



# DISASTER MONITORING AND MANAGEMENT: RUSSIAN APPROACH AND GLOBAL PERSPECTIVE



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Deputy Director General,  
JSC "RUSSIAN SPACE SYSTEMS"  
Chairman, ICPI Board  
Vice-President, International Academy of  
Astronautics



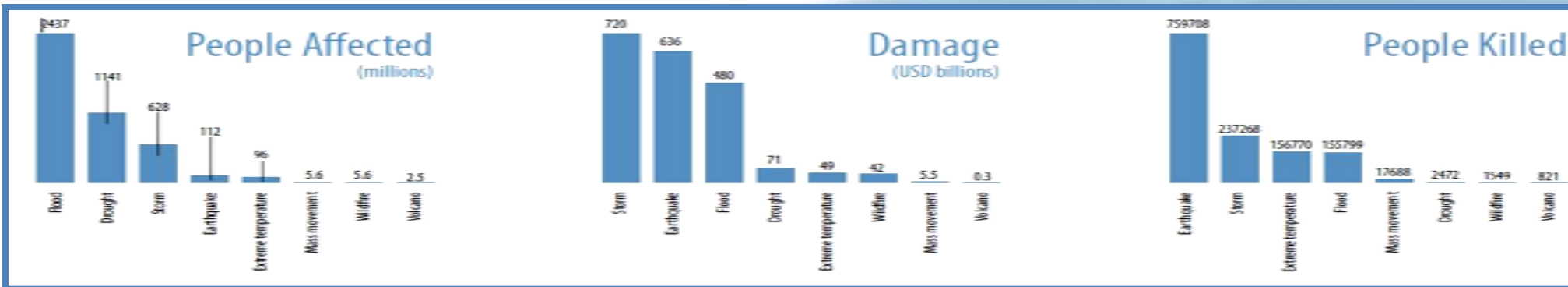
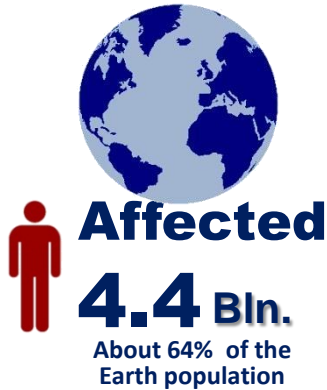
# Impacts of Natural Disasters (1992-2011)



(according to UNISDR report of June 13, 2012)



## ... IN THE WORLD



## IMPACT BY TOP 10 COUNTRIES

**China**  
**2.5 BILLION**  
people affected

India	928 million
Bangladesh	136 million
Philippines	92 million
Thailand	72 million
Pakistan	64 million
Ethiopia	46 million
Kenya	44 million
Iran Islam Rep	40 million
Viet Nam	39 million

**USA**  
**560 BILLION**  
in damage (USD)

Japan	402 billion
China P Rep	331 billion
Thailand	45 billion
India	43 billion
Italy	36 billion
Germany	31 billion
France	31 billion
Chile	31 billion
Australia	28 billion

**Haiti**  
**230675**  
people killed

Indonesia	185152
Myanmar	139351
China P Rep	128298
India	103182
Pakistan	85332
Russia	61152
Sri Lanka	36000
Iran Islam Rep	32680
Venezuela	30463



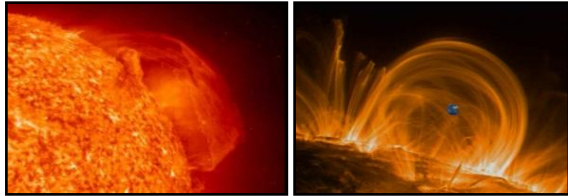


# GLOBAL THREATS TO THE PLANET AND THE HUMANITY

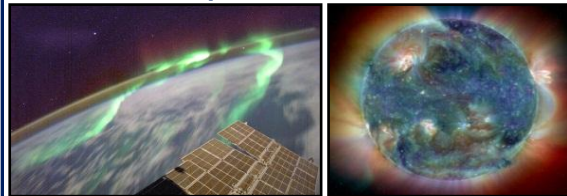


## Threats of cosmic origin

Anomalous Solar activity



Anomalous geomagnetic field perturbations



Asteroid/meteoroid and other threats



## Dangerous and Catastrophic Natural Disasters

Earthquakes M>6...7



Giant tsunamis



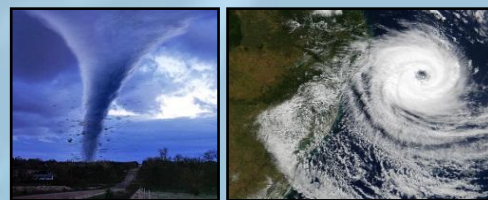
Volcano eruptions



Forest fires



Hurricanes, tornadoes



Droughts



Avalanches, landslides, mudflows



Floods and floodings







# GLOBAL THREATS TO THE PLANET AND THE HUMANITY



## Industrial accidents, emergencies and disasters

### Disasters in Particularly Hazardous Facilities



### Transport Accidents



### Major Fires at Oil Production Sites



### Major Accidents of Oil and Gas Pipelines



## Negative Man-Made Impacts on the Environment

### Degradation of Agricultural Land



### Global Pollution of Aquatic Environment



### Growing Magnitude of Atmosphere's Industrial Pollution





## International Charter on Space and Major Disasters



- Aims at providing a unified system of space data acquisition and delivery to those affected by natural or man-made disasters through Authorized Users.
- Each member agency has committed resources to support the provisions of the Charter.

