



# DEM OF THE MOUNTAIN TERRAIN BASED ON THE GNSS

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## **CONTENT**

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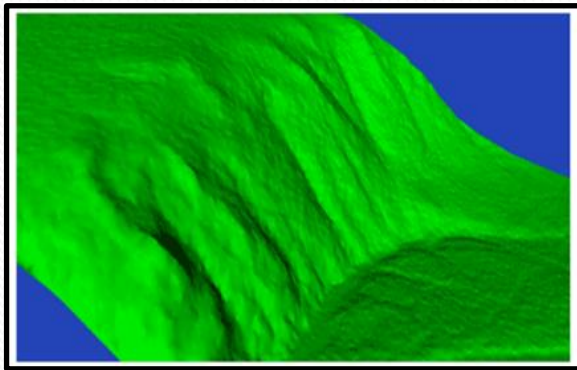
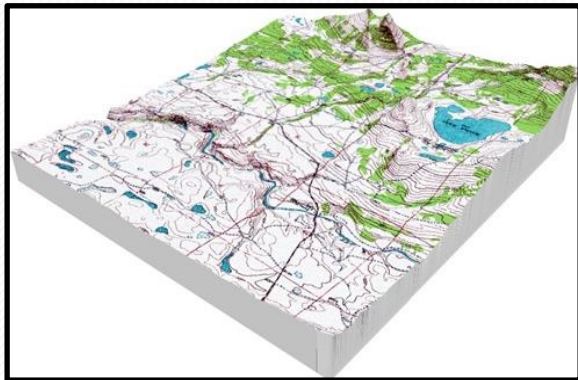
## TERRITORY OF THE CENTRAL ASIA



## THE TERRITORY OF UZBEKISTAN



## TOPOGRAPHICAL SURVEYING



## POLYGONOMETRY



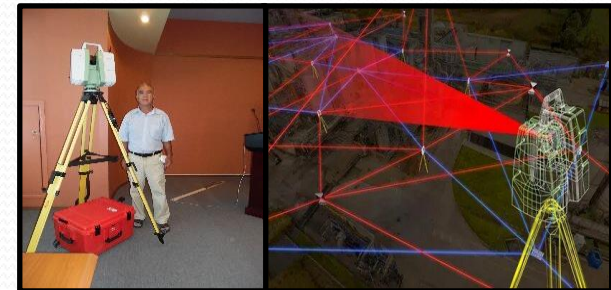
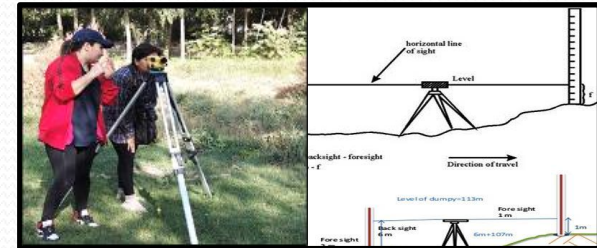
## SURFACE LEVELING

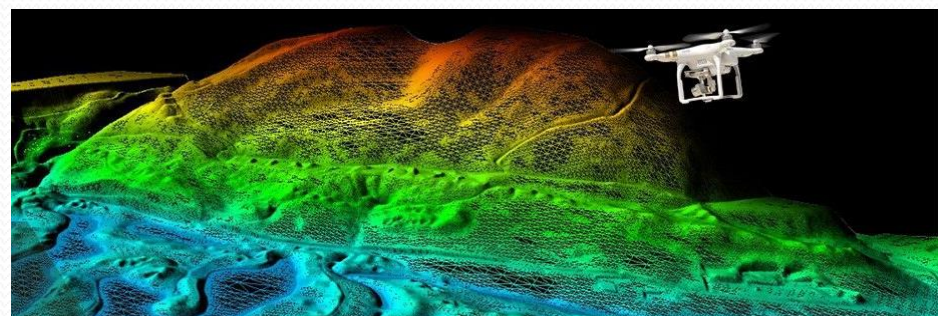
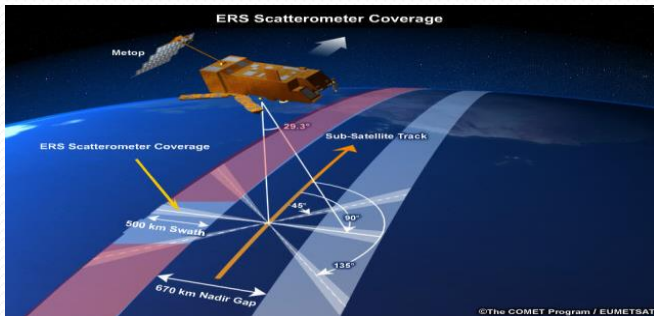
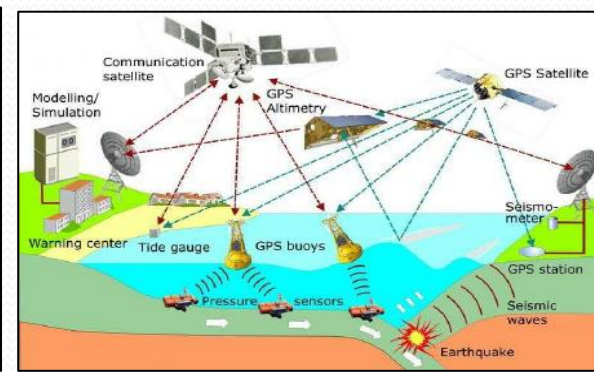
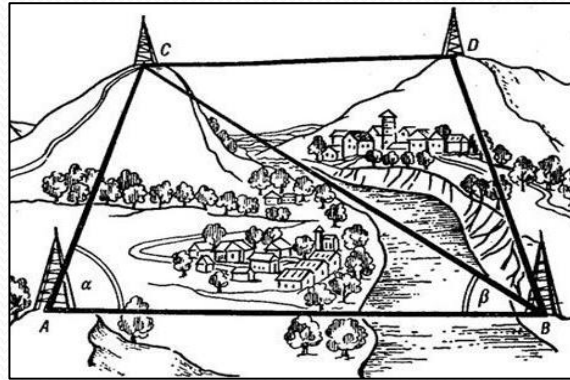


