Application of Resurs-DK1 Spacecraft Images for 3D Digital Terrain Model Construction

A.A. Peshkun, A.S. Shokol
Research Center for Earth Operative Monitoring, Moscow, Russia

Recently the 3D models of terrain, populated areas, and cities are gaining increasing acceptance worldwide. Such models may be applied to a great variety of areas and branches: cartography, architecture, building, designing, inventory, planning, forecasting, and to many other areas. Presently at the NTs OMZ of JSC Russian Space Systems on the basis of the RESURS-DK1 data there has been assimilated the technology of digital terrain model construction using stereo pair with regard to the specific character of this data. The NTs OMZ, drawing on its experience gained, pursues an experimental work on generating 3D terrain models using the RESURS-DK1 data. In particular, there has been carried out the experimental work on constructing the 3D model for one section of the Moscow territory.

To construct a stereo pair there were selected two overlapping panchromatic images. The images were taken in summer from ascending and descending orbits with 3.83° and 3.22° roll angles respectively, 22.64° and 24.38° solar elevation angles, and 1.2 meter spatial resolution on ground. The stereo pair was processed using the PhotoMod 5.23 digital photogrammetric station.

When constructing the 3D terrain model, the first stage involved the generation of digital elevation model and ortophotoplan, and then a manual vectorization of large nonstandard terrain objects using the stereo pair. This made it possible the objects to be maximum similar in size and form to real ones which is not feasible using topographic plans and maps. Then there were appended the finished small and large standard 3D objects to 3DMod which may be interpreted in stereo mode and in ortophotoplan but may not be vectorized for correct display in 3DMod: transmission towers, lampposts, bus stop pavilions, and fences. Standard objects were appended to the model from the NTs OMZ's 3D object library.

The constructed 3D terrain model is classified as standard. This model may be used for visual estimate of object location with consideration for relief features, modeling of different situations, and solving other applied problems. It may also form the basis for constructing a full-fledged 3D terrain map wherein one may perform measuring operations, select terrain objects to request data on an object, and etc.

The technology described may be applied to the RESURS-P spacecraft data which is scheduled for launch soon. The RESURS-P data will somewhat differ from that acquired by the RESURS-DK1 spacecraft. In particular, the RESURS-P orbit will be near-circular sun-synchronous that will enable acquiring images of the same resolution unlike the RESURS-DK1 data. The RESURS-P capability of stereo imaging from one orbit will allow us for the purpose of constructing stereo pair to use images acquired during a minimal interval rather than multi-date ones as with the RESURS-DK1 data that in turn will improve stereo pair visual quality and will enable more comprehensive facilities for processing automation to be used.