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# **An Integrated Satellite Altimetry, Gravity and Geodesy Data Base: Architecture, Verification, Data Processing, Data Base Management System**

Integrated Satellite Altimetry Data Base



<http://www.wdcb.rssi.ru/ALTIM/Welcome.htm>

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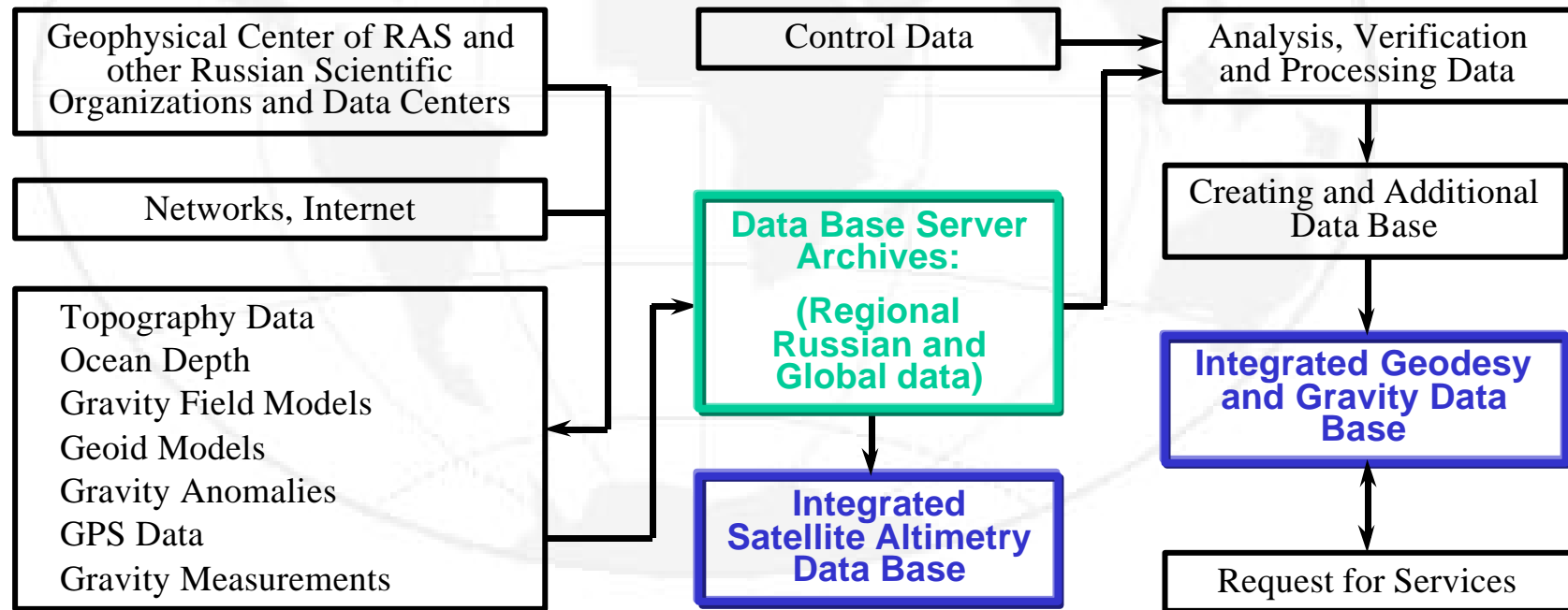
# Abstract

The integrated database of satellite altimetry data and supplementary gravity and geodesy information which is necessary for geodesy, geophysics, geology and oceanography applications was created in Geophysical Center of RAS. The satellite altimetry data sets include data measured by the Russian GEOIK geodetic satellites and by GEOSAT, ERS-1, ERS-2 and TOPEX/POSEIDON during the period 1985-1998. Database management system includes problem-oriented modes in addition to the usual DBMS functions. Database consists of three levels: preliminary data, integrated data, results of special processing. The architecture of database, database management system and data processing, future plans and problems are discussed. The work was supported by Russian Basic Research Foundation.



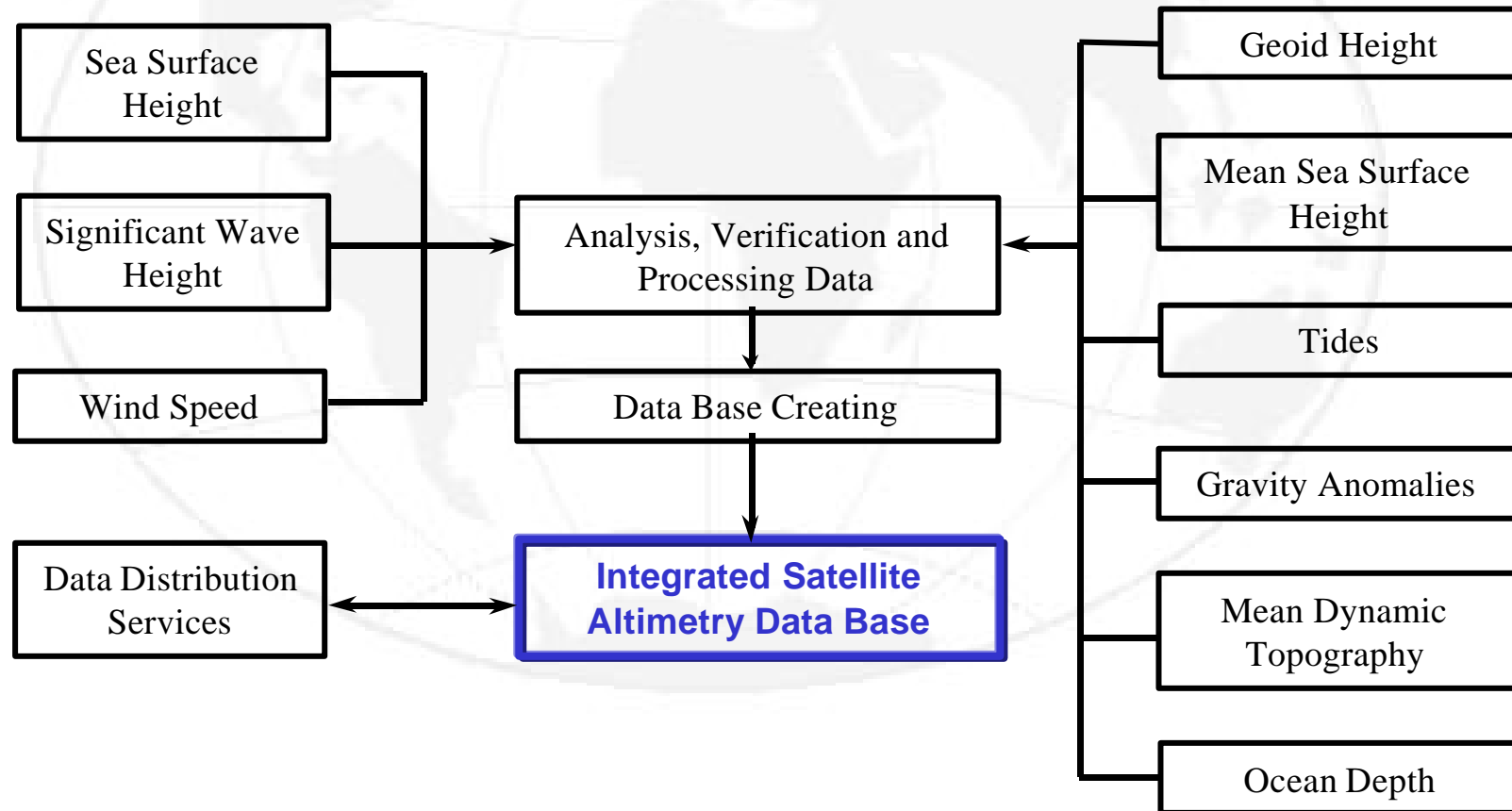
# Principles Satellite Altimetry, Geodesy and Gravity Integrated Data Bases Construction

