RECENT RESULTS OF THE ANALYSIS DORIS DATA AT THE INSTITUTE OF ASTRONOMY, RAS

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Abstract. *This paper presents results of the global DORIS network processing, carried out at the INASAN Analysis Center by the use of measurement data from all "old" satellites having onboard DORIS receivers (SPOT2 + SPOT4 + TOPEX/POSEIDON) for the time period April, 1999 - June, 2002. Data analysis was performed with the use of GIPSY/OASIS software. Time series of weekly station coordinates in the ITRF2000 system and geocenter variations are discussed. The free-network approach for a simultaneous estimation of orbital parameters, station coordinates and Earth's orientation parameters was applied.*

More detailed description of the methods used at the INASAN Analysis Center for DORIS data processing has been described in our previous work [Kuzin S.P. and S.K.Tatevian, 2000]. The station coordinates are estimated on daily basis using all "old" satellites (SPOT2, SPOT4, TOPEX). In addition to station coordinates, we estimate simultaneously the orbital parameters and several other parameters (EOP, tropospheric corrections, clock drifts offsets) with a free-network approach and weakly constraining the apriori station coordinates to a 100 meters sigma. Then daily solutions are combined into weekly solutions, projected (removing an indetermination due to loosely definition of the terrestrial reference frame) and transformed to a well defined reference frame using 7 parameters of Helmert transformation. The results of the transformation operation provide simultaneously the coordinates (and full-covariance matrix) and also the estimated 7 parameters of the transformation. Three translations parameters and scale factor are more significant as compared with 3 rotational ones as they can provide information on possible physical variations of the geocenter due to different seasonal mass redistribution in the Earth system and due to unstability of the unit of the length that is usually biased by unmodelled effects (ionospheric correction).

We recomputered Doris data from all operating stations of the DORIS network for the period 11.04.1999 - 01.06.2002 (3 years 2 months, 164 weeks). The data for the satellites having manoeuvres during the processing days were deleted. All weekly solutions were derived in the same reference frame (ITRF2000) with the accuracy depending on a quality of the DORIS solution itself and on the accuracy of the adopted reference system at the epoch of measurements.

Time series of weekly DORIS solutions for the coordinates of all DORIS stations were obtained. As an example time series of weekly DORIS solutions for the coordinates (3 components) of BADARY station, located at the Eurasian plate near Baikal Lake, are plotted in Fig.1-3. Along the y axis the differences between weekly values of coordinates (longitude, latitude and radial) and the values at the mean date of the first processed week (April 14,1999) are shown. In this figure, a significant displacement in

longitude can be seen. There is a small slope of the fitting curve for latitude component, and almost no slope for the radial one. Repeatability of station coordinates are estimated at the level 30 mm and standard deviations 1.5-5.0 cm. It can also be seen that besides systematic drift, there are temporal variations depending on the site location and the type of equipment.

Time series of weekly geocenter variations with respect to ITRF00 are shown at Fig. 4-7 for the same time period as stations coordinates. The data have been analysed through the harmonical analysis in order to determine short and long-periodic signals. A constant term and the trend have been estimated in order to express the time series in a common reference frame. For the annual and semiannual variations of the geocenter the amplitudes and phases (reffered to 1999.0) are presented in the table 1.

Table.1 Annual and semiannual amplitudes and phases of geocenter variations

Component	Annual			Semiannual		
	A, mm	φ, deg	Period, days	A, mm	φ, deg	Period, days
X	6.3	-49.6	377	3.2	215.8	183
Y	6.8	166.0	378	3.2	290.0	181
Z	34.1	85.7	349	18.3	63.8	165

The obtained values are comparable in amplitudes with the results from previous DORIS geocenter analysis [C.Boucher, P.Sillard, 1999]. The phases are different. The greater amplitude for z may be caused by the dominance of seasonal mass redistributions between the northern and southern hemisphere [H. Montag, 1999]. Additionally to the annual and semiannual signals several other periods were found situated in the region of a fortnight and of one to four months. It must be noted that the amplitudes of some short-periodic signals are comparable with the amplitudes of the semiannual signals.

