Man-made risks in Siberia: Enviro-RISKS Project Outcomes

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and
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ENVIROMIS 2010
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Man-Induced Environmental Risks: Monitoring, Management, and Remediation of Man-made Changes in Siberia

Co-ordination Action EC FP6 (EC 6FP INCO)	**Enviro-RISKS** NEESPI participant
Focus:	Siberia
Duration:	Nov 2005 – Jan 2009
Project co-ordinator: NIS-partners co-coordinator:	Alexander Baklanov, DMI Evgeny Gordov, SCERT
Info at Web-site:	http://projects.risks.scert.ru

Environmental Risks in Siberia

- Direct damage and influence to environment - including water, soil, vegetation and animals - caused by accidents in process of petroleum/gas production and transportation;
- Deforestation (cutting and forest fires) variations in Siberian rivers runoffs, wetland regimes and corresponding climate change;
- Direct and indirect influence of forest fires, flambeau lights and losses of gas and petroleum during their transportation on regional atmosphere composition;
- Deposition of hazardous species leading to contamination and risks for soils and water and consequently - food chains;
- Urban and regional air pollution resulted from local traffic and industry sources.

Project Strategic Objectives

- to facilitate elaboration of solid *scientific background and understanding of man-made associated environmental risks*, their *influence on all aspects of regional environment and optimal ways for it remediation* by means of coordinated initiatives of a range of relevant RTD projects

- to achieve *improved integration of the European research* giving the projects additional synergy in current and future activities and *potential for practical applications*

Thematic Focuses, Projects and Groups

- **Atmospheric Pollution and Risks**: *AR-NARP, EmergPrep, FUMAPEX, GEMS (DMI), Cities of Siberia, Forecast Methods, Risk (ICMMG), Dust, Hydrocarbons (KazGeoCosmos), Tomsk (SCERT) –* ***Penenko***, ***Baklanov***

- **Climate/Global Change**: *TCOS-Siberia (MPI-BGC), AMIP/CMIP (INM), SGBR (SCERT, IMCES), EACR (ICMMG), CARBO-North (DMI), -* ***Lykosov***, ***Heimann***

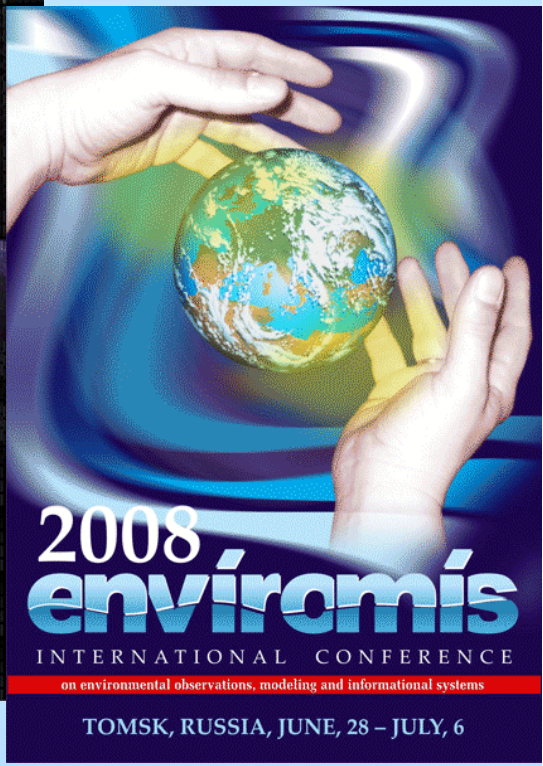
- **Terrestrial Ecosystems and Hydrology**: *Siberia-2 (IIASA), Siberian Taiga (IF), Yugra: Space Monitoring, Water Quality, Land Remediation (URIIT), Great Vasyugan Bog (IMCES), GIS/RS -Agro, Water Oil Poll (KazGeoCosmos) –* ***Kabanov***, ***Shvidenko***

- **Info-Systems, Integration and Synthesis**: *ENVIROMIS, ATMOS, ISIREMM (SCERT), GIS (KazGeoCosmos), all –* ***Gordov***, ***Zakarin***

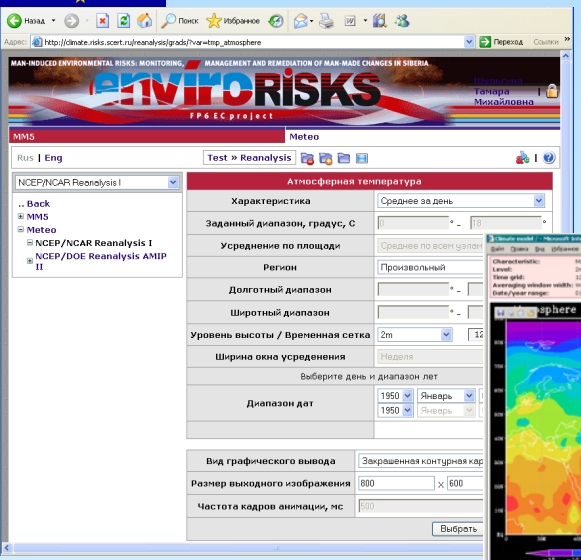
Assignment to Themes

- **Environment Observations** – MPI for Bio-geochemistry, IIASA, Institute of Forest SB RAS, KazGeoKosmos, Institute of monitoring of Climatic and Ecological Systems SB RAS and Ugra Research Institute of Information Technologies;
- **Modeling** – Danish Meteorological Institute, Siberian Center for Environmental Research and Training, Institute of Numerical Mathematics RAS, Institute of Computational Mathematics and Mathematical Geophysics SB RAS;
- **Atmospheric Processes** – DMI, SCERT, INM, ICMMG, KazGeoKosmos;
- **Hydrological Processes** – INM, Institute of Forest SB RAS (Krasnoyarsk) and URIIT;
- **Supporting Information – Computational Technologies (GIS, Databases, Web, GRID) –** SCERT, IIASA, INM, IF, KazGeoKosmos, IMCES, URIIT;
- **Remediation Technologies -** IF, KazGeoKosmos, URIIT, IMCES.

