

PRELIMINARY RESULTS OF ORBIT ESTIMATIONS FOR GRACE-A AND GRACE-B



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GRACE




Mission GRACE (the Gravity Recovery And Climate Experiment) is a joint US/German satellite mission. The GRACE mission have two identical spacecrafts flying about 220km apart in a polar orbit 500km above the Earth.

GOALS OF THE GRACE MISSION



- **The mapping the Earth gravity field by making accurate measure of the distance between the two satellites using GPS and range rate systems.**
- **The results from this mission will give information about the distribution and flow of mass within the Earth.**
- **Investigation of distance changes GRACE A and GRACE B due to surface and currents in the ocean: runoff and ground water storage on land masses, exchange ice sheets or glaciers and the oceans and variations of mass within the Earth.**

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- **Creation a better profile of the Earth's atmosphere.**
 - **Studies of the global climate changes.**
 - **Satellite laser ranging data will be used for validation of GPS Precision Orbit Determination.**

DYNAMIC MODEL



Gravity field GRIM5S1 (99,99)

Wahr solid earth tides: NASA/NIMA EGM96 ocean tides

Atmospheric drag DTM87

C_D solved for in half-day intervals

C_R direct solar radiation pressure equal to 1.2

Albedo and infrared Earth radiation

Relativistic effects

Acceleration in along-track and cross-track

REFERENCE FRAME



ITRF97 for epoch 1997.0 (model of station coordinates
–fixed)

IERS C04 earth orientation precession according to IAU
1976 (Lieske model)

Nutation according to IAU 1980 (Wahr model)

Pole tide

Ocean loading deformation, atmospheric pressure loading
deformation

COMPUTATION



Cowell 11-order predictor-corrector; step-size 15 sec
The solutions were produced employing the software
combination GEODYN II (Eddy et al., 1990).
It is described by (McCarthy et al., 1993)
Provided by NASA GSFC
Assistance of dr.Dave Rowlands is kindly
acknowledged

OBSERVATIONS



GRACE-A – two arcs 874 normal points
(2002.05.05-2002.05.21)

GRACE-B - two arcs 901 normal points
(2002.05.05-2002.05.21)

normal points provided by CDDIS and EDC,
Marini-Murray model for tropospheric delay
Center –of-mass correction not used,
Station-dependent data weighting

STATIONS AND NORMAL POINTS NUMBERS FOR 7-day arcs FROM May 05 To 19 2002

No	STATIONS		GRACE-A				GRACE-B			
			ARC 1		ARC 2		ARC 1		ARC 2	
			Passes	n.points	Passes	n.points	Passes	n.points	Passes	n.points
1	Simeiz	1873	3	83	0	0	0	0	0	0
2	Riga	1884	4	51	0	0	3	36	0	0
3	Fort Davis	7080	1	2	0	0	0	0	0	0
4	Yarragadee	7090	4	95	3	42	5	92	2	86
5	Greenbelt	7105	2	62	1	18	3	52	0	28
6	Monument Peak	7110	7	136	3	74	2	39	1	81
7	Papeete, Tahiti	7124	0	0	1	7	1	31	1	18
8	Haleakala	7210	0	0	0	0	1	3	1	21
9	Hartebeesthoek	7501	0	0	0	0	0	0	2	57
10	San Fernando	7824	0	0	0	0	0	0	2	124
11	Grasse	7835	1	21	2	38	1	19	2	46
12	Potsdam	7836	1	8	3	36	1	15	2	19
13	Graz	7839	4	73	6	66	4	68	0	0
14	Herstmonceux	7840	2	27	1	19	0	0	2	55
15	Mount Stromlo	7849	0	0	0	0	1	12	0	0
16	Wettzell	8834	0	0	1	16	0	0	0	0
S			29	558	21	316	22	367	15	534

