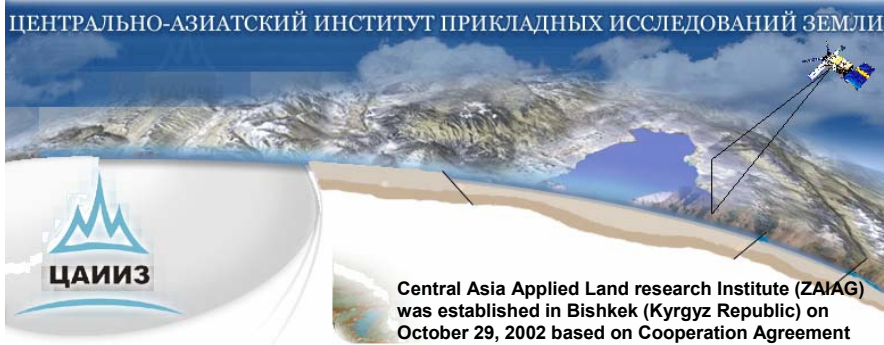




ZAIAG addresses natural disaster risk mitigation in Central Asia



ZAIAG: H. Raigber, B. Moldobekov, Sh. Usupayev
GFZ Potsdam: H-U Wetzel, V. Mikhalev, A. Raigber, Z. Roesner, A. Helm



Central Asia Applied Land research Institute (ZAIAG) was established in Bishkek (Kyrgyz Republic) on October 29, 2002 based on Cooperation Agreement between Kyrgyz Government and Land Research Center, Potsdam, Germany.

<http://www.caiag.kg>

Astana, June 25-26, 2007



Elevation of ZAIAG building at 73/2 Frunze Street, Bishkek



As of June 17, 2005



ZAIAG: Goals and Tasks Talking Points



Necessity of establishment and maintenance of a geological research institute in Central Asia is substantiated by

- **creation of efficient database for scientific research, field works and monitoring in CA**
- **efficient cooperation and land science activities with German, European and international institutions and organizations**
- **cooperation with a view to transfer know-how from lead geological research institutions and provision of teaching and training cadre from Europe to Central Asia**
- **cooperation for development, establishment and use of monitoring and other systems to prevent dangerous processes**

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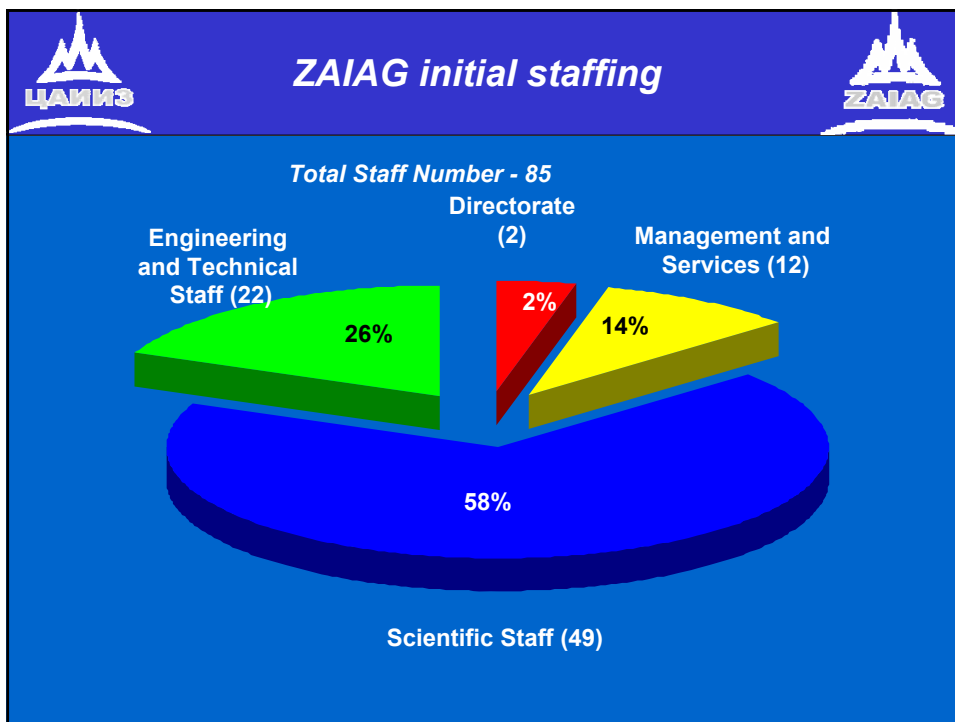
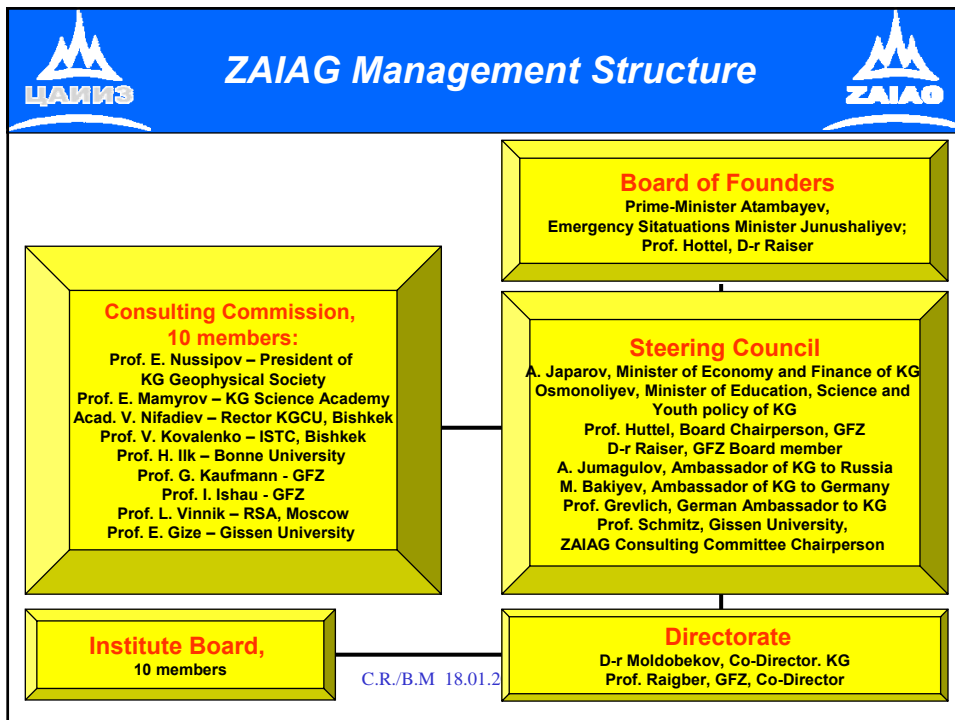


