokyo Astronomical Observatory, Mitaka (renamed the National Astronomical Observatory in 1988). Since 1984 the Tokyo PMC has been engaged in regular fundamental observations, being the main instrument for global astrometry in Japan. It is a photoelectric meridian circle with an oscillating V-shaped slit plate and a photon counting system operated automatically through dual computer control. The practical limit in observing faint stars was found to be around 12.2 mag, mainly because of the rather bright night sky at Mitaka.

An activity report of the Tokyo PMC has been published recently by Yoshizawa et al. (Publications of National Astronomical Observatory of Japan 3, 289, 1994) under the title *Ten years of the Tokyo Photoelectric Meridian Circle (Tokyo PMC): An activity report for the years from 1982 to 1993*.

In the first Tokyo PMC program in the years 1985 to 1993 about 33 000 stars were observed. A series of the annual catalogs containing the observations of the first Tokyo PMC program were published for the years 1985 to 1989. The results of the observations made in the last three years (1990, 1991, and 1992) will soon be published as a three-year-catalog, concluding the series of annual catalogs.

The construction of the First Tokyo PMC Catalog will then be initiated, based on all the observations made in the years 1985 to 1993, both for stars and Solar System objects (the Sun, five major and nine minor planets). The orientation of the final catalog will be aligned with the dynamical equinox derived from a discussion of observations of the Solar System objects.

1.4 Current catalogue projects at Pulkovo (Polojentsev)

The following is a list of Pulkovo catalogue projects recently completed or currently being observed:

- Absolute meridian catalogue of the declinations of ~ 500 bright stars made with the Zverev Photographic Vertical Circle. This instrument will be

equipped with a CCD micrometer in the near future (G A Goncharov).

- All-sky photographic catalogue of positions and proper motions of ~ 6 million stars down to mag 13 using observations made in Chile, Bolivia and Spain (second epoch). Proper motions will be derived using the AC for first epoch positions. The star positions have been published (H I Potter).
- Catalogue of absolute proper motions of stars down to 17-18 mag in 150 selected areas in the Southern hemisphere using the Maksutov astrograph in Chile (El Roble). The first epoch was taken in 1969-72. The second will be taken circa 2000 (H I Potter).
- Catalogue of precise positions of bright stars in the Southern hemisphere using photographic observations made in Ordubad (Azerbaijan) and Tarija (Bolivia) with a mean epoch of 1983 (R F Zalles).
- Meridian catalogue of RA of ~ 1000 Time Service stars using the photoelectric transit instrument (V L Gorshkov).
- Catalogue of all-sky absolute declinations from zenith telescopes in Barenzburg (Spitzbergen), Pulkovo, Blagovestsensk and Kitab, and from the Zverev Photographic Vertical Circle in Santiago (Chile).
- Improved photographic FOCAT-S catalogue made from observations in Ordubad (Azerbaijan), Tarija (Bolivia), Zelenchuk station of Kazan University (Russia) and Gissar Observatory (Tadjikistan) in the declination zone -10° to -32° (D Polojentsev).
- Finishing the catalogue of absolute proper motions relative to galaxies in the declination zone -5° to $+90^\circ$ (KSZ plan), and using it for the extragalactic link of HIPPARCOS (N M Bronnikova).
- Catalogue of proper motions and UBV photometry of 225 multiple systems of 5 or more stars (I I Kanaev).

1.5 Nikolaev catalogue projects (Pinigin)

- Catalogue of 2104 reference stars brighter than mag 10 in the fields of ~ 238 extragalactic radio sources in the declination range -20° to $+80^\circ$ has been made with the photoelectric Repsold MC ($D=190$ mm; $F=2160$ mm).
- Photographic Zodiacal Catalogue in ecliptic latitude -10° to $+10^\circ$ was made in 1975-82 with the Zone Astrograph ($D=120$ mm; $F=2044$ mm; $5^\circ \times 5^\circ$). Double overlap was taken (985 plates) with a limiting magnitude of 12 which includes $\sim 180\,000$ CdC and PPM stars. Measurement of the plates started in 1994 using the PARSEC machine. The expected accuracy is $\sim 0''.1$.

- Photographic Equatorial Catalogue in declination belt -4° to $+4^\circ$ was made in 1990-93 with the Zone Astrograph. There are 750 plates with four-fold overlap. The limiting magnitude is 12 and the programme includes $\sim 75\,000$ CdC and PPM stars. Measurement of the plates started in 1994 with PARSEC and the expected accuracy is $\sim 0''.1$.
- It is planned to form and observe a catalogue of 12-14 mag reference stars in the fields of 210 extragalactic radio sources in the declination range -30° to $+90^\circ$ for the purpose of linking the optical and radio frames. The stars will be selected from the GSC and the observations will be made with the Axial Meridian Circle (D=180 mm; F=2480 mm) equipped with a CCD $9' \times 13'$ (228×256 pixels). The expected accuracy is $0''.04$ from three years of observations beginning in 1995.