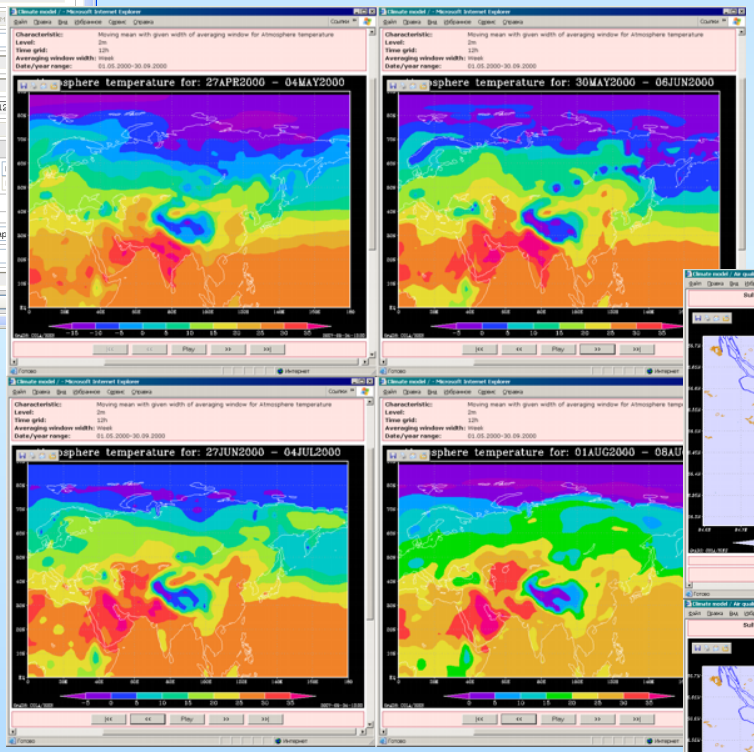
Co-organised International Conferences



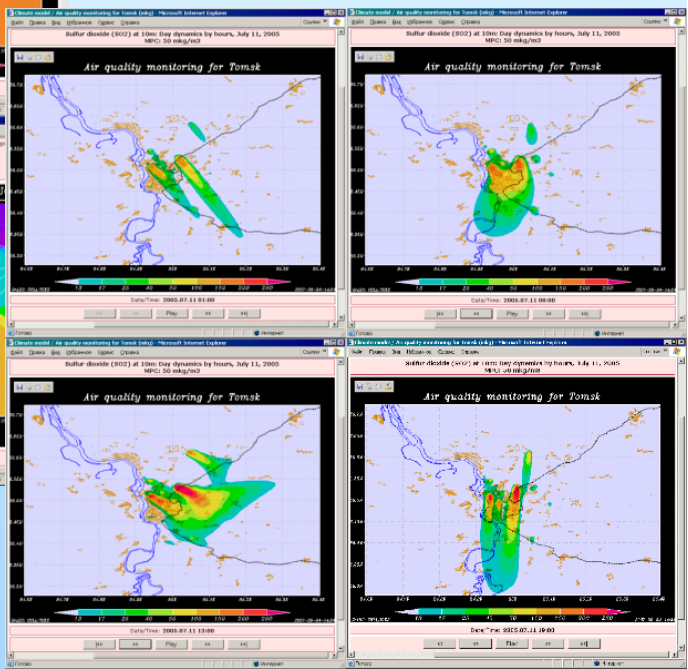
Informational Enviro-RISKS web-portal



Enviro-RISKS web portal Climate site (http://climate.risks.scert.ru/) providing an access to interactive web-system for regional climate assessment on the base of standard meteorological data archives;



ATMOS web portal Climate site current version (http://climate.atmos.iao.ru) providing an access to climatic and mesoscale meteorological models;

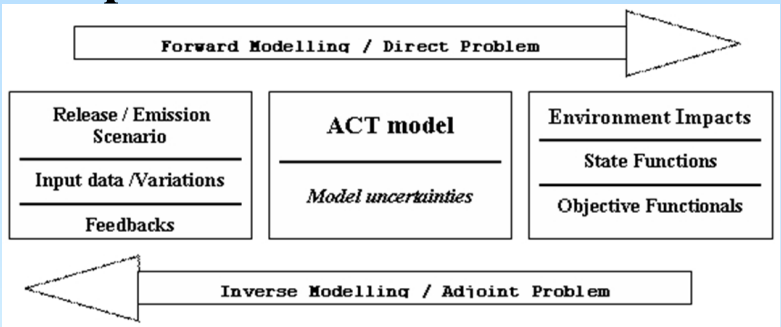


The web system for visualization and analysis of air quality data for city Tomsk and modeling of regional airborne pollution impact (http://air.risks.scert.ru/tomsk-mkg/);

Web system for presentation of climate modeling results (http://kvs.inm.ras.ru/index.html).

Direct and Inverse Modelling for Environmental Risk Assessment and Emission Control

