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Using Visualization in the Educational Process in the Direction of Environmental Protection

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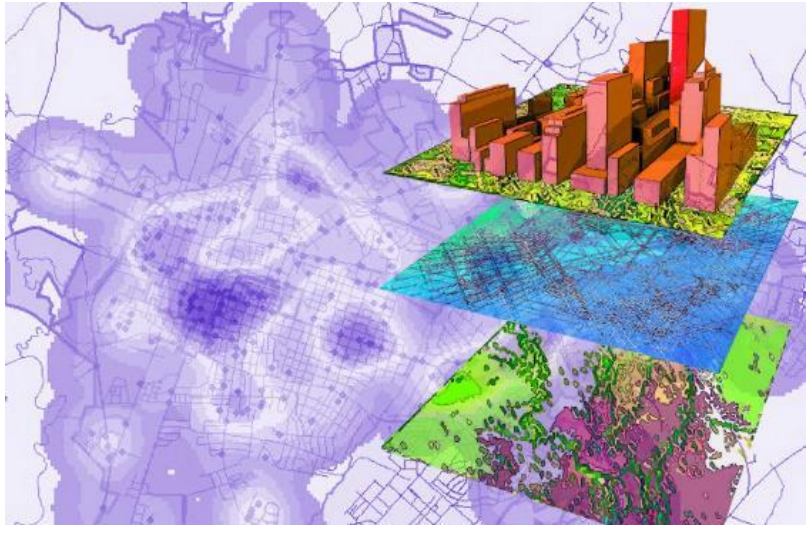
