

THE HIPPARCOS DATA AND RESOLVING THE PROBLEMS IN THE NORTHERN POLAR REGION

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ABSTRACT

In addition to well known possibilities offered by the Hipparcos and Tycho catalogues the authors emphasize that the possibilities exist to resolve positional problems belonging to special regions of the sky. In this connection, the problems of northern area of the sky are discussed.

Key words: astrometry; near-polar area.

Dramatic progress in astrometric observation technique, especially milliarcsecond accuracy achieved, as the brilliant accomplishment of the Hipparcos mission demonstrated, crucially changed the appearance of contemporary astrometry, promoted looking at it from a new point of view and revising basic programs of astrometry, as well as generated a lot of further tasks. Far-reaching potentialities of the Hipparcos mission have already brought and will still give in the nearest future extremely important results in astronomy.

Among the tasks that can be solved using the Hipparcos results, the authors would single out some old problems in separate sky regions. Northern near-pole area is, in particular, one of such regions. The attempts to remove distortions in the position and proper motion system of stars in this area have not given satisfactory results up to now. This is mainly associated with the correlation between star positions in different catalogues obtained with the help of methods, typical for traditional astrometry.

To study the origin of coordinate system peculiarities in polar region the authors tried to combine all the observations available, beginning with those of Carrington and up to the latest results of CAMC, concerning the stars in the region mentioned. Thirteen catalogues, both meridian and photographic, were used in all. As a result a combined catalogue of positions and proper motions of stars, FK5 system, J2000, were compiled (hereinafter referred to NPC, Taff 1997). The catalogue contains 4272 stars north of 80° declination. The mean epoch of positions is near 1940, external standard uncertainties of positions estimated using comparison with the PPM and ACRS catalogues are about 50 and 160 mas for

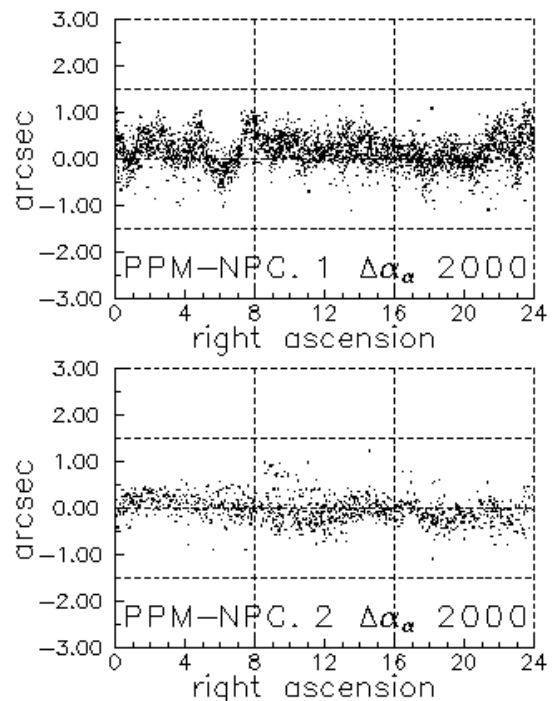


Figure 1. Individual PPM-NPC $\Delta\alpha_\alpha$ differences for NPC star subset 1 (declination range from 80 to 85°), and for the rest of NPC stars (subset 2, declination range from 85 to 90°) computed for the epoch of 2000. Near-two-hours oscillations are clearly seen in the case of first subset, especially in 0 - 8^h right ascension range.

the epoch of 1940 and 2000, respectively. Averaged external standard error for proper motions was estimated to be 1.6 mas/yr.

A comparison of the NPC with the PPM, ACRS, and FK5 revealed several specific peculiarities of the system of modern catalogues in area under consideration. For example, unusual oscillations of coordinate differences depending on right ascension, period near two hours, were registered (see Figure 1). The reason of these peculiarities is, probably, a plate-structure of