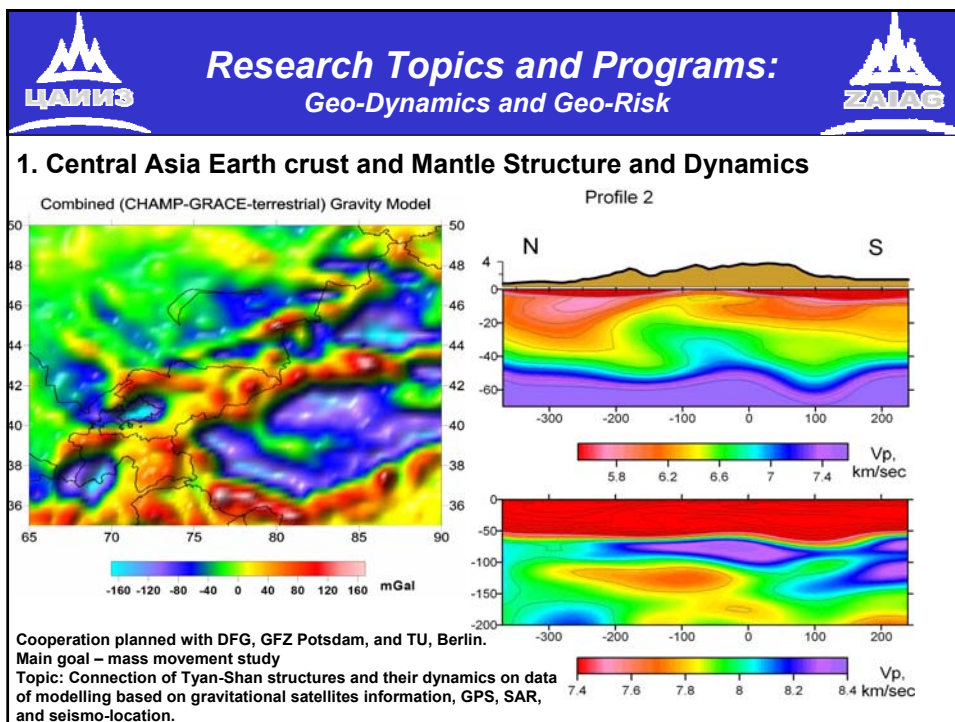
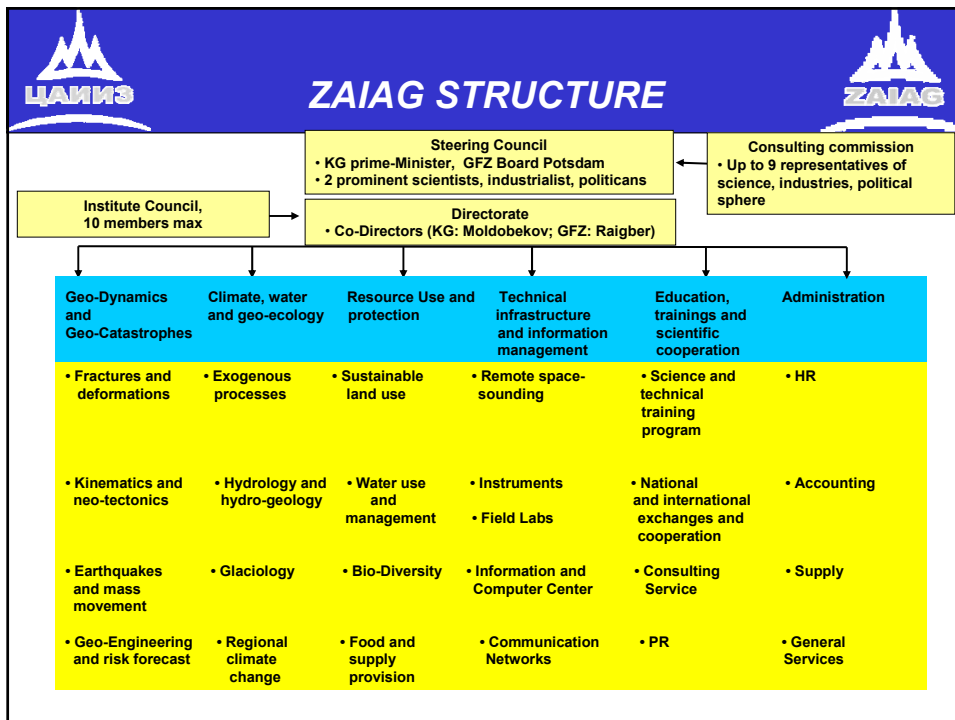
ZAIAG: Main Goals and Tasks