In conclision we would like to underline that our investigations will be continued for the analysis of more longer time series of stations coordinates and geocenter variations.

References:

S.P.Kuzin, S.K.Tatevian "DORIS data analysis at the Institute of Astronomy, RAS", Proceedings of "DORIS DAYS", 1-3 may, 2000, Toulouse, France.

C.Boucher, P.Sillard "Synthesis of submitted geocenter time series", IERS Technical Note 25, IERS Analysis Campaign to Investigate Motions of the Geocenter J.Ray (Ed.), April 1999.

H.Montag "Geocenter motions derived by different satellite methods", IERS Technical Note 25, IERS Analysis Campaign to Investigate Motions of the Geocenter J.Ray (Ed.), April 1999.

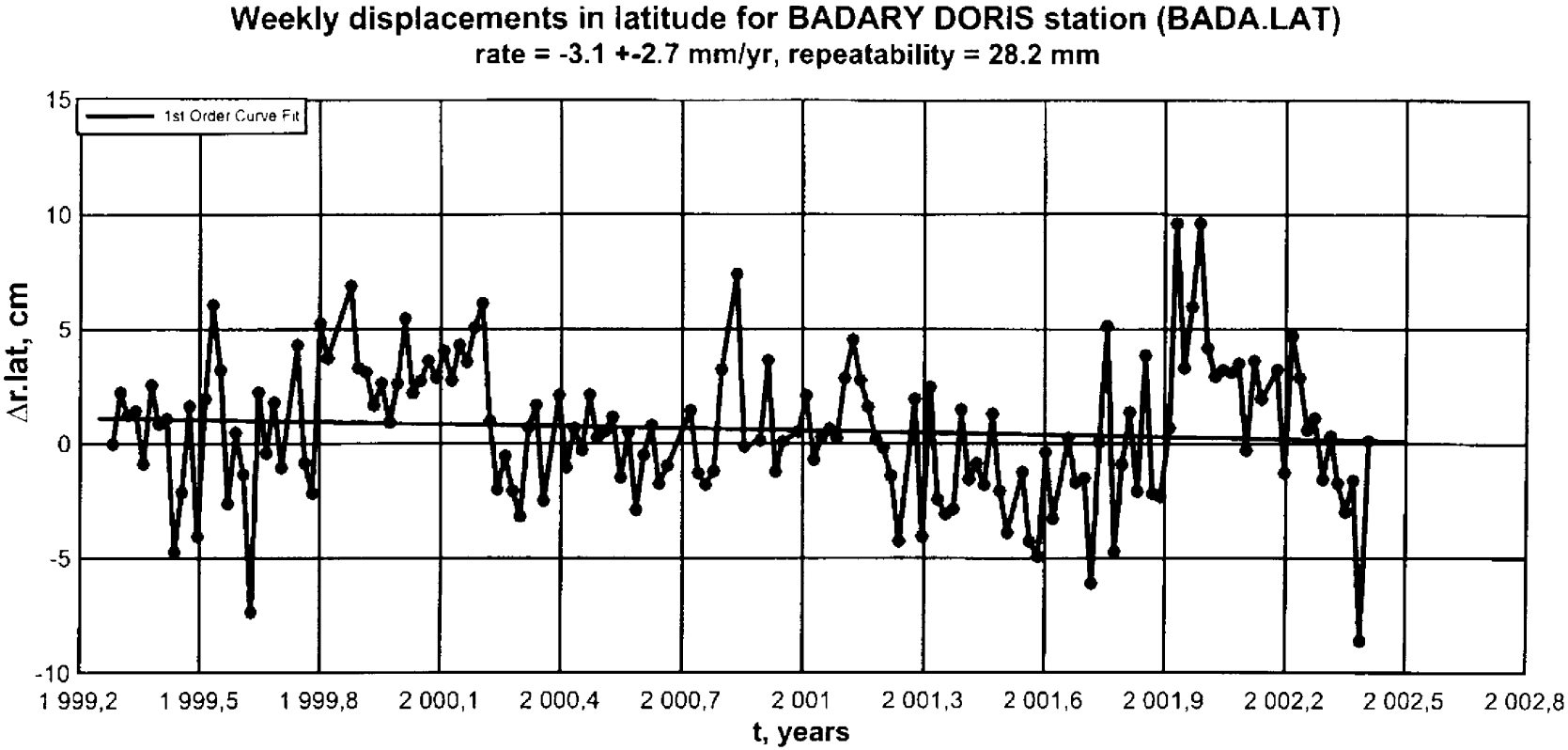
Weekly displacements in latitude for BADARY DORIS station (BADA.LAT)
rate = -3.1 +-2.7 mm/yr, repeatability = 28.2 mm
1st Order Curve Fit
15
10
5
0
-5
-10
Δr.lat, cm
1 999,2
1 999,5
1 999,8
2 000,1
2 000,4
2 000,7
2 001
2 001,3
2 001,6
2 001,9
2 002,2
2 002,5
2 002,8
t, years