## LASER SCANNING



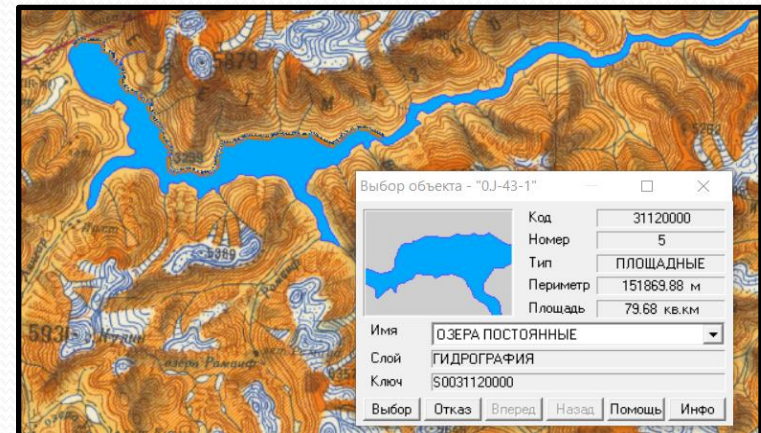
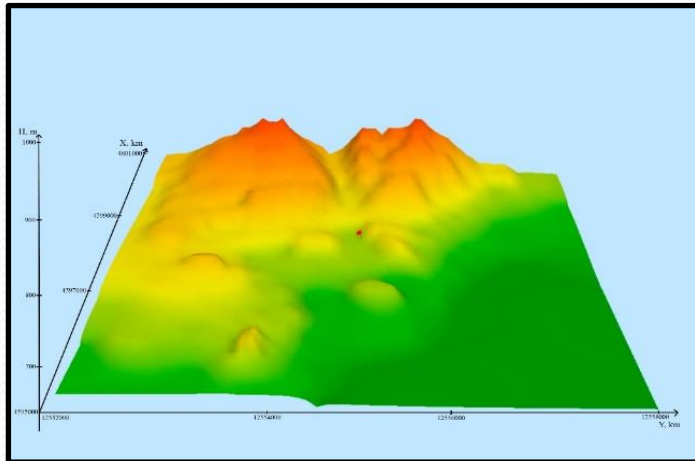
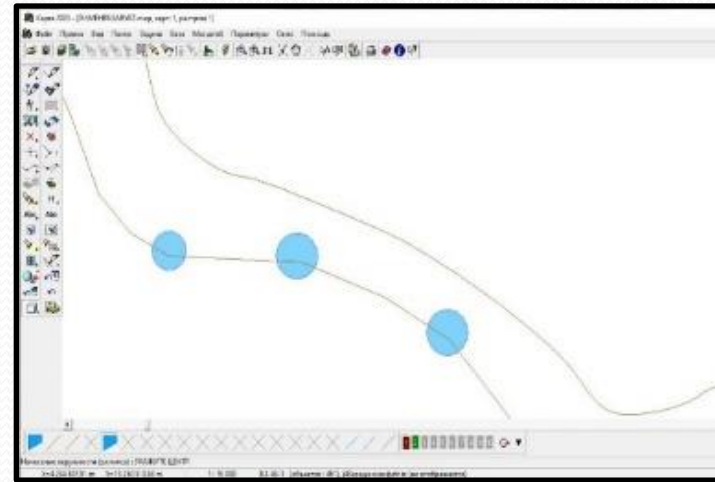
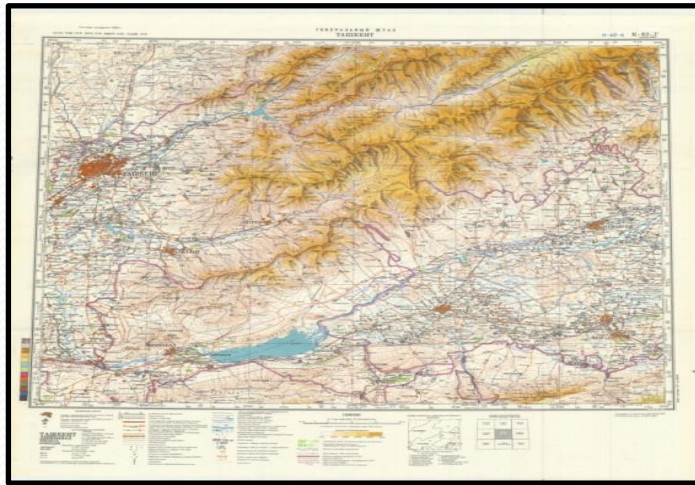
## MAP CREATION



