

# An Integrated Data Base of Satellite Altimetry Data for Fundamental Geosciences Research\*

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## Abstract

The purpose of the project is to set up an integrated satellite altimetry data base (ISADB), which would include the results of altimetry measurements conducted by the Russian GEOIK geodetic satellites and by GEOSAT, ERS-1, ERS-2 and TOPEX/POSEIDON during the period starting from 1985 until present. ISADB would also include supplementary information necessary for the processing and interpretation of experimental data. The software, besides its standard DBMS functions, would also carry out the functions of data processing and data visualization for the problem-oriented study of the sea level changes of the world ocean and large inland basins and for the determination of the detailed characteristics of the gravity field of the Earth.

## Developing the information system

The purpose of the project is to set up an integrated satellite altimetry data base (ISADB), which would include the results of altimetry measurements conducted by the Russian GEOIK geodetic satellites and by GEOSAT, ERS-1, ERS-2 and TOPEX/POSEIDON during the period starting from 1985 until present. ISADB would also include supplementary information necessary for the processing and interpretation of experimental data. The software, besides its standard DBMS functions, would also carry out the functions of data processing and data visualization for the problem-oriented study of the sea level changes of the world ocean and large inland basins and for the determination of the detailed characteristics of the gravity field of the Earth.

The final ISADB version shall be loaded on the WWW server of Geophysical Center and thus will be available in the Internet. We believe that the range of application of the data base shall be sufficiently wide, because the altimetry measurements, carried out by the GEOIK satellites, have not been available to the wide scientific community before.

The most developed software for work with the satellite altimetry data was realized by NASA. This software, however, allows to analyze information measured by satellites of

the same family, whereas the ISADB would allow operation this information obtained by different satellite families. As regards the system of express-analysis and visualization of altimeter data, the study of the corresponding NASA methods has shown that the set of programs realized by the participants of the project is in no part inferior to them.

The specific feature of the satellite altimetry data is that these data take up much space and the larger part of them is resented on the CD-ROMs. The information is recorded in the binary Hewlett-Packard format, or VAX, as the direct-access files inverted by time (the geodetic and exact repeat GEOSAT program), by time and satellite series (the GEOIK experiment), by space (the intersection point bases), by exact repeat cycles (the TOPEX/POSEIDON satellite), or by the numbers of orbital arcs (the ERS-1 experiment).

The search and selection of data, stipulated by the developed software, are oriented on the specific features of the structure of satellite information. The search criterion is a logical construction based on a single search attribute (the simple search criterion) and on the combination of simple search criteria by the logical operations OR, AND, NOT in order to organize the search by several attributes. Moreover, a few additional virtual attributes of search are suggested: region, data and time, season, cycle, the serial number of the satellite, and the orbit's number. The attribute «region» allows to select the region of research on a real geographical map with precision up to 0.1 sec. Since the time in the data bases is given in seconds or the number of days and seconds from the start of the count, the virtual «data and time» parameter, for the user's convenience, permits to give the time of measurement in the usual terms: data, month, year, hour, minute and second. The attribute «season» is designated for selection of a certain seasonal period of time or the whole base. The presence of virtual attributes of search, such as the cycle, the satellite series, and the number of the orbit, provides accomplishment of automatic selection without involving the supplementary data.

The so-called map of search is compiled before the search by using the selected criterion of search on the basis of inverting the files procedure. The map is a succession of the disk number for the multi-volume data base, and the names of the files, the information from which satisfies, in the first approximation, the given logic of the search. This procedure greatly increases the rate of search and selection. Moreover, the system automatically requests the disk necessary for reading. We should note that in the process of search and selection, the system operates only with the disk number, the name of the file and the number of recording; consequently, the volume of the service file with the results of

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selection is small.

The important peculiarity of the system is the availability of multistage selection of information. After completion of the first stage of selection into the subbase-1 and the analysis of the selected information, we can undertake the search with previously selected data by using any new or already existing criterion and store the data into the subbase-2. After selection of information, the system allows copying of selected information either in the symbolic format into the file,  $r$  in the binary format with merging of the entire bulk of information within one data base. On this step one can specify the parameters necessary for the next steps of processing. One can also to conserve the binary format of distributive or to decode the data if the data is output in the binary format.

The system allows to conduct simultaneous selection and copying of information into the user's data base. This data base retains the inverted structure of the initial CD-ROM. The system allows to display values of parameters of selected records and to draw plots of selected temporal data series without termination of the search mode.

The block of express-analysis and preliminary data processing allows to identify selected data with tracks of satellite, to determine the type of these tracks (ascending or descending), and to check their position in space. It allows also to display variations of any parameter along the track, or on some part of it. The function of improvement of the values of sea surface heights by introducing various corrections and the function of visualization of these values as deviations from the reference surface (for example, from the geoid in the dynamic topography of the ocean) are realized in this block.

The space structure of the studied parameter is analyzed by averaging the data on a selected grid at the knots or centers of its cells with subsequent visualization of the obtained field in the form of isolines; an opportunity is provided, by analogy with the previous statement, to correct the values of heights of sea surface by introducing different corrections, or by the display of deviations from the standard surface.

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