Integrated Satellite Altimetry Data Base



# Integrated Satellite Altimetry Data Base

Integrated Satellite Altimetry Data Base

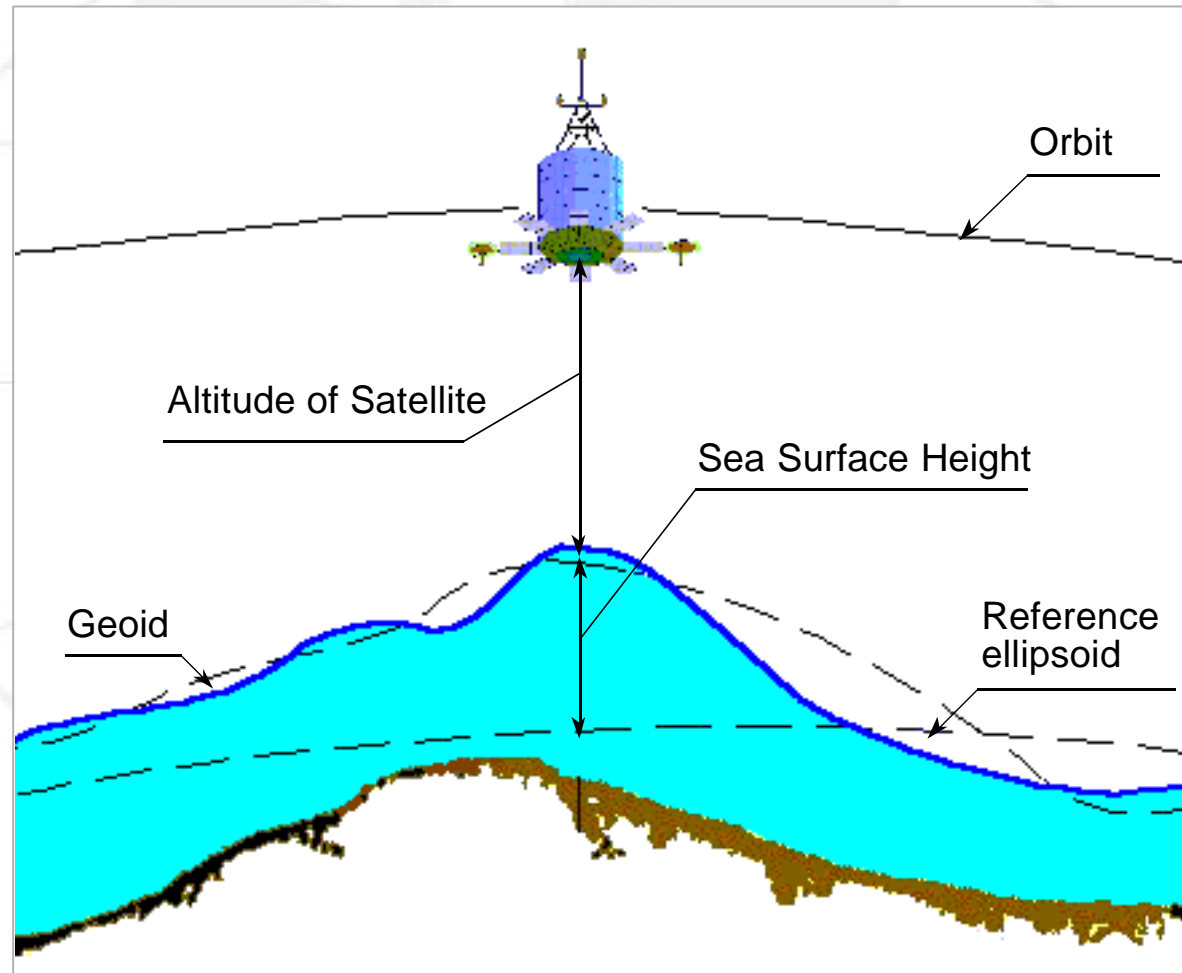


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# Satellite Altimetry Method

Integrated Satellite Altimetry Data Base



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# ISADB Data Records Format

Integrated Satellite Altimetry Data Base

	Parameter	Units
1	UTC (refers of January 1, 1985 00:00:00)	sec
2	UTC (continue)	$10^{-3}$ sec
3	Latitude	$10^{-6}$ deg.
4	Longitude	$10^{-6}$ deg.
5	Sea Surface Height (with instrumental and environmental corrections)	$10^{-2}$ m
6	Number of Valid points for 1s altitude	
7	RMS One Per Second Altimeter Range	$10^{-2}$ m
8	Additional to Sea Surface Height	m
9	Inverse Barometer correction	$10^{-3}$ m
10	Mean Sea Surface Height	$10^{-2}$ m
11	Geoid Height	$10^{-2}$ m
12	Gravity Anomaly	$10^{-4}$ Gal
13	Elastic Ocean Tide	$10^{-3}$ m
14	Full Ocean Tide	$10^{-3}$ m
15	Solid Tide	$10^{-3}$ m
16	Geocentric Pole Tide	$10^{-3}$ m
17	Ocean Mean Dynamic Topography	$10^{-1}$ m
18	Ocean Depth	m
19	Significant Wave Height	$10^{-3}$ m
20	Wind Speed	$10^{-2}$ m/s
21	Flags	



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# Satellite Altimetry Missions

Satellites	Country	Work Periods
GEOS-3	(USA)	Apr. 1975 - Dec. 1978
SEASAT	(USA)	Jul. 1978 - Nov. 1978
GEOSAT	(USA)	Mar. 1985 - Dec. 1989
GEOIK	(Russia)	Mar. 1985 - Jul. 1995
ERS-1	(ESA)	Aug. 1991 - to our time
TOPEX/POSEIDON	(USA-France)	Sep. 1992 - to our time
ERS-2	(ESA)	Apr. 1995 - to our time
GFO	(USA)	Feb. 1998
JASON-1	(USA)	May 2000
ENVISAT	(ESA)	May 2000
GEOIK-2	(Russia)	after 2000



# Russian GEOIK mission

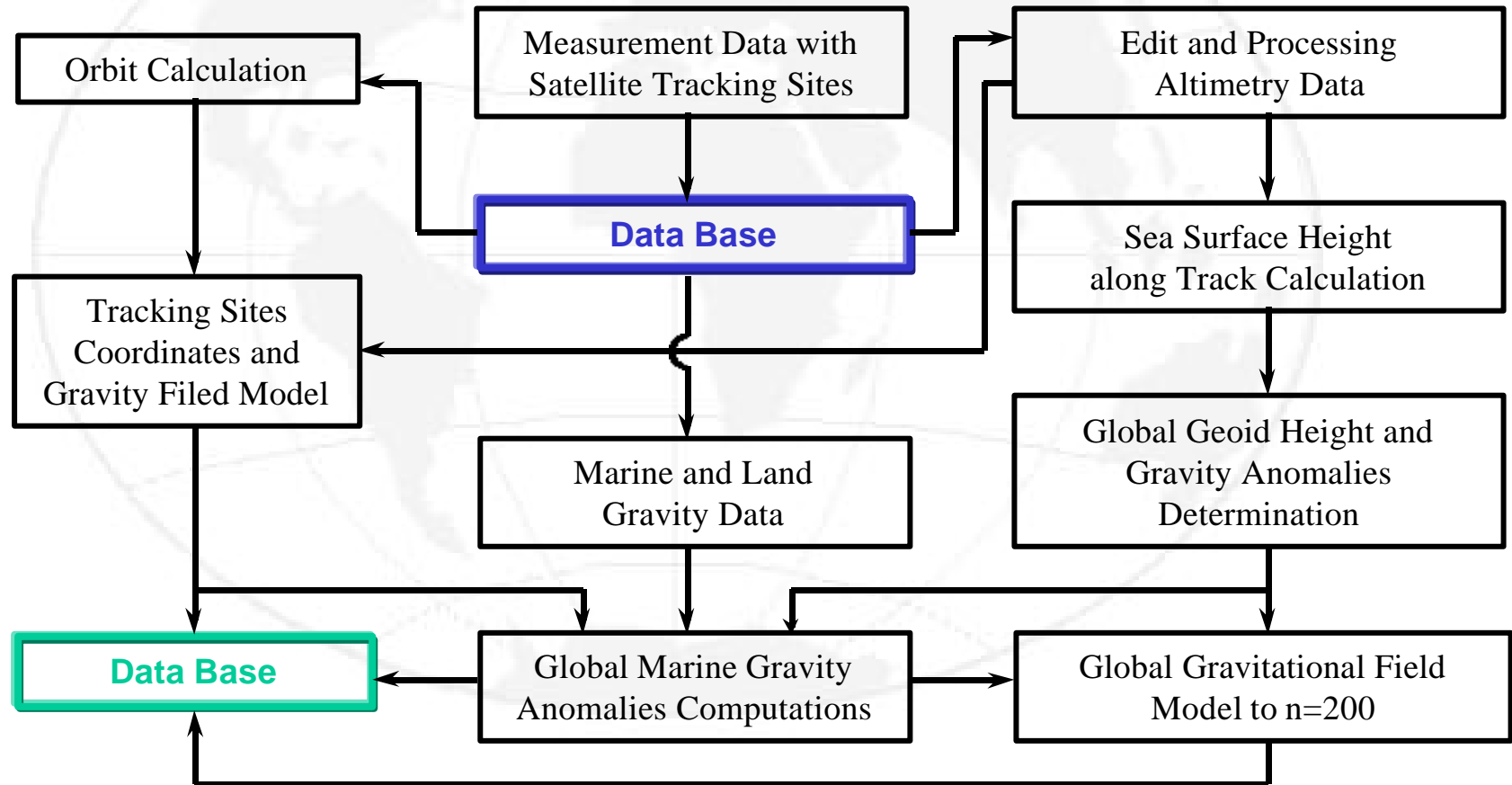
Satellites	Date of launch	Inclination, deg.	Periods	Standard deviation, sm
GEOIK-1	14.06.85	73.6	85.07.08 - 86.10.31	60
GEOIK-2	11.02.86	73.6	86.03.03 - 86.03.28	140
GEOIK-3	02.12.86	83.6	86.12.21 - 87.12.15	166
GEOIK-4	19.02.87	73.6	87.03.09 - 87.10.12	105
GEOIK-5	30.05.88	73.6	88.06.20 - 90.07.27	88
GEOIK-6	28.08.89	73.6	89.09.18 - 90.09.26	-
GEOIK-7	30.07.90	73.6	90.08.19 - 93.03.05	-
GEOIK-8	01.10.93	73.6	93.01.10 - 93.07.23	-
GEOIK-9	01.12.94	73.6	94.12.18 - 95.07.28	-



