

**IMPROVEMENT OF ACCURACY OF  
PROPER MOTIONS OF HIPPARCOS CATALOGUE  
STARS USING OPTICAL LATITUDE OBSERVATIONS**

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**Abstract.** Commission 19 (Earth Rotation) of the International Astronomical Union (IAU) established the Working Group on Earth Rotation in the Hipparcos Reference Frame (WG ERHRF) in 1995 to collect the optical observations of latitude and universal time variations, made during 1899.7 – 1992.0 in line with the Earth orientation programmes (to derive Earth Orientation Parameters – EOP), with Dr. Jan Vondrák (Astronomical Institute of Academy of Sciences of the Czech Republic, Prague) as the head of WG ERHRF. We participated in this international project using Belgrade Visual Zenith – Telescope (BLZ) latitude data for the period 1949.0 – 1986.0, after a new reduction of BLZ data made in my MSc thesis, finished in 1997 at the Faculty of Mathematics of University of Belgrade. Dr. Vondrák collected 4.4 million optical observations of latitude/universal time variations made at 33 observatories. The data were used for the EOP investigations, Hipparcos satellite Catalogue – radio sources connection, etc.

Nowadays, it is customary to correct the positions and proper motions of stars of Hipparcos Catalogue (as an optical reference frame) using ground – based observations of some Hipparcos stars. In this PhD thesis we use the latitude observations made with several types of classical astrometric instruments: visual (ZT) and floating zenith – telescope (FZT), visual zenith tube (VZT) and photographic zenith tube (PZT); 26 different instruments located at many observatories all over the world (used in the programs of monitoring the Earth orientation during the 20th century). We received the data from Dr. Vondrák via private communication. The observatories and instruments are: International Latitude Service – ILS (Carloforte – CA ZT, Cincinnati – CI ZT, Gaithersburg – GT ZT, Kitab – KZ ZT, Mizusawa – MZZ ZT, Tschardjui – TS ZT and Ukiah – UK ZT), Belgrade (BLZ ZT), Blagoveschtschensk (BK ZT), Irkutsk (IRZ ZT), Poltava (POL ZT), Pulkovo (PU and PUZ ZT), Varsovie (VJZ ZT), Mizusawa (MZL FZT), Tuorla – Turku (TT VZT), Mizusawa (MZP and MZQ PZT), Mount Stromlo (MS PZT), Ondřejov (OJP PZT), Punta Indio (PIP PZT), Richmond (RCP and RCQ PZT) and Washington (WA, W and WGQ PZT).

The task is to improve the proper motions in declination of the observed Hipparcos stars. The original method was developed, and it consists of removing from the instantaneous observed latitudes all known effects (polar motion and some local instrumental errors). The corrected latitudes are then used to calculate the corrections of the Hipparcos proper motions in declination (Damljanović 2005). The Least Squares Method (LSM) is used with the linear model.

We compared the calculated results with ARIHIP and EOC-2 data, and found a good agreement. The newly obtained values of proper motions in declination are substantially more precise than those of the Hipparcos Catalogue. It is because the time interval covered by the latitude observations (tens of years) is much longer than the Hipparcos one (less

than four years), and because of the great number of observations made during this interval (Damljanović et al. 2006).

Our method is completely different from the one used to compute the EOC-2 catalogue (Vondrák 2004). It was also an almost independent check of the proper motions of EOC-2. The catalogue EOC-2 is used in this thesis to distinguish the corrections of the two stars of a pair observed by using the Horrebow – Talcott method. The difference between the two proper motions is constrained by the difference in the EOC-2 and Hipparcos catalogues (Damljanović and Pejović 2006). The main result of the thesis is the catalogue of proper motions in declination of 2347 Hipparcos stars.

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