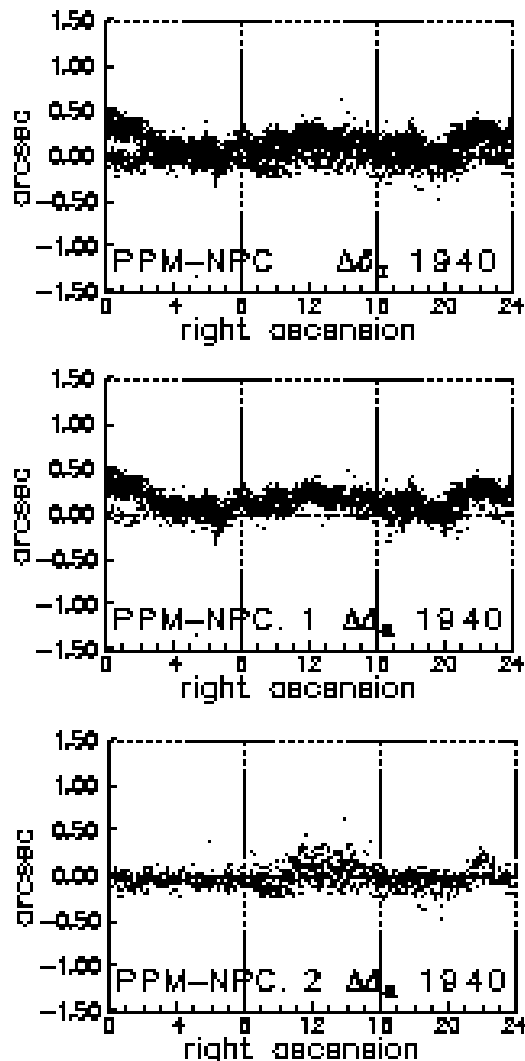


Figure 2. Individual $\Delta\delta_\alpha$ differences PPM-NPC for all the NPC stars, that for subset 1 of NPC stars (declination range from 80 to 85°), and for the rest of NPC stars (declination range from 85 to 90°) computed for the mean epoch of the NPC, 1940. Splitting into two subsets is clearly visible in the upper picture, which is a superposition of middle and lower ones substantially differing from each other.

the AGK2/AGK3 systematics. In Figure 2 one can see some splitting of the star ensemble into two subsets with respect to declination differences, computed for the mean NPC epoch, depending on right ascension. The map of differences between catalogues (see Figure 3) demonstrates that a behavior of systematic differences is clearly distinguished in the north area, on the one hand, and in area 80 - 85° declination, on the other hand.

Unfortunately, the high level of correlation mentioned above did not allow us to remove on appropriate level of accuracy the systematic distortions which, is believed, were accumulated during many decades of observations, did not allowed us to formulate the

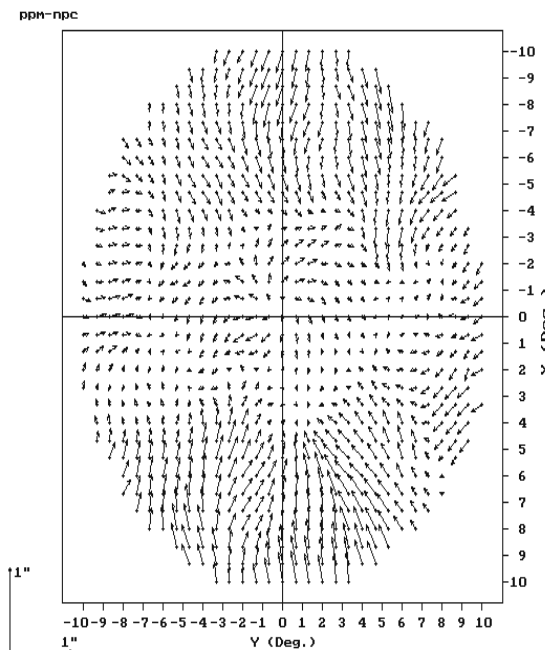


Figure 3. Map of the PPM-NPC systematic differences, computed for the mean NPC epoch, near 1940, in rectangular coordinates (as is seen from North Pole). The averaging was carried out using a circle with the radius of one degree. Scale of one arcsec is shown in the lower left corner of the map. Regularities and central symmetry are clearly visible in the differences. Behavior of systematic differences is seen to differ for the north area, on the one hand, and area of 80 - 85° declination, on the other hand.

reliable conclusion about the reason of deformations coordinate system in this area.

To clarify the problem discussed, new independent data are required. The use of the Hipparcos and Tycho catalogues data, is believed to provide a final resolving of this tangled problem.

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