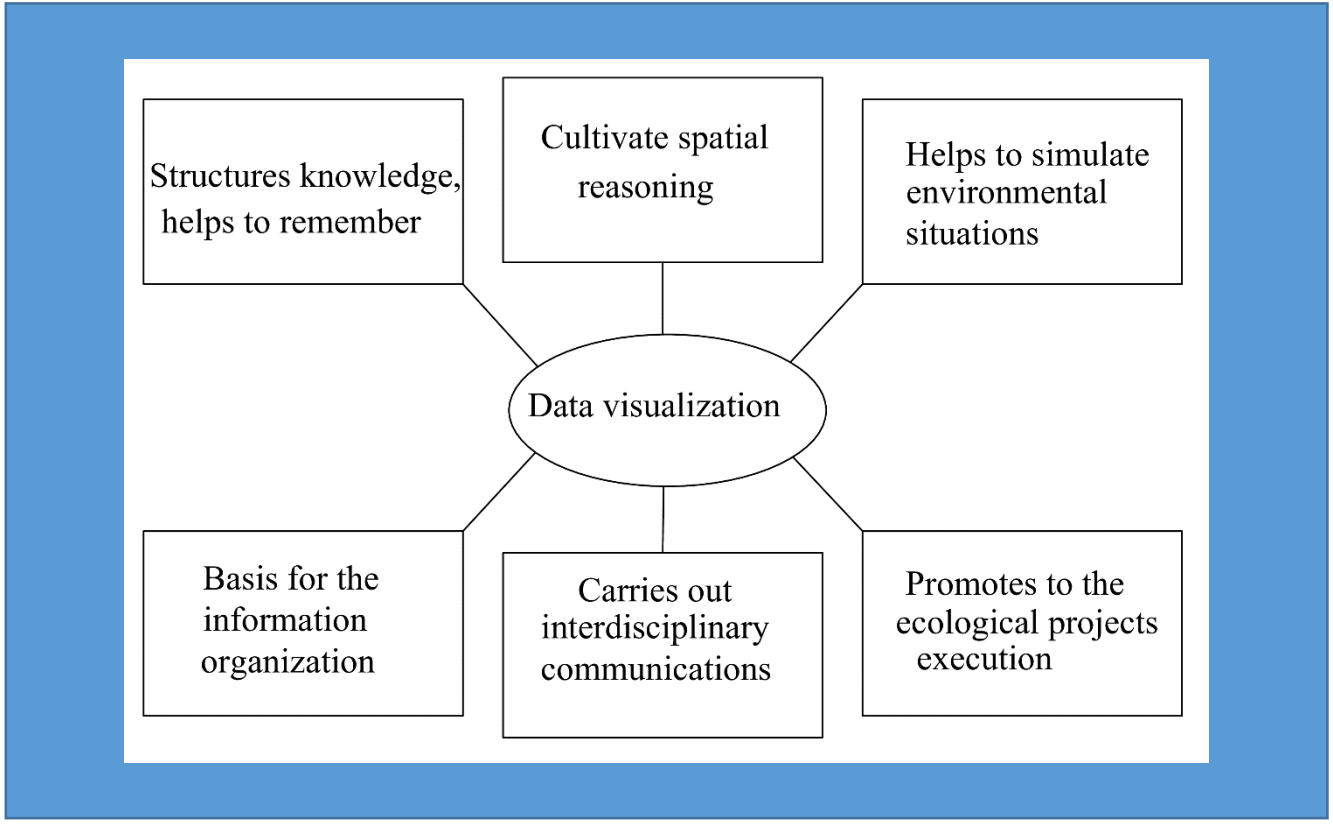
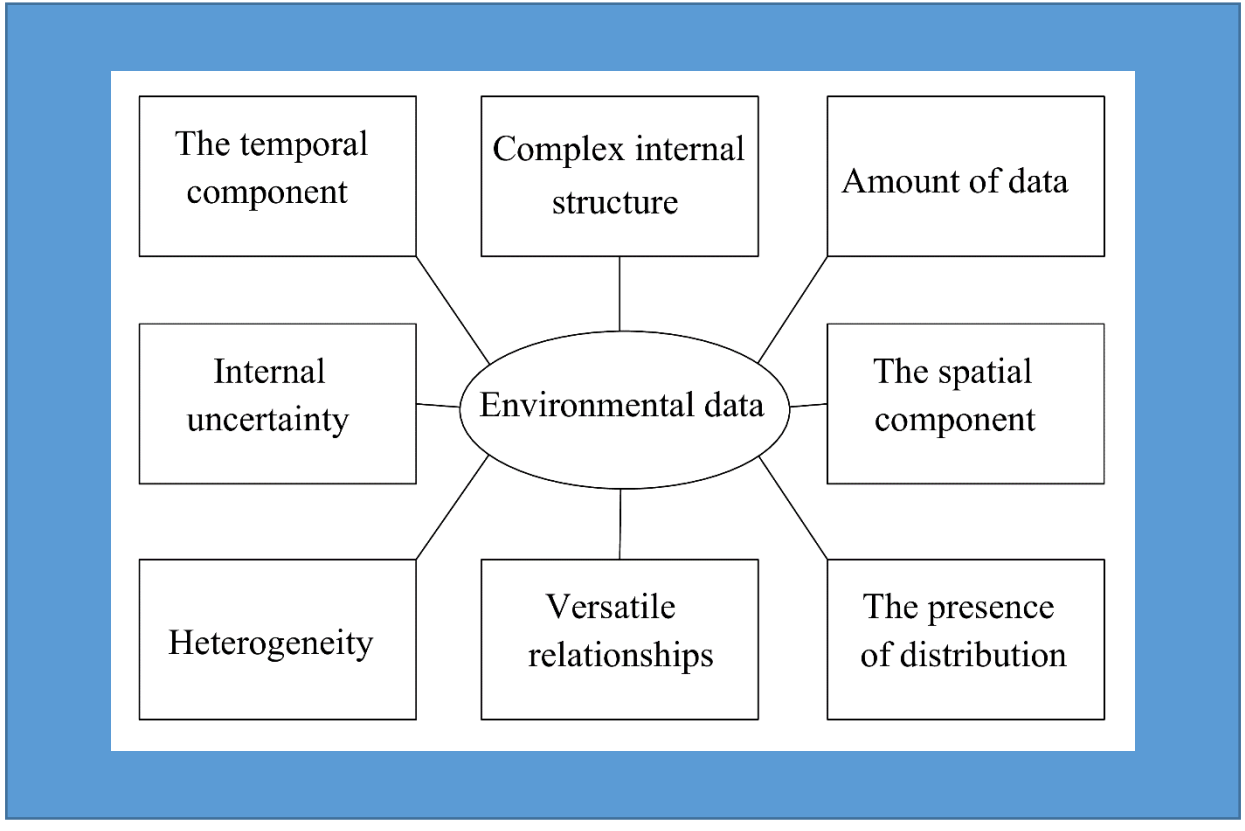
The **report** is devoted to the problem of visualization of environmental data in the training of future ecologists and in practice