## Flood in Slovenia, September 19, 2010



## Sentinel - Asia



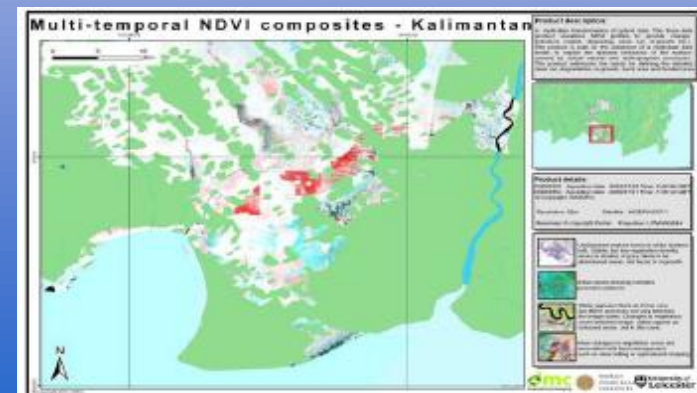
- A voluntary basis initiative led by the Asia-Pacific Regional Space Agency Forum (APRSF)
- Uses WEB-GIS and space based technology.

## Disaster Monitoring Constellation (DMC)



Proof of concept constellation: 6 satellites, 5 countries, providing 22-32 m MS data, Imaging everyday.

## Mapping Deforestation in Indonesia





## UN-SPIDER (United Nations Platform for Space-based Information for Disaster Management and Emergency Response)

- Aims to ensure access to and use of space-based solutions during all phases of the disaster management cycle, including the risk reduction phase, which will significantly contribute to reducing the loss of lives and property.
- A **gateway to space information** for disaster management support, by serving as a **bridge to connect** the disaster management and space communities and by being a **facilitator of capacity-building** and institutional strengthening, in particular for developing countries.

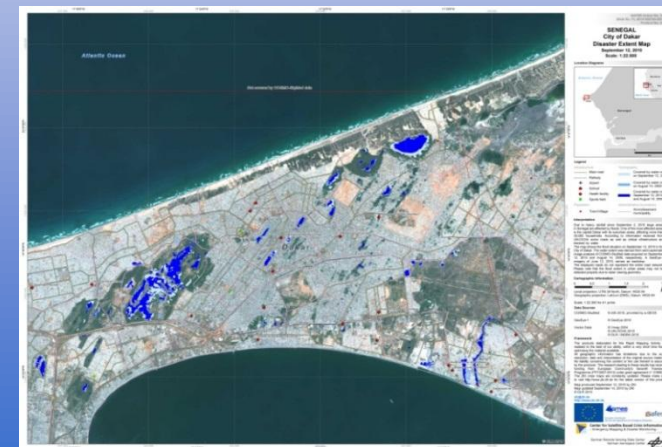


## GMES- SAFER



- In the frame of the GMES initiative (Global Monitoring for Environment and Security), SAFER (Services and Applications for Emergency Response) project aims at implementing pre-operational versions of the Emergency Response Service.