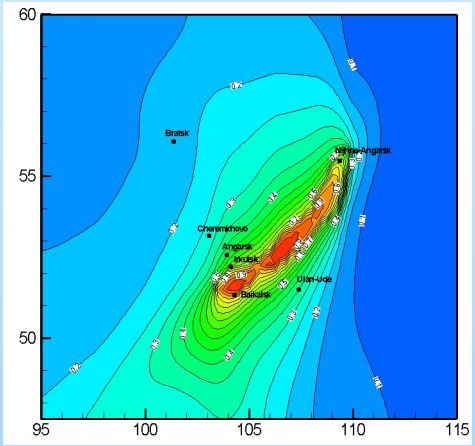
Concept of Environmental Modelling



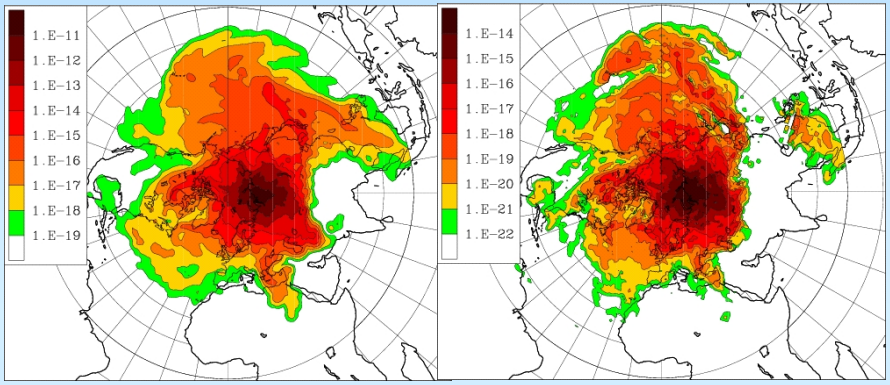
Applications for Siberian Region:

- *Scenario approach*
- *Long-term environmental Impact*
- *Principle factors*
- *Risk assessment*

Sensitivity functions: Total estimates of the relative contribution of pollutant emission from acting and potentially possible sources to the **Baikal Lake**.

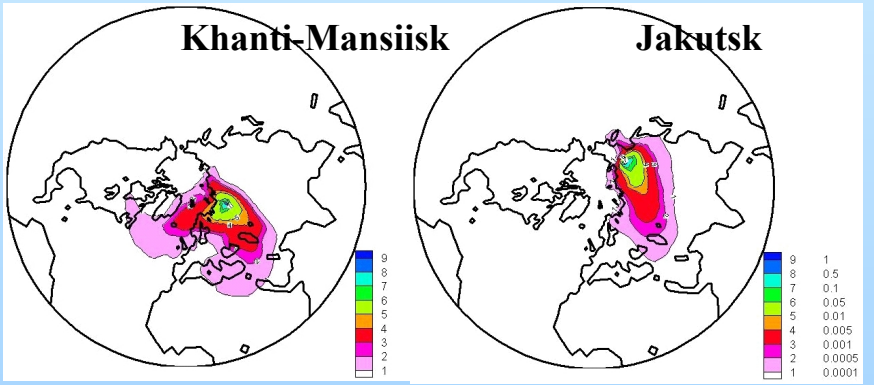


Results of the long-term dispersion modelling: annual **time integrated air concentration** & **wet deposition** patterns



for sulphates from the **Norilsk nickel plant**

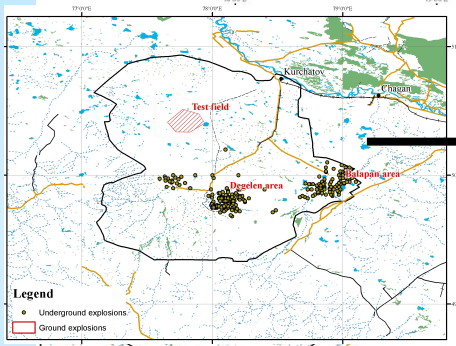
Risk/vulnerability/sensitivity functions (reference values) for Siberian industrial regions**:**



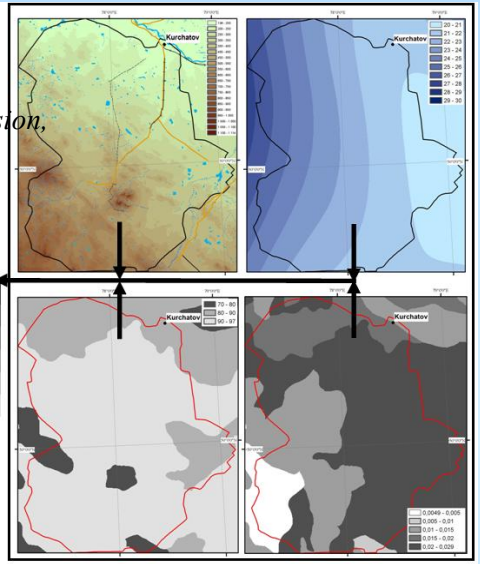
GIS Modelling of Radionuclide Transport from the Semipalatinsk Test Site

Mapping (from databases —

3D terrain, average annual amount of precipitation, water permeability and erosion, soil properties, land use, economic-agricultural factor, etc.)