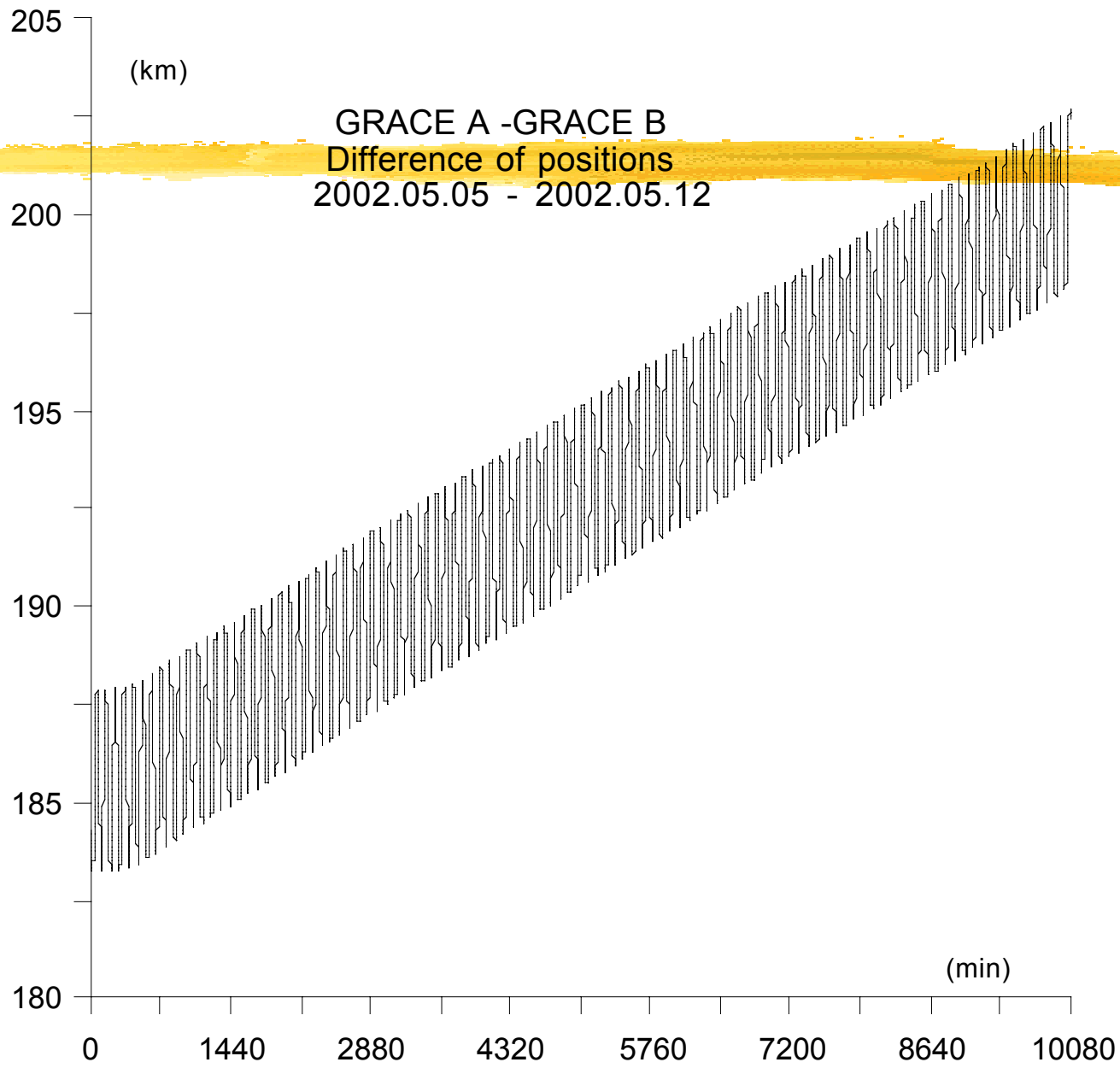
PRELIMINARY RESULTS

