SEARCH OF TRACES OF GEOPHYSICAL PHENOMENA IN SERIES OF LATITUDE DETERMINATIONS ON PRISMATIC ASTROLABE IN POLTAVA

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ABSTRACT. The influences of some geophysical phenomena on the long-term observation results which are obtained in Poltava with prismatic astolabe, are have been studied. It is established: 1) the non-polar variations of latitude reveals global cycles, typical for uniform system the Ears - the ocean - the atmosphere; 2) the correlation degree between non-polar zenith shifts and Solar activity index in media-term region (6-12 years) of spectrum is very high.

Key words: Astrometry: Earth orientation parameters(EOP), Chandler wobble, non-polar variations of coordinates; geophysics: the Earth- the atmosphere- the ocean oscillations, Solar activity index (SAI).

1. Introduction

Astronomical observations of point coordinate changes were conducted with the purpose of determination of the EOP. The results of these observations have been influenced by many factors, geophysical ones in particular, that become apparent in non-polar components of coordinates variations. In the preceding period the non-polar variations were considered as interferences in the study of EOP. After the scientific and technological breakthroughs that substantially improved accuracy of EOP, the geophysical influences themselves became the object of researches (Gorshkov *et al.*, 2005; Chapanov, 2005; Hui hu *et al.*, 1989).

45-year series of observations on prismatic astrolabe on coordinate variations have been accumulated in Poltava observatory. The astrolabe observations give an accurate account of movement of the observatory zenith. Data collection and processing automatization allowed to improve the theory of instrument that was taken into account in the process of series revisions (Khalyavina, 1999; Khalyavina, Kislitsa, Borisyuk *et al.*, 2001; Khalyavina, 2005). The astrolabe observation sets is reprocessed in reference to the ICRS catalogues (HC, ARIHIP, Tycho-2) and with use of the IAU2000 precession-nutation model (D.McCarthy, N.Capitane, 2002).

2. Series analysis.

Analysis of latitude series of astrolabe observations on basis of additive-multiplicative model of the process has been conducted (Zalivadnyi *et al.*, 2005). The proposed algorithm allows to determine parameters of the components of the series under study more precisely as compared to the traditional analysis methods. Effectiveness of this method is confirmed by the resulted assessment of the parameters of the polar components of latitude series of Poltava astrolabe. The following values of component periods (T) and amplitudes (A) have been received: Chandler term: T=$432.13^d \pm 0.26$ (days) and A=$0.136'' \pm 0.005$; annual: T=$365.06^d \pm 0.19$ and A=$0.086'' \pm 0.004$. These results are in good agreement with the characteristics of polar oscillations, received as the result of analysis of many series (Vicente, Wilson, 1997).

The significant cyclicity with periods of 14.00; 7.00; 4.67; 3.23; 2.80; 2.33; 2.00; 1.83 years have been revealed as the result of analysis. It should be noted that some of the cyclicities are multiple of Chandler term $T_C \approx 1.18$y. Thus $6 \times T_C \approx 7.00$; $4 \times T_C \approx 4.67$; $2 \times T_C \approx 2.33$ years, i.e. they are sub-harmonics of Chandler term. Existence of such periodicals in series that determine global meteorological conditions and their connection with polar motion are specified in Sidorenkovs works (Sidorenkov, 2002). In the authors opinion, existence of such sub-harmonics is an evidence of close connection of processes in the atmosphere and in the ocean and luni-solar nutation and Earths polar motion. The cyclicities close to 2 years are probably related to quasi-biennial variations appearing in many processes on the Sun and the Earth. They are discovered in heliomagnetic activity indexes, in changes of terrestrial and solar magnetic fields, in low-latitude stratospheric wind, in Earths rotational velocity, and it is determined that quasi-biennial variations on the Sun and the Earth are interrelated (Ivanov-Kholodnyi, Chertoprud, 2005).

Therefore there is quite real significanc
harmonics discovered in the series of non-pola
nents. These harmonics may reflect long-run
in the atmosphere caused by the mentioned
It is the custom to call the Sun the most i
influence on atmospheric processes.

3. Influence of solar activity

Influence of solar activity on results of diffe
physical observations, including astronomical
been the subject of intensive study for m
half a century. The references about the r
are given, for example, in (Turenko, 1992).
ries comparison the series of average monthl
of solar activity(SAI) were used (RI - Wolf
($ftp : //ftp.ngdc.noaa.gov/STP/SOLAR -$
$SUNSPOOT - NUMBERS$). It was found
components with periods: 7.0; 5.25; 3.23; 2
years are revealed for the series under consi
The components with the same periods or clos
are revealed in the latitude series as well.

Study of slow variations of non-polar
components (T≥6 years) and medium-term v
SAI (T≥11 years) points to their statistical
nection. The changes of meridional comp
that are in anti-phase to the mentioned v

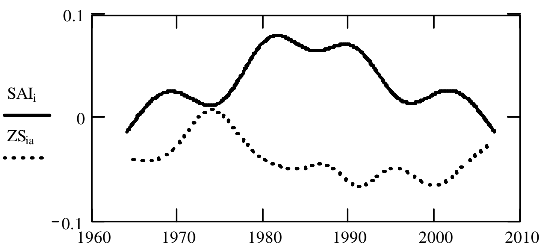

Figure 1: Long-period modulation of SAI
non-polar latitude variations.

The similar comparison of non-polar vari
longitude direction (WS) and modulations F
period of 1988-2006 points to synchronism
changes (Fig.2). (The cause of reduced size
series is inaccuracy of assessment of instrumental errors in longitude before 1988). After excluding of linear trends on the given segments SAI and WS correlation coefficient of the mentioned components reaches +0.91.

The findings should be considered as exploration ones. They should be thoroughly checked and substantiation of specific mechanism of influence of solar

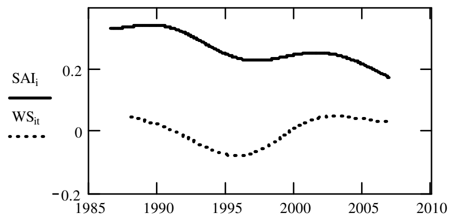

Figure 2: Long-period modulation of SAI and slow non-polar longitude variations.

activity on atmosphere parameters should be given. Perhaps use of SAI, as the one of main parameters, will allow to develop a real model of accounting of long-term atmospheric influences on astrometrical observations.

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