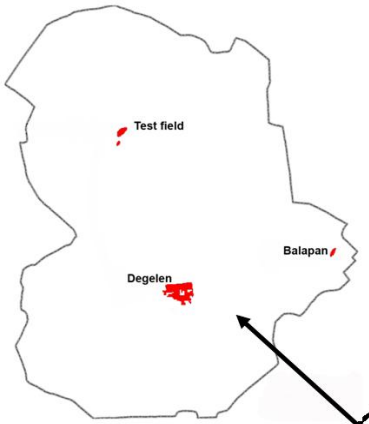


Mapping places of nuclear explosions

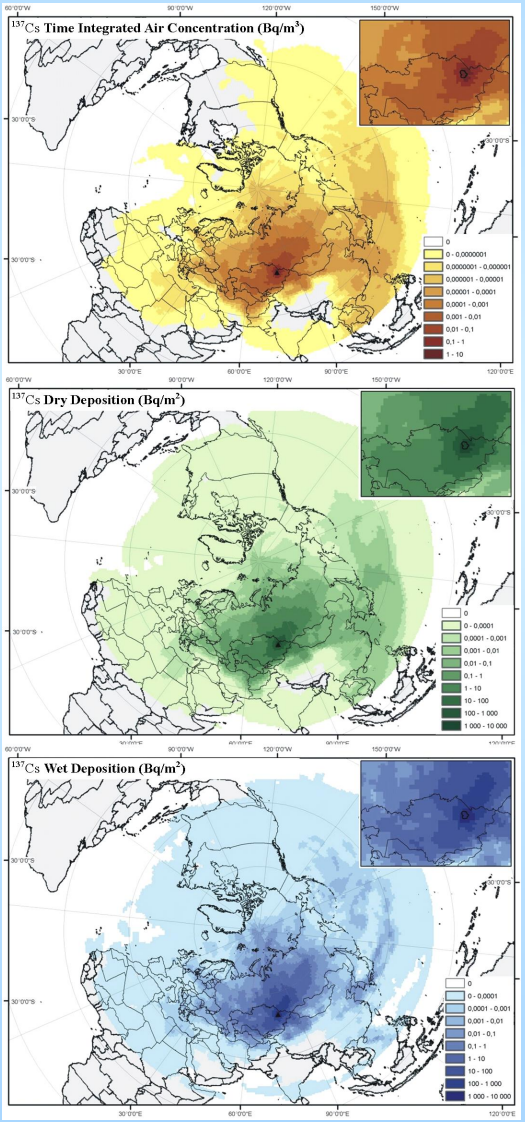


Mapping of spatial distribution for surface soil radioactivity

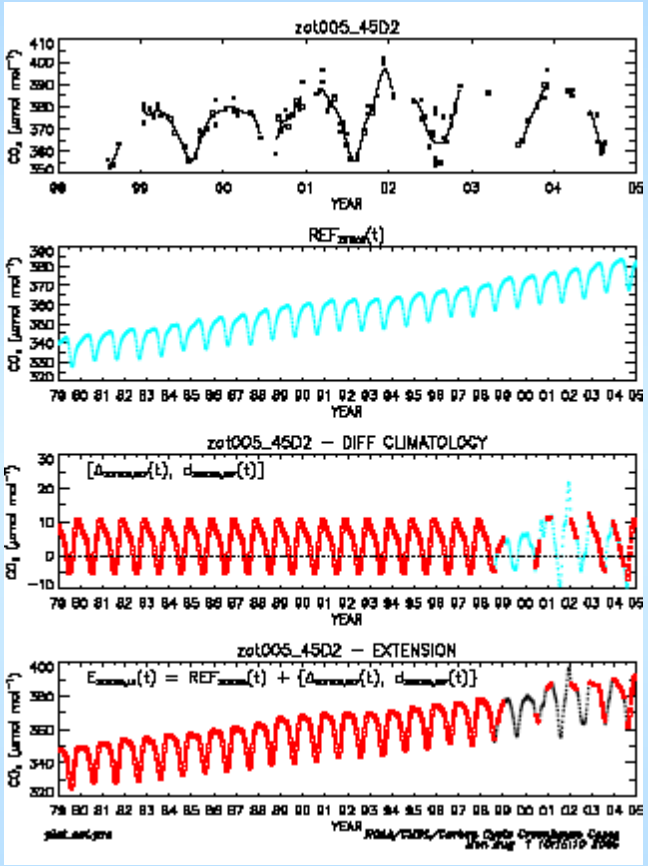
Mapping of repeatability for high temperature zones



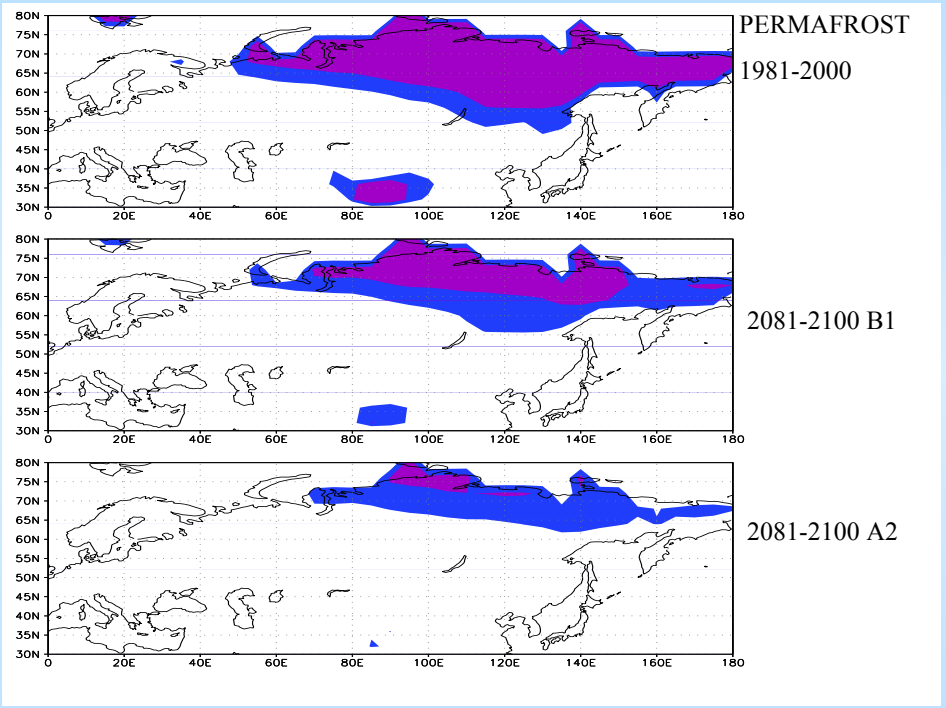
Resulted: *areas/ epicentres of radioactive aerosol transport due to wind erosion*



Climate Change Studies for Siberia:



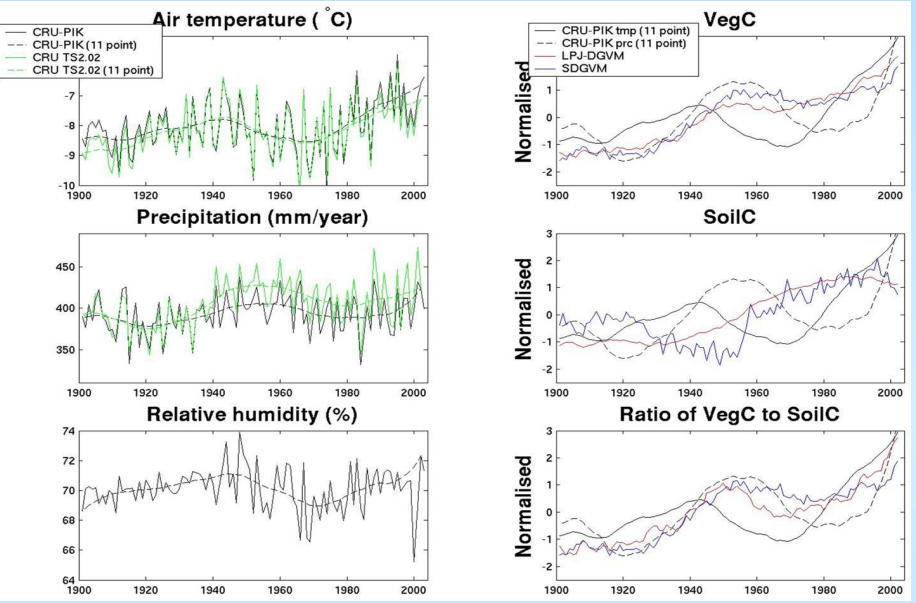
<= CO2 data from the lowest flight level at Zotino profile site (TCOS-Siberia, MPI-BGC)



Siberia seems to be a smaller sink than assumed: the amount of the carbon sequestration of Siberia is only less than 20% of the fossil fuel emissions from RF

Spatial distribution of continuous (violet) and sporadic (blue) permafrost as follows from INM climate model experiments: in 1981-2000 (top), 2081 - 2100 under scenario B1 (middle) and in 2081 - 2100 under scenario A2 (bottom).

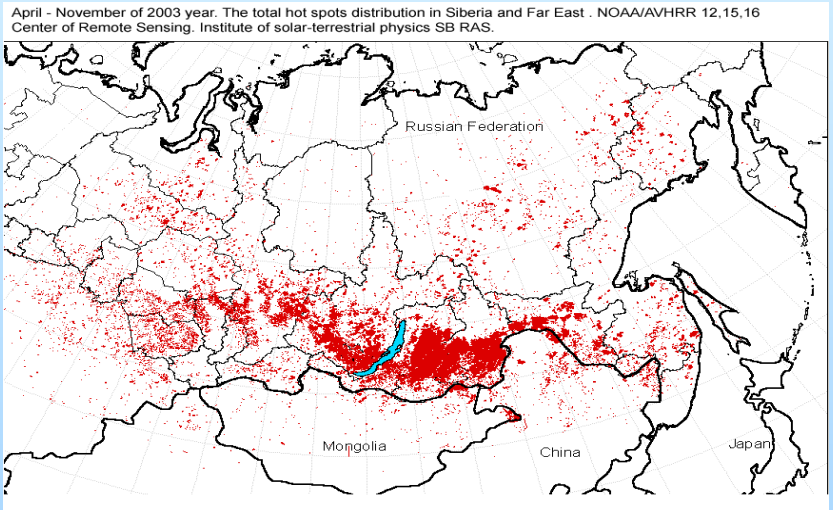
Terrestrial Ecosystems and Hydrology



Impacts of climatic indicators on ecological parameters of ecosystems. Climatic data are calculated based on CRU-PIK and CRU TS.02 databases. Estimates were done using the LPJ and Sheffield Dynamic Global Vegetation Models **(SIBERIA-II)**

Main ecological and landscape-ecosystem consequences:

(1) permafrost degradation,
(2) increasing sea level and flooding coastal areas,
(3) acceleration of rates of decreasing sea ice,
(4) shifting of all types of vegetation to the north,
(5) acceleration of natural disturbances, such as fire,
(6) transformation of the hydrological cycle,
(7) dangerous acceleration of biogeochemical cycles,
(8) steady deficit of water resources.