Fig.1

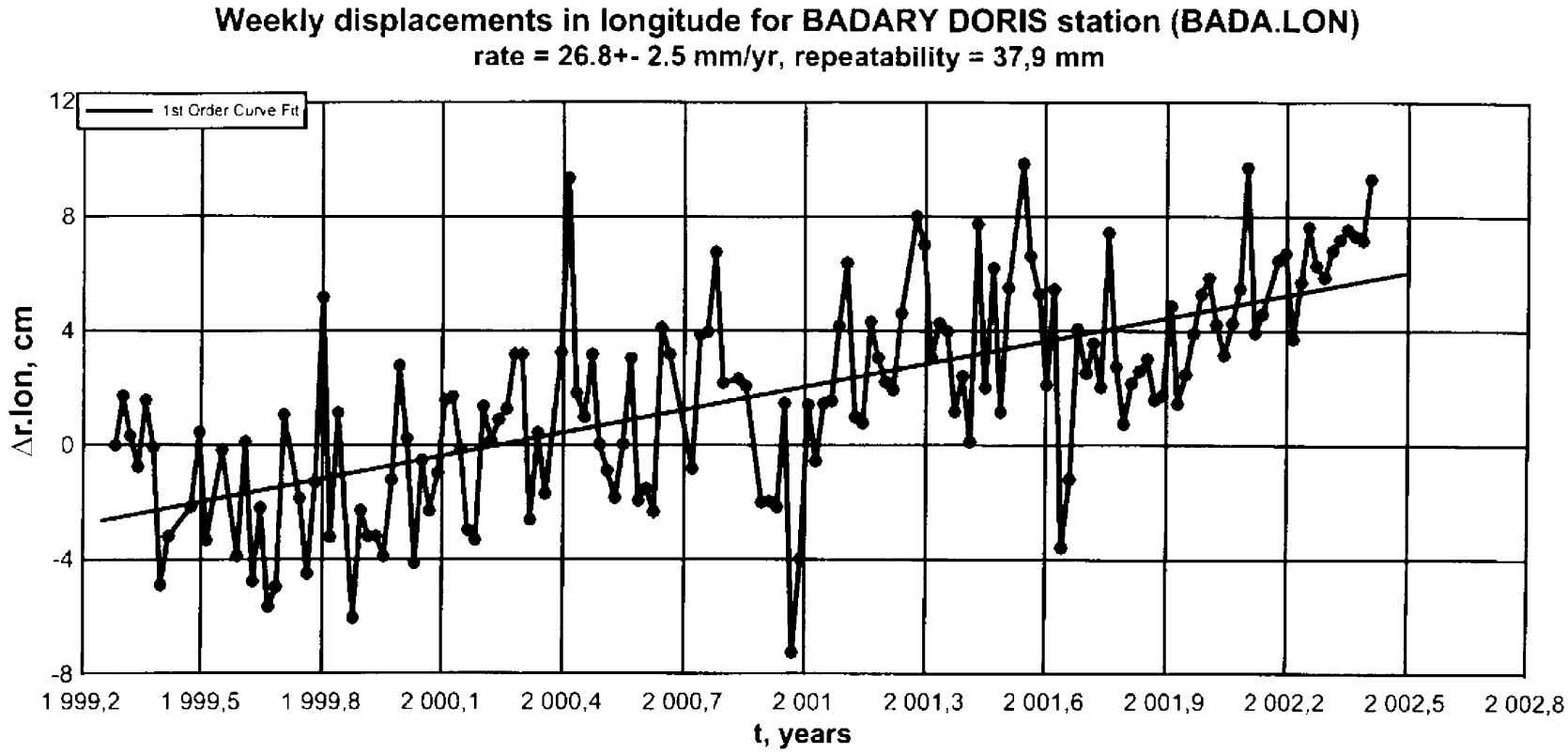
Weekly displacements in longitude for BADARY DORIS station (BADA.LON)
rate = 26.8+- 2.5 mm/yr, repeatability = 37,9 mm
1st Order Curve Fit
12
8
4
0
-4
-8
Δr.lon, cm
1 999,2
1 999,5
1 999,8
2 000,1
2 000,4
2 000,7
2 001
2 001,3
2 001,6
2 001,9
2 002,2
2 002,5
2 002,8
t, years