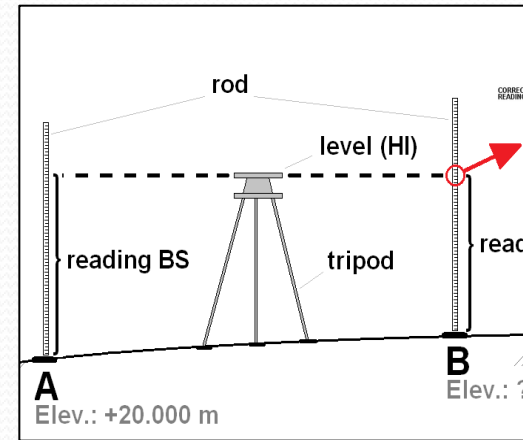
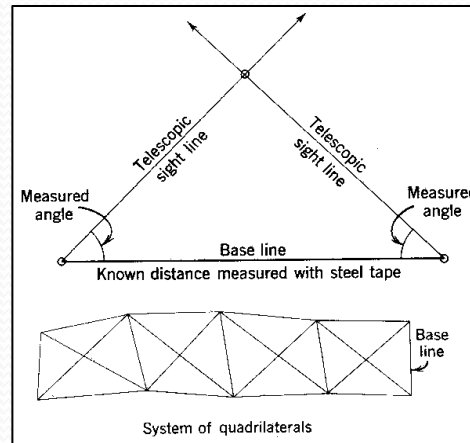
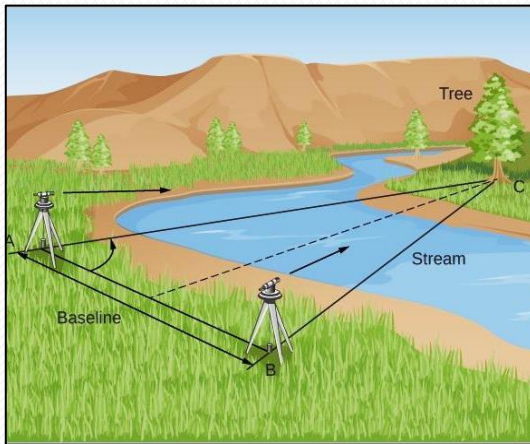
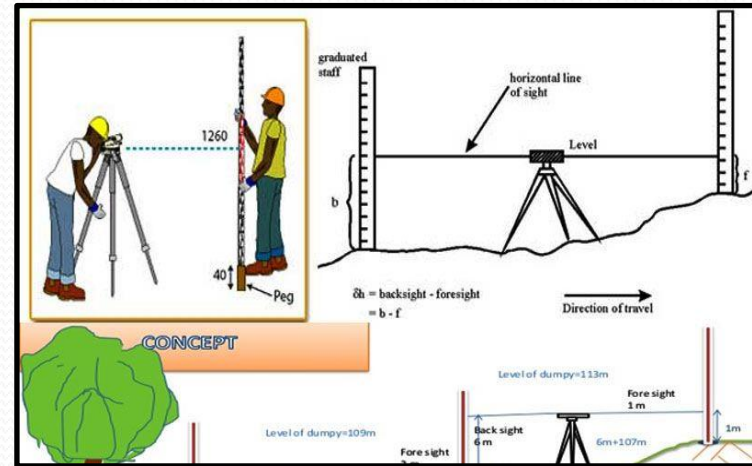




## GIS "PANORAMA"

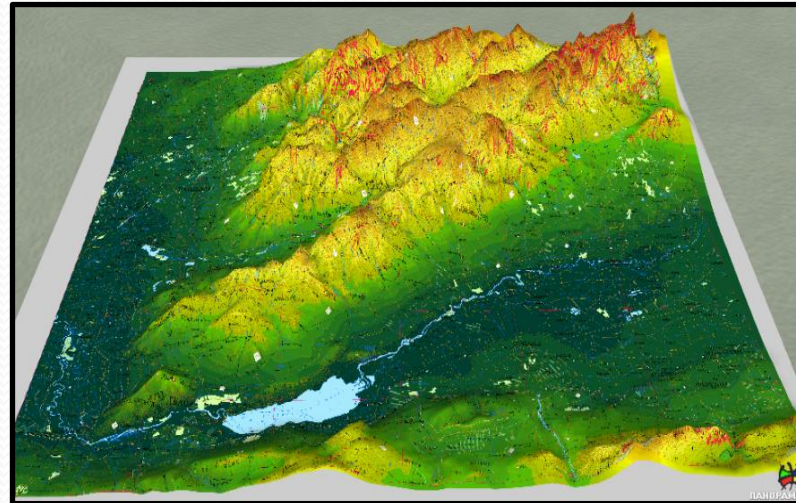


## GEODETIC MEASUREMENTS





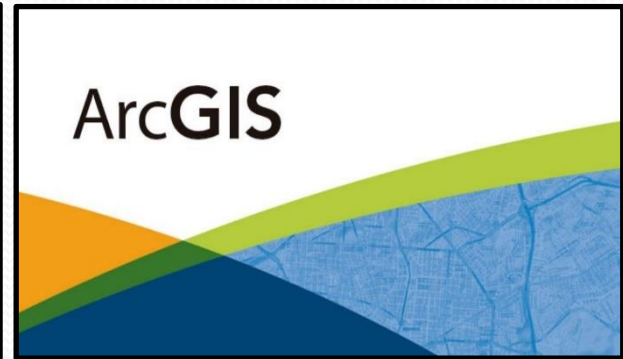
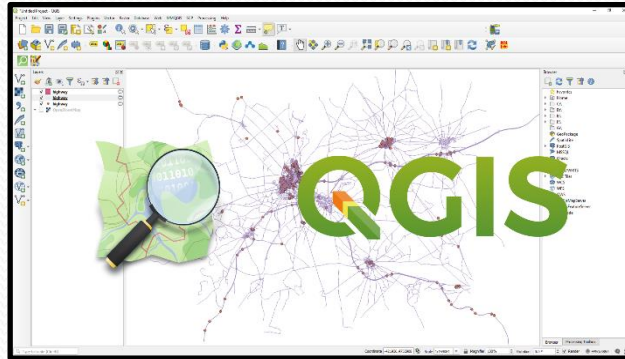
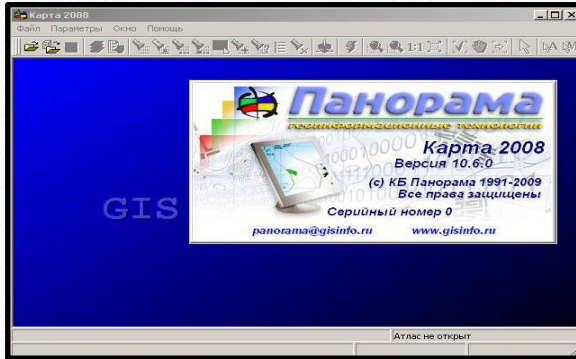
DIGITAL  
MAP