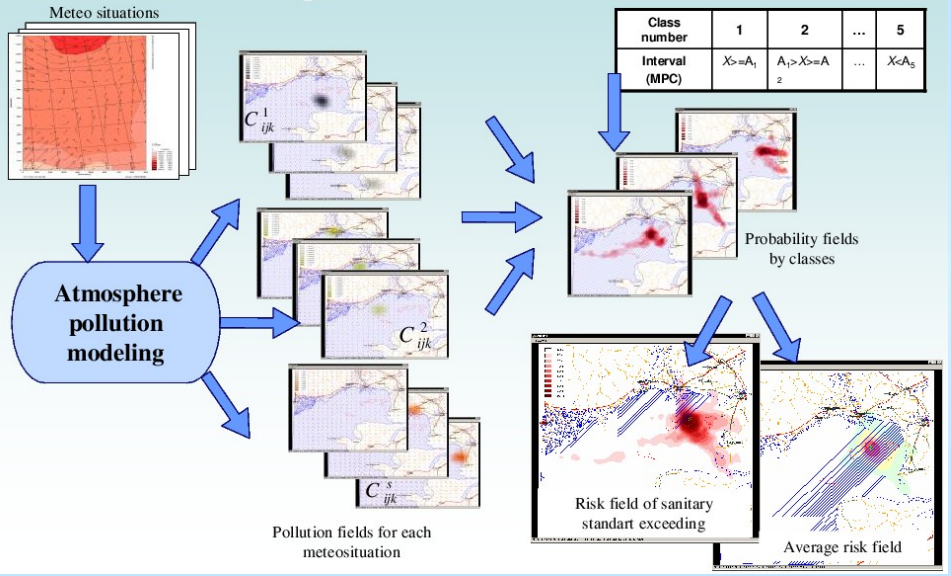


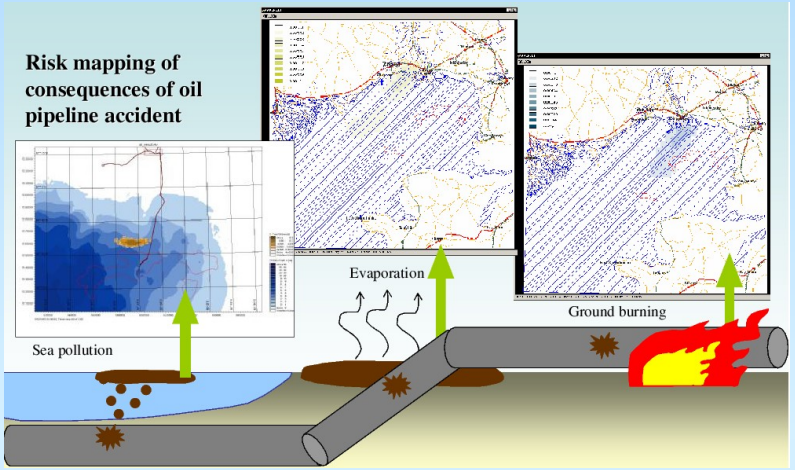
Areas of vegetation fire in Asian Russia in 2003

APR: Risk mapping of consequences of oil pipeline accident

Project Enviro–RISKS

The algorithm of risk field calculation

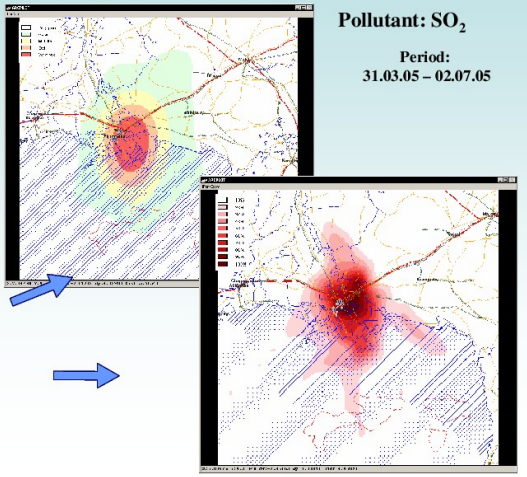




The risk of atmosphere pollution at oil pipeline damage

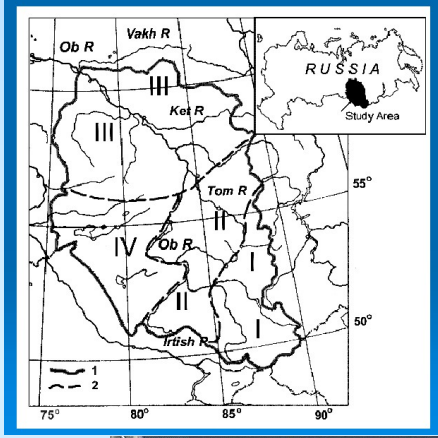
GIS-technology consist of:

- Compasiting the set of meteosituations ;
- Calculation of oil spill mass;
- Calculation of polluted air emission at the burning of oil saturated ground;
- Atmosphere pollution calculation by IAP model for all meteosituations;
- Risk area mapping by expectation value;
- The risk area mapping where air pollution exceeding MPC.



TEH: Hydrological risks in West Siberia

Ecoregions of the upper and medium part of the Ob river basin (total area 850,000 km^2)



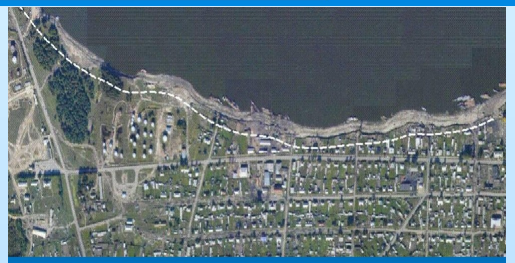
1 – the study area boundary;
2 – boundaries of the ecoregions.
I – High Mountains Ecoregion
II – Low Mountains Ecoregion
III – Taiga Ecoregion
IV – Steppe Ecoregion

The quality of surface waters characterises ecological conditions both a water body and its hydrographical basin as a whole

Physiographic settings along with typical historically developed landuse patterns (or background man's activities) define background patterns of water quality in local water bodies

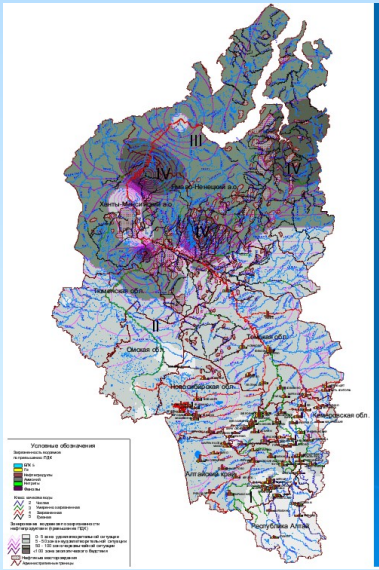
Ecoregions represent areas within which ecosystems are generally similar

An 'ecoregional concept' is useful for describing spatial water-quality patterns and for water quality management

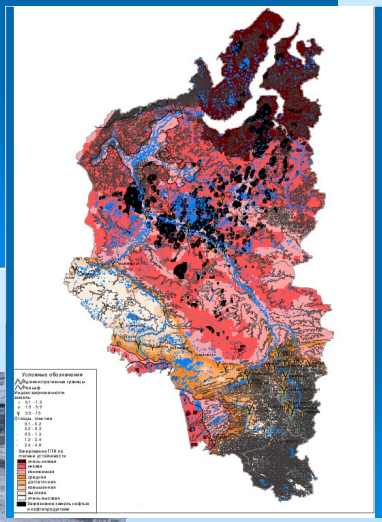


Shoreline of the Ob river at Kargasok (white dotted line shows the forecasted change of the shoreline by 2010)
(Source: Krutovskiy, 2000)

Zemtsov et al.