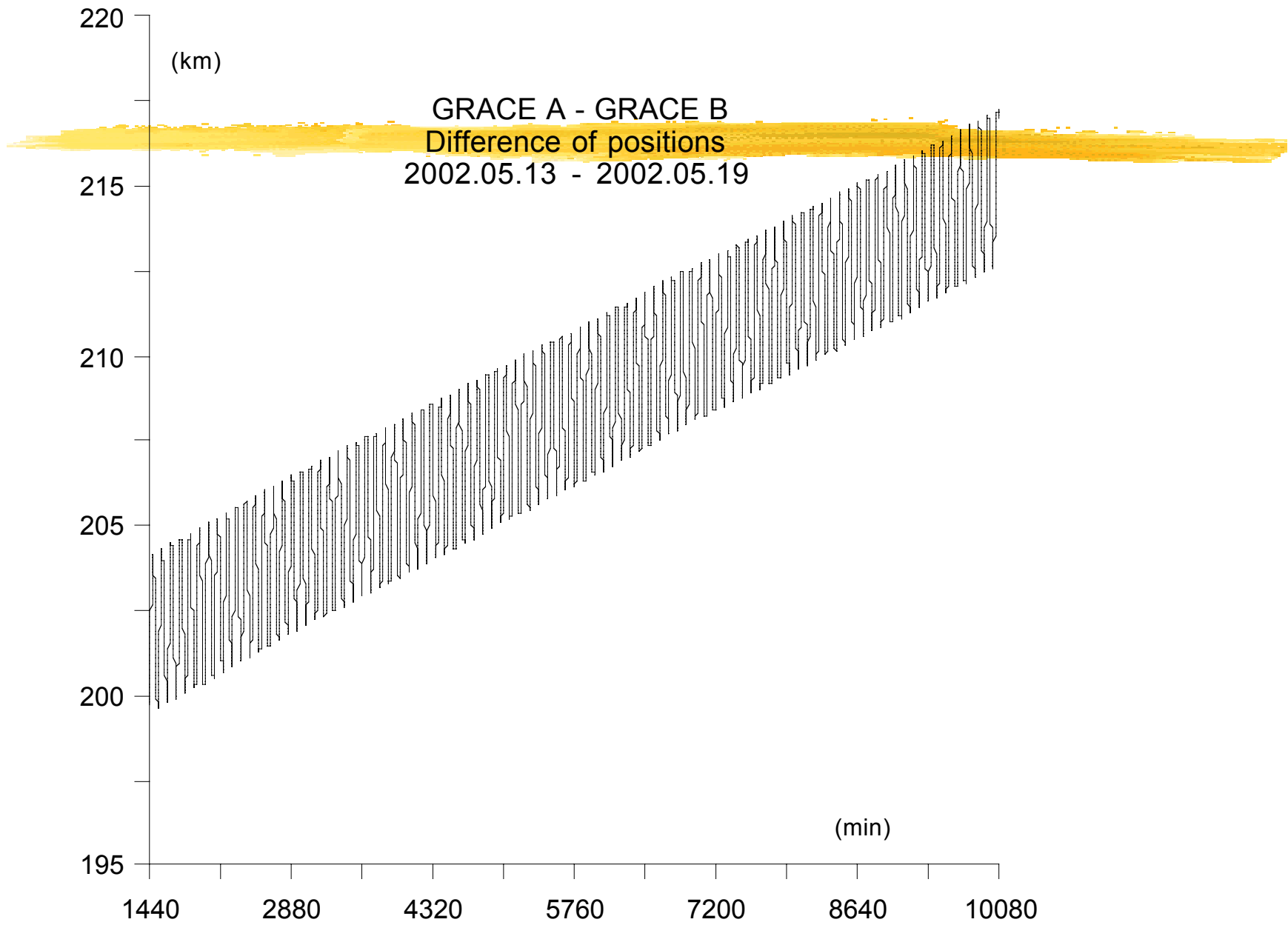
ORBIT ESTIMATION FOR GRACE-A AND GRACE-B

