Working Group on
Siberia Integrated Regional Study development

General description

The first meeting of the Working Group on the Siberia Integrated Regional Study (SIRS) was held on March 23, 2005, in Novosibirsk (Russia), within the framework of the Conference on Computational and Information Technologies for Environmental Sciences (CITES 2005, http://scert.ru/en/conferences/cites2005/). This event took place under the auspices of the Siberian Branch of the IGBP Russian National Committee, with the support of the Siberian Centre for Environmental Research and Training (SCERT, http://scert.ru/en/) and MEDIAS-France (http://medias.obs-mip.fr). It gathered regional, national and international researchers and attracted the attention of representatives of institutions and funding agencies interested in the development of SIRS as a part of the Earth System Science Partnership and the IGBP2 Network of Integrated Regional Studies in selected regions of the globe.

This brainstorming session brought together a small group of regional scientists and their close national and international partners, in order to deepen and strengthen the preliminary project and propel it to the international scene. It took place just after the CITES 2005 Conference, which provided an unique opportunity to gather the relevant people, get a better insight of the regional state of the art, and have an in-depth discussion to chose the right tracks in order to achieve a fruitful synergy with endorsed global change regional programmes.

The workgroup was preceded by the "SIRS Scientific Background" cross-disciplinary session devoted to the state of the art on environmental investigations in the region under study. According to the current knowledge summarised in the seven papers reported during the session and highlighted during the whole CITES Conference (http://scert.ru/en/conferences/cites2005/conferencepr/ see also relevant presentations), Siberia is the place in the world where the most pronounced signature and consequences of climate change are already happening and will occur (Pr. M.V. Kabanov, IMCES, Tomsk). Various models have been developed to address different dimensions of this issue (Pr. A.A. Baklanov, DMI, Denmark; Pr. V. N. Krupchatnikov, ICMMG, Novosibirsk; Pr. V.N. Lykosov, INM, Moscow). Variability in space and time as well as regions of critical importance ("hotspots") have been evidenced through in situ and remote sensing measurement techniques (Pr. M.V. Kabanov, IMCES, Tomsk; Pr. A.A. Lagutin, Altai State University, Barnaul; Dr. K.G. Rubinstein, Hydrometcentre of Russia,, Moscow) and were forecasted by advanced climatic models (Dr. Sci. E.M. Volodin, INM, Moscow). Climate warming will cause changes in the temperature and humidity regimes of several large areas. In some places, it will generate new large bogs, which will act as active sources of CH_4 (and probably of CO_2, at least at the beginning). In other places, the boundary of the boreal forest will move to the North, covering new areas and generating new CO_2 sinks (Pr. E.D. Schulze, MPI for biogeochemistry, Germany; Pr. A.S. Svidenko, IIASA, Austria). Dramatic modifications in disturbance regimes, in particular fire and insect outbreaks, are foreseen as well. Thawing permafrost is likely to entail the physical destruction of landscapes and infrastructures, and may dramatically change the hydrological regime and vegetation condition of vast territories.

What will be the net balance of such changes in terms of carbon, water and energy cycles at the local and sub-regional scales? How will it interact with regional and global scales? What will be the feedback to the climate system at all these scales? In addition to these questions, anthropogenic interference must be taken into account properly. What will be the reactions of citizens, policy and decision makers, public and private industries? Are we able to predict and model that? How should regional predictions be linked with the conventional IPCC climatic and

human dimension scenarios? What is the current and future role of the Kyoto Protocol in the regional aspect? Many disciplinary and interdisciplinary local and regional studies on environmental, climatic and human dimension issues have been provided so far in Siberia by regional, national and international groups, in order to obtain answers to these questions.

Significant inputs to the present knowledge were gained from Interdisciplinary Integrated Projects funded by the Siberian Branch of the Russian Academy of Sciences (SB-RAS), including:

- "Siberian Geosphere-Biosphere Programme: Integrated Regional Study of Contemporary Natural and Climatic Changes" (SGBP, http://sgbp.scert.ru/en/about),
- "Ecological Problems of Siberian Cities",
- "Complex Monitoring of the Great Vasyugan Bog: modern state and development processes research", and
- "Siberia Aerosols-2".

