

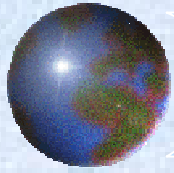
A satellite map of the Caucasus region, showing the borders of Armenia, Azerbaijan, and Georgia. The Caspian Sea is visible to the east. The map is overlaid with text for a workshop.

**United Nations/Moldova/United States of America
Workshop on the Applications of Global Navigation
Satellite Systems**

**Application of Global Positioning System
in Natural Disaster Studies**

17 - 21 May 2010, Chisinau, Moldova,

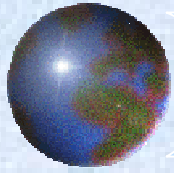
**Presented by: Saida Salahova –
Engineering Consulting Technologies LLC/
Azerbaijan National Aerospace Agency,
Rustam B. Rustamov -
Institute of Physics National Academy of
Sciences**



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CONTENT

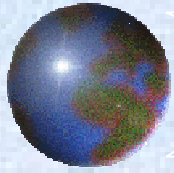
- ✚ Introduction
- ✚ Method
- ✚ Key Findings
- ✚ Space Image Processing
- ✚ Field measurements
- ✚ Conclusion



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INTRODUCTION

- Integration of information systems, satellites imaging systems and improved software technologies
- Development database using the remote sensing methods and GIS technology for access to resources and opportunities of prediction, reduction of natural risk
- Project titled “Application of Remote Sensing and GIS Technology to Reduce Flood Risk” ProVention Consortium in association with the University of Wisconsin-Madison, Disaster Management Centre within the programme “Research and Action Grants for Disaster Risk Reduction”.

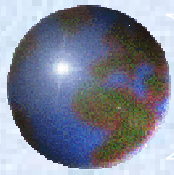


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⊕ **Natural Disaster Impacts:**

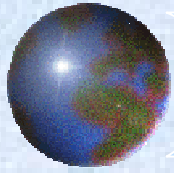
- **Landslides**
- **Floods**
- **Earthquakes**
- **Fires**
- **Raising of the Caspian Sea Coastal Line**

⊕ **Others.**



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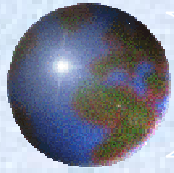




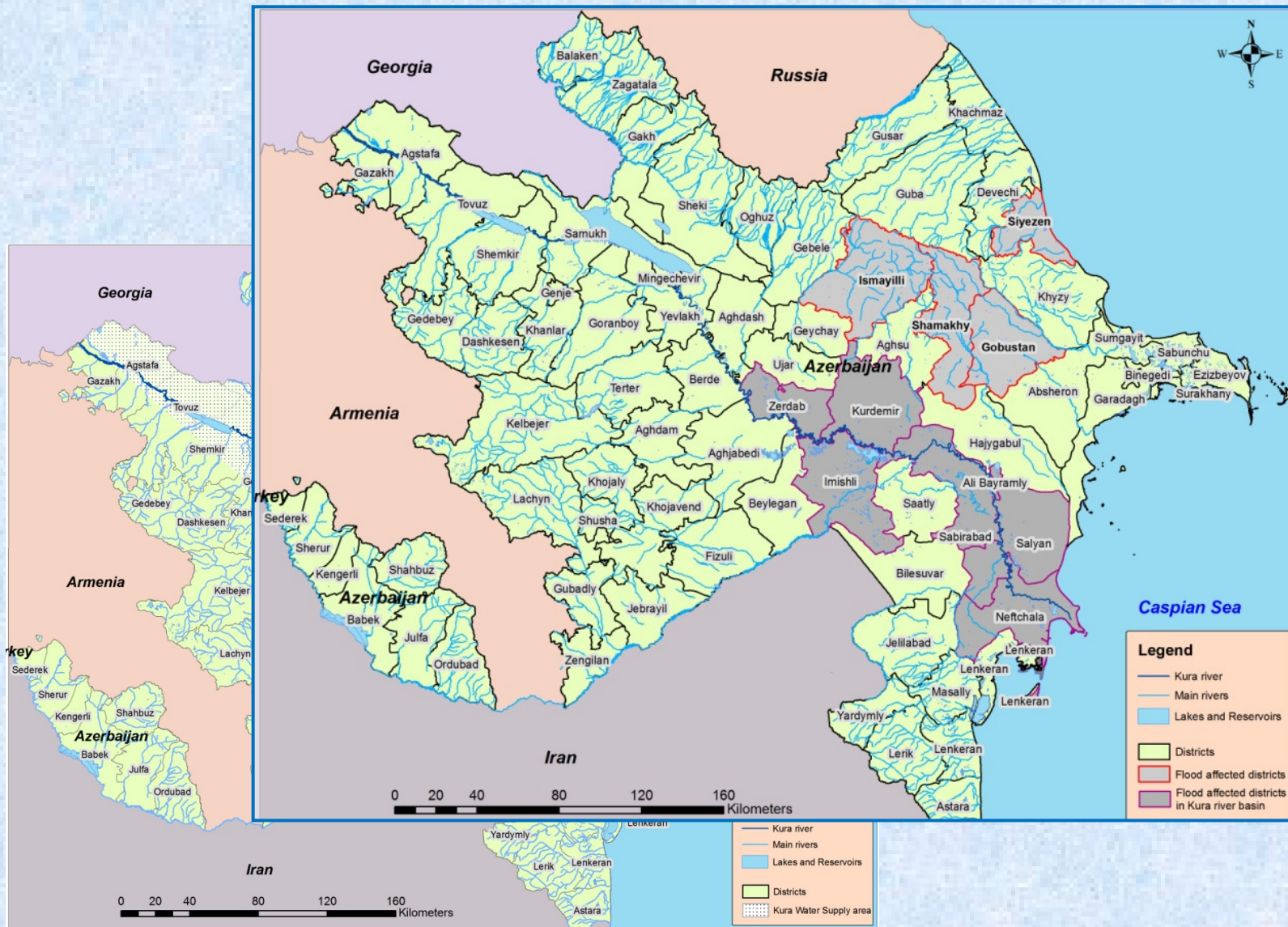
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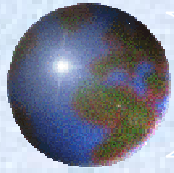
ADVANTAGES