Fig.2

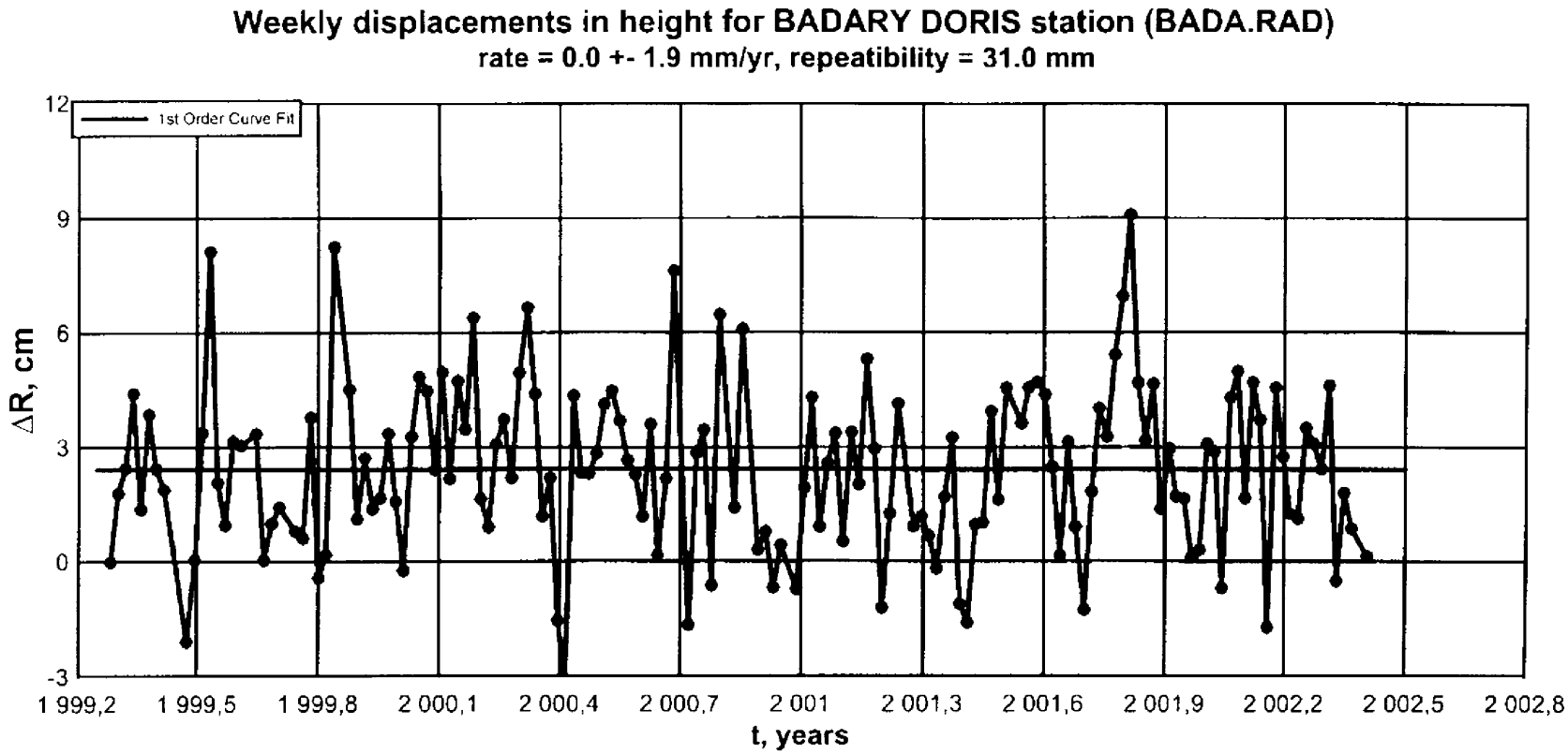
Weekly displacements in height for BADARY DORIS station (BADA.RAD)
rate = 0.0 +- 1.9 mm/yr, repeatibility = 31.0 mm
1st Order Curve Fit
12
9
6
3
0
-3
ΔR, cm
1 999,2
1 999,5
1 999,8
2 000,1
2 000,4
2 000,7
2 001
2 001,3
2 001,6
2 001,9
2 002,2
2 002,5
2 002,8
t, years