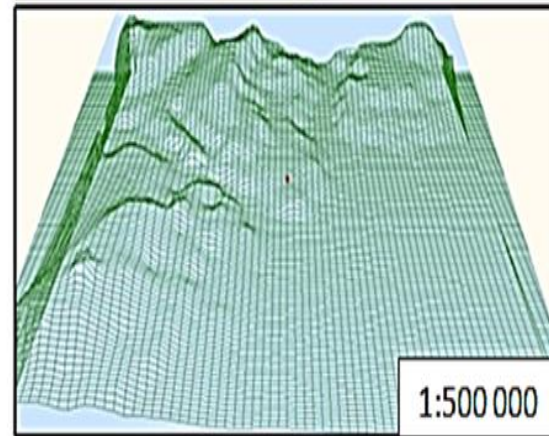
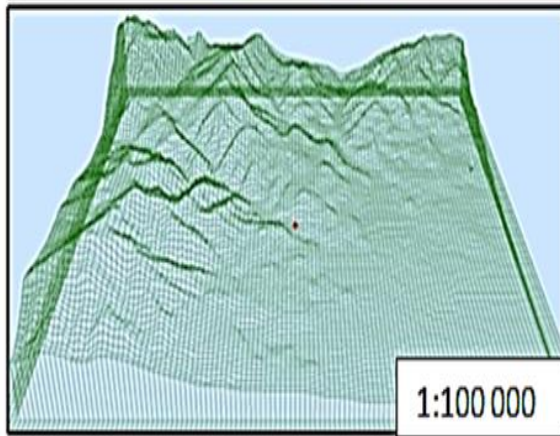
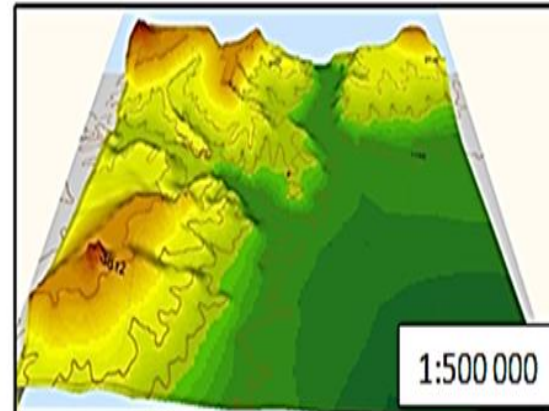
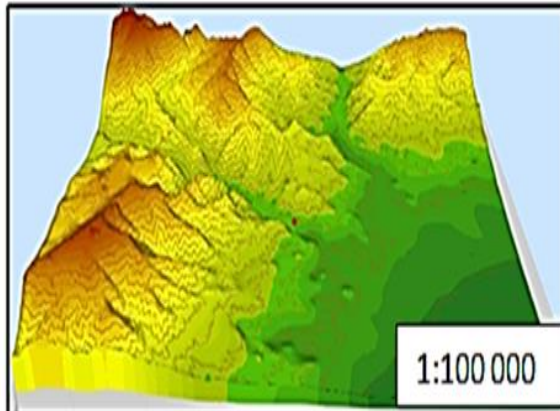




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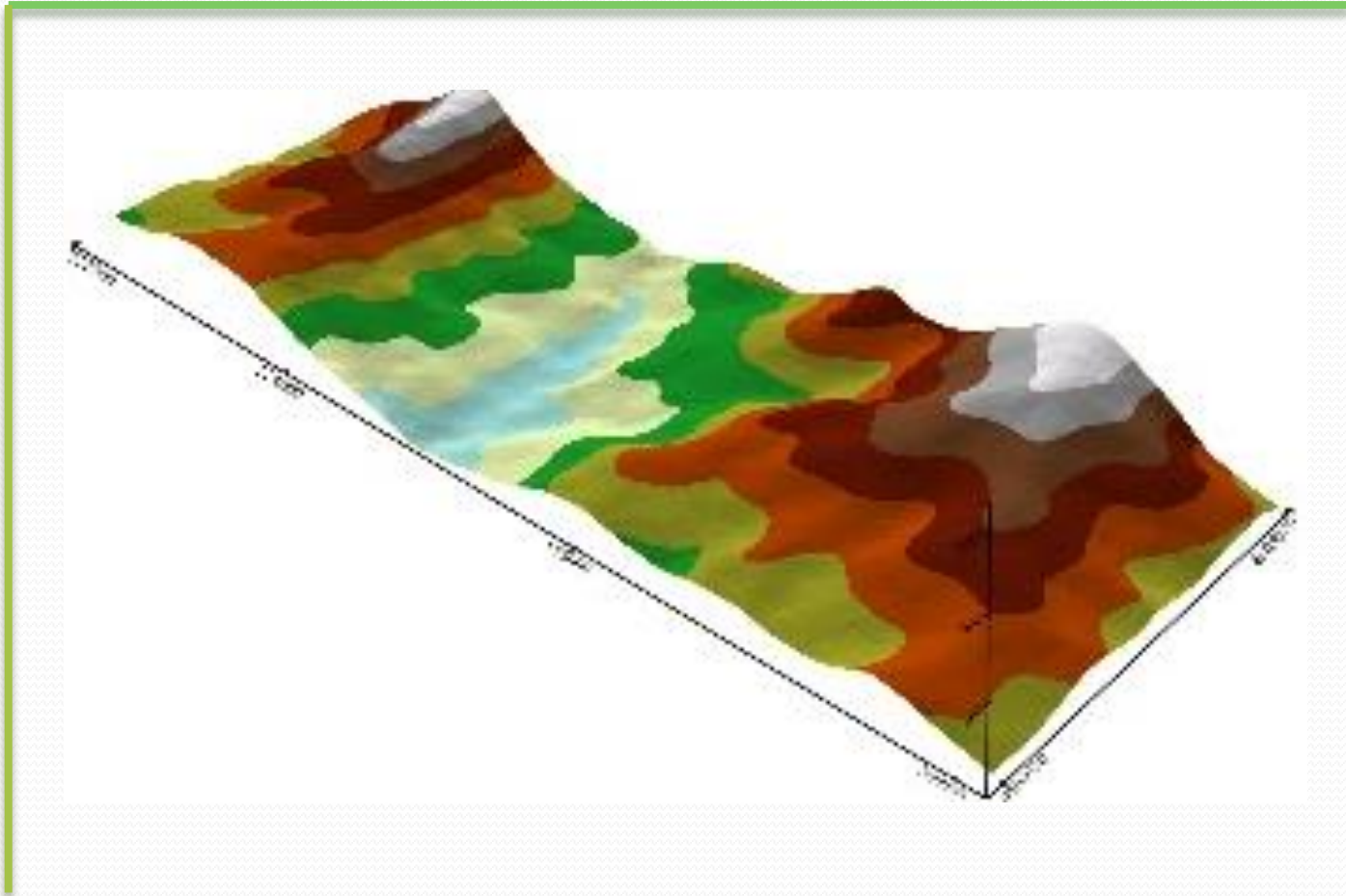