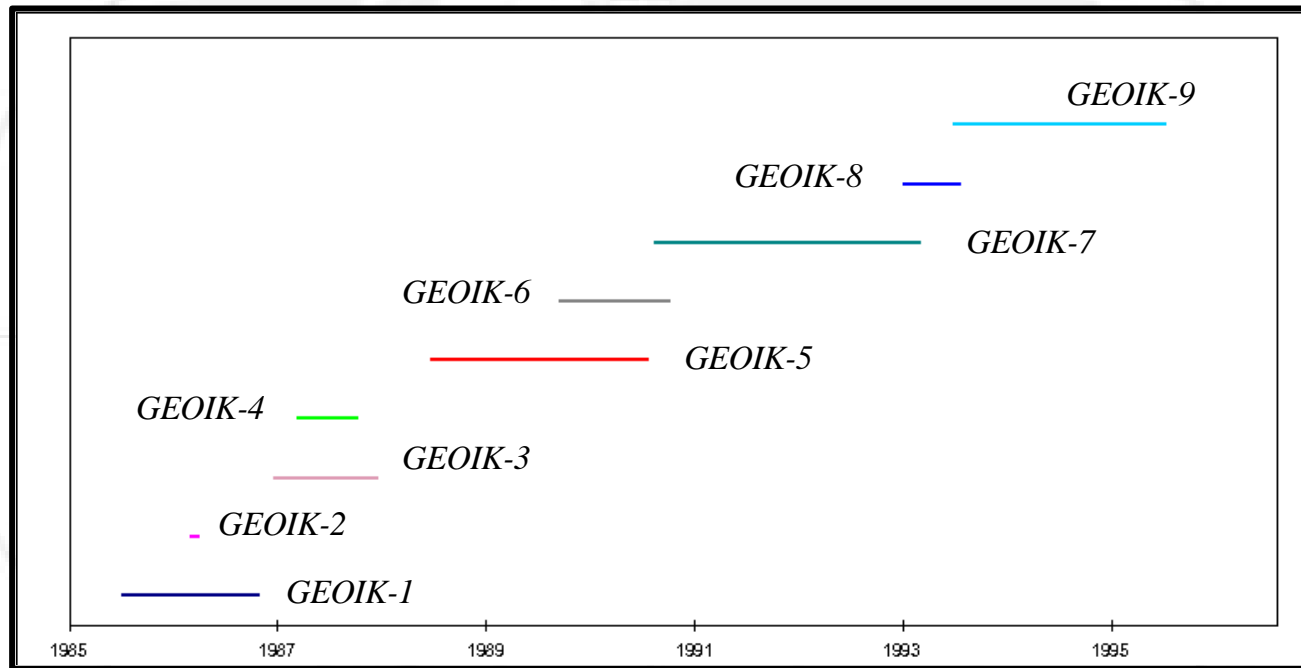


# GEOIK Data Processing

Integrated Satellite Altimetry Data Base



# Statistics of GEOIK measurements

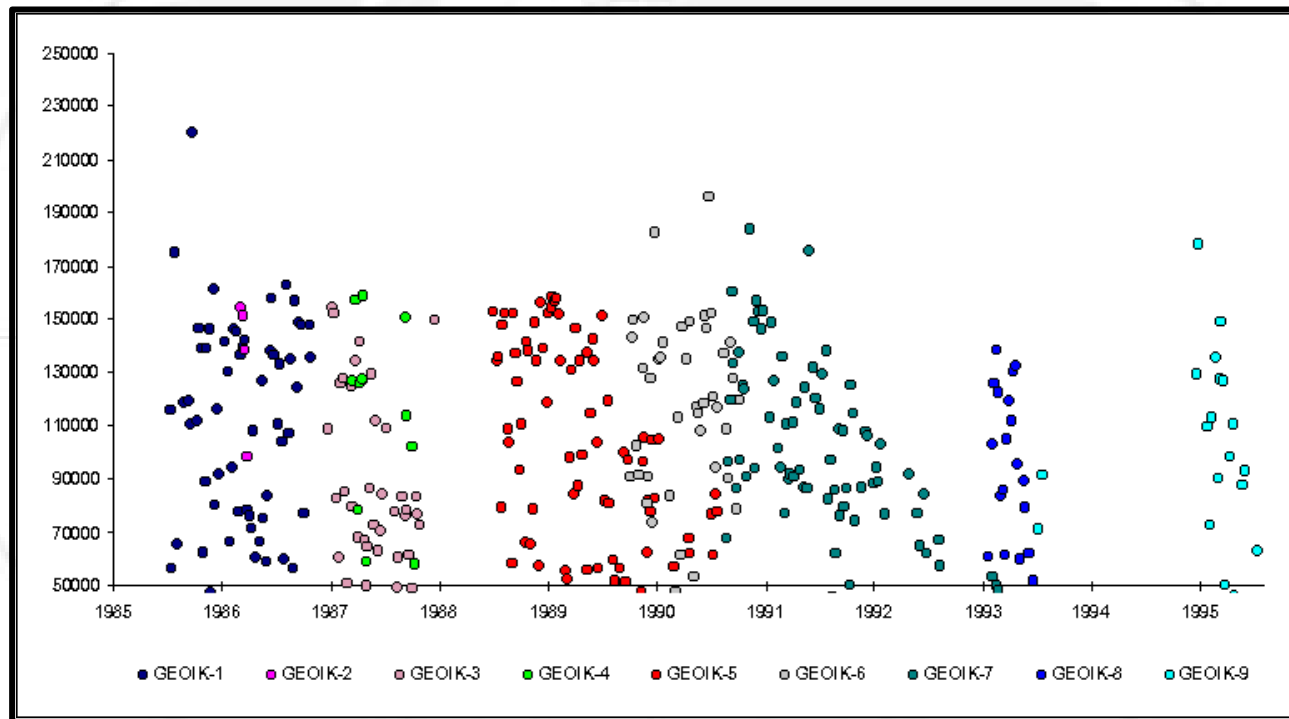


Time Period for All GEOIK Satellites



# Statistics of GEOIK measurements

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Number of Each Week Measurements for All GEOIK satellites



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# Satellite Altimetry Data Base

Integrated Satellite Altimetry Data Base

Satellites	Data Base	Inverting method
GEOSAT	Geodetic and Exact Repeat Mission	Time
GEOSAT	Crossover Difference Data Base	Regions
GEOIK	Geodetic program	Time and Satellite Number
ERS	Exact Repeat Mission	Pass
TOPEX/ POSEIDON	Exact Repeat Mission	Cycle and Pass



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# Data Base Management System

Data Base Management System:

Effective operation access to all data

Quick search of necessary information from Data Base

Data preparation for geodesy, gravity, oceanology research and applications

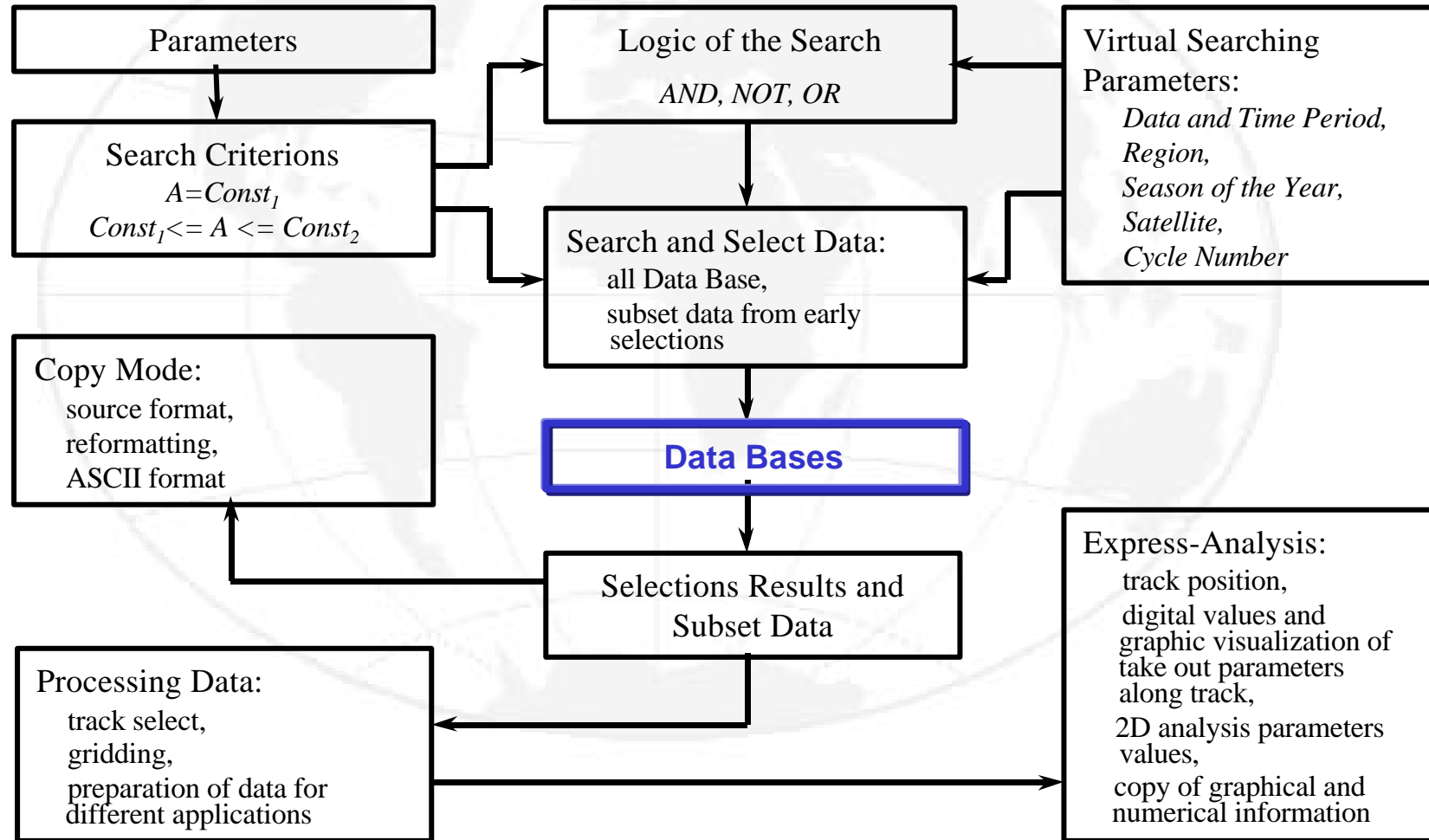
Including new data

The ARGOS system was development and use for it by Geophysical Center of RAS



# ARGOS System

Integrated Satellite Altimetry Data Base



# Operation Modes of ARGOS System

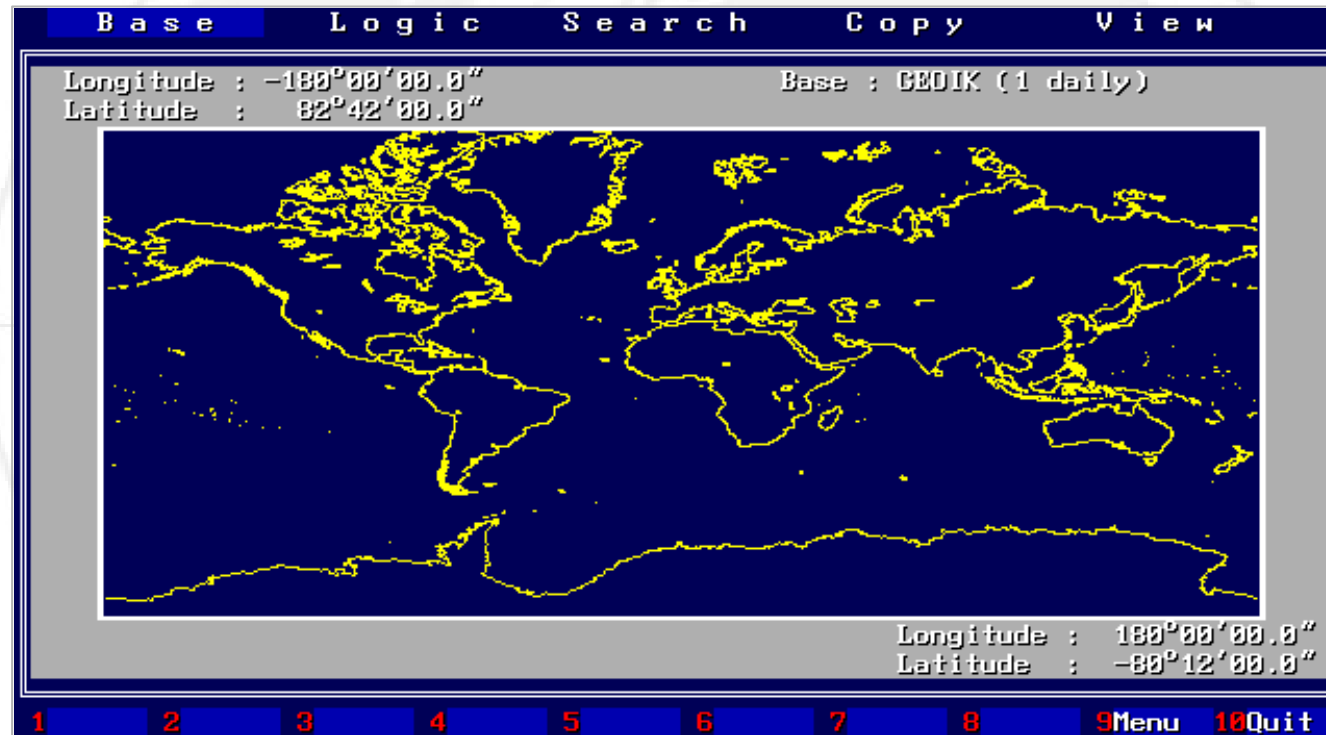


Users input:  
language,  
data input medium, device (CD-ROM, HD ),  
longitude system ( $-180^{\circ}$   $180^{\circ}$ ,  $0^{\circ}$   $360^{\circ}$ ),  
first number of picture,  
delay slid.



# Date Base Management (main menu)

Integrated Satellite Altimetry Data Base



Data Base selected

Select and subset data logic input

Multiple logic constructions input

Copy and reformatting selected data

Ground track positions visualization and numerical view of selected data



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# Simple Logic Search Input



Each parameter may be include by input ( $Const_1 \leq A \leq Const_2$  or  $A = Const_1$ )



# Region Data Select

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The screenshot shows a terminal-style interface with a menu bar at the top: Base, Logic, Search, Copy, View. Below the menu bar, there are fields for Longitude and Latitude, and a dropdown menu for 'Region'. The 'Region' menu is open, showing options: < REGION >, < SEASON >, < DATE and TIME >, and < SATELLITE >. A larger window titled '< REGION >' is displayed in the foreground, containing a table with columns for 'Minimum' and 'Maximum' values for 'Latitude' and 'Longitude'. The 'Longitude' value '170°00'00.0"' is highlighted in cyan. At the bottom of the window, there are numbered buttons from 1 to 9, and a 'Quit' button.