Fig.3

DORIS weekly geocenter variations (TX component) compared to ITRF00 with superimposed annual, semiannual and annual+semiannual curves

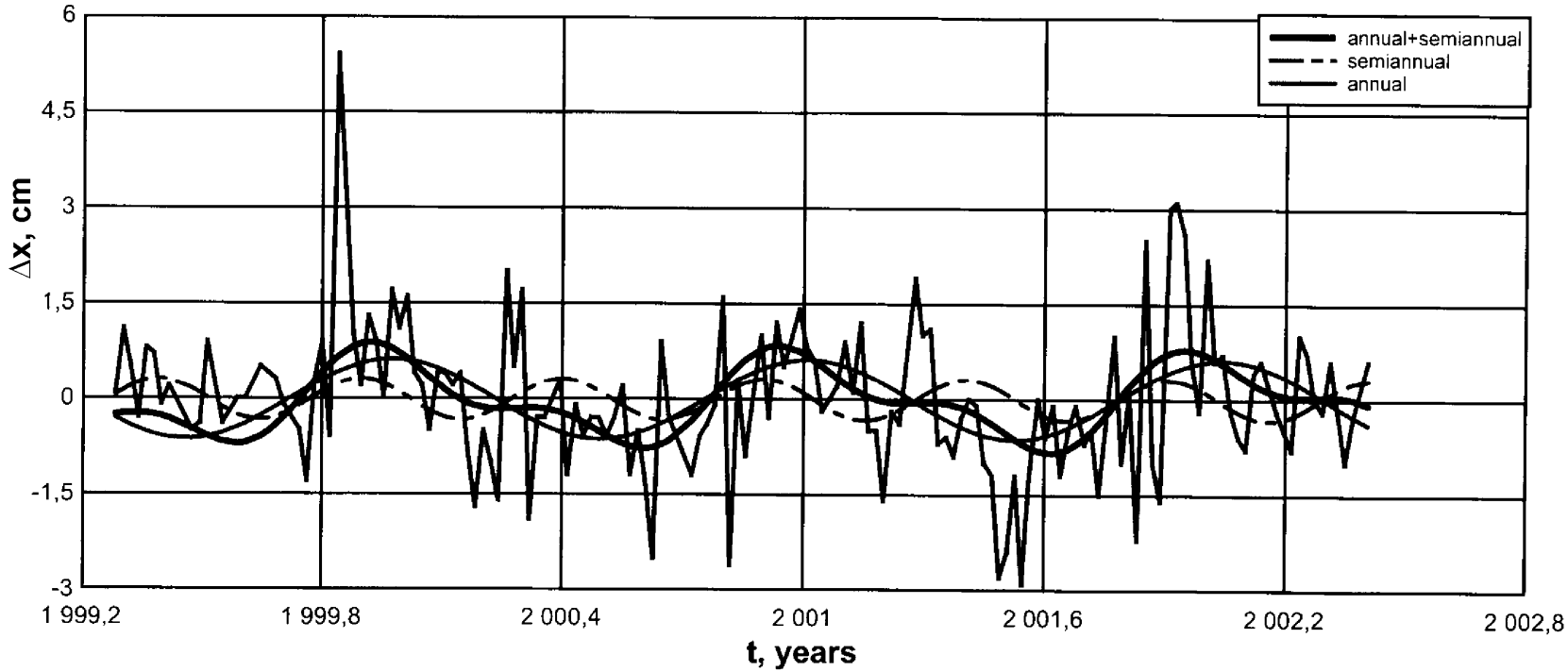

Fig.4

DORIS weekly geocenter variations (TY component) compared to