- **Land science research and associated support. Main tasks refer to research on:**
 1. **Geo-dynamics and geo-catastrophes**
 2. **Water, climate and geo-ecology**
 3. **Resources use and protection**
- **Provision of technical infrastructure and information management as well as education and career training of scientific cadre**
- **Contract based cooperation with Kyrgyz, German, CA and European organizations including publication of scientific research findings**

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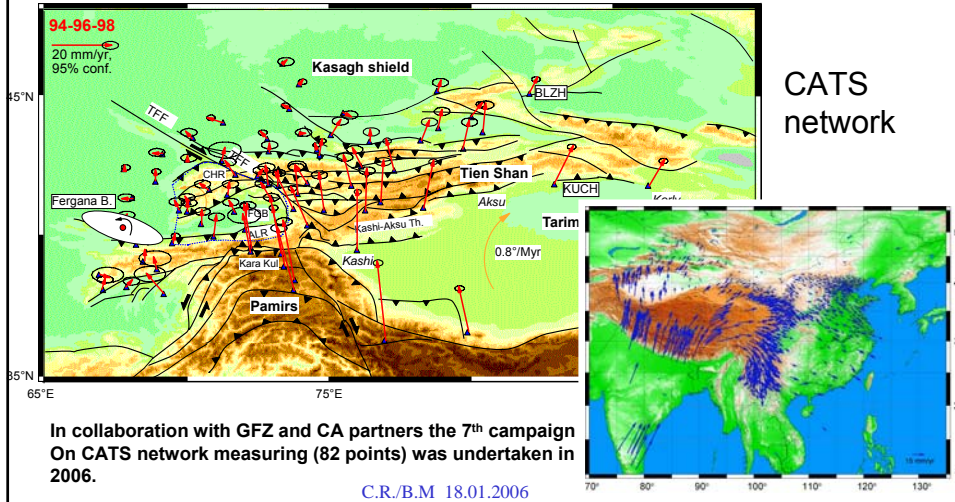




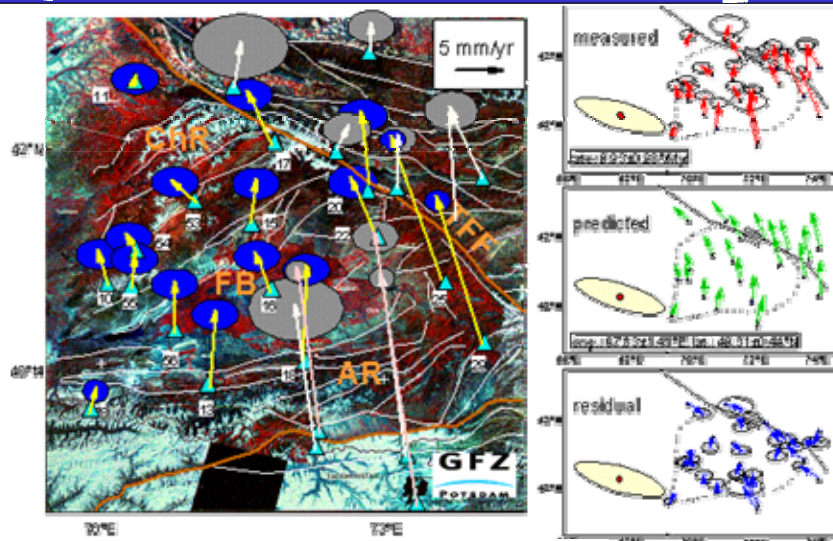
Research Topics and Programs: Geo-Dynamics and Geo-Risk



2. Neo-Tectonics, deformations and tension in Tyan-Shan region



Research Topics and Programs: Geo-Dynamics and Geo-Risk

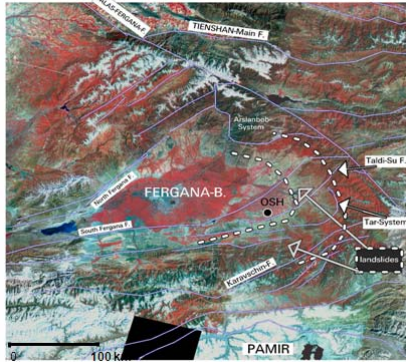




Research Topics and Programs: Geo-Dynamics and Geo-Risk



3. Monitoring of dangerous processes and alert system (landslides)



A study on Dangerous Processes Monitoring and Early Alert System is being developed jointly with GFZ, TU Berlin, and TU München under the BMBF Geo-Technology program

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Research Topics and Programs: Geo-Dynamics and Geo-Risk



Capacity of Satellite Monitoring of KG Landslides

Purpose: Assessment of satellite sounding methods in landslide process research
And identification of landslide-forming factors with the help of GIS

Methodology:

- improved quality of shots for multi-spectral and dynamic analysis
- processing of stereo-data for creation and analysis of multi-dimensional topo-models
- GIS creation based on multi-spectral, topographic and geological data analysis

Selected data from Geo-research Satellites:

Parameter	Multispectral						Hyperspectral
	LANDSAT-5	LANDSAT-7	MOMS-2P*	ASTER	IKONOS	QuickBird	HYPERION
Launch date	March 1984	April 1999	April 1996	Dec 1999	Sep 1999	Oct 2001	Nov 2000
Swath width (km)	185	185	105	60	11	16,5	7,5
Stereo capability	no	no	yes	yes	yes	no	no
Stereo resolution (m)	N/A	N/A	18	15	1	N/A	N/A
Spectral range (µm)	0.4 - 2.4	0.4 - 2.4	0.4 - 0.8	0.5 - 2.4	0.4 - 0.9	0.4 - 0.9	0.4 - 2.5
Number of bands**	6	6	4	9	4	4	220
Spatial resolution (m)	30	30	18	15 - 30	4	2,8	30
Panchromatic band	no	yes	yes	no	yes	yes	no
Spatial resolution (m)	N/A	15	6	N/A	1	0,7	N/A

* operated on Russian MIR space station between 1996 and 2001

** within reflective part of spectrum

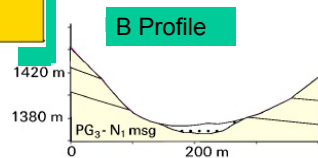
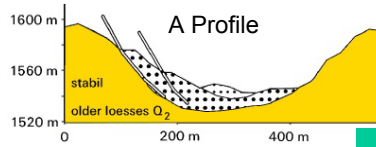
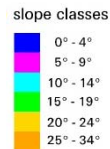
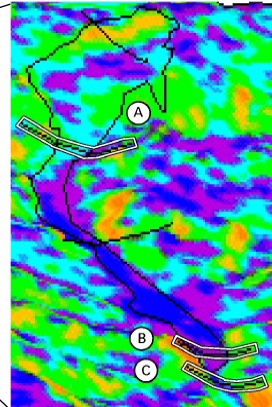
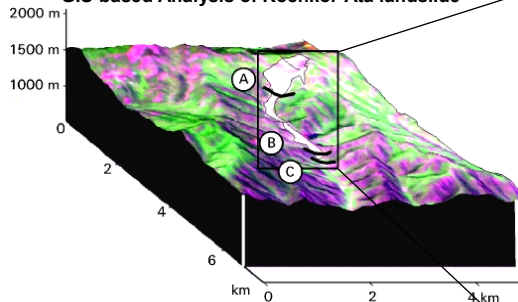
Data used within presented study



Research Topics and Programs: Geo-Dynamics and Geo-Risk



GIS-based Analysis of Kochkor-Ata landslide



Dynamics of crust conditions' changes in Ak-Shaluu landslide area

сентябрь 1989

июнь 1993

август 1998



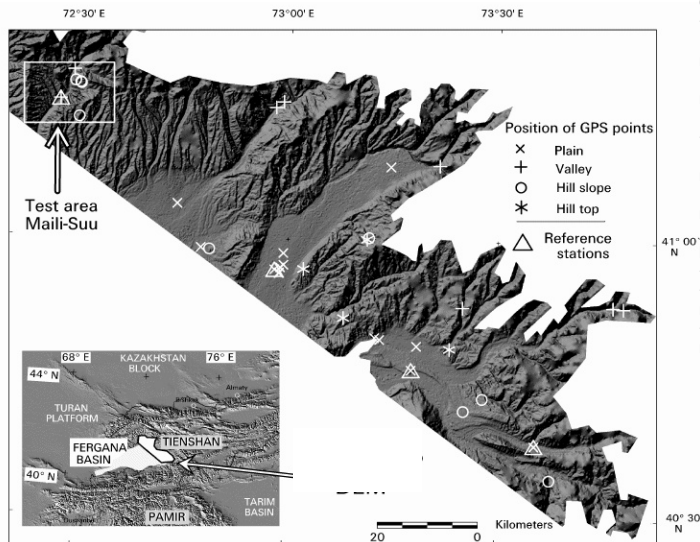
Landsat-TM, K:7, 3:4, Г:1, 30m; re-vegetation of landslide material (quaternary loess), regression of ponded lake

Opinion on landslides' inventory with the help of optical satellite systems:

- Data necessary for landslide identification (minimal size – 3-4 pixels);
- Depending on the morphological conditions landslide life can be a long-term thing; due to high seasonal and inter-seasonal dynamics of climatic factors landslide monitoring requires high frequency observation;
- In case of application of the whole set of dimensional, spectral and temporal information data analysis requires automated processing methods;



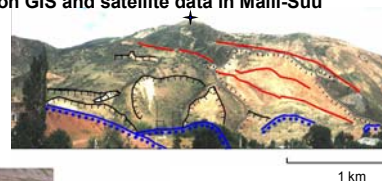
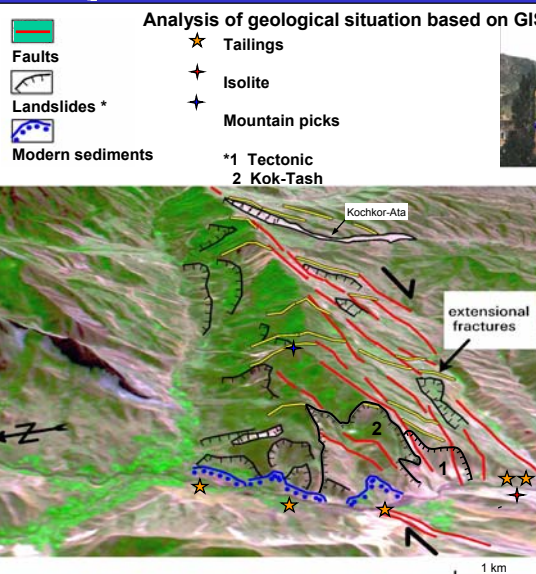
Research Topics and Programs: Geo-Dynamics and Geo-Risk