- The large covering area;
- Sufficiently high accuracy data;
- Investigation of the inaccessibility areas;
- More flexibility of process dynamic changes;
- Other



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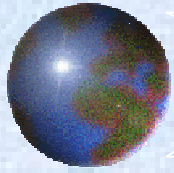




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METHOD

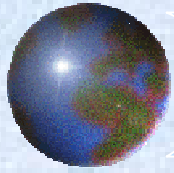
- The use of ALOS space imagery to be created the land use / land cover basic map for the investigated area using urban, agriculture, garden, scrub, open area, river, stream, canal, road, railroad basic classes;
- The use of Landsat ETM space imagery to be detected potential flood inundation areas within the Kura River watershed in the Salyan district of Azerbaijan using a tasseled cap transformation;
- The derive 1 m Digital Elevation Model (DEM) from contour lines and elevation points of the investigated area to be generated a deterministic model of potential inundated areas for the region using the DEM and a convex-areas surface;
- The evaluate the sensitivity of each approach to be characterized the flood inundations through statistical tests involving comparison of flooding areas extracted from an inventory of soils and a geomorphology maps.



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KEY FINDINGS

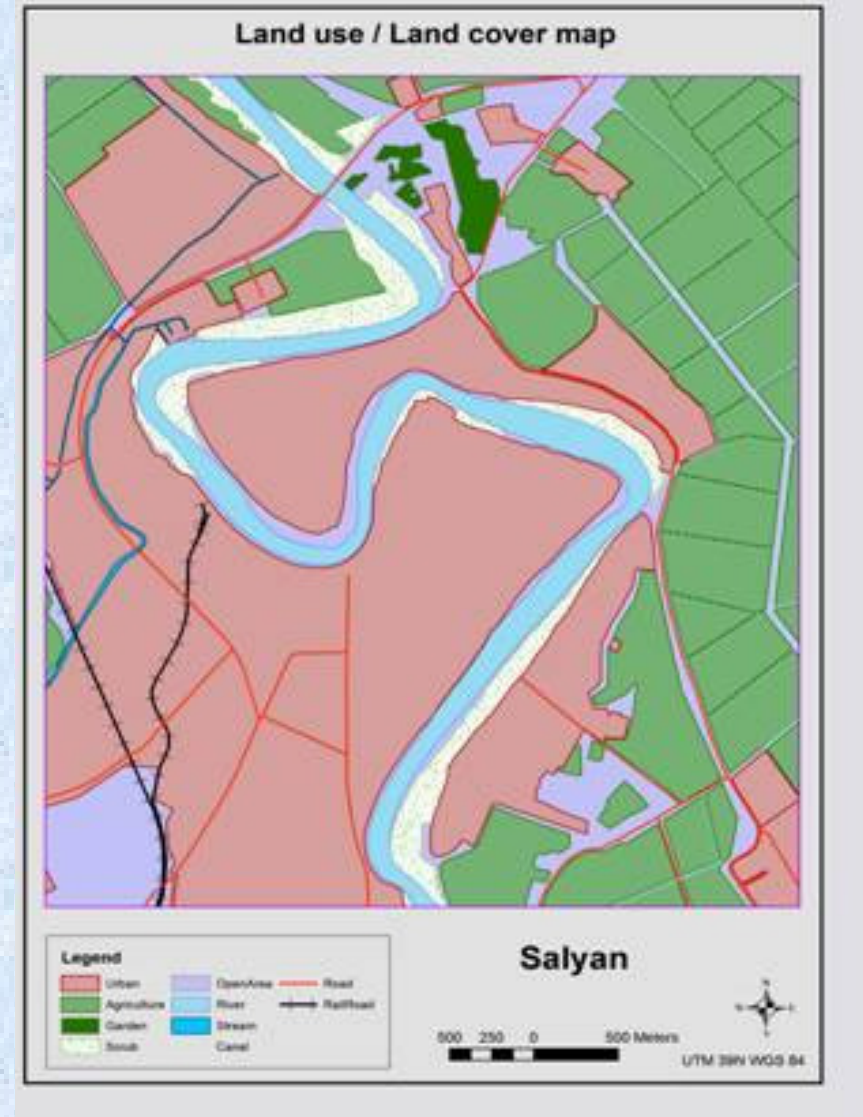
- Space technologies are to develop of an advance tool for monitoring, data collection, data processing, review and report on progress and challenges in the implementation of disaster risk reduction and recovery actions undertaken at the national level.
- As a further step a wide scale of river monitoring is required for successful and effectively forecasting, preparedness and reduces of the natural disaster impact.
- Awareness information program of this hazard has to be developed and implemented in order to safe the human life, properties as well as to reduce disaster damage impacts.
- Potential flood inundation areas can by identified by satellite imagery and ground-based measurements.
- The mapping of potential flood areas can help for further settlement planning in this region.

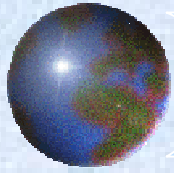


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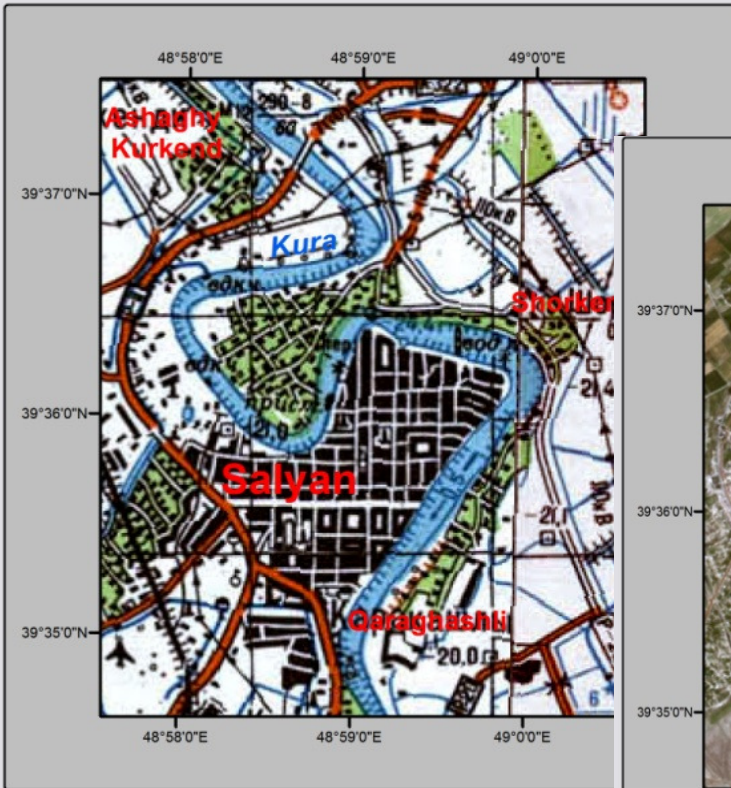
SPACE IMAGE PROCESSING

1. Urban or Built-up Land
2. Agricultural Land
3. Garden
4. Scrub
5. Open area
6. River
7. Stream
8. Canal
9. Road
10. Railroad





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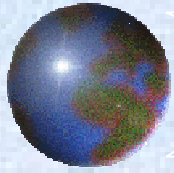
➤ Topographic map