## DIGITAL ELEVATION MODEL BASED ON A TOPOGRAPHIC MAP.

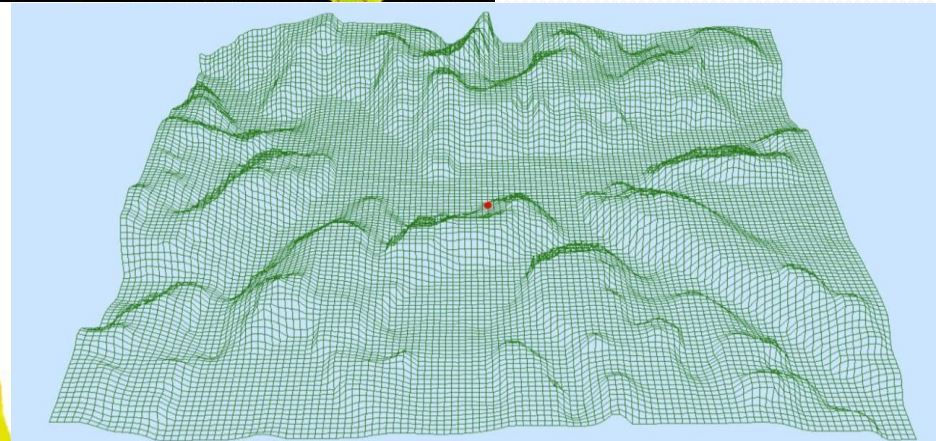
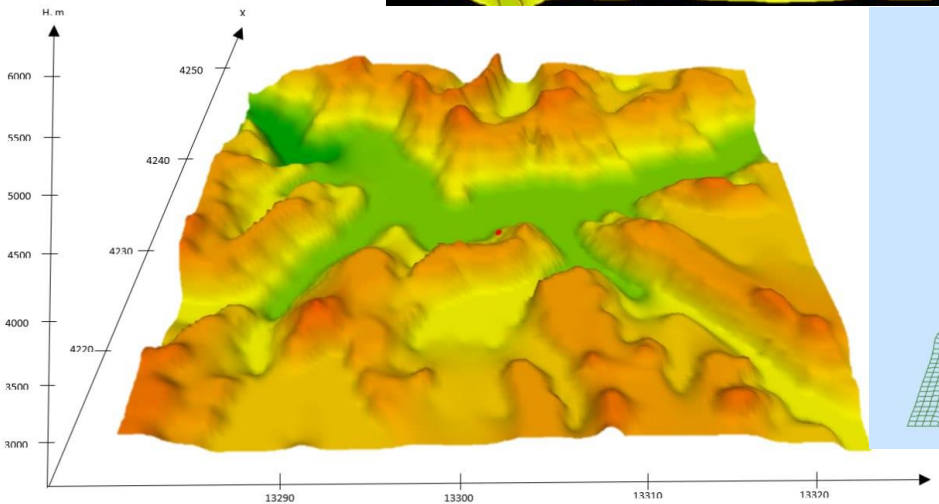
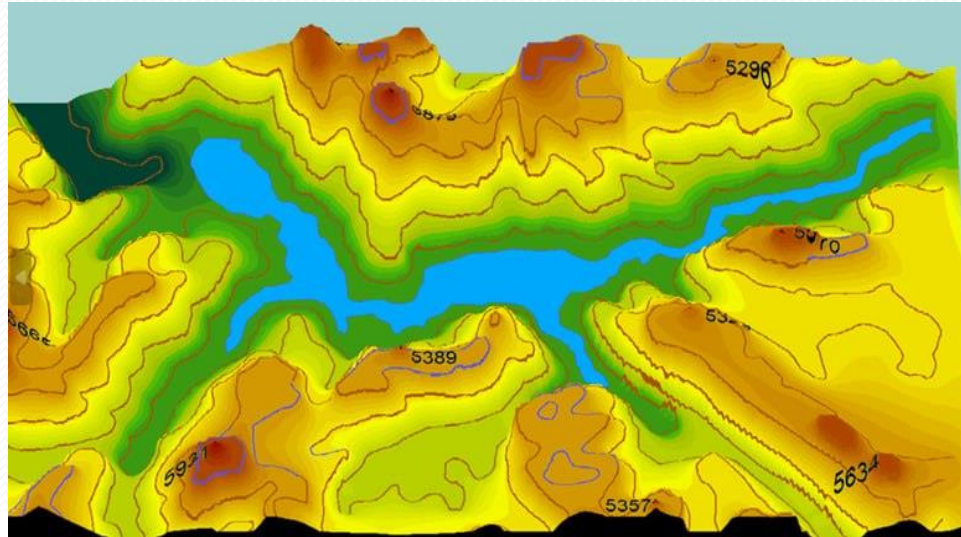


## SRTM - SHUTTLE RADAR TOPOGRAPHY MISSION

Currently, detailed information about the terrain can be obtained using aerospace photography, unmanned aerial vehicles, lidar and satellite navigation systems. But, the most optimal way is the shuttle radar topography mission (SRTM - Shuttle Radar Topography Mission).