ITRF00 with superimposed annual, semiannual and annual+semiannual curves

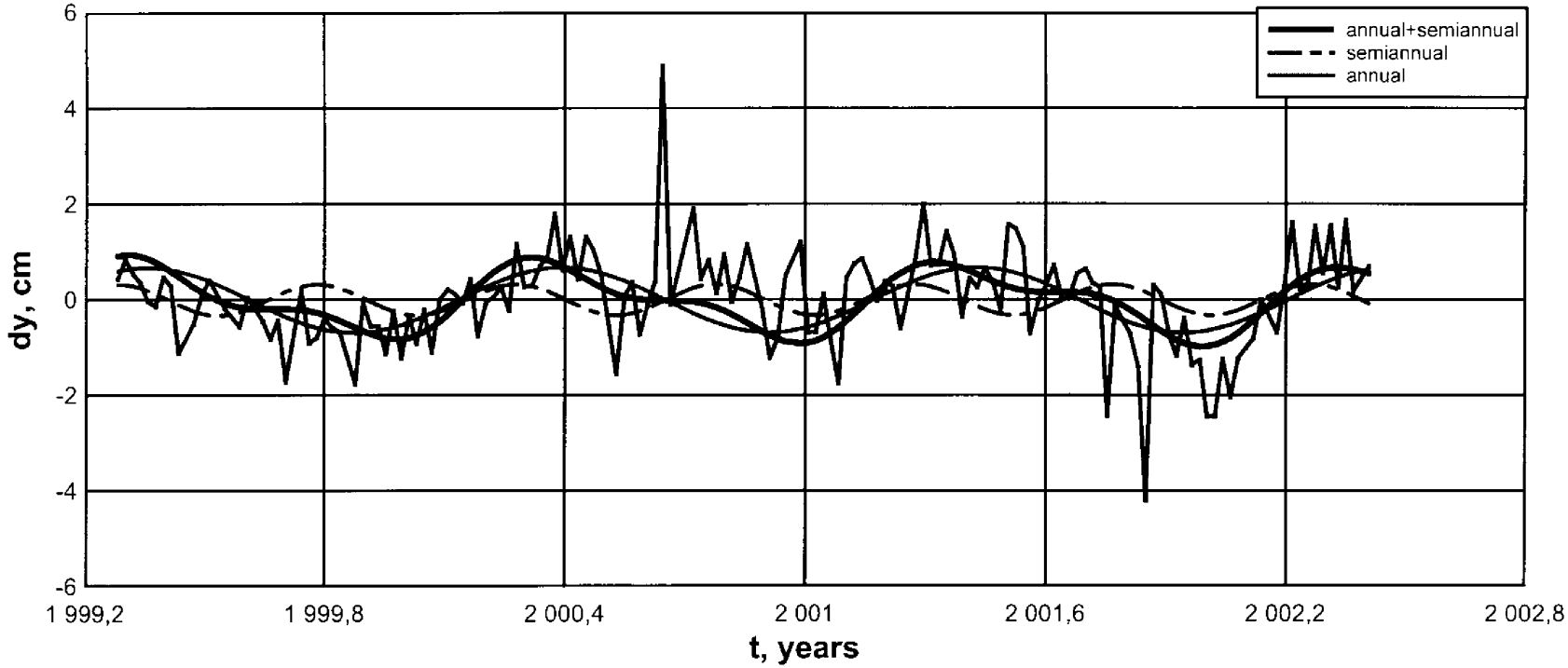

Fig.5

DORIS weekly geocenter variations (TZ component) compared to ITRF00 with superimposed annual, semiannual and annual+semiannual curves