SB-RAS is also planning to start developing information infrastructures to support interdisciplinary environmental studies on Siberia.
EC Framework Programme Projects have been and are still playing an important role in this region, for instance:

- "Terrestrial Carbon Observation in Siberia" (TCOS),
- "Multi-sensor concept for Greenhouse Gases Accounting in Northern Eurasia" (Siberia 2, http://www.siberia2.uni-jena.de/index.php),

which are also funded by the Max Planck Institute via the ISTC Zotino Tall Tower Observation facility (ZOTTO).
A number of projects on Siberian forestry are supported by the International Institute for Applied System Analysis (IIASA, http://www.iiasa.ac.at/Research/FOR/index.html), within the framework of the Forestry Project. A set of projects on greenhouse gas exchanges between biota and atmosphere are backed by the National Institute for Environment Study (NIES, http://www.nies.go.jp/). Recently organised by the NASA, the Northern Eurasia Earth Science Partnership Initiative (NEESPI, http://neespi.gsfc.nasa.gov/) is a quite promising approach to use Remote Sensing tools in order to investigate Siberian environmental dynamics.

Pr. E. Gordov (SCERT, Tomsk) initiated the Working Group with some brief introductory remarks. The recently organised Siberian Branch of the IGBP Russian National Committee - headed by Pr. E. Vaganov (Institute of Forest, Krasnoyarsk) and organisationally supported by SCERT - was presented and its role in the development of SIRS was described. According to the Siberian Branch of the IGBP Russian National Committee, the initial stage of SIRS should focus on the four following activities:

- Quantification of the terrestrial biota full greenhouse gas budget, in particular exchange of major biophilic elements between biota and atmosphere (Leader: Evgeny Vaganov; Regional Core Group including: Andrej Degermendgi, Vaycheslav Kharuk, Nikolai Kolchanov, Vadimir Krupchatnikov and Alexander Onuchin);
- Monitoring and modelling of regional climate change impact (Leaders: Mikhael Kabanov and Vasily Lykosov; Regional Core Group including: Vladimir Krutikov, Viktor Kuzin, Vladimir Penenko, Gdaly Rivin, Vladimir Shaidurov, Valerian Snytko, Yurii Vinokurov, Arnold Tulokhonov);
- Development of SIRS information-computational infrastructure (Leader: Evgueni Gordov; Regional Core Group including: Igor Bychkov, Alexander Fazliev, Anatoly Fedotov, Anatoly Lagutin and Alexander Starchenko);
- Development of an anticipatory regional strategy of adaptation to and mitigation of the negative consequences of global change (Leader and Group to be determined).

Dr. G. Bégni (MEDIAS-France) briefly described the conclusions and recommendations elaborated during the dedicated INTAS Strategic Scientific Workshop entitled "Towards an integrated multidisciplinary study of the Northern Eurasia climatic Hot Spots", held in Tomsk from July 23 to 25, 2004 (http://scert.ru/en/conferences/enviromis2004/recommendations/), which materialised the first step to SIRS. It was stressed that the region requires a new research paradigm. An overarching vision of the regional aspects and their various connections to global aspects is now needed, in line with the Earth System Science Partnership / Integrated Regional Studies (IRS) approach, which could result in a coherent Siberia IRS (SIRS) programme. This requires bringing together scientists from several disciplines and sub-regions into a much wider approach and setting up the suitable structures (institutions; regional, trans-regional and international networks; funding) to lead these integrative studies. The results of such studies should be bridged with and acknowledged by relevant decision and policy makers in order to implement proper mitigation and remediation actions at managerial and political decisional levels. An overall classical scheme to meet such an ambitious objective as SIRS is to deal extensively with the following issues (some of them have already been addressed from some specific points of views, but most of them have never been considered in a consistent integrated approach):

