THREE CAMPAIGNS OF SOLAR OBSERVATIONS WITH AN ASTROLABE AT SIMEIZ

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Positional observations of the Sun have become, in recent years, one of the most important contribution of astrolabes to fundamental astrometry. After pioneer observations at CERGA and Sao Paulo, both in 1974, other astrolabes have been adapted for observations of the Sun in Paris (now at Malatya, Turkey), Santiago de Chile (Chollet & Noël 1993) and San-Fernando (Sánchez et al. 1993,1995). First experimental campaign of solar observations with an astrolabe installed at Simeiz Observatory (Crimea, Ukraine) has been undertaken in 1986 (Kolesnik 1987). After some instrumental improvements, observations covering about 2.5-3 months were continued in 1987, 1990, 1991. The results are reported here.

Classical Danjon astrolabe OPL-23 equipped with an equilateral 60° transparent glass prism has been adapted for observations of the Sun. An attenuating 20 mm thick chrome coated quartz filter was mounted at the capote of the astrolabe. The angle of the equilateral prism was monitored by autocollimation with an uncertainty of about 0.06″. The classical technique of observations and reduction first developed in CERGA (Chollet & Laclare 1977) has been applied. Corrections to adopted mean longitude and latitude of an astrolabe linking observations of the Sun to a reference catalogue were derived from night-time observations of stars. Actually, all reductions have been performed in the IAU 1976,1980 system of constants with the FK5 as a reference catalogue and DE200 as an ephemeris of comparison.

The latitude of Simeiz (44° 24′ 12″) allows only 3-month campaigns of solar observations each year from May to beginning of the August. Statistical summary of 3 campaigns in 1987, 1990, 1991 is given in Table 1.

Comparison of the random and systematic accuracy of Simeiz observations in right ascension with 10 meridian instruments has been made by Kolesnik (1995). Here, using the same method, they are compared with the respective accuracies of other active astrolabes in this field, at CERGA,

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TABLE 1. Number of observations (NO) and the mean standard errors of unknowns $\Delta\alpha, Y$ and Δd for the three campaigns of solar observations with the Simeiz astrolabe

Year	NO	$\sigma(\Delta\alpha)$	$\sigma(Y)$	$\sigma(\Delta d)$
1987	19	0.043^s	$0.32''$	$0.34''$
1990	31	0.039^s	$0.30''$	$0.30''$
1991	20	0.026^s	$0.19''$	$0.19''$

TABLE 2. Internal ε_i^2 and external ε_e^2 standard deviations of solar observations in right ascension made with Simeiz, CERGA, San-Fernando and Santiago astrolabes

Instrument	NO	Years	ε_e^2	ε_i^2	$\varepsilon_i^2/\varepsilon_e^2$
San-Fernando	61	91.3-92.7	0.056^s	0.048^s	0.74
Santiago	155	90.3-93.0	0.051^s	0.046^s	0.81
CERGA	687	76.3-89.0	0.041^s	0.040^s	0.97
Simeiz	69	87.5-91.6	0.042^s	0.040^s	0.89

San-Fernando and Santiago (see Table 2). Ratio $\varepsilon_i^2/\varepsilon_e^2$ gives an idea of the systematic deviation of the a series with respect to the mean instrumental system formed with 15 meridian and astrolabe series.

As follows from table 3, random accuracy of all astrolabe observations is around $0.040^s - 0.050^s$. This is comparable with errors of the best transit circles (see Kolesnik 1995). It may also be concluded that the random and systematic accuracy achieved by the Simeiz astrolabe is comparable with that provided by the best optical instruments which observe now the Sun.

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