- Optical stereo-data:
- **MOMS-2P DEM (shape):**
30 m – horizontal resolution
10 – 20 m vertical resolution
 - **ASTER DEM**
30 m – horizontal resolution
10 – 20 m vertical resolution
- Interferometric radar data
- ERS1-2: 30 m resolution
 - SRTM: C-spectrum: 90 m resolution (global)
 - SRTM: X-spectrum: 30 m resolution (strip)



Research Topics and Programs: Geo-Dynamics and Geo-Risk



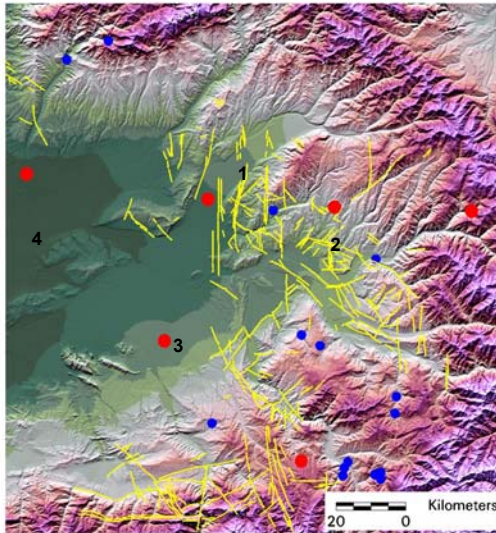
- Conclusions :**
- identification of modern shear zones of anticlines (red lines)
 - shear zones are formed as a result of right-side shears
 - development of tectonic fractures (yellow lines)
 - dimensional correlation between modern fractures and landslide locations

Shear zone





Research Topics and Programs: Geo-Dynamics and Geo-Risk



SRTM-UTM (NASA-JPL)

- basic resolution: 30 m
- model resolution (NIMA): 90 m
- absolute vertical resolution: 5 m

Events

- Earthquakes (≥ 4.0 MSK) between 2001 and 2004.
- Main landslides between 2002 and 2004.

■ structure of modern tectonic blocks basing on satellite sounding data

- 1 Jalal-Abad
- 2 Uzgen
- 3 Osh
- 4 Andijan

SRTM UTM for the area of high landslide activity, Eastern Fergana

ERS-2-Mosaic of the TIEN-SHAN area

KG1 – Ak-Terek

KG2 - Uzgen

KG3 - Salamalyk

Ташкент

Installation of corner Reflectors jointly with Kyrgysgeodezy

Fergana Valley

Landslides

Issyk-Kul

Almaty

POTSDAM

Receipt and processing of satellite data on ground station GFZ-DLR (Uzbekistan), 1999

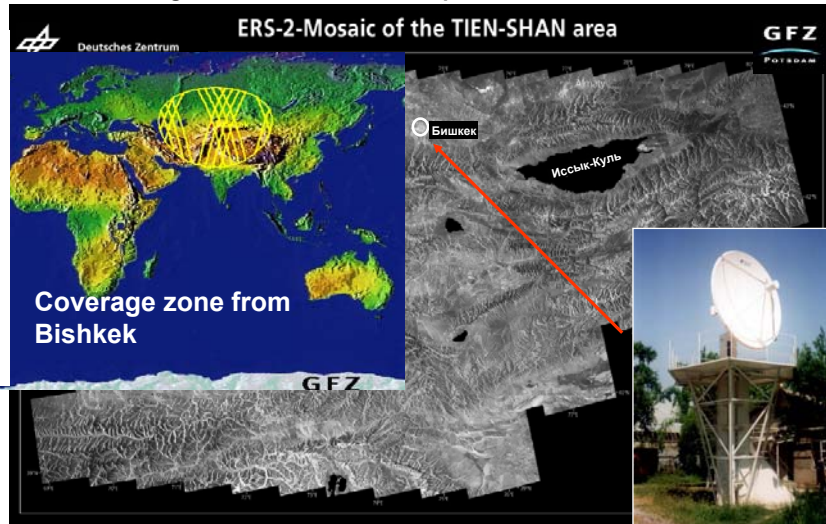
C.R./B.M 18.01.2006



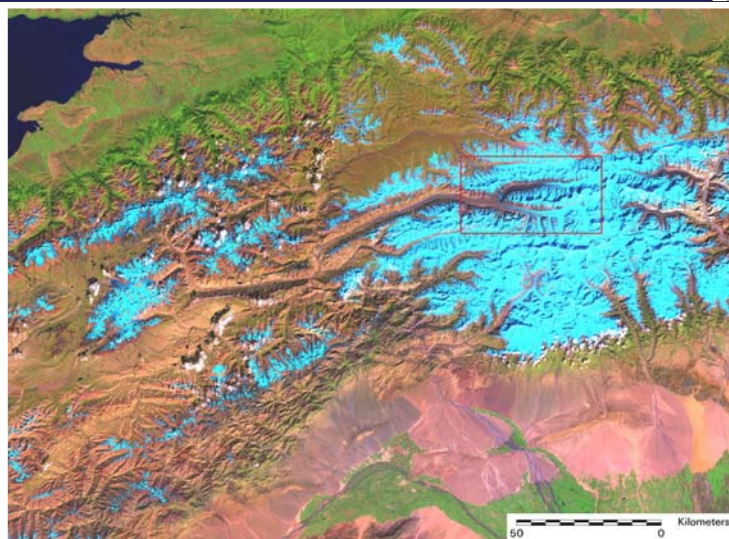
Research Objects and Programs: Technical Structures and Information