- What are the main features of regional Siberian climate changes (overall trends, sub-regional trends and anomalies, interactions between terrestrial and water ecosystems, permafrost, atmosphere and human society, etc…)?
- What are the regional drivers of these changes?
- How are they linked to the features of global climate change?
- How does the former impact the latter?
- In particular, what are the connections with surrounding sub-regions and regions such as Arctic area, central Asia, Mongolia, , the Aral Sea basin, …?
- How can sub-regional and regional modelling be incorporated into continental and global models?
- What is the optimal interconnection of regional and IPCC scenarios? What are the results of such scenarios?
- What are the anticipated geophysical, biological and socio-economic impacts of/responses to global change according to each scenario?
- Are relevant socio-ecological models available and could they be satisfactorily validated with respect to the above problems?
- What adaptation and mitigation measures should be implemented in order to decrease/eliminate the negative consequences of global change? At what cost?

To answer such questions, a Siberia Integrated Regional Study (SIRS) should be initiated, and the associated institutions, official and unofficial organisational structures (interdisciplinary collaborative networks, central structure, etc…) should be created.

Then basing on results obtained by SB RAS researchers and their abroad partners Pr. E. Gordov briefly summarized scientific background for SIRS development. He stressed out importance of results on regional climate dynamics gained in course of performance of the SB RAS Interdisciplinary Integrated Project "Siberian Geosphere-Biosphere Programme: Integrated Regional Study of Contemporary Natural and Climatic Changes" (SGBP, http://sgbp.scert.ru/en/about), which became in essence the phase zero for SIRS development. Also the role of similar project "Complex Monitoring of the Great Vasyugan Bog: modern state and development processes research" devoted to study of dynamics of the unique Siberian natural complex under pressure of Global Change as a structure element for SIRS was underlined. Funded by EC, MPG and ISTC international projects, like "Terrestrial Carbon Observation System - Siberia" and "Zotino Tall Tower Observation", performed by the world leaders in the area MPI for biogeochemistry (Jena) and IIASA (Laxenburg) in cooperation with

the Institute of Forest SB RAS and other partners are very important for Global Carbon cycle understanding and should be accounted as pillars for the developing SIRS.

The ensuing discussions involved: Pr. A. Baklanov, Pr. V. Bogolubov (National Agrarian University, Kiev); Pr. A. Chavro (INM, Moscow); Pr. V. Efimov (NASU Hydrophysical Institute, Sebastopol); Pr. E. Gordov, Pr. K. Kutsenogii (Institute of Chemical Kinetics and Combustion, SB-RAS, Novosibirsk); Pr. G. Panin (Institute of Water Problems, RAS, Moscow); Pr. V. Penenko, Pr. V. Lykosov, Dr. K. Rubinstein, Pr. I. Sutorikhin (Institute of Water and Ecology Problems, Barnaul); Pr. R. Tamsaly (Tartu University); Pr. E. Vvyazilov (Russian Research Institute for Hydrometeorological Information - World Data Centre, Obninsk); and Pr. E. Zakarin (KazGeoKosmos, Kazakhstan). Specific propositions on the possible elements and structure of SIRS were issued. They are summarised in the subsequent WG Conclusions and include among others the following suggestions:

- Pr. I. Sutorikhin proposed summertime measurements and observations of a wide set of environmental characteristics from research vessels on the Novosibirsk-Salekhard route as a SIRS project;
- Dr. K Rubinstein recommended to launch, as a SIRS project and as a background for other ones, the localisation of a MM5 model for Siberia, especially for modelling and monitoring snow characteristics. This would be led in cooperation with Russian Research Institute for Hydrometeorological Information –World Data Center, Obninsk;
- Pr. K. Kutsenogii suggested to relay as a SIRS project the “Aerosols of Siberia” SB-RAS Integrated Interdisciplinary Project that he is coordinating;
- Pr. A. Lagutin promised to pay special attention to the retrieval from satellite images of data on snow in Siberia and on the specific features of the Great Vasyugan Bog;
- Pr. E. Vyazilov advocated to launch a SIRS website, and to provide it with an electronic journal. He stressed the importance of information infrastructures and thematic Decision Support Systems as outputs of basic research;
- Pr. G. Panin highlighted the necessity to consider temperature and humidity heterogeneities at the meso-scale and smaller scales (lakes, swamps);
- Pr. V. Penenko emphasised the need to consider the connection between climatic and biosphere processes from the point of view of risk estimation and suggested to create the consortuim of projects in the frames of SIRS in which the “Ecology of Siberian Cities” project could be incorporated together with other SB-RAS Integrated Interdisciplinary Projects;
- Pr. A. Baklanov proposed to relay on the “Enviro-RISKS” FP6 EC Coordinated Action as a project linked with the SIRS programme and to try to establish links of the SIRS and “Ecology of Siberian Cities” project with the GURME WMO Programme (Asia), to include one of Siberian cities as its case study. For future generation integrated models he suggested to consider the feedbacks between different scales of the processes, environmental pollution and urban meteorology/climate, health impacts and ecological conditions (FUMAPEX), first of all for studies of the aerosols and climate. He also recommended paying careful consideration to the Kyoto Protocol.

A clusterisation of relevant SB-RAS Integrated Interdisciplinary Projects was suggested and the necessity to establish links with appropriate initiatives at the national and international levels was acknowledged.

Both the discussion and derived conclusions show that the main goals of the Working Group were achieved, i.e.:

- to analyse various research programmes and activities in the region from a systematic point of view, based on integrated ideas of the ESS-P/IRS approach;
- to identify gaps and overlaps and the ways to reduce them;
- to understand how these activities pave the way to the next integration steps; and

- to define such next steps.

Now we are ready to set out more precisely a preliminary plan to develop the scientific basis and to implement an Integrated Regional Study which would address the unique features of climate change in Siberia, its local and regional impacts, the responses and vulnerabilities of ecosystems, and its interconnection with global processes. We hope that the Working Group produced a clear manifestation to the international community that the regional scientific community, reinforced by strong international links, is quite ready and eager to work within the framework of ESS-P, and aims at developing an IRS which would correspond to the mainstream of national and international global change sciences.

Conclusions of the SIRS workshop, CITES-2005
Novosibirsk, March 23, 2005

PREREQUISITE - Preliminary work and circulation of information

Identify the largest set of disciplinary and interdisciplinary research programmes that can be of interest as a basis to SIRS. Most of them have been funded by SB-RAS in conjunction with other donors. (=> have a standard description sheet about projects & results and put it on the website). Enviro-RISKS[1] INCO EC Project may be one of the backbones.

Collect all the existing data and research results. Create a SIRS website including a metadata base and an information portal.

Take advantage of the environmental information structure that SCERT is continuously setting up.

OBJECTIVE - Identify where we want to go

=> We need to have an overarching structure in order to define our Integrated Regional Study.

Key points as defined by SB-RAS:

- Study of greenhouse gases and aerosol exchange between biota, land and atmosphere.
- Monitoring and modelling of regional climate change impact.
- Development of SIRS information-computational infrastructure.

Additional suggestions (goals & tools):

- Create an overarching structure embedding the specific studies led and/or to be led. System modelling could be an overarching process => what system modelling do we need?
- Projects must be of an interdisciplinary nature. Have proper interactions to define them.
- Role of socio-economic sciences: how to incorporate them? (scenarios in line with IPCC ones – societal impacts & mitigation/adaptation/alleviation costs).
- It is mandatory to cluster relevant SB-RAS integrated interdisciplinary projects and to establish links with appropriate initiatives at national & international levels.
- Attract some projects that are not aware of SIRS (e.g. YAK)[2]. SIBERIA should be contacted too.
- Also establish links with the GURME WMO Programme (Asia), to include Novosibirsk case study and consider the influence of environmental processes on city ecological conditions, natural disasters (FUMAPEX), aerosols and climate and Chemical Transport Models (CTMs). Pay special attention to the Kyoto Protocol[3].
- Define appropriate relations with NEESPI.
- Organising data is a key issue. Set up a committee to collect and format proper data. Address current data as well as data leading to long-term trends.
- Set up the SIRS website. Provide it with an electronic journal. Stress the importance of information infrastructures and thematic DSS[4] as outputs of basic research[5].