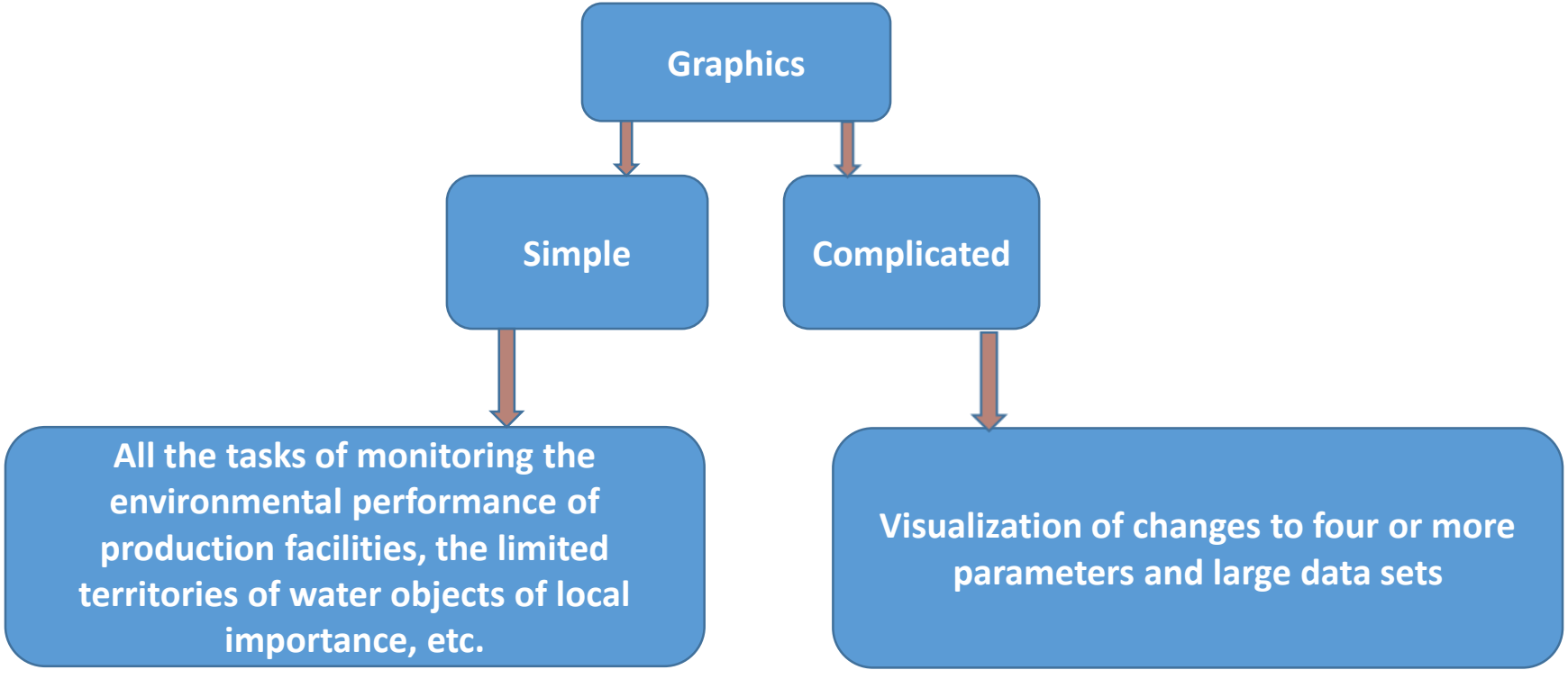
The visualization possibilities in education