2. Planned ground station to receive space-data



Research Objects and Programs: Geo-Dynamics and Geo-Risk

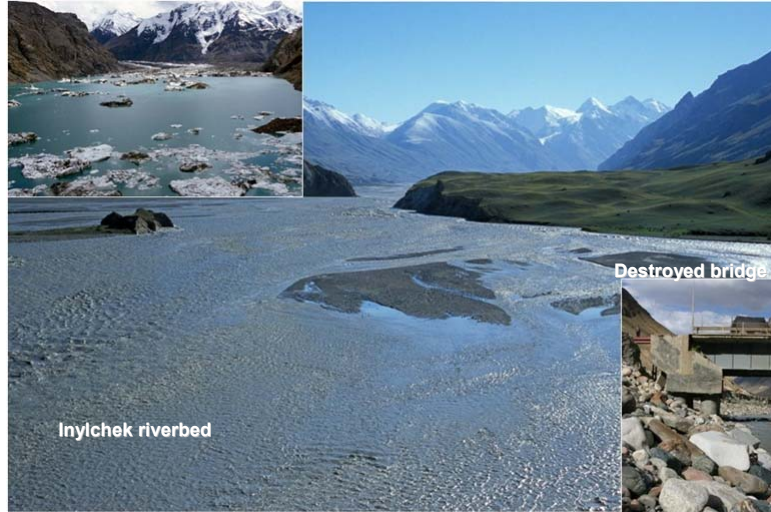


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Inylchek Glacier System



Research Topics and Programs: Geo-Dynamics and Geo-Risk



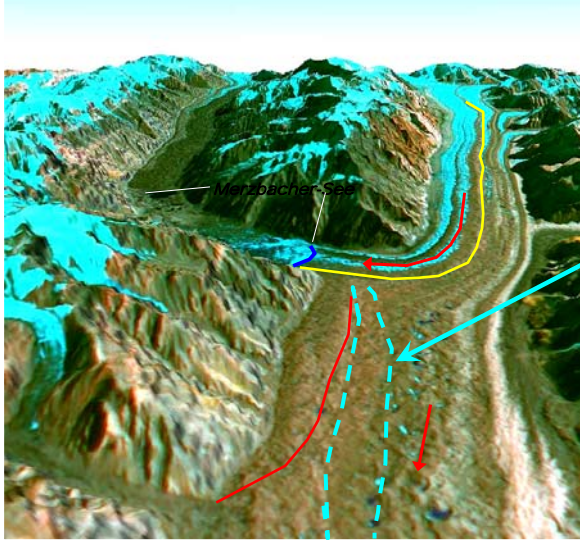
Inylchek riverbed

Destroyed bridge

Consequences of the lake debacle (sample)



Research Topics and Programs: Geo-Dynamics and Geo-Risk



Glacier channels

- Border between two parts of South Inylchek
- Border between dead ice and South Inylchek
- ← Glacier movement direction
- Border of the lake dam

Inylchek Glacier

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Research Topics and Programs: Geo-Dynamics and Geo-Risk



Optical sensors

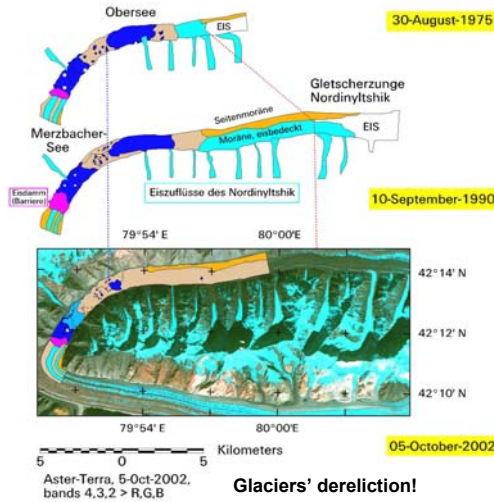
MSS August 12, 1975
 MSS August 30, a 1975
 MSS June 13, 1976
 MSS October 16, 1976
 MSS May 20, 1977
 MSS August 18, 1977
 MSS September 23, 1977

TM September 10, 1990
 ETM September 13, 2000

ASTER June 08, 2002
 ASTER October 05, 2002
 ASTER June 25, 2003

Envisat Radar Sensors

August 19, 2004
 September 23, 2004
 October 28, 2004



Dereliction of
North Inylchek
glacier:

about 6 km for
15 years;

Total:

about 8 km for
27 years

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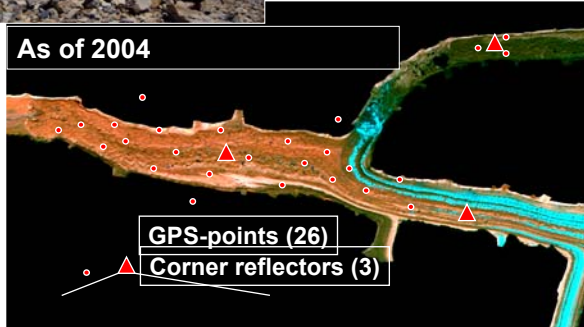