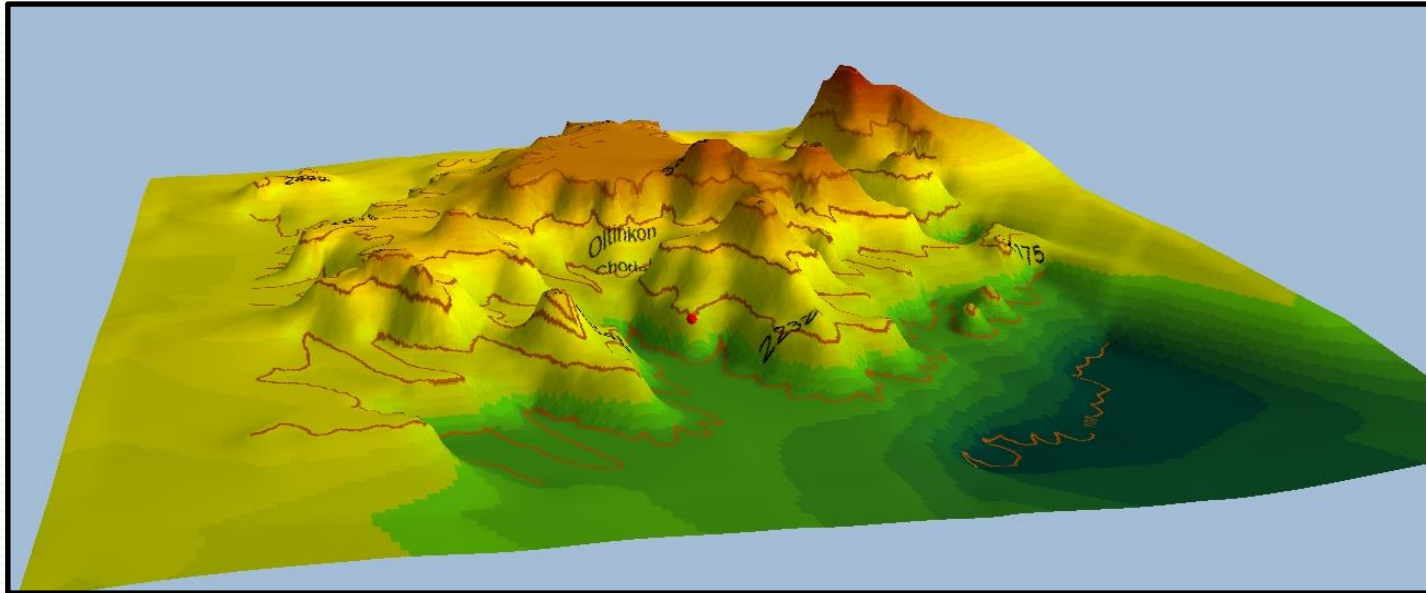


## A DIGITAL MODEL BASED ON GNSS.

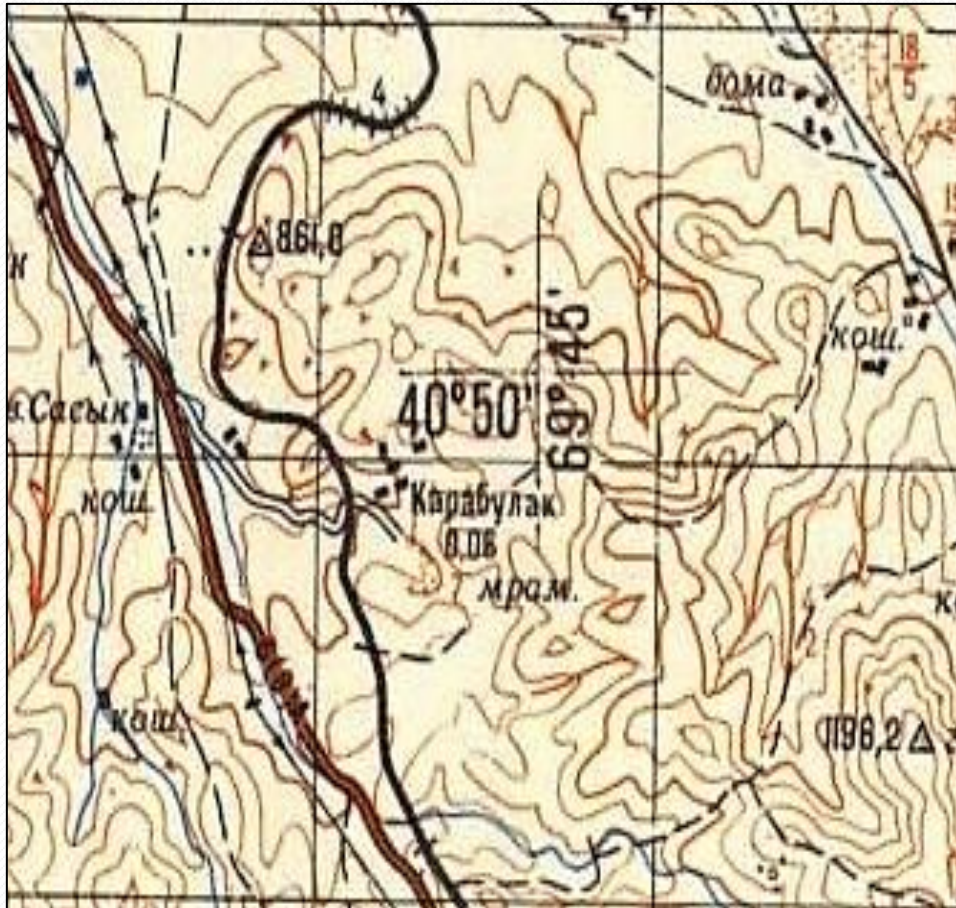




MEASUREMENT AND SEGMENTATION  
**KALMAKIR QUARRY**



FRAGMENT OF TOPOGRAPHIC MAP  
**K-42-116**



$$\lambda = 69^{\circ}43'49''.0,$$
$$\varphi = 40^{\circ}49'42''.9,$$
$$H = 737.9 \text{ m}$$

High-precision coordinates of this benchmark are still used to refine the geodetic network. Reconnaissance of the area was carried out using the K-42-116 topographic map, as well as the Juno 3 mobile navigator.

The measurements were carried out in real time (RTK), where a **GNSS rover** was used instead of a pole at a distance of **50 -100 meters** from the picket points.