Chemical status of surface waters in West Siberia
(Source: Adam, 2003)



Background conditions:
Sensitivity of landscapes to technogenic impacts - hydrocarbons pollution
(Source: Adam, 2003)

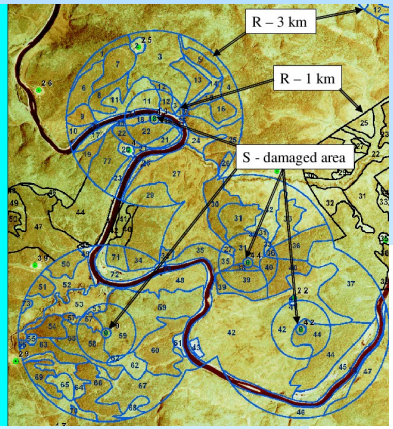
Brown colored areas – very low resilience
Red – low resilience
White – very high resilience
Black – oil-polluted areas
Black lines – contours

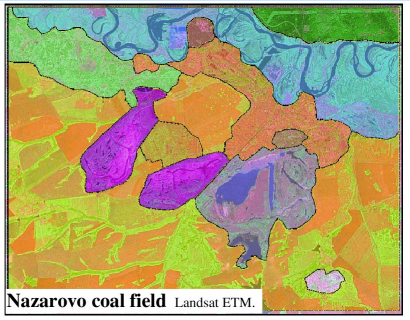
TEH: Transformation of Middle Siberian landscapes at field development of minerals

Cosmic image of hydromechanical (1) and drag (2) testing grounds for mining placer gold Landsat ETM System.

Contour deciphering in zones of impact of prospecting wells of Sobinsk oil field

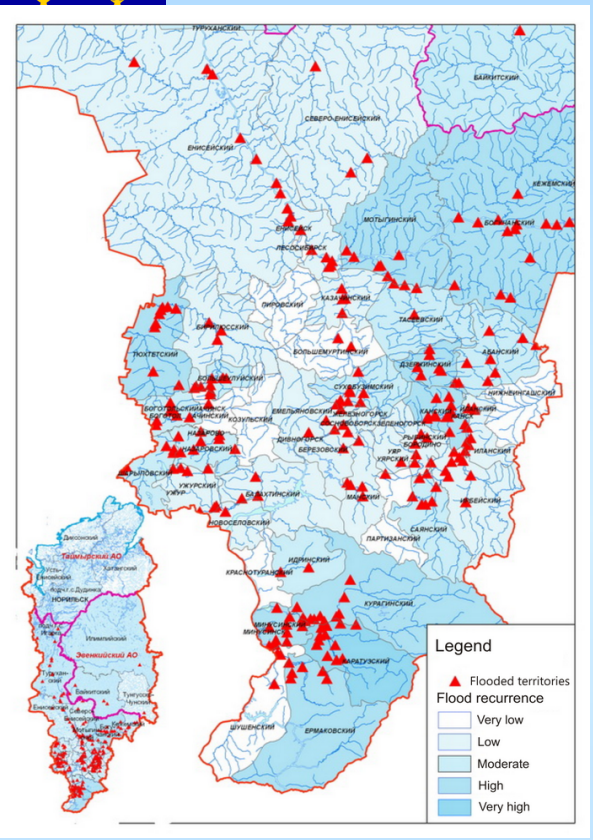
(East Siberia)
Cosmic image
M 1:200 000



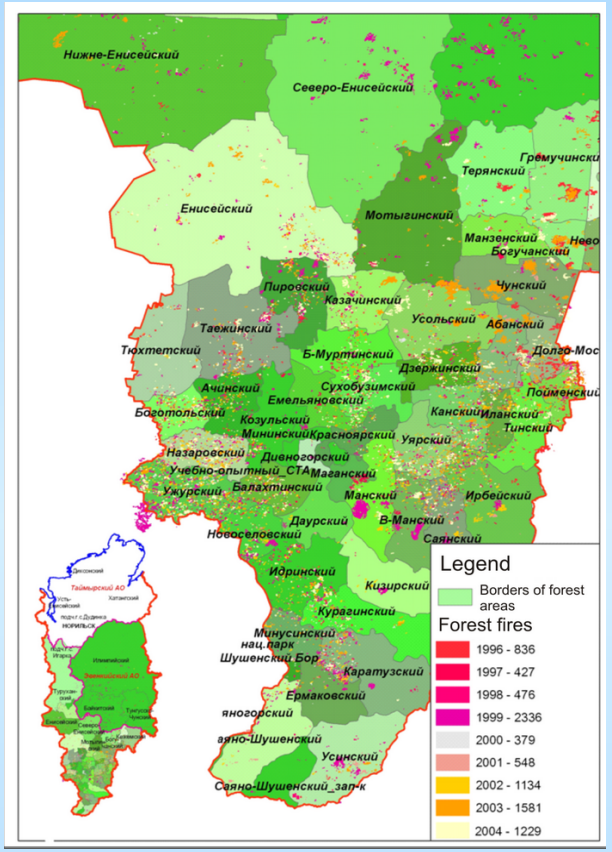


Shishikin et al.

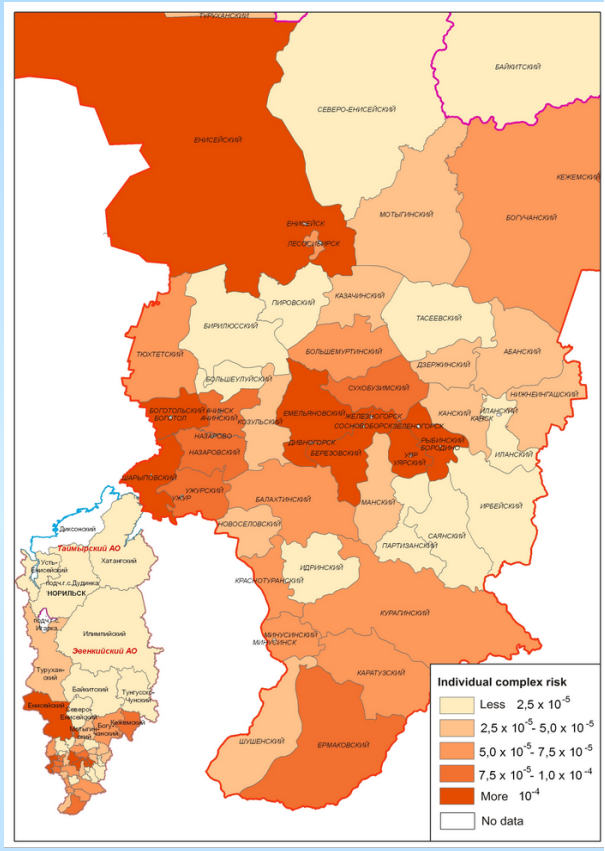
Natural and man-induced risk on Krasnoyarsk region