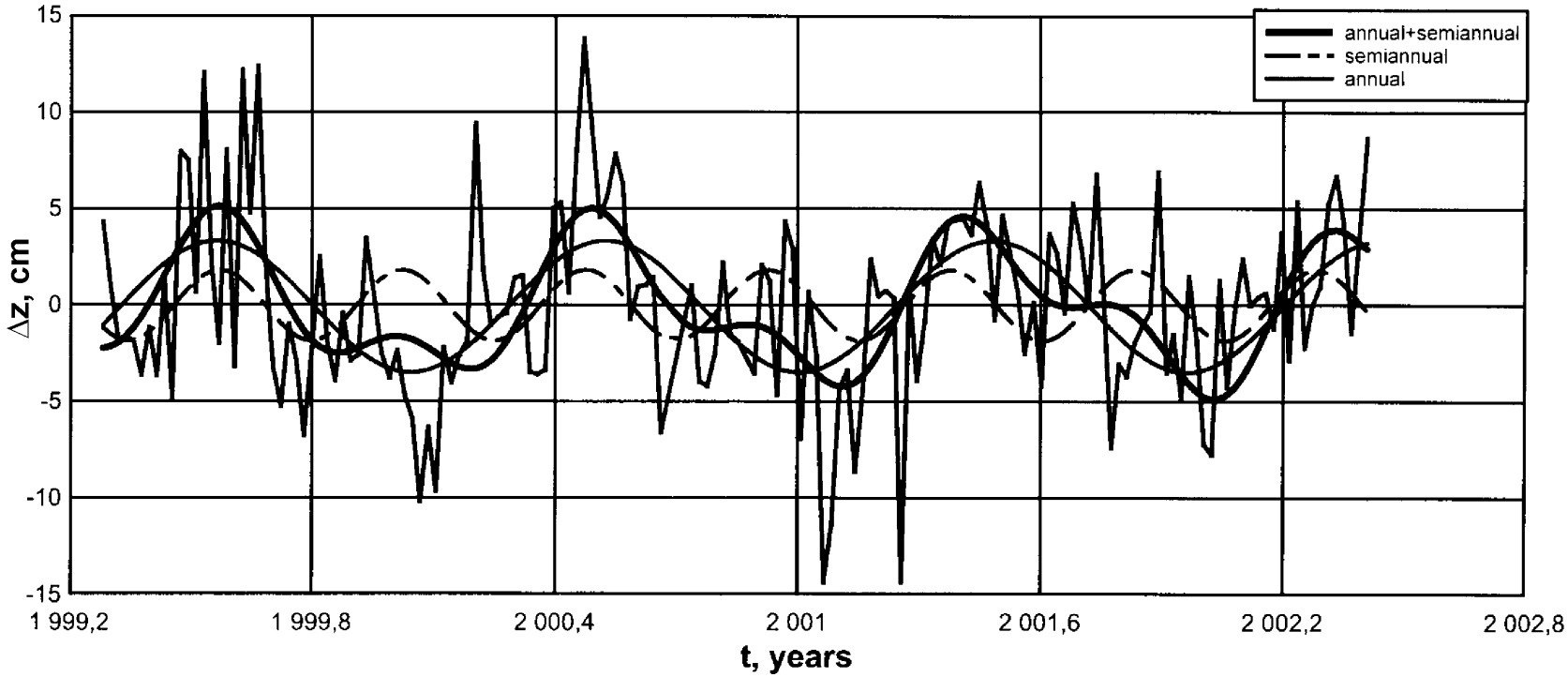

Fig.6

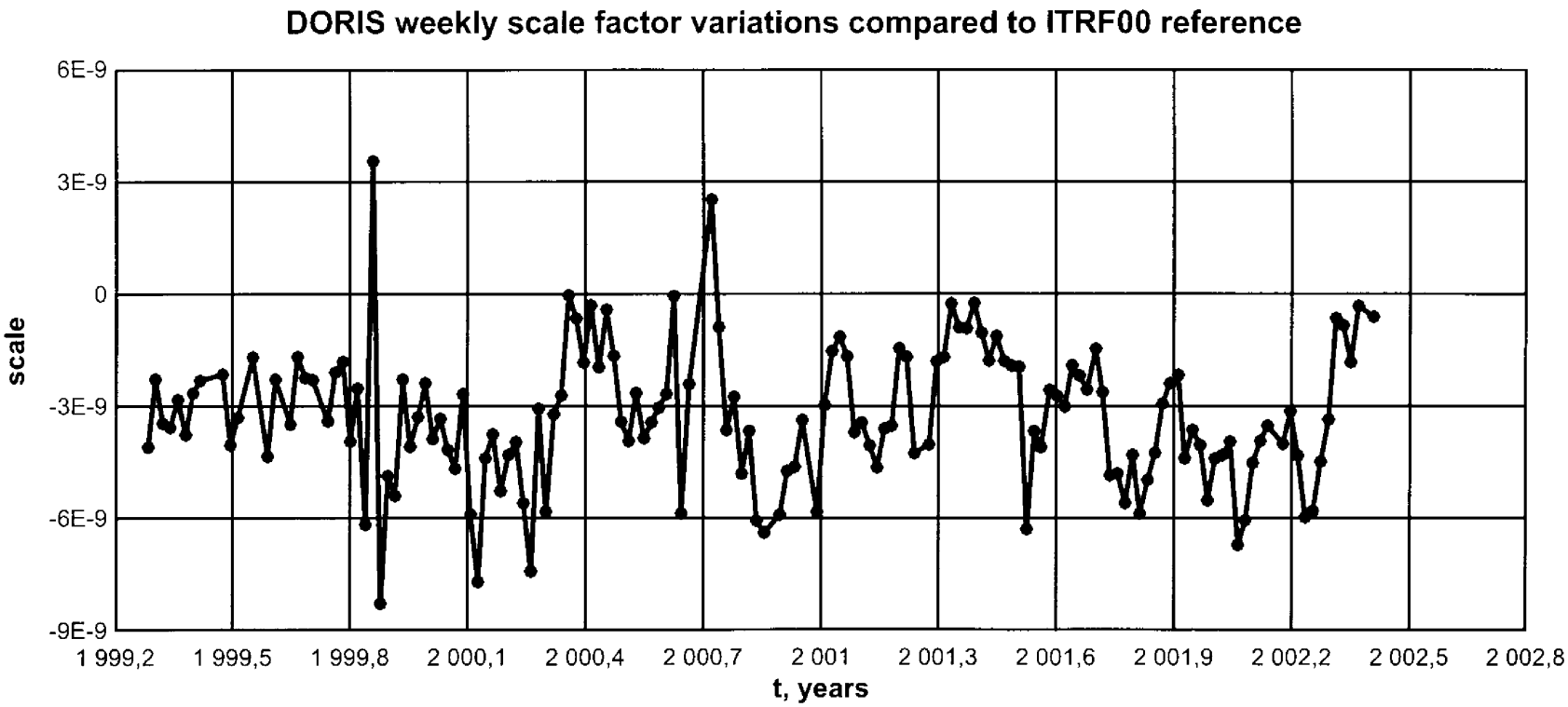
DORIS weekly scale factor variations compared to ITRF00 reference
6E-9
3E-9
0
-3E-9
-6E-9
-9E-9
scale
1 999,2
1 999,5
1 999,8
2 000,1
2 000,4
2 000,7
2 001
2 001,3
2 001,6
2 001,9
2 002,2
2 002,5
2 002,8
t, years

Fig.7