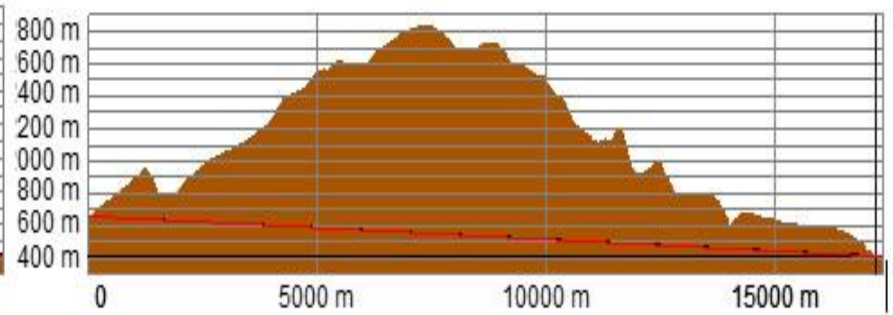
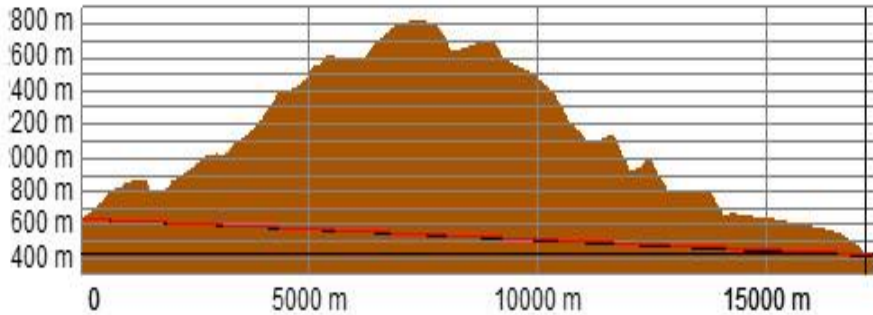
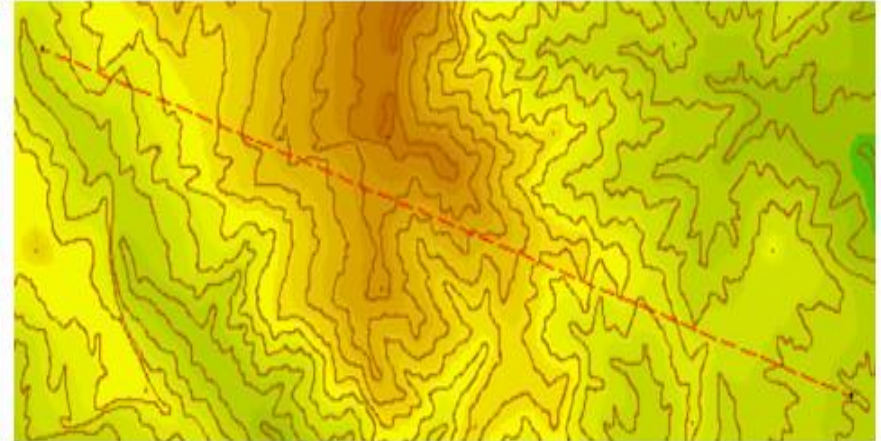
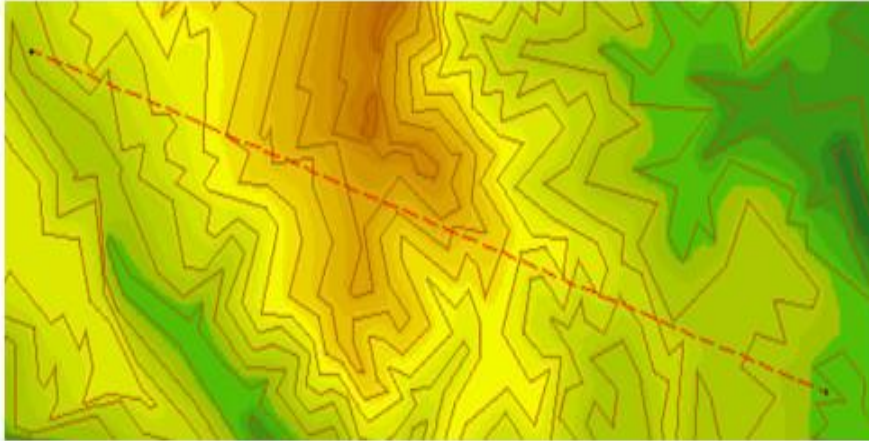
GNSS rover at picket points