Flood risks of the areas of the region



Forest fires, recorded in 1996-2004



Complex risk (population-normalized)

Methodology of evaluation of natural and man-induced risk on a territory was developed in Institute of Computational Modeling SB RAS (Krasnoyarsk, EnviroRISKS Associated Partner) and applied to the Krasnoyarsk region (Tridvornov, 2008).

Final Scientific EnviroRISKS report

MINISTRY OF CLIMATE AND ENERGY

Scientific Report 08-05

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Alexander Baklanov and Evgeny Gordov, Editors

Volume 1:

Enviro-RISKS Project and its Major Outputs

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Contributing Authors: M. Heimann, M. Kabanov, V. Lykosov, A. Onuchin, V. Penenko, P. Pushistov, A. Shvidenko, E. Zakarin

MAN-INDUCED ENVIRONMENTAL RISKS: MONITORING, MANAGEMENT AND REMEDIATION OF MAN-MADE CHANGES IN SIBERIA

enviroRISKS

FP6 EC project

Copenhagen 2008

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Volume 2:

Atmospheric Pollution and Risk

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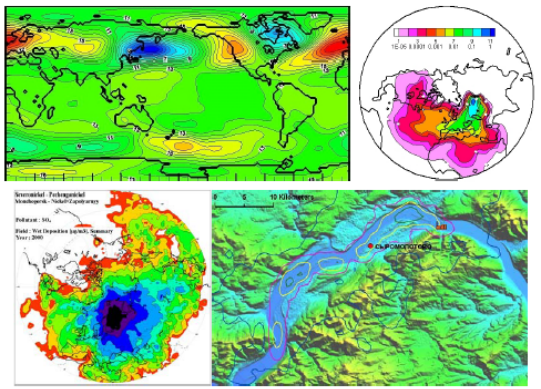

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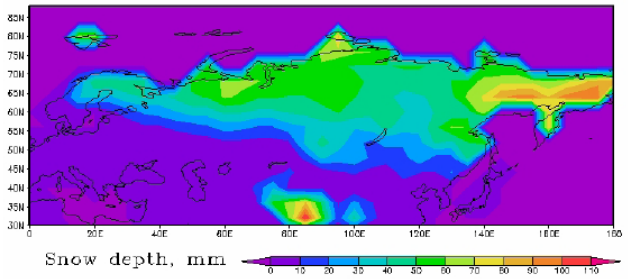

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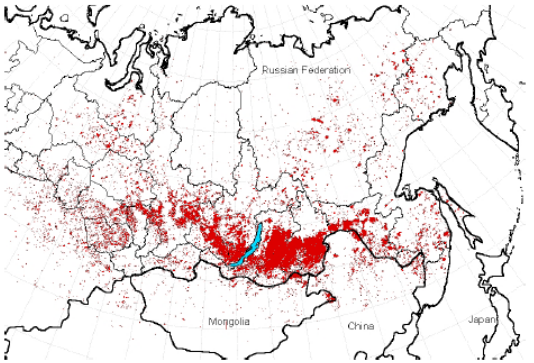
Volume 4: Terrestrial Ecosystems and Hydrology

Leading Author: Anatoly Shvidenko

Contributing Authors: M. Kabanov, V. Lykosov, A. Onuchin, P. Pushistov, D. Schepaschenko, M. Vtorushin, I. McCallum



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Final Scientific EnviroRISKS report

Available also from Web-site:

http://projects.risks.scert.ru

Planned to be published as a book in Springer

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Volume 5: Information Systems, Integration and Synthesis

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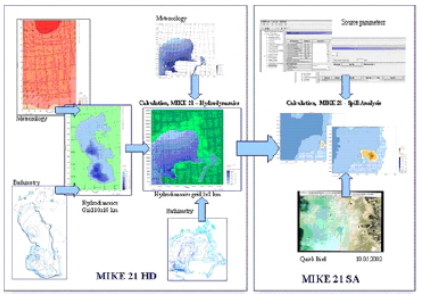
Contributing Authors: A. Baklanov, D. Belikov, V. Lykosov, A. Mahura, B. Mirkarimova, I. Okladnikov, A. Starchenko, J.H. Sørensen, A. Titov, A. Tridvornov



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Thank you for your attention !

Info at Web-site: http://projects.risks.scert.ru

Contacts: Alexander Baklanov, alb@dmi.dk
Evgeny Gordov, gordov@scert.ru

Megacities: Emissions, Impact on Air Quality and Climate, and Improved Tools for Mitigation Assessments (MEGAPOLI)

EC 7FP project for: ENV.2007.1.1.2.1. Megacities and regional hot-spots air quality and climate

Project duration: Oct. 2008 – Sep. 2011

27 European research organisations from 11 countries are involved.

Coordinator: A. Baklanov (DMI)

Vice-coordinators: M. Lawrence (MPIC) and S. Pandis (FRTHUP)

(see: Nature, 455, 142-143 (2008), http://megapoli.info)

The main aim of the project is

(i) to assess impacts of growing megacities and large air-pollution "hot-spots" on air pollution and feedbacks between air quality, climate and climate change on different scales, and

(ii) to develop improved integrated tools for prediction of air pollution in cities.