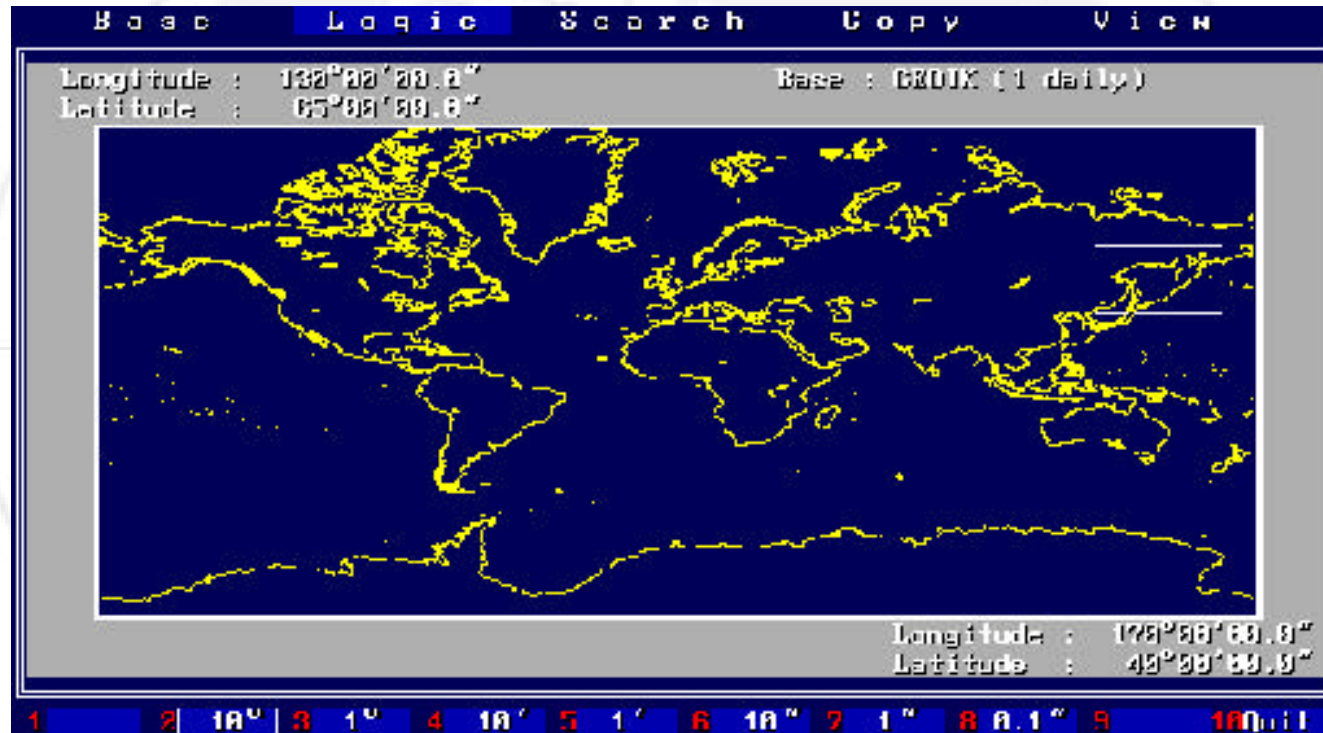
	Minimum	Maximum
Latitude :	40°00'00.0"	65°00'00.0"
Longitude :	130°00'00.0"	170°00'00.0"

Source data for select: degrees, minute, second (0.1".)



# Region Data Select Improvement

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# Time Period and Data Input



# «Season» Item Input



# Searching Data Modes



Subbase creating modes:

- search from Main Base to *SUBBSAE-1*,
- search from Main Base to *SUBBSAE-2*,
- search from *SUBBSAE-1* to *SUBBSAE-2*,
- copy from *SUBBSAE-2* to *SUBBSAE-1*



# More Intricated Search Logic

Base    Logic    **Search**    Copy    View

Longitude : -180°00'00.0"

N	Parameter (Logic)	One value or Range	
1	LATITUDE (microdeg)	40000000	65000000
2	LONGITUDE (microdeg)	135000000	170000000
3	< REGION > < AND >	Line : 1	Line : 2
4	< SEASON >	01-01 01:05:30	31-01 22:10:15
5	< DATE and TIME >	01-09-1985 01:45:10	15-11-1994 14:25:40
6	< SATELLITE >	1	
7	Ocean TIDE (cm)	32767	
8	Sign spread surface	0	Sea
9	< NOT >	Line : 7	

Longitude : 180°00'00.0"  
Latitude : -80°12'00.0"

1    2Select 3<NOT> 4<OR> 5<AND> 6    7    8    9    10Quit

Intricated search logic use logic expressions with logic operators  
*AND*, *NOT*, *OR*.



# Copy Data Modes



One input file or many  
All parameters from Data Base or not  
Binary or ASCII data format





# Express-Analysis of Selected Data

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Tracks analysis  
Simple gridding data  
Simple spatial analysis data



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# Ground Track Positions Visualization

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# Parameters Correction

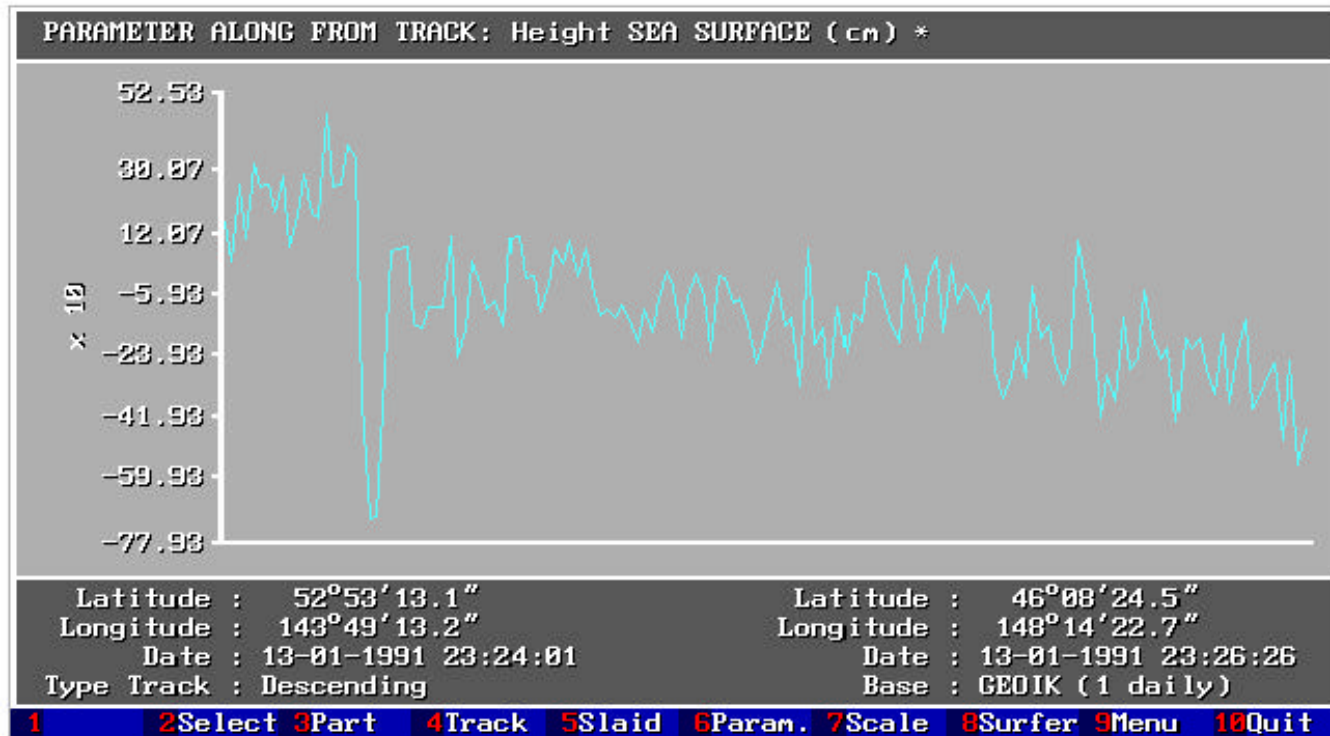


This option include Tide, Geoid Height and other corrections if it needed



# Along Track Analysis

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# Spatial Analysis

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Creating grid  
Data visualization



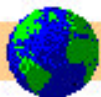
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# Regular Grid for Averaging Data Input

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Grid	Parameter	Ground Track	Picture																
Longitude : 130°01'54.4"		Base : GEOIK (1 daily)																	
Latitude : 62°40'22.9"		Subbase : SUBBASE_2																	
																			
<table border="1"> <thead> <tr> <th colspan="4">&lt; G R I D &gt;</th> </tr> <tr> <th></th> <th>Minimum</th> <th>Maximum</th> <th>Step</th> </tr> </thead> <tbody> <tr> <td>Latitude :</td> <td>30°00'00.0"</td> <td>63°00'00.0"</td> <td>1°00'00.0"</td> </tr> <tr> <td>Longitude :</td> <td>130°00'00.0"</td> <td>170°00'00.0"</td> <td>1°00'00.0"</td> </tr> </tbody> </table>				< G R I D >					Minimum	Maximum	Step	Latitude :	30°00'00.0"	63°00'00.0"	1°00'00.0"	Longitude :	130°00'00.0"	170°00'00.0"	1°00'00.0"
< G R I D >																			
	Minimum	Maximum	Step																
Latitude :	30°00'00.0"	63°00'00.0"	1°00'00.0"																
Longitude :	130°00'00.0"	170°00'00.0"	1°00'00.0"																
Date : 19-09-1989 20:08:57 ÷ 16-06-1991 23:46:06		Longitude : 169°59'47.6"																	
Total Number Record(s) : 1336		Latitude : 30°13'49.6"																	
1	2	3	4																
5	6	7	8																
9	10Quit																		