Environmental data features



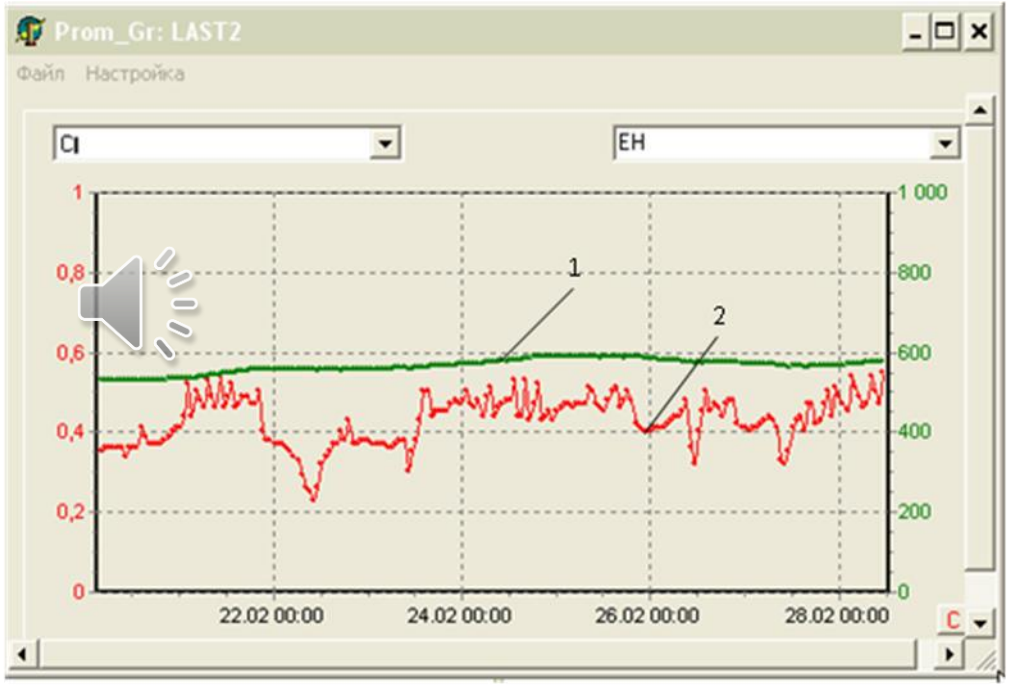
Using graphs for the representation of changes in environmental parameters



Simple graphs of time dependencies

A graph of changes in the main parameters responsible for the water quality of the swimming pool of the **PROM** system.