STATE OF THE ART - Issues fairly investigated or easy to push forward

- *Climate:*

[1] Pr. A. Baklanov (DMI, Denmark)
[2] Dr. Gérard Begni (MEDIAS-France) to contact Philippe Ciais
[3] Pr. A. Baklanov (DMI, Denmark)
[4] Decision Support Systems
[5] Pr. R. Tamsalu (Tartu University, Estonia) and Pr. E. Vyazilov (VNIIGMI, Obninsk) - ready to cooperate with SIRS as well.

    - There are good results from comprehensive regional studies of present natural and climatic changes.
- *Snow:*
    - Localisation of MM5 models for Siberia, using 3dvar data assimilation and making Siberia Reanalysys, especially for modelling and monitoring snow characteristics[6].
    - Retrieval of snow cover from satellite images over the great Vasyugan bog[7].
- *CO_2:*
    - There is reasonable knowledge about forest fires.
    - TCOS Siberia gives an insight about seasonal CO_2 variations (including burnt areas). Several other projects address the carbon cycle and must be taken into proper account within SIRS.
    - Specific areas such as the great Vasyugan bog: regulating role of climate, CO_2 & CH_4 biological cycles, general and specific patterns.
- *Aerosols:*
    - The "Aerosols of Siberia" SB-RAS project brings a sound knowledge about aerosols.
    - Studies (i) about interactions between land and the Arctic Ocean and (ii) about combustion in Siberia[8] led to improved knowledge about aerosols.
- *Environment:*
    - A wide set of environmental data can be collected in the summertime on board research vessels (Novosibisrsk-Salekhard)[9] and along the Moscow-Vladivostok railway.
    - The "Ecology of Siberian Cities"[10] integrated interdisciplinary project may bring specific anthropogenic input.

STATE OF THE ART - Identify the gaps that need to be filled

- *Climate:*
    - Some phenomena have no explanation so far (high significant temperature increase).
    - There is a need to consider temperature and humidity heterogeneities at the meso-scale and smaller scales (lakes, swamps)[11].
    - The influence and/or coupling with phenomena such as NAO (and AO) must be studied.
- *Biosphere:*
    - There is a need to better understand biosphere evolution and its interactions with climate features, and to consider biosphere processes from the point of view of risk estimation[12].
- *Interdisciplinary aspects:*
    - Define and lead proper interaction with socio-economic sciences.

ORGANISATION – Propositions for a step-by-step progress

- Organise all the ideas that were proposed during the dedicated 2004 SSW and the 2005 CITES workshops to develop a coherent plan (first level of regional interaction).
- Interact with relevant ESS-P managers (firstly with those who showed interest in SIRS[13]) in order to define how this plan fits with the SIRS concept and what points are lacking. Face-to-face meetings may prove necessary.
- Write down a refined plan bringing together integrated studies and defining how they interact to build up SIRS (second level of regional interaction): what objectives/results, what projects, what organisation/schedule? That plan has to be endorsed by the IGBP Russian Committee/SB and ESS-P managers. MEDIAS-France can help. Then start building the SIRS website.

Pr. E. Gordov & Dr. G. Bégni

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[6] Dr. K Rubinstein (RosHydromet, Moscow)
[7] Pr. A. Lagutin (Altai State University, Barnaul)
[8] Pr. K. Kutsenogii (I Chem. Kin. and Combustion, SB-RAS, Novosibirsk)
[9] Pr. I. Sutorikhin (IWEP SB-RAS, Barnaul)
[10] Pr. Penenko (ICMMG, SB-RAS, Novosibirsk)
[11] Pr. G. Panin (IWP RAS, Moscow) - ready to participate in SIRS hydrology-oriented studies
[12] Pr. Penenko (ICMMG, SB-RAS, Novosibirsk)
[13] Pr. Guy Brasseur, Pr. Josep Canadell, Pr Dennis Ojima.

Appendix 1. Organisers

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Appendix 2. List of participants

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