➤ Selected area of
ALOS AVNIR-2
image

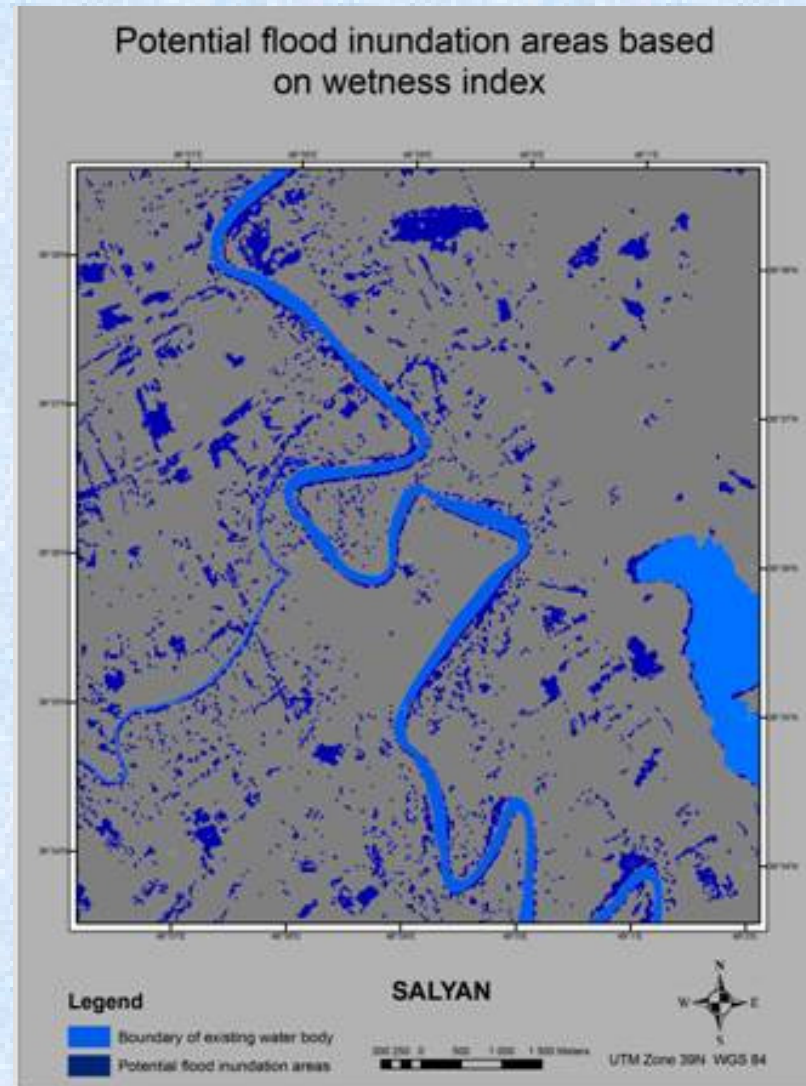


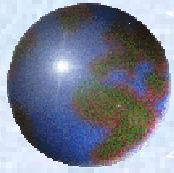
➤ Image of
LANDSAT



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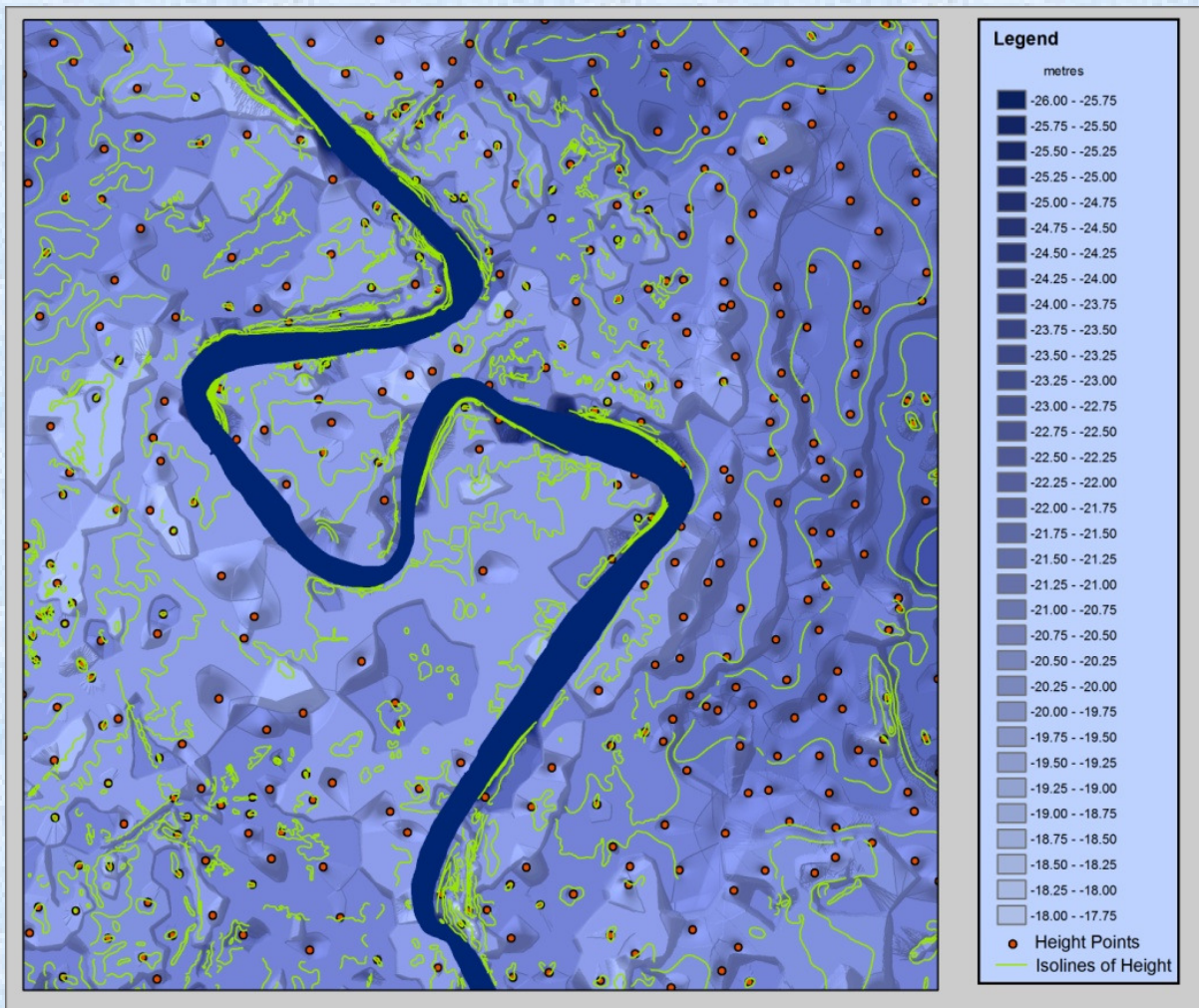
Potential flood inundation areas based on wetness index

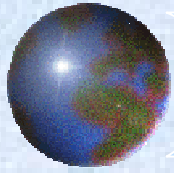




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Digital Elevation Model of the selected area with high points and isolines





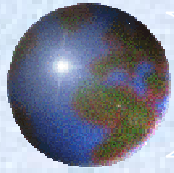
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Forecasting of the potentially flood inundation areas

Potential flood inundation areas derived from
the DEM-based surfaces for -22.0 m level



RF - Zones reflect potentially flood areas



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Field trips implementation using GPS