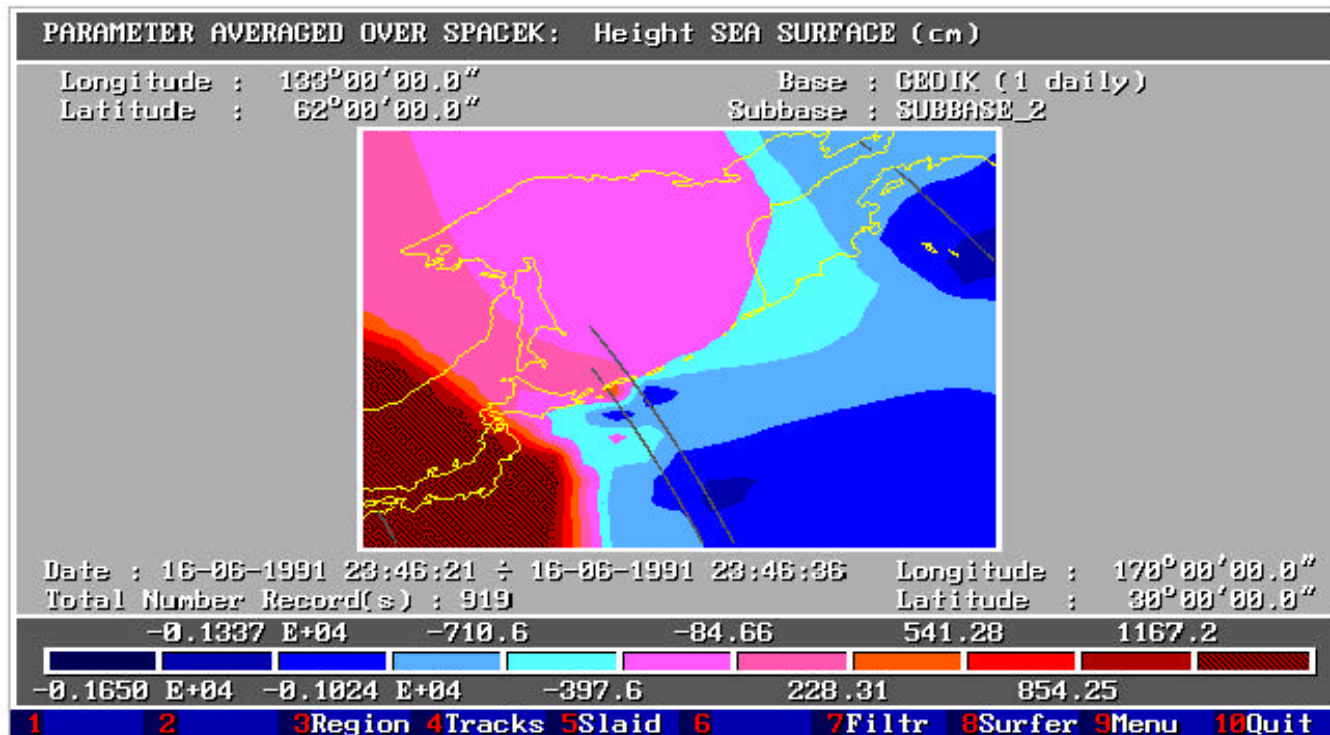


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# Selected Parameter Visualization

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# Access to ISADB Data Base

On-line access to hypertext data base  
(<http://www.wdcb.rssi.ru/ALTIM/Welcome.htm>)

On-line express-analysis of available data

Request for services

Data distribution (off-line):

- CD-ROM,
- other media,
- server (*anonymous ftp*).





# ISADB Hypertext Data Base of Statistics and Availability Measurements

Integrated Satellite Altimetry Data Base

**Ground Tracks and Statistic Distribution of GEOIK-07 Data**

ISADB ИБДСА  
*Russian Version this Page*

1990 1991 1992 1993

Time Interval	Number of Measurements					Ground Tracks
	Total	Sea	Land	Ice	Bad	
19.08.1990-31.08.1990	187537	164075	22890	522	50	<a href="#">Ground tracks</a>
03.09.1990-26.09.1990	498921	438363	58769	1760	29	<a href="#">Ground tracks</a>
01.10.1990-31.10.1990	513079	448228	63923	554	374	<a href="#">Ground tracks</a>
01.11.1990-28.11.1990	485811	420006	61219	4255	331	<a href="#">Ground tracks</a>
02.12.1990-28.12.1990	577475	508834	67455	967	219	<a href="#">Ground tracks</a>
<b>19.08.1990-28.12.1990</b>	<b>2262823</b>	<b>1979506</b>	<b>274256</b>	<b>8058</b>	<b>1003</b>	<a href="#">Ground tracks</a>
10.01.1991-29.01.1991	333909	293029	41109	1587	184	<a href="#">Ground tracks</a>