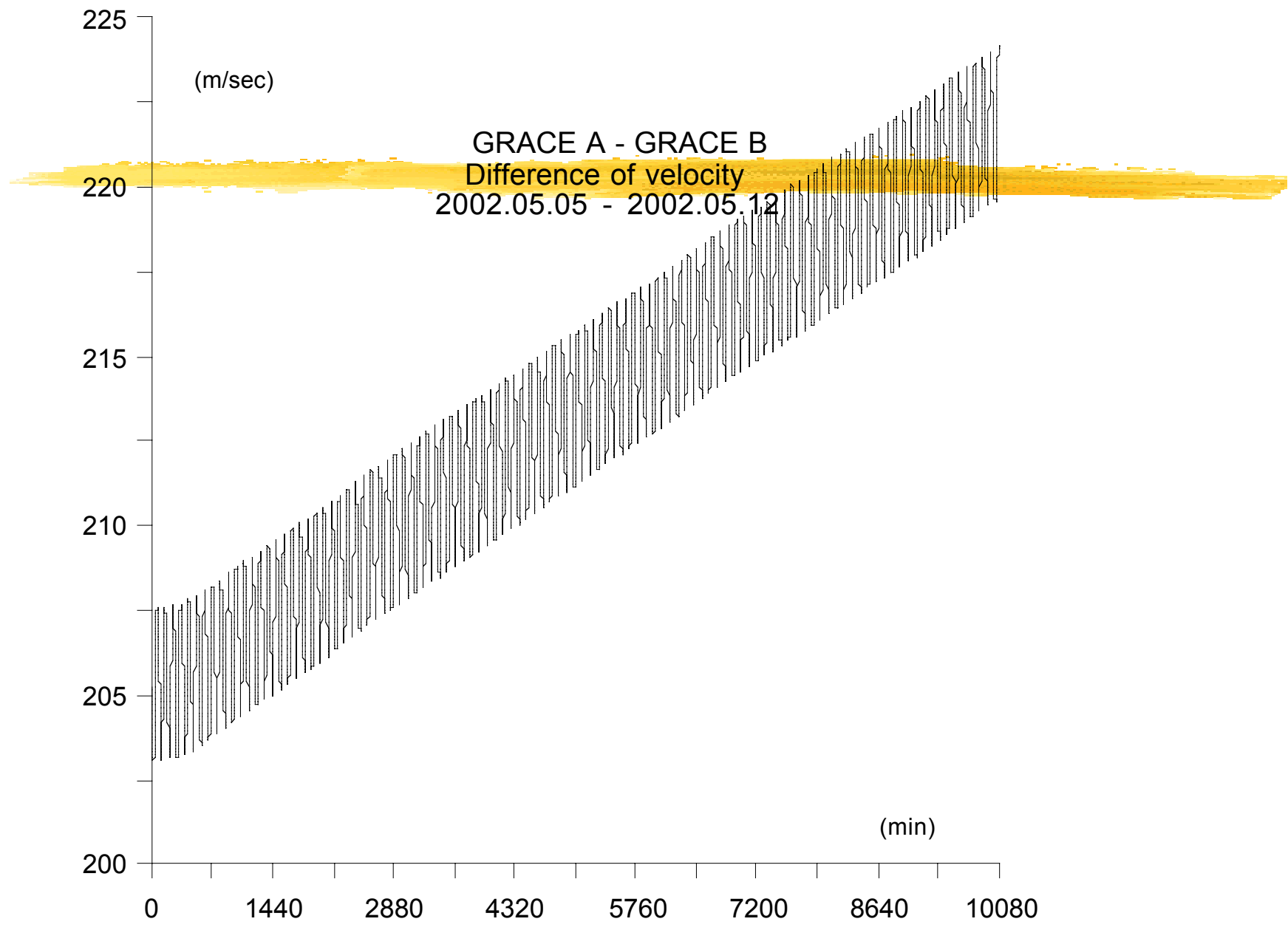
	GRACE A		GRACE B	
ARC	05.5-05.12 2002	05.12-05.20 2002	05.05-05.12 2002	05.12-05.20 2002
Nb. n. Points	558	316	367	534
RMS	2.82 m.	0.80 m.	2.67 m.	1.69 m.
Orbit error	0.93 m.	0.18 m.	3.35 m.	1.55 m.
Orbit elements (estimated)	2002.05.05 0h	2002.05.12 0h	2002.05.05 0h	2002.05.13 12h
<i>a</i>	6867015.114 m.	6866801.936 m.	6876951.292m.	6876425.55m.
<i>e</i>	0.0035208	0.0029971	0.0036746	0.0033511
<i>i</i>	89.02268 deg	89.02000 deg	89.02256 deg	89.02049 deg
Ω	348.11926 deg	347.20248 deg	348.12003 deg	347.00553 deg
\dot{u}	98.45994 deg	90.30218 deg	99.21591 deg	65.20794 deg
M_0	78.09082 deg	315.95435 deg	75.78594 deg	285.96833 deg