1.6 Chinese astrolabe catalogues (Tongqi)

Preliminary catalogues of visual (A) and photoelectric (PA) astrolabes have been published. These have been compiled into Four General Catalogues (GC) as shown in the following table:

Cat.	Mean epoch	FK5	FK4	FK4 Supp.	GC	Total stars	$\sigma(\text{RA})$ 0 ^s .001	$\sigma(\text{Dec})$ 0 ^s .01
GCA ¹	1973.6					606	3.2	5.0
GCPA ²	1975.0		642	516	421	1579	3.3	5.8
GCPA ³	1988.0	980			1626	2606	3.8	6.4
CGSC ⁴	1988.0	2226			1830	4056	4.0	7.0

1 GCA: General Catalogue Astrolabe visual observations

2 GCPA: General Catalogue of Chinese photoelectric astrolabes

3 GCPA2: Second General Catalogue of Chinese photoelectric astrolabes

4 CGSC: Chinese Geodetic Survey Catalogue

The photoelectric astrolabes have been automated.

The Type II photoelectric astrolabe of Beijing Observatory has been moved to La Plata Observatory, San Juan, Argentina. A preliminary catalogue of has been compiled (PASJ1) of 1400 stars with an accuracy of about $0''.06$ in RA and Dec.

When the Type III PA and the four Type II PAs are equipped with CCDs, they will observe stars down to mag 16 and 13, respectively. With these instruments we will undertake the following programmes: positions and proper motions of faint stars, survey of parallaxes, discovery and determination of stars with large parallaxes, research into dynamics of the Solar System and measurement of variations in the Sun's diameter.

1.7 New Astrolabe General Catalogue (Chollet & Débarbat)

At the IAU GA in Buenos Aires the WG on Astrolabes decided to compile a new General Catalogue and to divide the work into several parts. Our Chinese colleagues were given responsibility for the Northern part of the sky and Clauzet

of Brazil the Southern part. Our colleague, Xu Tongqi, has reported on the Chinese General Catalogues.

For the formation of the North Catalogue of General Astrolabes (NCGA), the catalogues of Pulkovo, Paris, San Fernando and preliminary Chinese catalogues have been sent to Xu Jiayan. The NCGA is expected to be completed in 1995. For the South Catalogue (CGAS), Bénévidès, who took over from Clauzet after his untimely death, has reported the following progress. He has placed the work in the hands of J Rego, under his supervision, and it is hoped that the project will be completed in 1995, at the same time as the NCGA.

The linking of the two hemispheres, which is to be made simultaneously by both teams, will benefit, perhaps, from the application of the global method of reduction which Y Kolesnik has applied to the re-reduction of the Quito observations. By using all the modern global methods available, such as those of Bénévidès, Manabe et al., Chollet & Najid will not only provide positional catalogues, but also long series of time and latitude measurements, and improvements in the positions of planets and radio stars. The results will be improved further by re-reduction to the FK5 and eventually the HIPPARCOS catalogue.

2 Reports on formation of large photographic catalogues

2.1 The astrometric recalibration of the HST Guide Star Catalog (Bucciarelli)

Revision 1.2 of the HST Guide Star Catalog (GSC) is being prepared at the Space Telescope Science Institute for release to the astronomical community. This revision, which relies on the same x, y measurements as those of GSC 1.1, is based on a completely new plate reduction strategy. Specifically, the so-called mask method and sub-plate method (Taff, Lattanzi & Bucciarelli, *ApJ* 361, 667, 1990) are applied, and the 'best' solution is chosen on a plate-by-plate basis.

Another notable improvement, especially for the Southern hemisphere, comes from the use of the PPM North and South (Röser & Bastian, *A&AS* 74, 449, 1988), as well as the PPM Supplement (Röser, Bastian & Kuzmin, *A&AS* 105, 301, 1994), as reference catalogues. Moreover, the Carlsberg Meridian Circle Catalogue series (CMC4, CMC5, CMC6, CMC7, 1989, 1991, 1992, 1993, Copenhagen University Obs., Royal Greenwich Obs. and Real Instituto y Obs. de la Armada en San Fernando) are routinely used as an external, independent check on the final astrometric quality. The expected average positional accuracy of GSC 1.2 is $0''.45$. However, because of the non-optimal average density of the reference catalogues, some systematic errors at the plate edges, characterized by a plate-dependent signature, still remain. A magnitude equation very recently detected (Röser, private communication), presently not taken into account by the model, will be addressed and hopefully corrected in a subsequent version of the GSC.