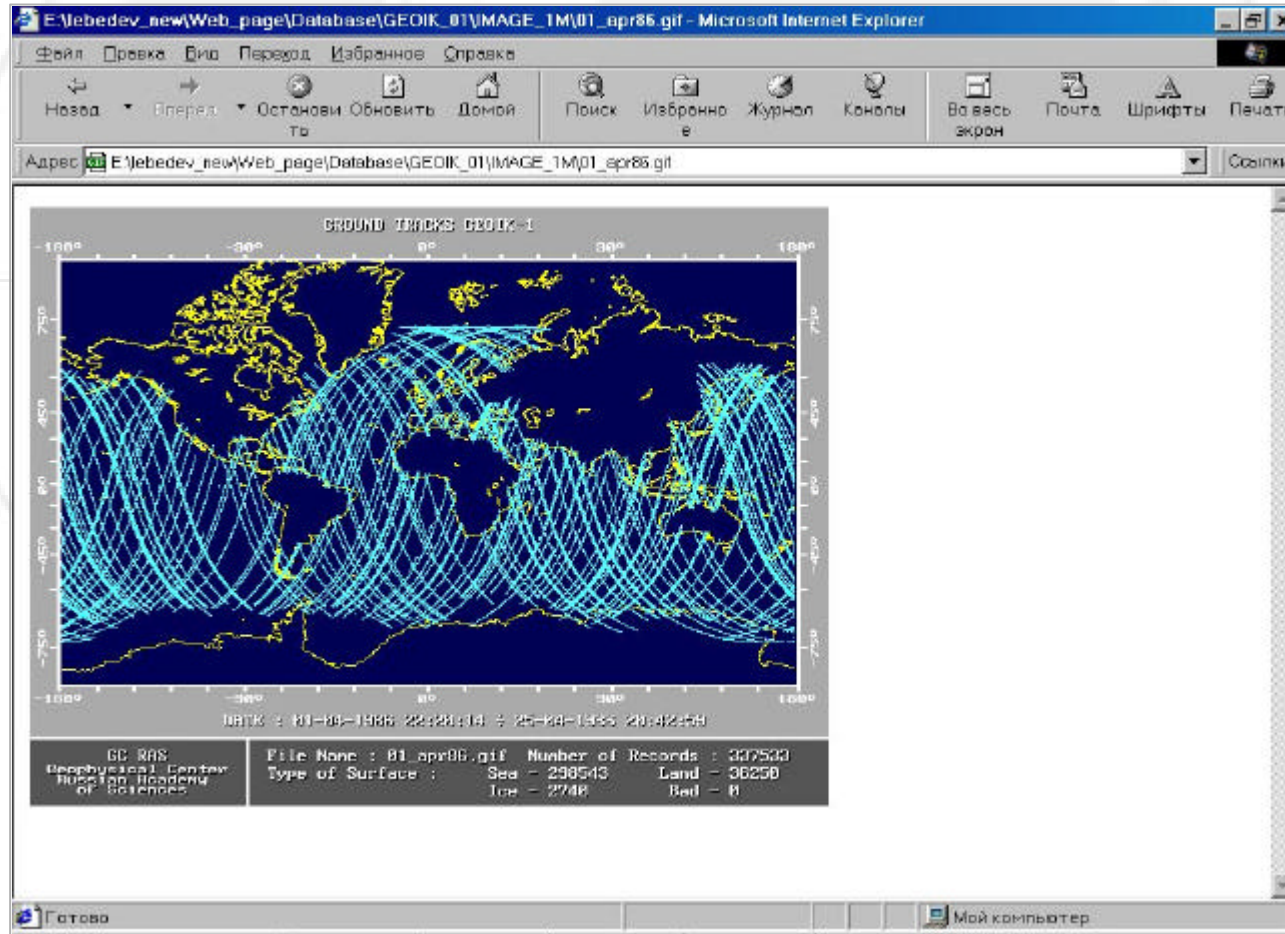


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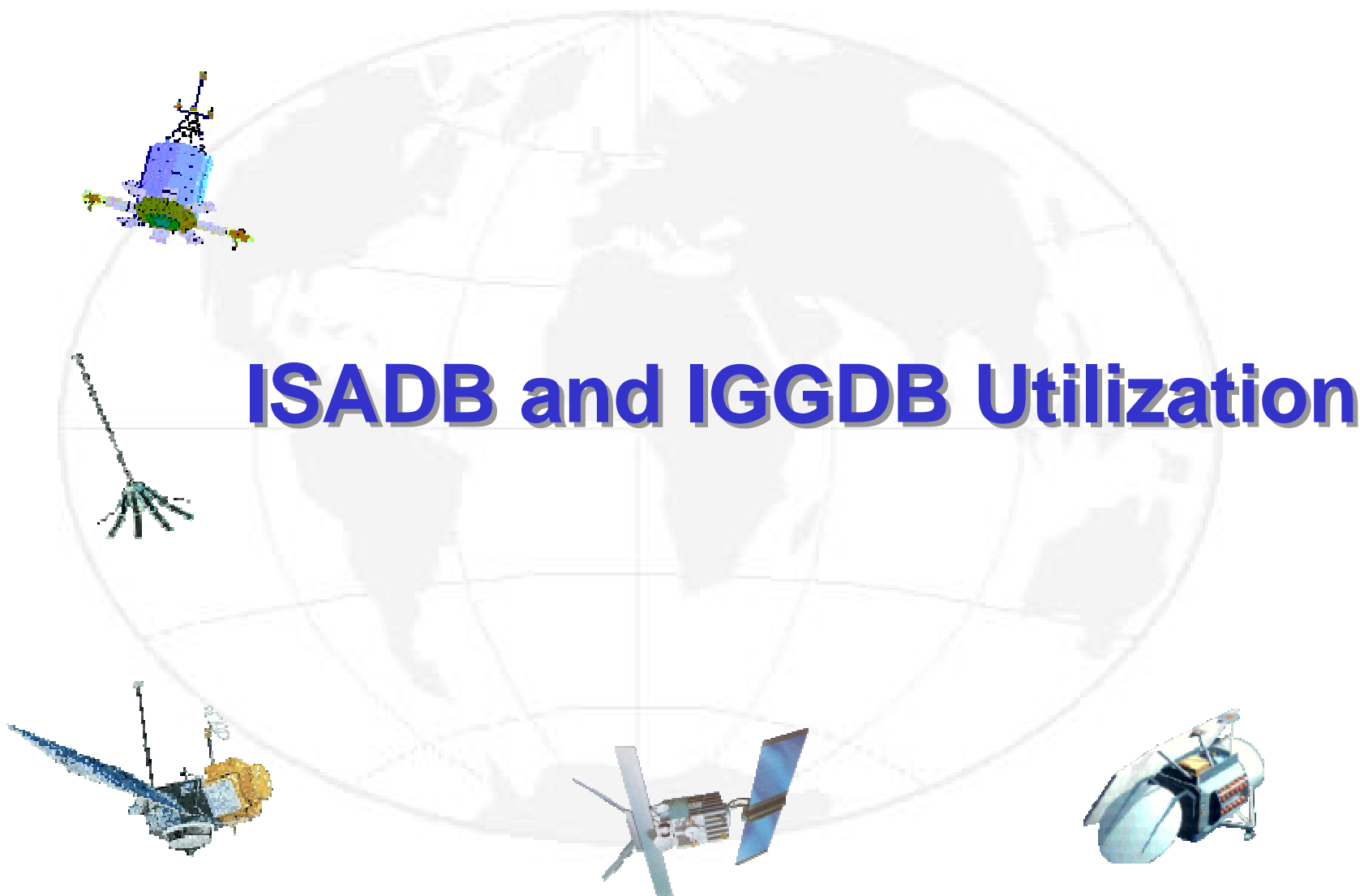
# ISADB Hypertext Data Base of Statistics and Availability Measurements

Integrated Satellite Altimetry Data Base



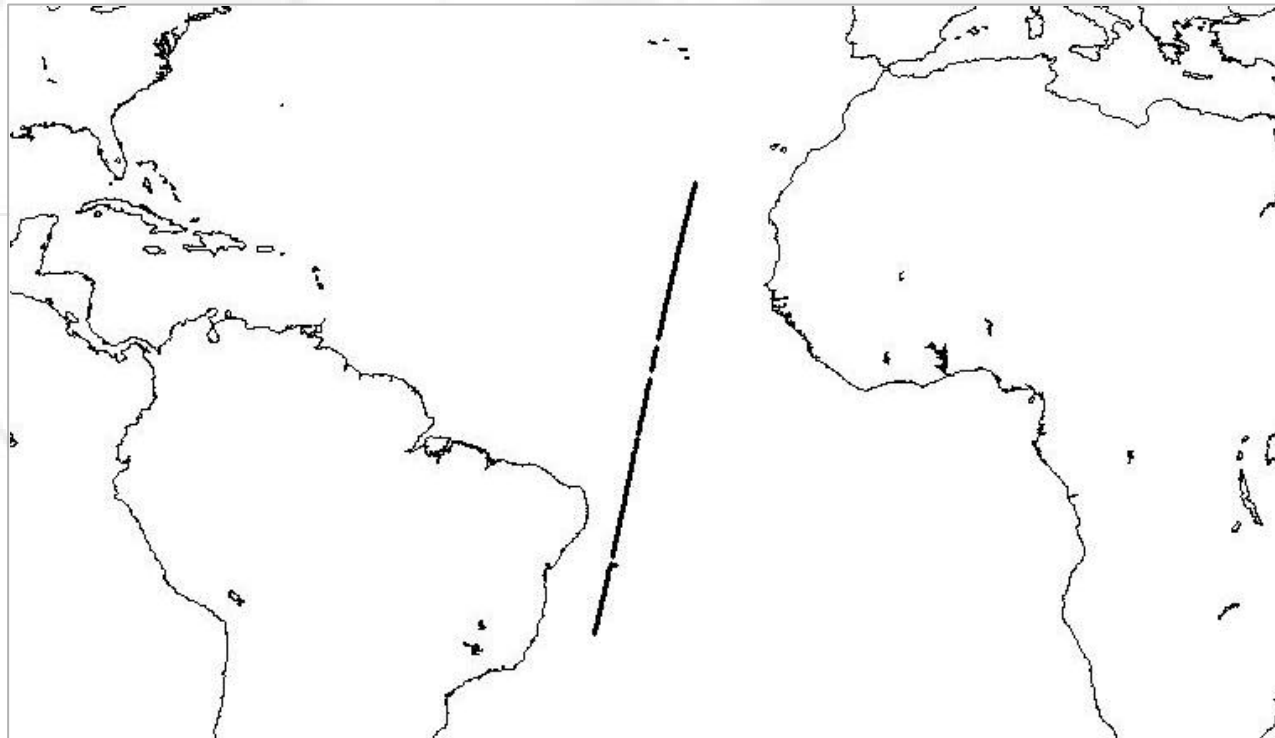
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# Comparison of Gravity Anomalies Derived with Use Altimetry Data Along GEOIK Ground Track with Marine Gravity Measurements

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December 1997

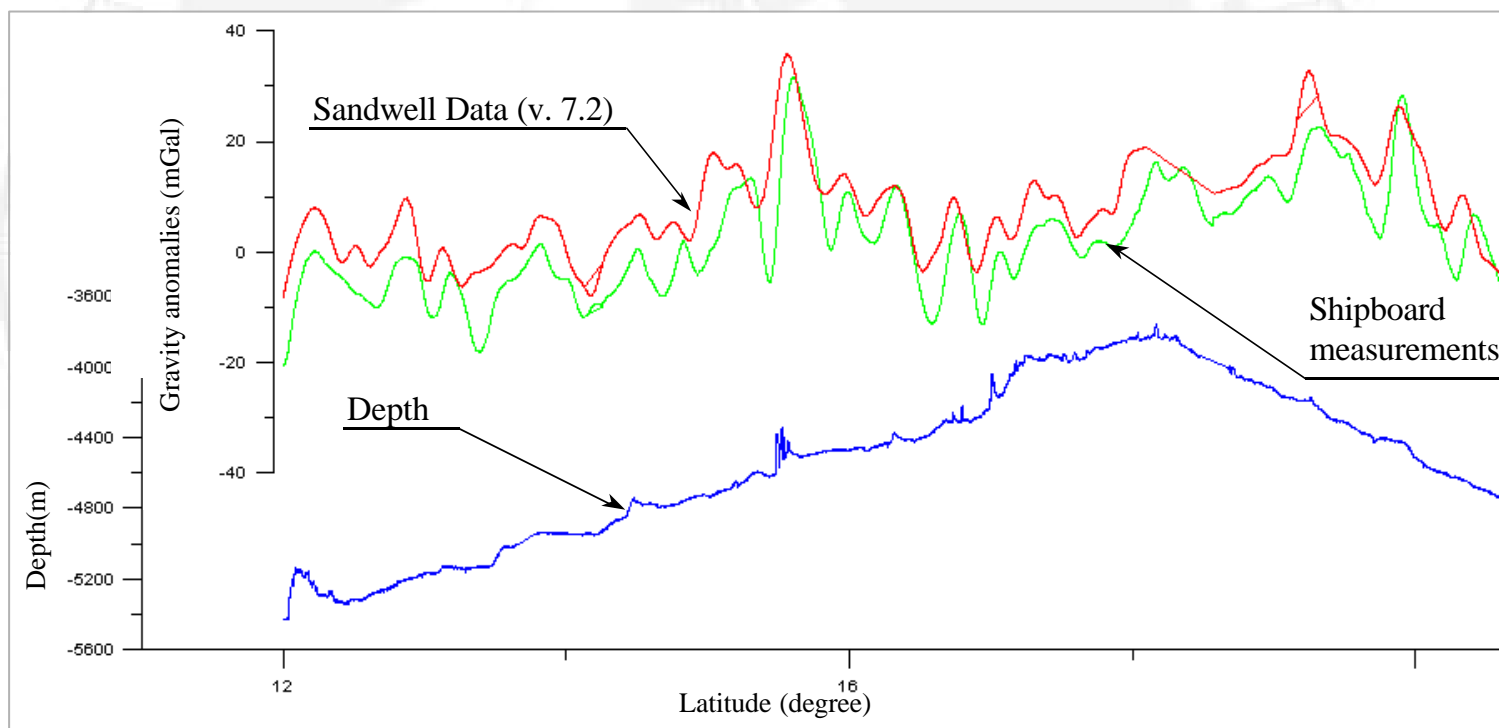


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# Comparison of Shipboard Gravity Anomalies Along Ground Track GEOIK with Sandwell Data (v. 7.2)