## ANALYSIS

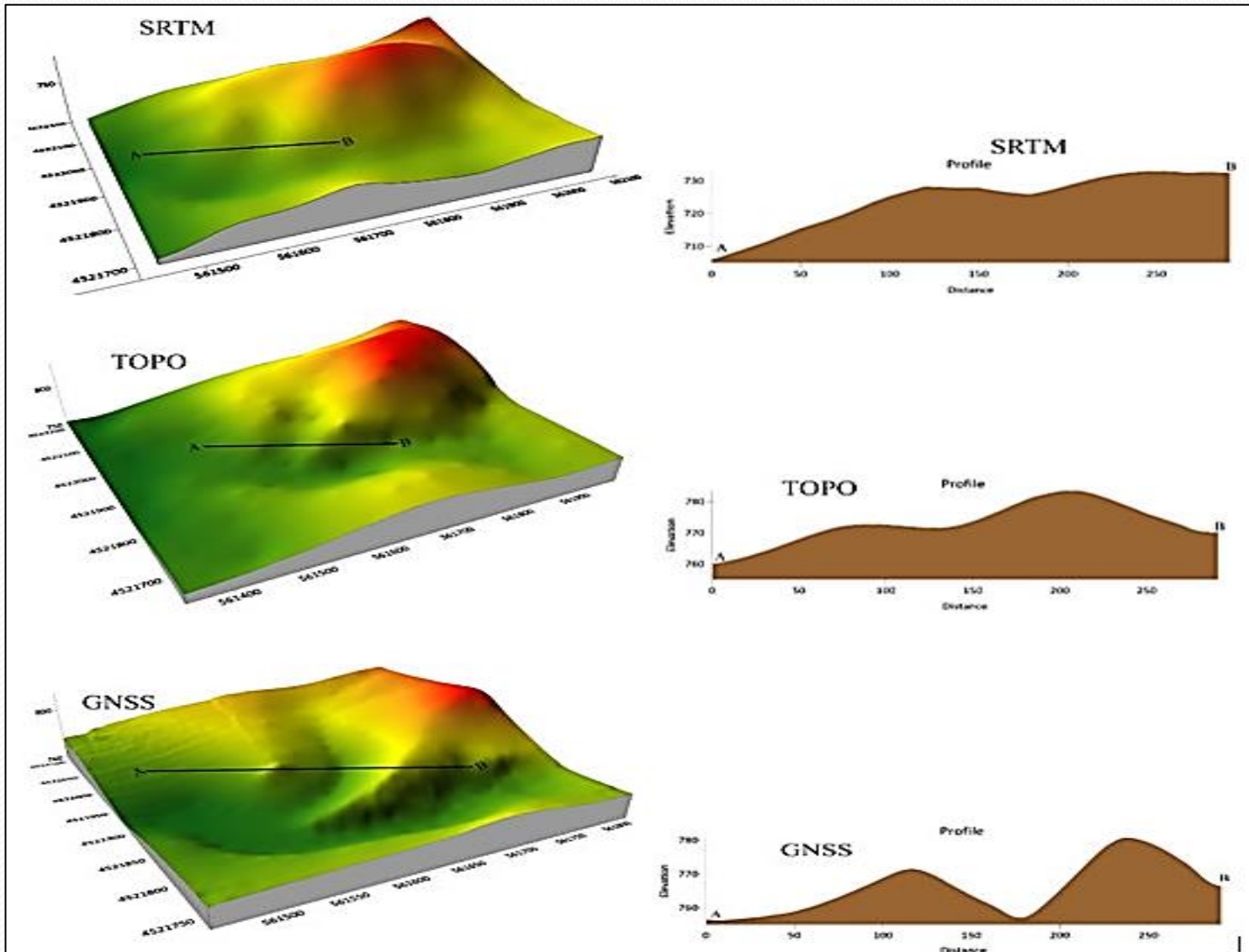
- **The Gauss-Kruger transverse cylindrical projection**
- **Kronstadt benchmark**
- **$\pm 0.054$  m for the base station**
- **$\pm 0.068$  m for the altitude component**
- **overall root mean square error of spatial coordinates is  $\pm 0.008$  m**
- **the maximum PDOP value of the base station reached 1.359**





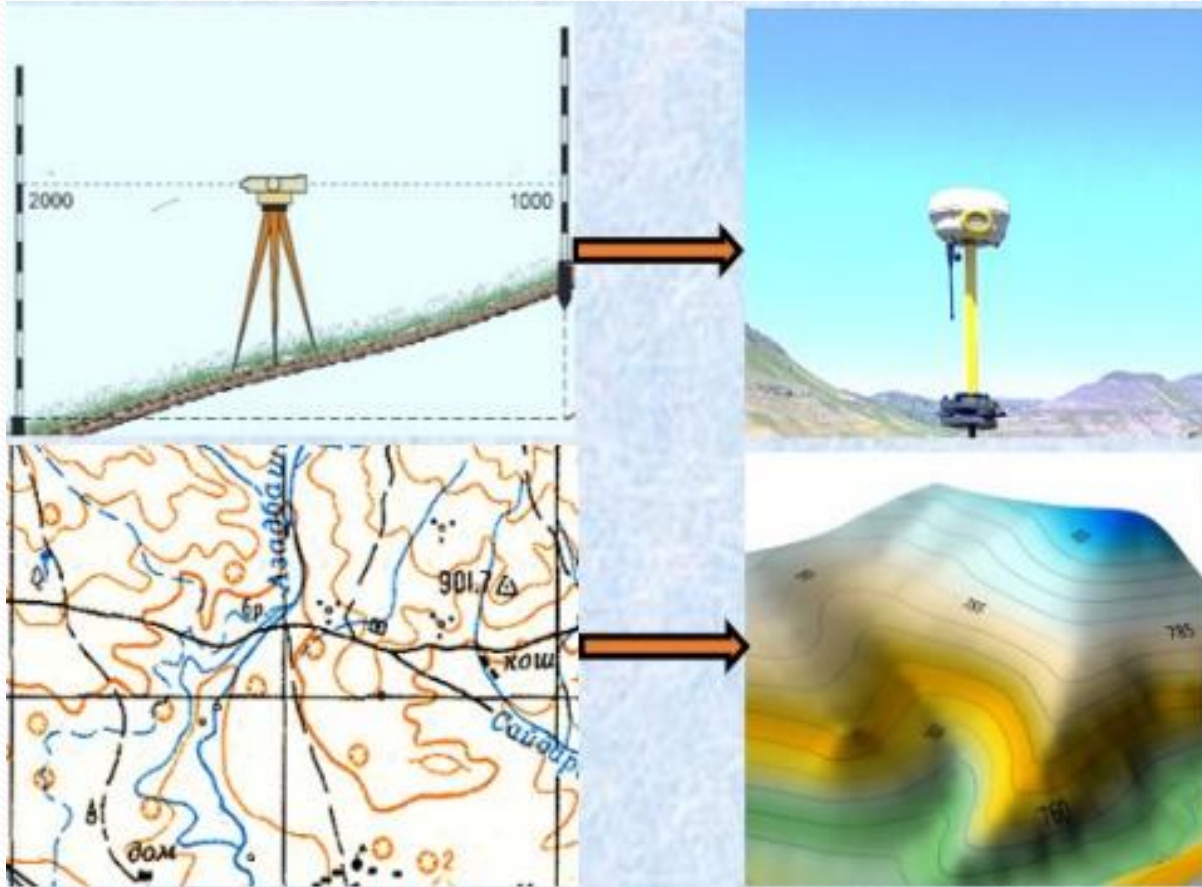


### Segmentations in the GIS “Panorama”



## CONCLUSION

**GNSS  
measurements**





## **IN THE FUTURE**

- **Creating of digitization of topographic maps.**
- **Creating of methods of development of digital elevation models of mountainous areas.**
- **Creating digital web maps.**





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