Field trip Ground Control Points



Legend

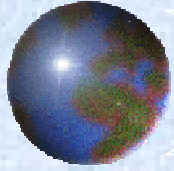
- Field_GCP
- River

Salyan

500 250 0 500 Meters



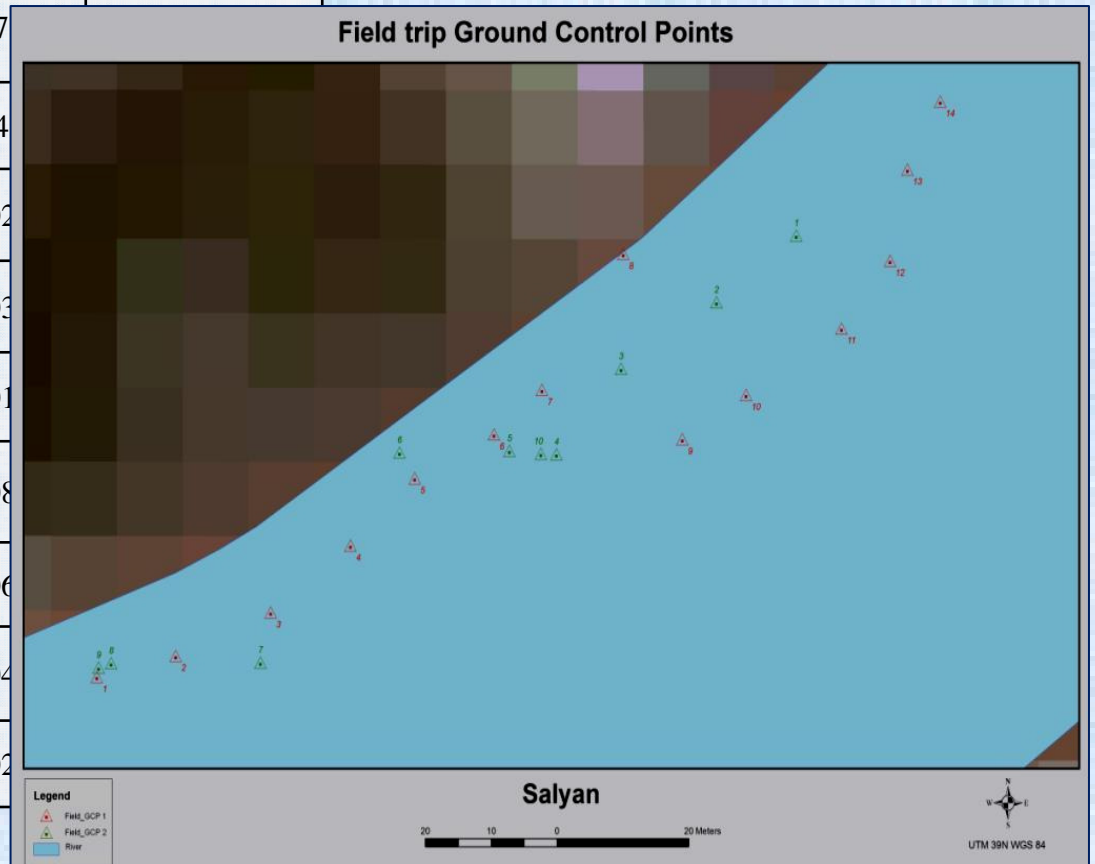
UTM 38N WGS 84

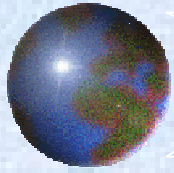


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Ground Control Points

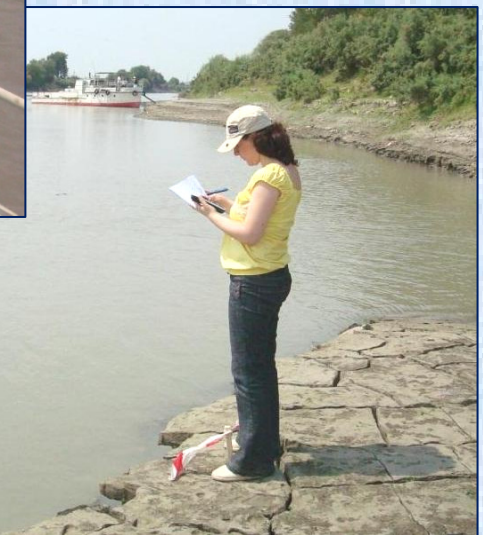
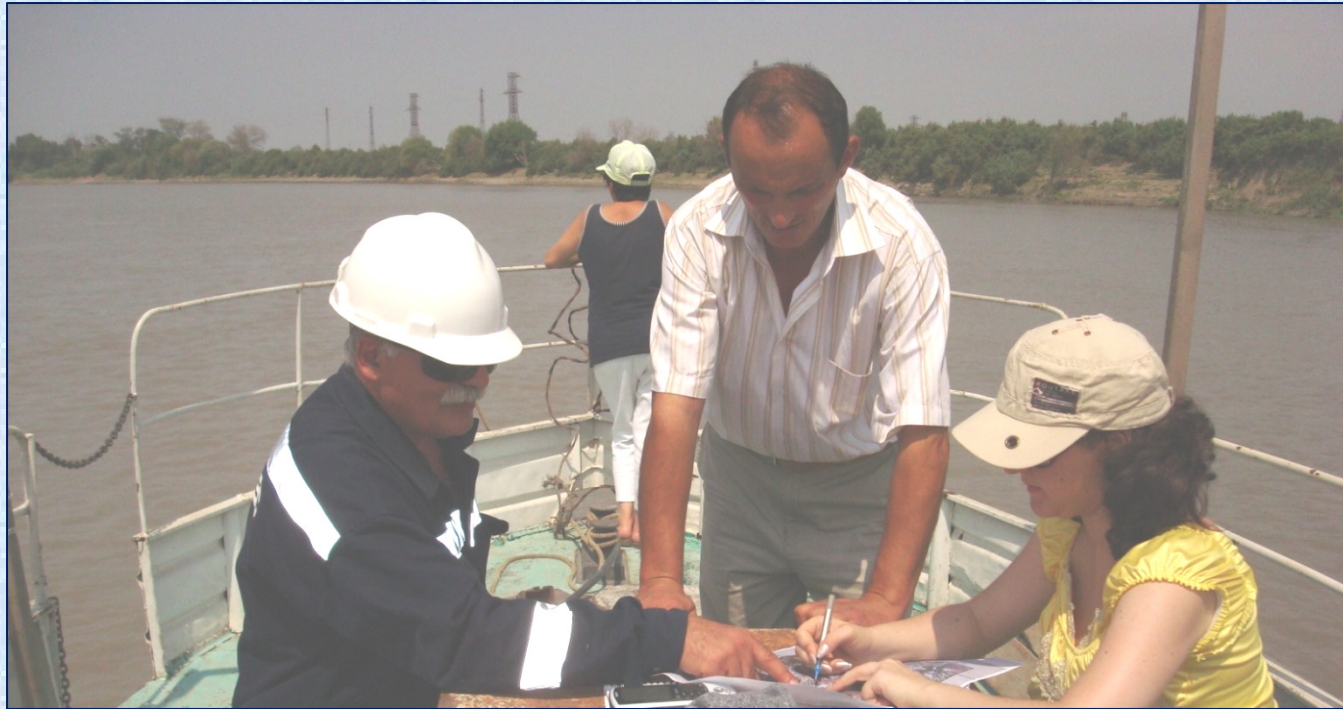
| No | N | E | No | N | E |
|----|-------------|-------------|----|--------------|-------------|
| 1 | 39°36'42,0" | 48°59'00,0" | 1 | 39°36'44,0" | 48°59'03,4" |
| 2 | 39°36'42,1" | 48°59'00,1" | 2 | 39°36'43,7" | |
| 3 | 39°36'42,3" | 48°59'00,6" | 3 | 39°36'43,4" | |