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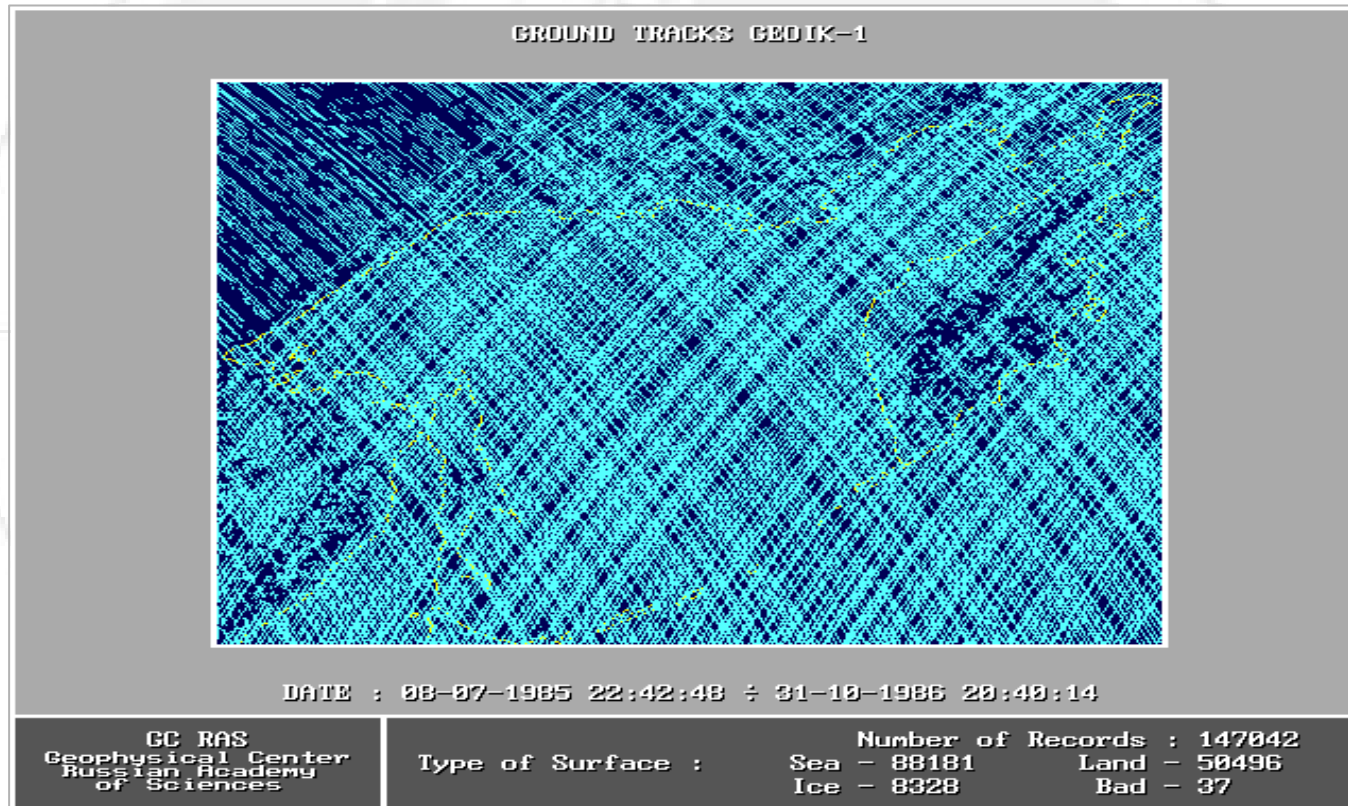


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# GEOIK-1 Altimetry Measurements Statistic for Sea of Okhotsk

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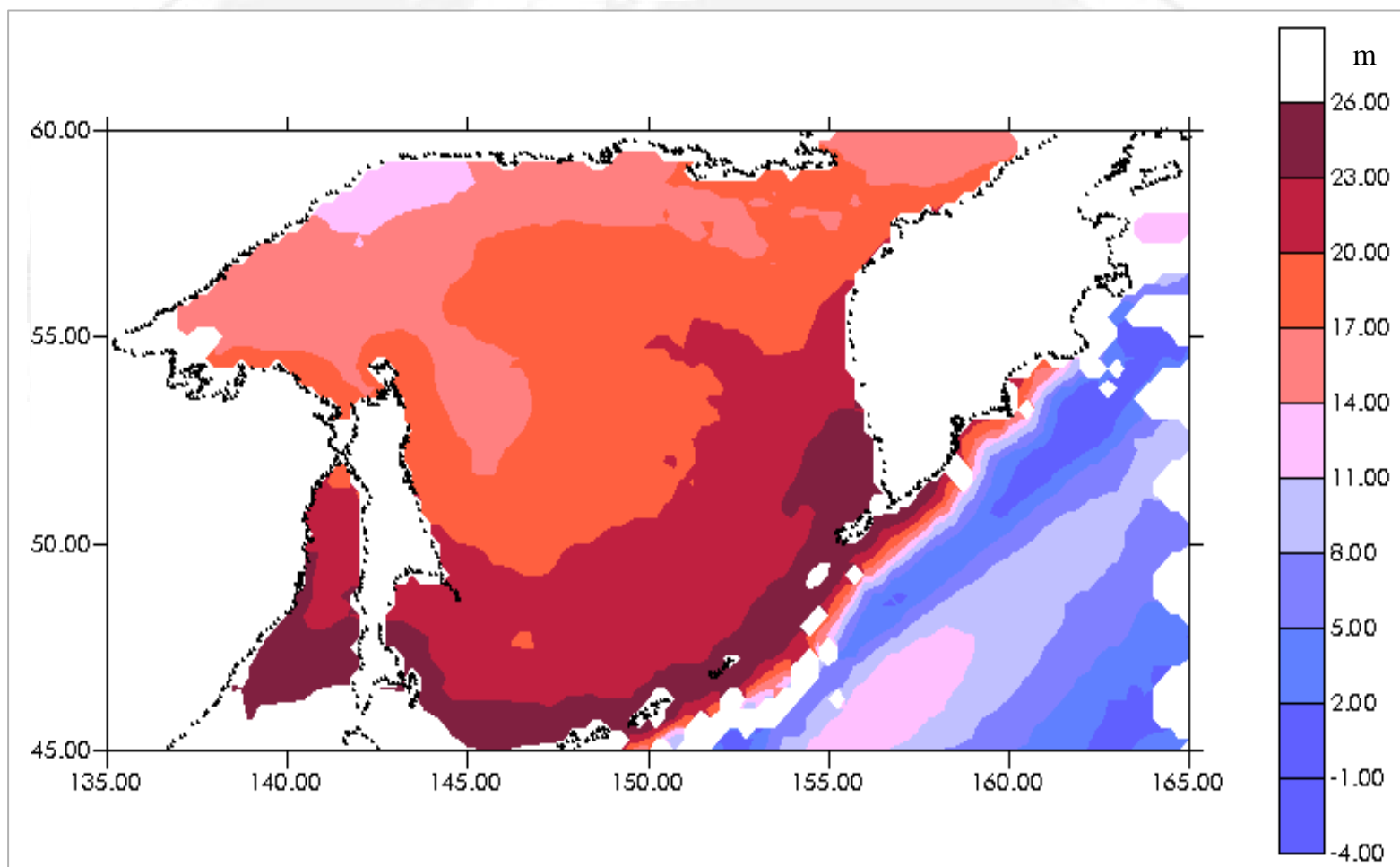


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# GEOIK Sea Surface Height for Sea of Okhotsk

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