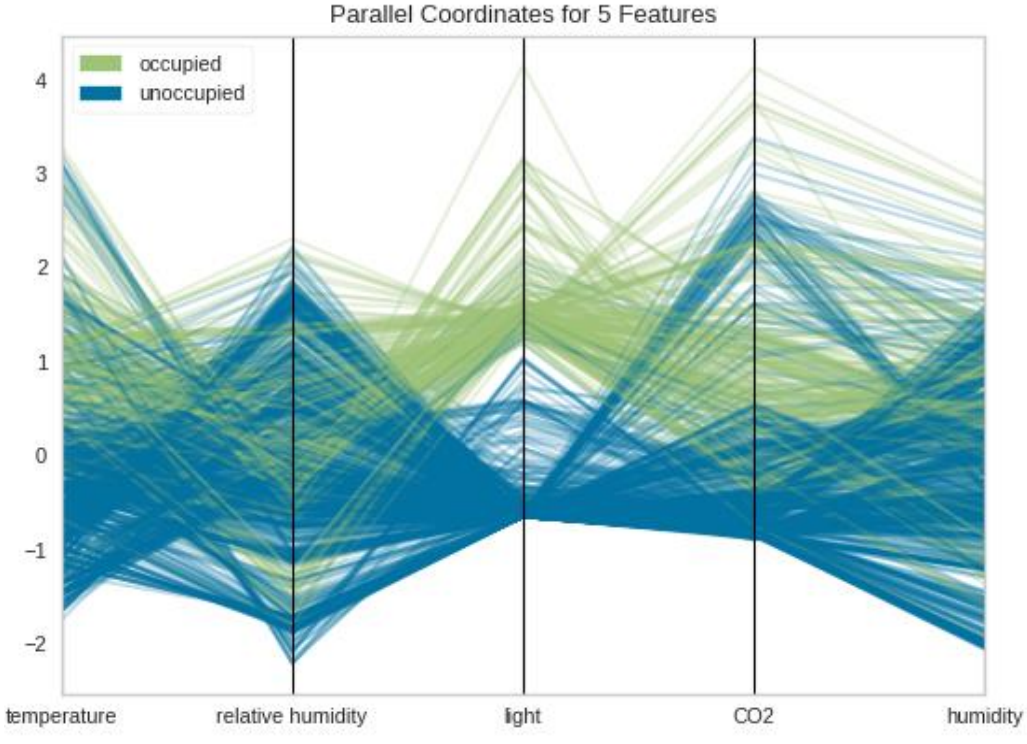
PROM system was developed at the National Research University "MPEI" at the department Engineering Ecology and Labor Safety. The system works successfully in several pools of Moscow and the Moscow region and is used in the educational process in the course of laboratory work on the discipline "Methods and means of protection of the aquatic environment".



Complicated graphs of changes in environmental parameters

Using **the parallel coordinate method** to visualize large amounts of environmental monitoring data.

The parallel coordinate method allows you to visualize changes in several parameters. In the database on which the graph presented in in figure contains approximately 28,000 records. This density of lines is not visible and cannot be visually assessed. But the distinction of individual lines is not always mandatory and a color gradient is sufficient for visual analysis of the data.