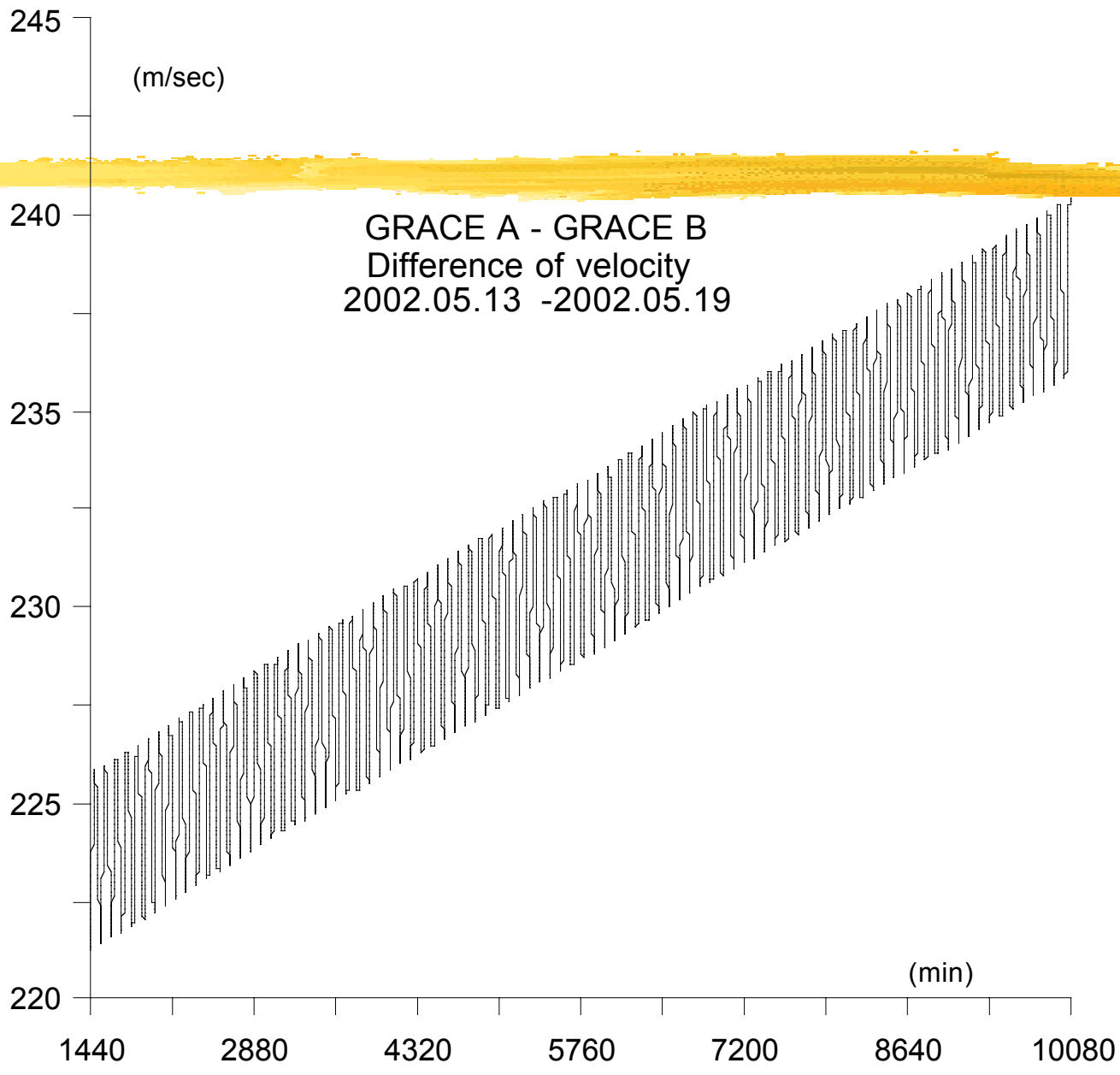


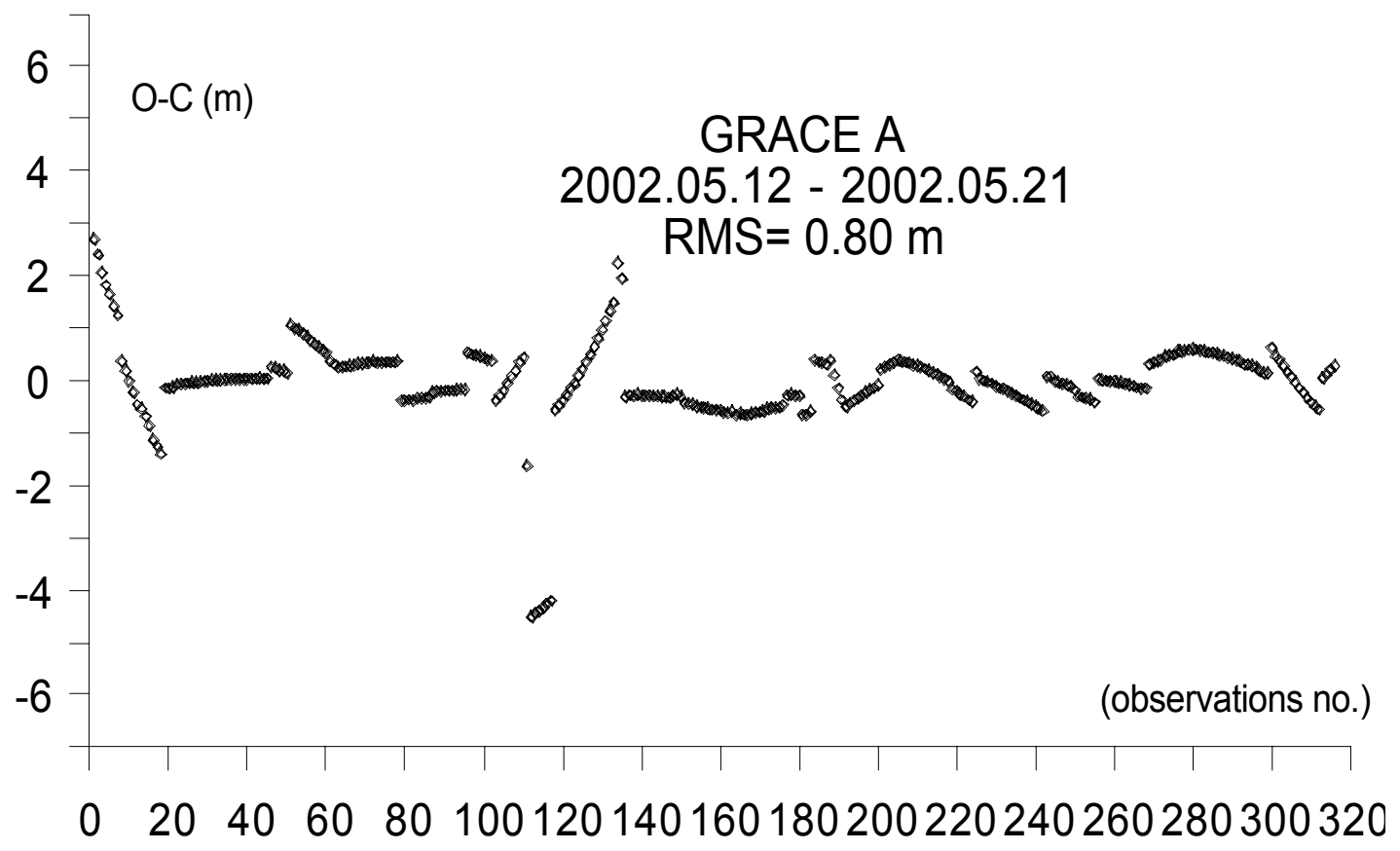
Changes of semi-major axis (a)	-29.6m. /day	-34.1 m/day
Changes of: separation (m.) velocity (m/s)	Systematic trend for week Periodic for one revolution Systematic trend for week Periodic for one revolution	+14420 m 4666 m 17 m/sec 4.5 m/sec