Research Topics and Programs: Geo-Dynamics and Geo-Risk



Concentration of the local GPS-network and repeated
measurements

As of 2004



GPS-points (26)

Corner reflectors (3)



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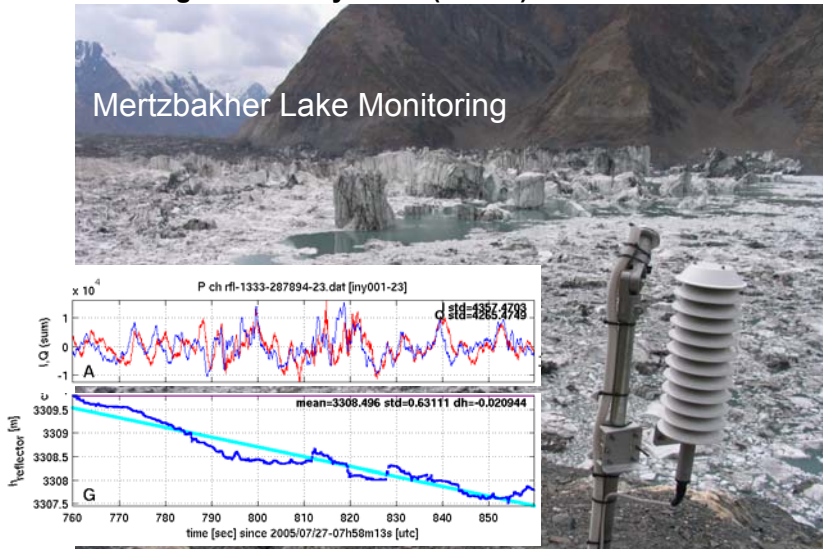


Research Topics and Programs: Geo-Dynamics and Geo-Risk

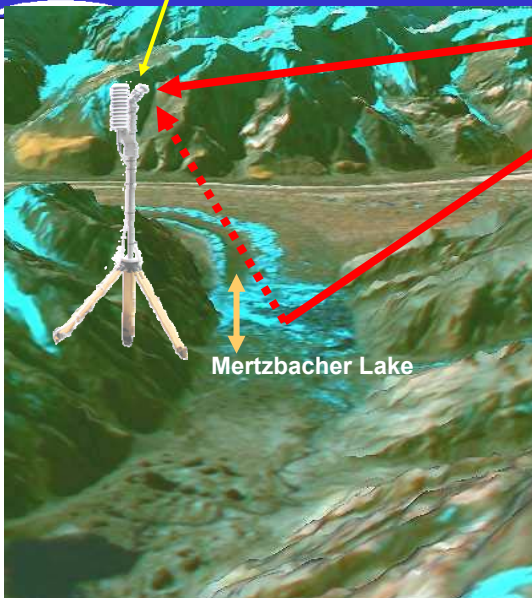


4. Monitoring and alert systems (floods)

Mertzbacher Lake Monitoring

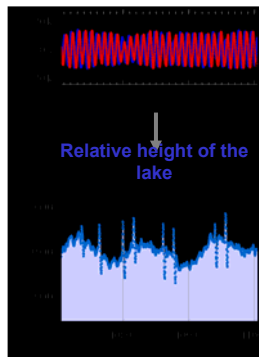


GPS-principle in altimetry



GPS Satellite

Interference

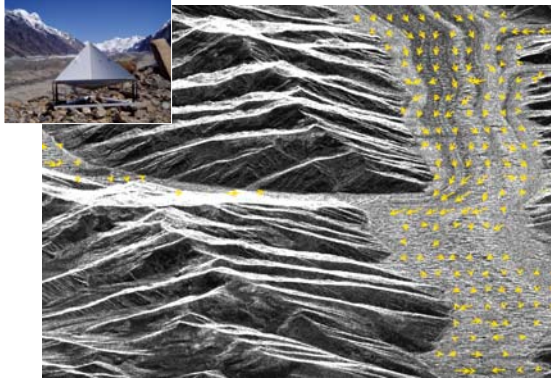




Research Objects and Programs: Climate, Water and Geo-Ecology



1. Dynamics and Balance of glaciers (Inylchek)



Shear vectors –
2005 data
Envisat Satellite

Preparation to TerraSAR- X mission held by DLR under the
GFZ TOR experiment (tart – June 14, 2007)

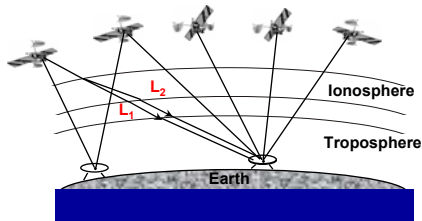
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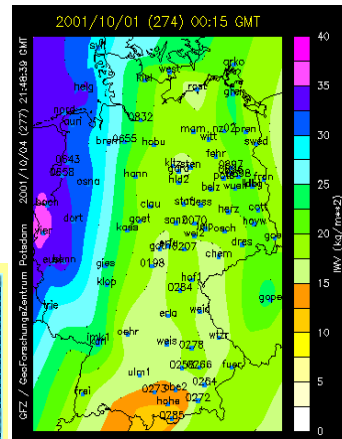
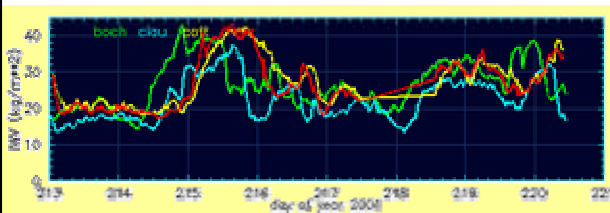
Research Objects and Programs: Climate, Water and Geo-Ecology