| 4 | 39°36'42,6" | 48°59'01,0" | 4 | 39°36'43,02" | |
| 5 | 39°36'42,9" | 48°59'01,5" | 5 | 39°36'43,03" | |
| 6 | 39°36'43,1" | 48°59'01,8" | 6 | 39°36'43,01" | |
| 7 | 39°36'43,3" | 48°59'02,3" | 7 | 39°36'42,08" | |
| 8 | 39°36'43,9" | 48°59'02,7" | 8 | 39°36'42,06" | |
| 9 | 39°36'43,1" | 48°59'03,1" | 9 | 39°36'42,04" | |
| 10 | 39°36'43,3" | 48°59'03,7" | 10 | 39°36'42,02" | |
| 11 | 39°36'43,6" | 48°59'04,0" | | | |
| 12 | 39°36'43,9" | 48°59'04,1" | | | |
| 13 | 39°36'44,3" | 48°59'04,1" | | | |
| 14 | 39°36'44,6" | 48°59'04,1" | | | |

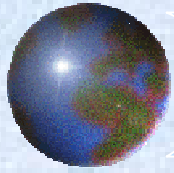




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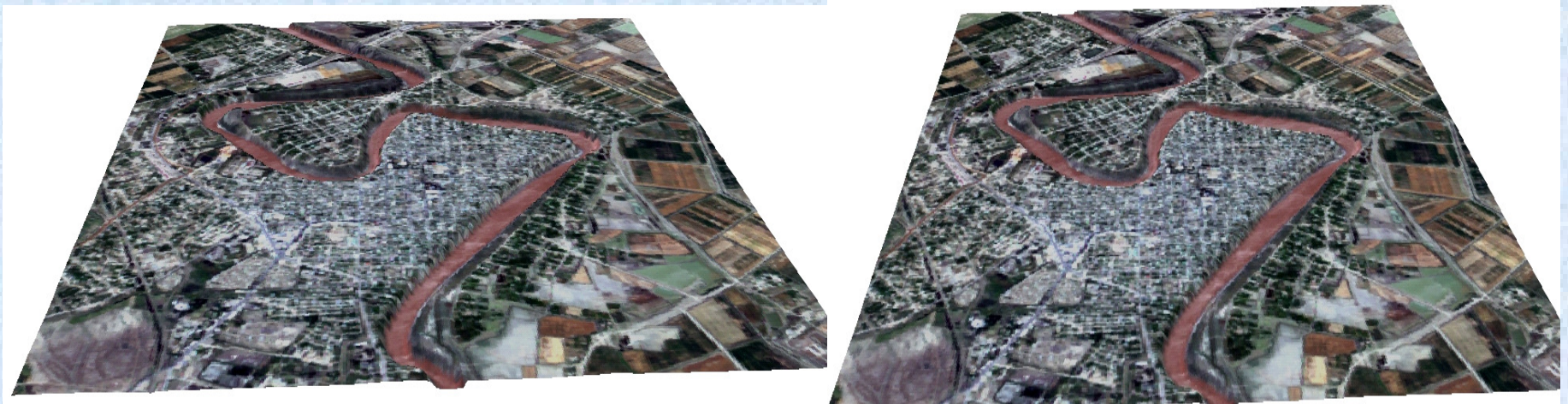
Ground Control Points

