PROCEDURE FOR ERS PROCESSING BASED ON GEODETIC COUPLING DATA FOR ARRAY STATIONS

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Experience in earth remote sensing (ERS) data processing (high-resolution space survey imagery) is given based on data of horizontal and vertical tie-in for array stations (coordinates and elevation of stakes of seismic profiles and wells).

The interest in oil and gas resources of Eastern Siberia which significantly increased in past years is due on the one hand to depletion of hydrocarbon material reserves generally arranged within Volga-Ural and Western Siberia oil and gas bearing provinces, on the other hand to apparent effectiveness of development plans for the largest fields in the Eastern Siberia region.

Development of oil and gas resources in Eastern Siberia requires substantial financial expenses. It is obvious that economic effectiveness and project life directly depend not only on the selected strategy and tactics of scheduled activities but also on the degree of application of up-to-date information technologies and research works.

In order to achieve maximum effectiveness while performing a range of geological-geophysical activities on hydrocarbon deposit exploration and operation, wide application of up-to-date technologies to process and analyze continuously changing geographically dispersed information and integrated use of unified digital databases of geological exploration targets, digital elevation models and space survey imagery is required.

Geometrical rectification of space survey imagery is the most important component of thematic processing of Earth remote sensing data. The process of ERS geometrical rectification is the most labor-consuming and sophisticated and requires considerable expenses for field survey in order to define coordinates of ground control points.

The basic idea of the ERS processing technique is to generate a database of vertical and horizontal ground control point network being a basis for geometrical rectification (geopositioning) and orthorectification of ERS raster images. The ground control network is established based on existing database of spatial position of array stations and digital elevation model (DEM) using software developed in ZAO Krasnoyarskgeofizika [1].

Starting from the 70s the regional and local geophysical activities on establishing the seismic grid have been carried out and recently very intensively performed in Eastern Siberia. Currently the seismic grid database of CJSC Krasnoyarskgeofizika includes more than 10 thousand seismic profiles which are totally about one million line kilometers long consisting of 200 million stakes defined in 3-D coordinates. Seismic profiles represent rectangular clearings reliably identified on space survey imagery of medium (Landsat 7, IRS, etc.) and certainly high (QuickBird) spatial resolution.

Intersection of seismic profiles between themselves and typical optical centers (turning points) can be a basis for horizontal and vertical tie-in and generating orthorectified ERS-based images. Points of intersection between seismic profiles and contours of linear DEM objects, established based on published large-size ground maps of 1:25000 and 1:100000 scale (linear objects of the drainage system, power transmission lines, pipelines, roads, clearings) can be also used as initial geodetic point. Thus, ground control point grid spacing for ERS geometrical rectification can reach several points per square kilometer of surveyed terrain [2].

The database of array stations (coordinates and elevations of optical centers and stakes of seismic profiles and wells) is specially structured data controlled by ORACLE DBMS. The

DEM database consists of digital ground and thematic maps generated using known technologies.

ENVI 4.3 software package of RSI company serves as ERS processing and interpretation system.

Digital orthophoplans generated by processing using the expected procedure represent rectified scaled raster image of terrain objects and a topographic base for production and update of digital thematic maps and resolution of research tasks while exploring and operating hydrocarbon deposits. Being actually a raster ground map of respective scale and accuracy they serve as objective base for planning geologic-geophysical activities, taking ecological measures, approving and allotting land plots for construction of field and well infrastructure facilities. Digital elevation models (DEM) produced using this technique allows for quick identification of longitudinal and transverse profiles of linear objects, absolute elevations of ERS raster image points, identification of survey loop area with account of terrain relief, generation of dynamic 3-D terrain models by means of geoinformation systems.

The developed technique of ERS processing based on data of geodetic coupling of array stations allows for quickly and low-budget DEM generation and update for vast areas of frontier and adverse terrains, which eventually enhances effectiveness and quality of surveying and its planning.

References

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