2. Regional sounding of atmospheric water steam with the help of GPS-stations



Sample:
Germany

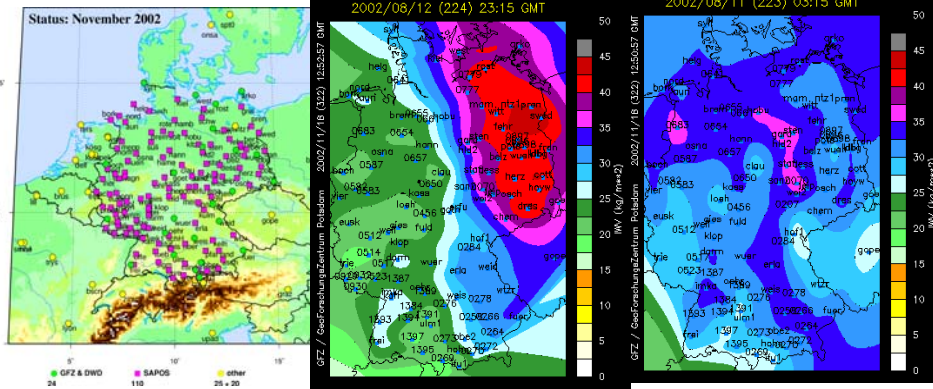




Research Objects and Programs:
Climate, Water and Geo-Ecology



2. Regional sounding of atmospheric water steam with the help of GPS-stations



Sample:
Germany

C.R./B.M 18.01.2006

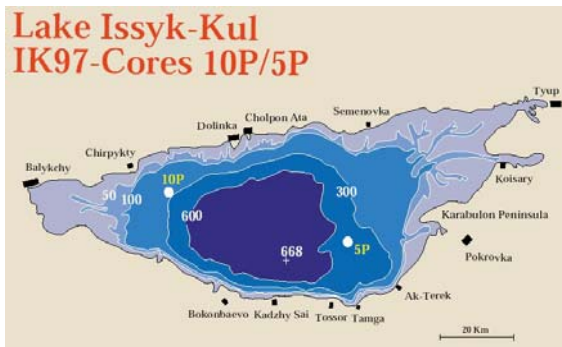
Distribution of atmospheric water steam during the Elba flood in August 2003



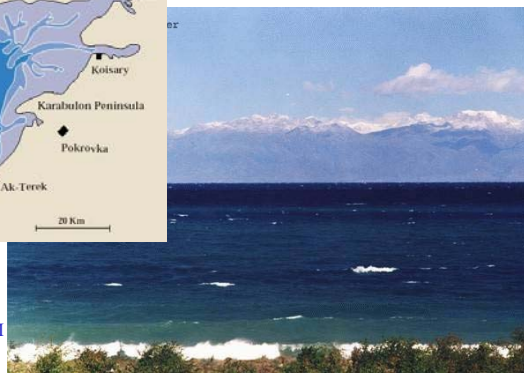
Объекты исследования и программы
Климат, воды и геоэкология



3. Fluctuation of the water surface level and water resources



C.R./B.M





Research Objects and Programs: Technical Structures and Information



1. Permanent GPS-stations and Galileo/Meteo-networks



GSTB- V1/ GRAS- GPS-network, GFZ with a permanent station of ZAIAG



2 ground frequency GPS-receivers, computer, energy and information management block, meteo-station



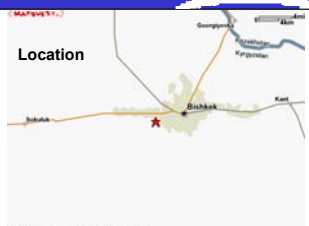
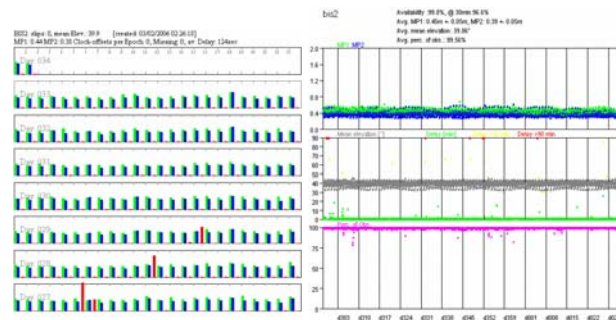
BIS-2 station performance quality check

http://www.gfz-potsdam.de/pb1/igs/igs_stat/bis2.htm



Plot of QC-Output of the last 7 days

Plot of QC-Output, last 100 days



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1. Seismology and Seismic Danger Assessment
International course under UNESCO aegis in 2006



Venues and years:

Germany: 92,94,96,00,02,
04,05

India: 93

Nicaragua: 95

Kenya: 97

China: 99

Chili: 01

SAR: 03

KR (ZAIAG): 06



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Main directions of potential joint research of
ZAIAG with Ministries of Emergency
Situations of Central Asia and Russia



- **Survey of dangerous endogenous geo-dynamical processes;**
- **Regional climate change;**
- **Space-monitoring of natural and man-caused processes;**
- **Professional training and career training.**

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Thank you for your attention!

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