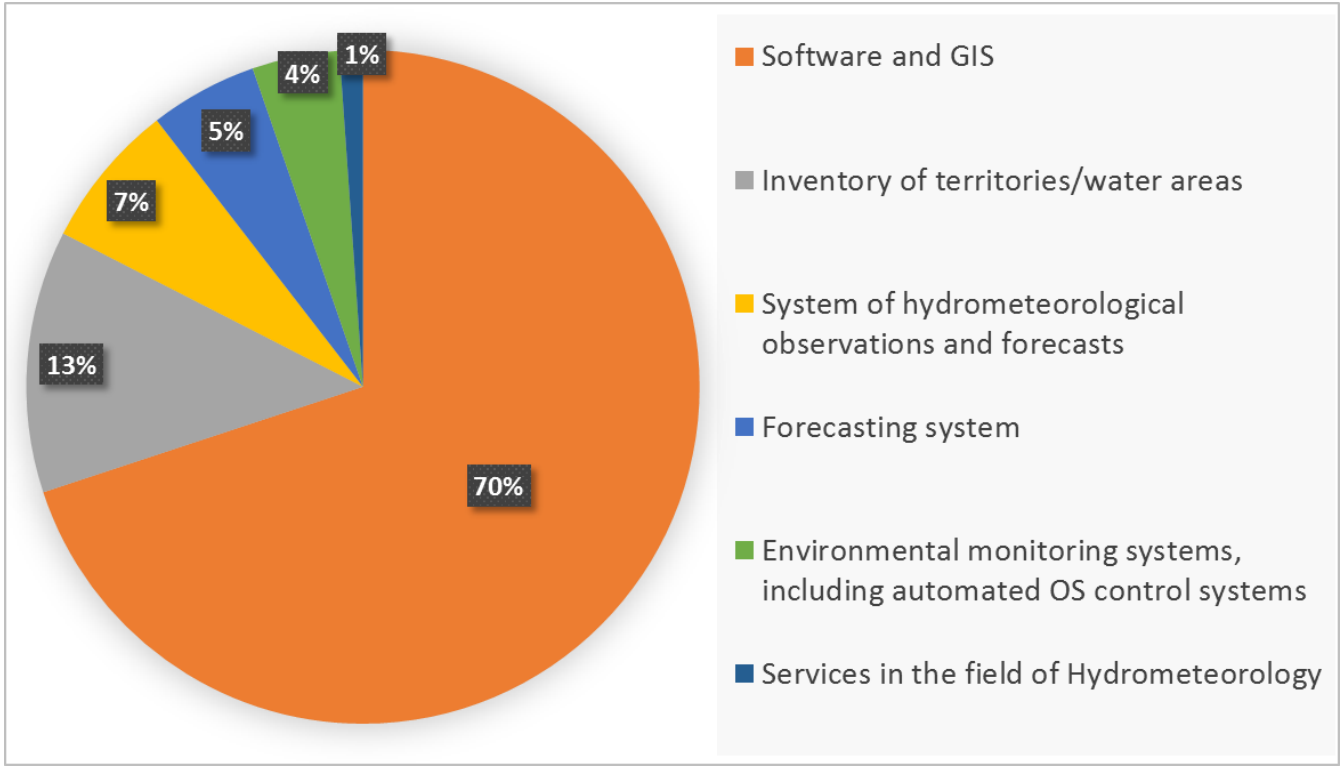


Using GIS

The possibilities of using GIS:

- storage and processing of data having not only spatial but also temporal characteristics
- Integrated processing of digital data having different types of representation and obtained from different sources: cartographic, statistical, field research results, aerial photography materials
- presentation of information on the map in on-line mode with the possibility of simultaneous work with cartographic information and database
- modeling of the development of the ecological situation in different environments and study of the dependence of the state of the ecosystem on weather conditions, characteristics of pollution sources, values of background concentrations, anthropogenic load, etc.

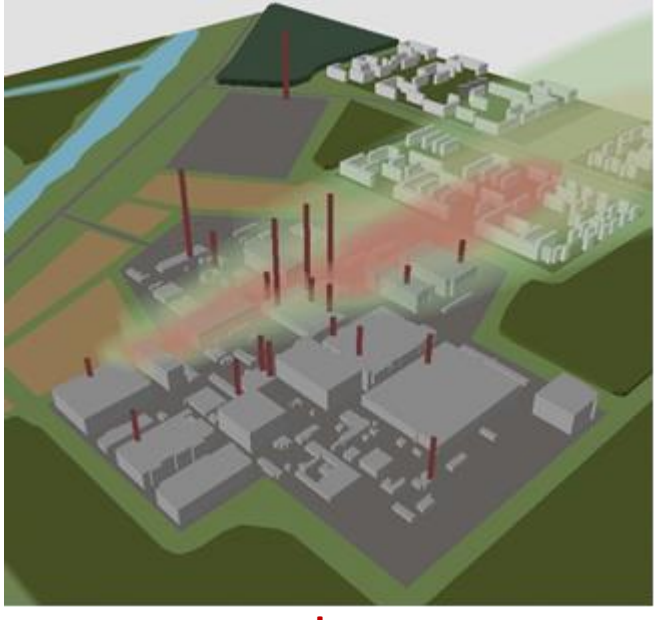
Total assessment of the market volume from 2012 to 2020 in the direction of "Environmental Management»



Using GIS in the educational process

The solution of the problem of calculating the dispersion of emissions of industrial enterprises with the help of the software product "**Ecologist**". Figure shows the results of calculating the emission dispersion of an industrial object in 2D (as isolines **a**) and 3D (as clouds **b**), respectively. 3D visualization was made with help of ArcGis software.

a



b

Prospects of development

Data on changes in the environmental situation can be recorded by users and entered into the General system in the same way as information on changes in the traffic situation in navigation software products.

A **progressive student community** can actively contribute to the development of public environmental monitoring systems

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Thank you for attention!

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