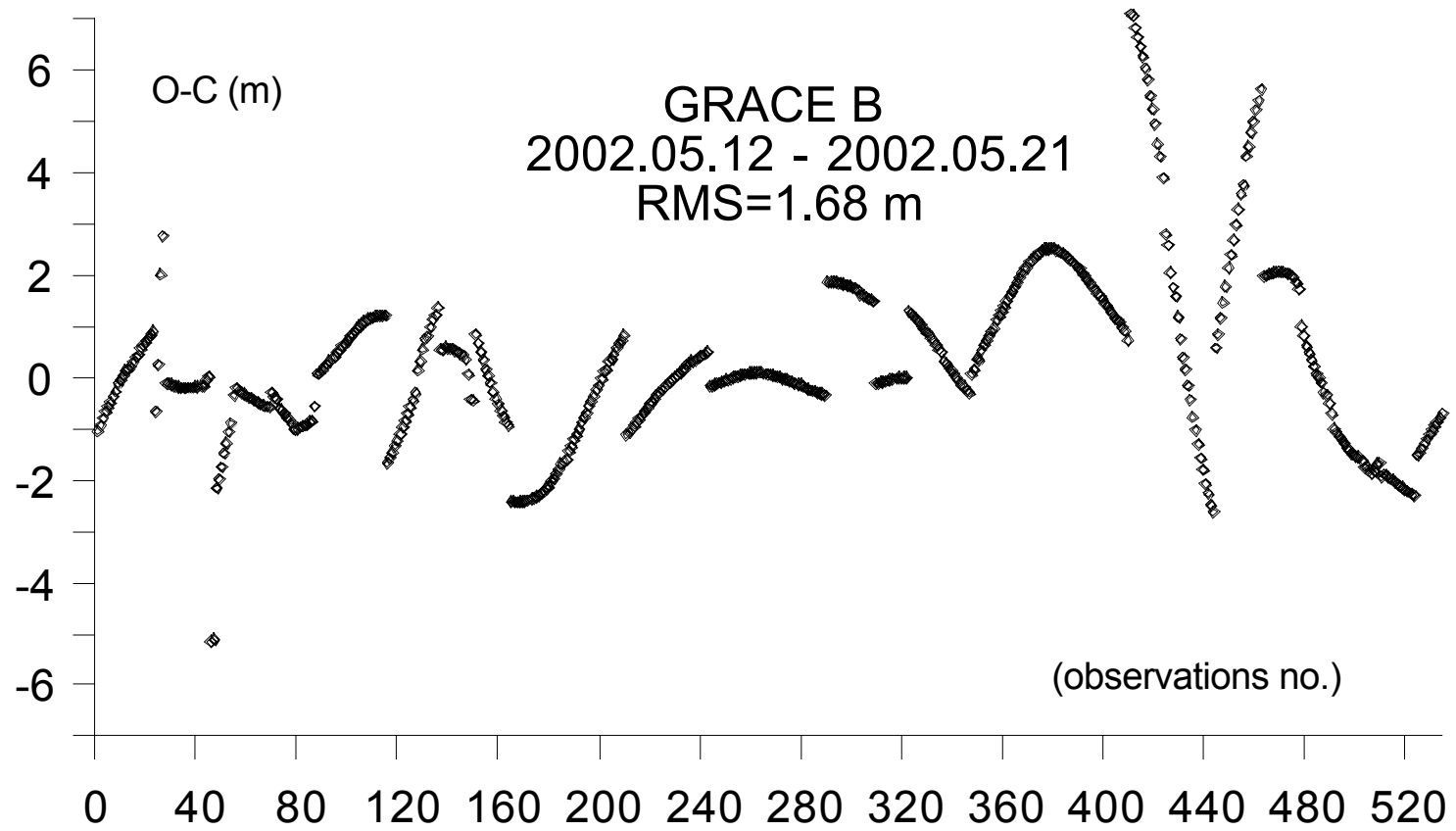


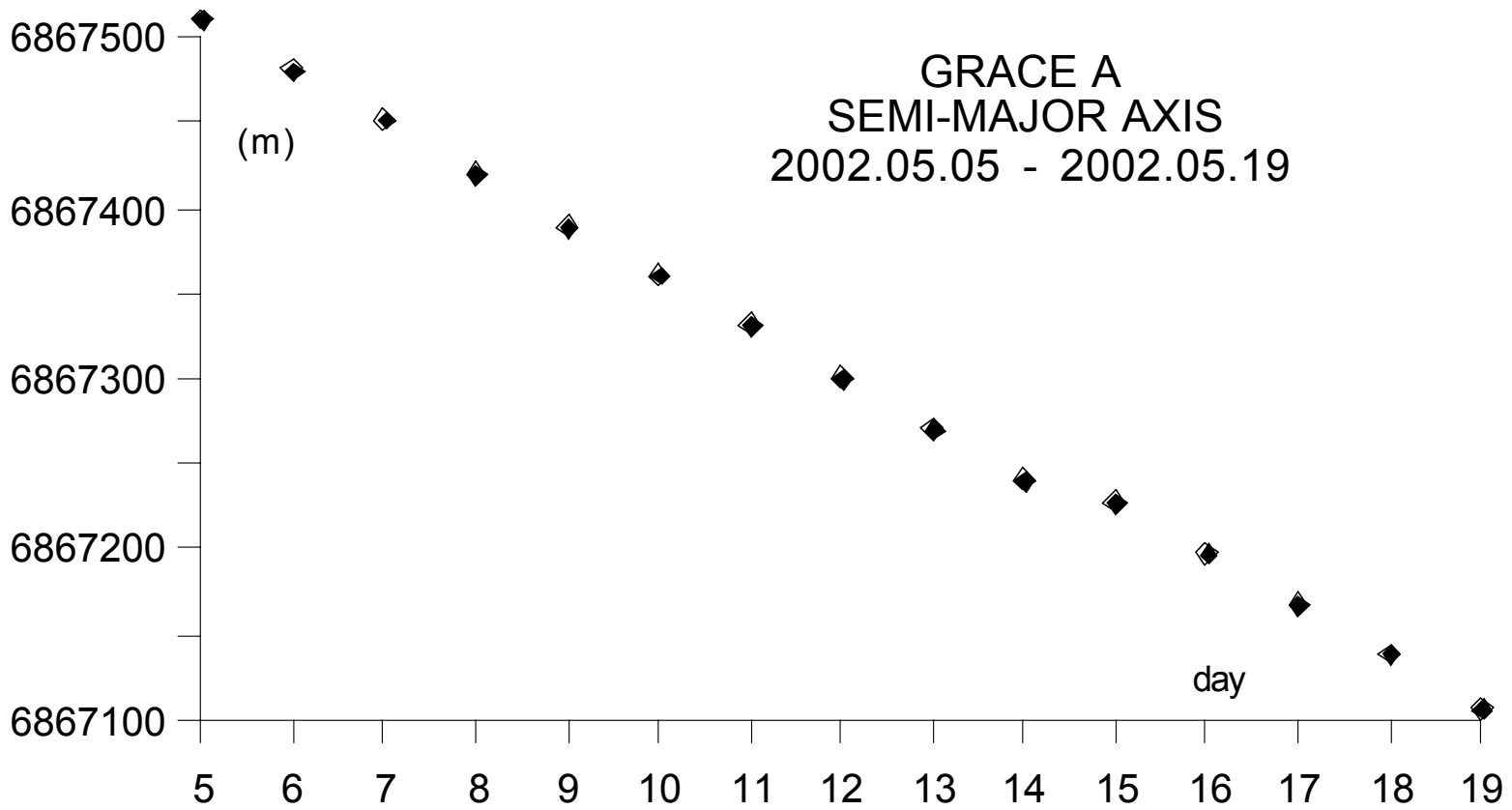


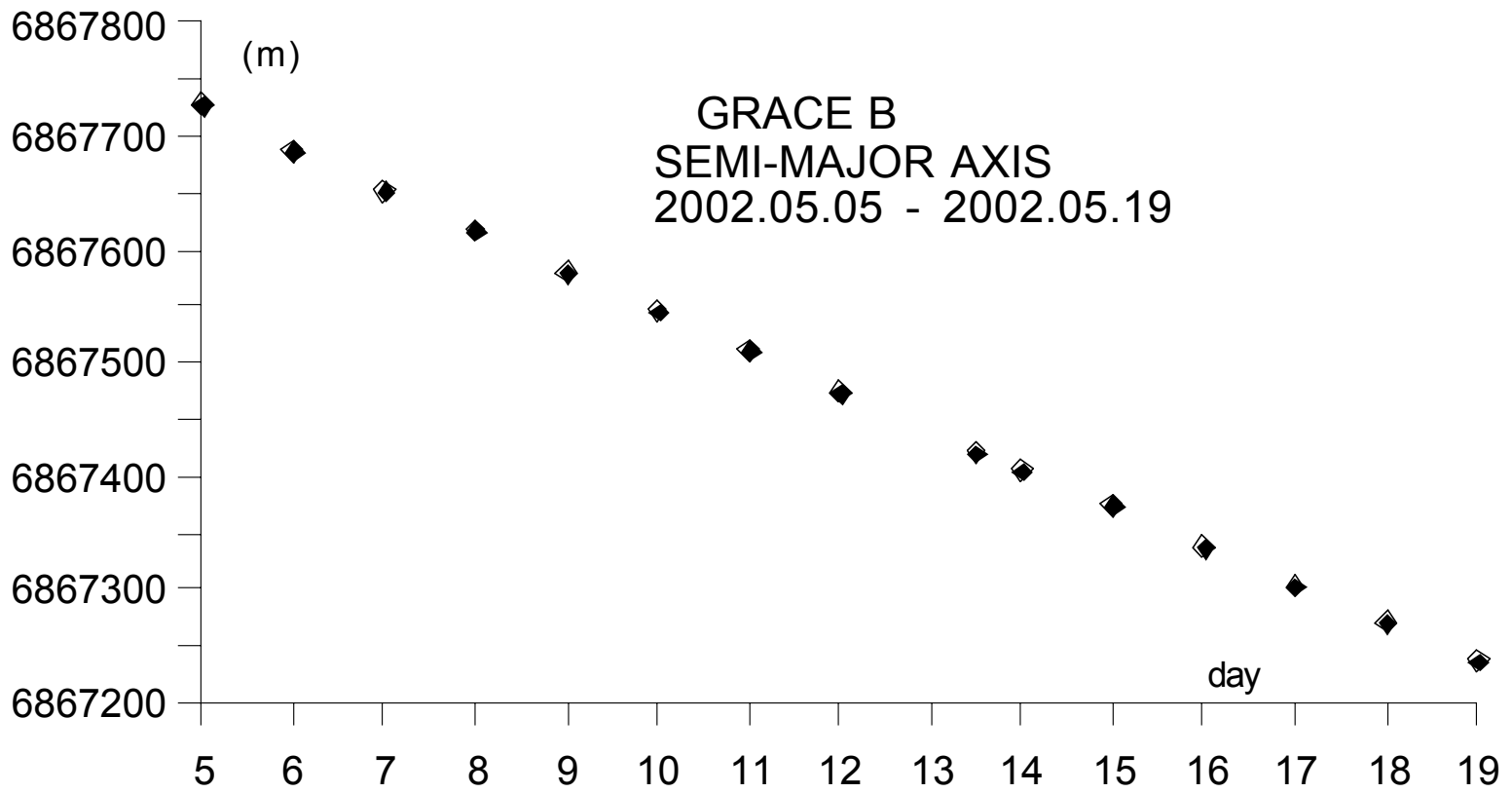














Thank You
For Your Attention



Elem. Estimated Orb. Elements				
C_D	6	6	6	6
	half day	half day	half day	half day
C_R	1	1	1	1
<small>General Acceptor</small>				
<small>10m</small>	4	4	4	4
Σ	24	24	24	24