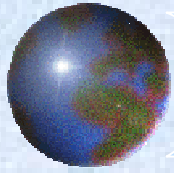




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3D modified view of the selected area

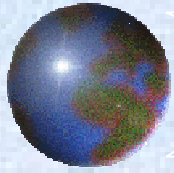




Developing GIS

✚ Detailing leveling of Kura river

| 2003 | Level, m | Water exp, m3/s | 2004 | Level, m | Water exp, m3/s | 2005 | Level, m | 2007 | Level, m | Water exp, m3/s |
|----------------|-------------|-----------------------|------------|-------------|-----------------------|------------|-------------|------------|-------------|-----------------------|
| April - May | | | May | | | May | | May | | |
| 07.04.2003 | 4,61 | 975 | 05.05.2004 | 4,20 | 855 | 06.05.2005 | 3,76 | 14.05.2007 | 4,45 | 780 |
| 08.04.2003 | 4,71 | 1130 | 06.05.2004 | 4,20 | 855 | 07.05.2005 | 3,60 | 15.05.2007 | 4,71 | 930 |
| 09.04.2003 | 4,79 | 1166 | 07.05.2004 | 4,28 | 920 | 08.05.2005 | 3,46 | 16.05.2007 | 4,90 | 1140 |
| 10.04.2003 | 4,90 | 1300 | 08.05.2004 | 4,60 | 980 | 09.05.2005 | 3,40 | 17.05.2007 | 5,36 | 1264 |
| 11.04.2003 | 5,02 | 1280 | 09.05.2004 | 4,80 | 1015 | 10.05.2005 | 3,27 | 18.05.2007 | 5,40 | 1280 |
| 12.04.2003 | 5,12 | 1330 | 10.05.2004 | 4,85 | 1050 | 11.05.2005 | 3,08 | 19.05.2007 | 5,63 | 1475 |
| 13.04.2003 | 5,19 | 1490 | 11.05.2004 | 4,80 | 1045 | 12.05.2005 | 2,95 | 20.05.2007 | 5,85 | 1585 |
| 14.04.2003 | 5,39 | 1570 | 12.05.2004 | 4,80 | 1045 | 13.05.2005 | 2,80 | 21.05.2007 | 5,99 | 1660 |
| 15.04.2003 | 5,48 | 1530 | 13.05.2004 | 4,80 | 1045 | 14.05.2005 | 2,67 | 22.05.2007 | 6,15 | 1735 |
| 16.04.2003 | 5,44 | 1480 | 14.05.2004 | 4,79 | 1045 | 15.05.2005 | 2,63 | 23.05.2007 | 6,31 | 1715 |
| 17.04.2003 | 5,40 | 1430 | 15.05.2004 | 4,80 | 1045 | 16.05.2005 | 2,51 | 24.05.2007 | 6,33 | 1725 |
| 18.04.2003 | 5,36 | 1480 | 16.05.2004 | 4,80 | 1045 | 17.05.2005 | 2,60 | 25.05.2007 | 6,25 | 1785 |
| 19.04.2003 | 5,33 | 1510 | 17.05.2004 | 4,90 | 1080 | 18.05.2005 | 2,92 | 26.05.2007 | 6,05 | 1635 |

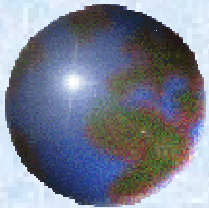


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CONCLUSION

- ❖ The main target has been undertaken to assist the local authorities to build useful database in disaster risk reduction in particularly for the selected area with a more sensitively part of country in point of view the river flood.
- ❖ In the meantime has been demonstrated a contribution of the possibility and advantage of remote sensing methods and GIS technology use based on space image data collection and data processing for application of similarity problem solving
- ❖ It has been demonstrated of use of GPS system during field measurements for identification of dynamic change processes in case of space image eliminations.

Thank you for attention!



Making Space For Everyone