## Floods in Senegal, June, 2010



## Global Earth Observation System of Systems (GEOSS)



Disasters: One of the 9 Societal Benefit Areas of GEO



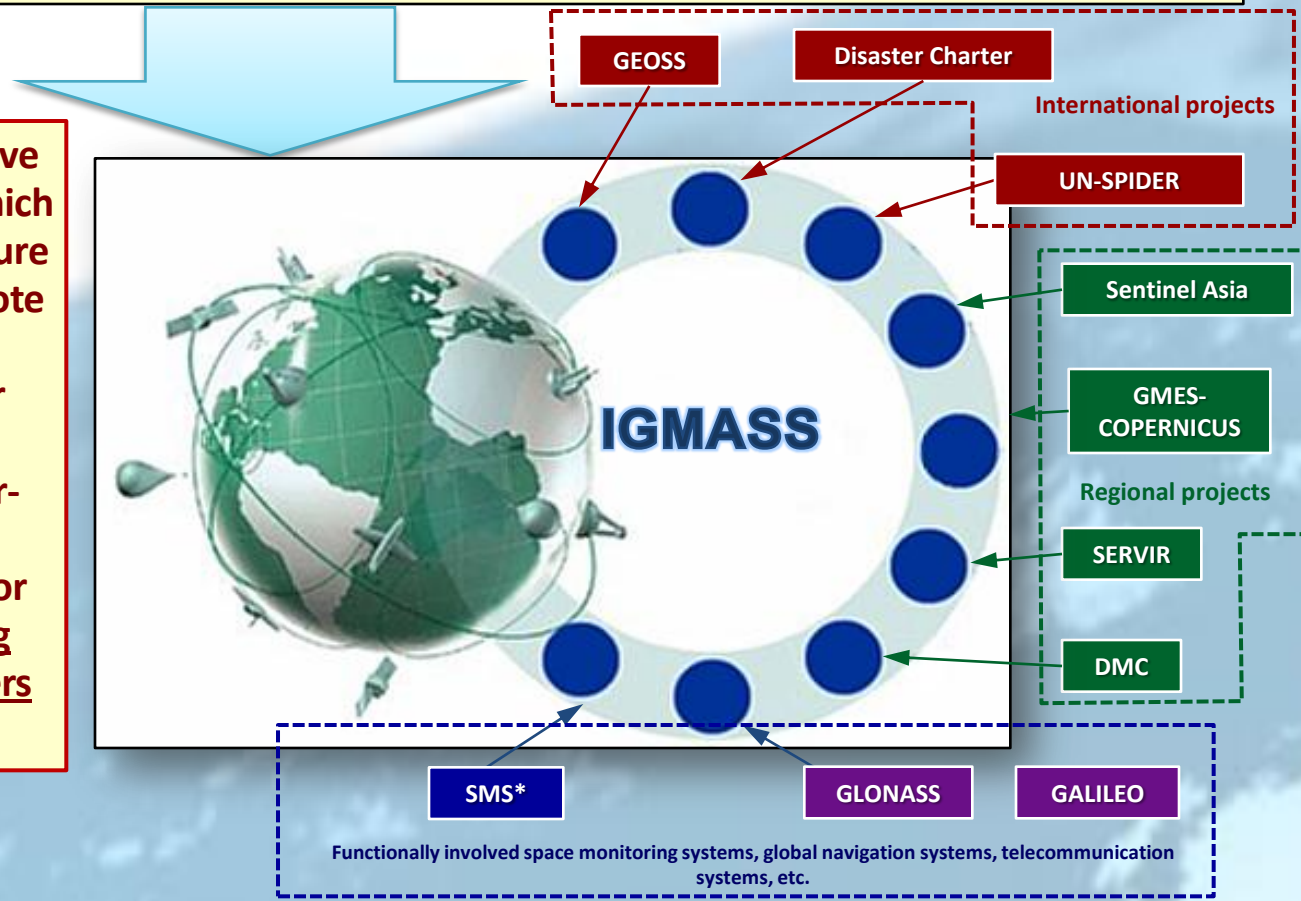
# International Global Monitoring Aerospace System (IGMASS) Project



## GLOBAL THREATS TO THE EARTH AND HUMANITY



The IGMASS Project is Russian initiative to create the “System of Systems”, which has to integrate both existing and future national and international space remote sensing, communication and relay, weather and navigation systems (or allocated data and organizational resources), as well as appropriate air-born and ground-based facilities, including specialized infrastructure for global forecasting and early warning about natural and man-made disasters Earth and space origin.



\* - Space Monitoring System (SMS)





# Space-based Disaster Management: The Need for International Cooperation



<b>Chair</b>	<b>Ranganath Navalgund</b>	<b>India</b>
<b>Co-Chair</b>	<b>Valery Menshikov</b>	<b>Russia</b>
<b>Rapporteur</b>	<b>Akinyede Joseph</b>	<b>Nigeria</b>
<b>Members</b>	<b>Ciro Arevalo Yepes</b>	<b>Austria</b>
	<b>V. G. Degtyar</b>	<b>Russia</b>
	<b>V.S. Hegde</b>	<b>India</b>
	<b>Masanori Homma</b>	<b>Japan</b>
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	<b>Igor Kabashkin</b>	<b>Latvia</b>
	<b>Sergey Lysyy</b>	<b>Russia</b>
	<b>Mikhail Novikov</b>	<b>Russia</b>
	<b>Sergey Pushkarsky</b>	<b>Russia</b>
	<b>Lydia Rykhova</b>	<b>Russia</b>
	<b>Jeannie Seelbach</b>	<b>USA</b>
	<b>Arnoldo Valenzuela</b>	<b>Germany</b>

## IAA WG Disaster Management/Natural Hazards

### The Working Group acknowledges:

- International Academy of Astronautics
- Space Agencies
- Jean Michel Contant
- Corrine Jorgenson
- V. Koteswara Rao
- Organisers of Riga Conference
- Indian Space Research Organisation
- Astronautical Society of India
- Additional Contributors:
  - Ajay Rajawat, India
  - Shibendu Ray, India
  - V. N. Sridhar, India



- **Strengthen constellation of earth observation satellites** (optical and radar sensors) specific to disasters through virtual constellations, ensuring their continuity and establishing a mechanism for proper orbit allocation, satellite tasking for emergencies and meeting rush access of EO data.
- **Augment communication network** through international cooperation in the Data Relay Satellite System (DRSS) and near real time global network of data dissemination systems for timely availability of data, products and services to stakeholders.
- **Encourage collaborative research efforts for development of early warning models and their validation** through early warning programs of GEOSS, UN-SPIDER, IGMASS and other regional/global initiatives.
- **Facilitate augmenting in-situ observation networks** and sharing such data across geographical boundaries to provide alerts and improve early warning.





# The IGMASS Project Objectives

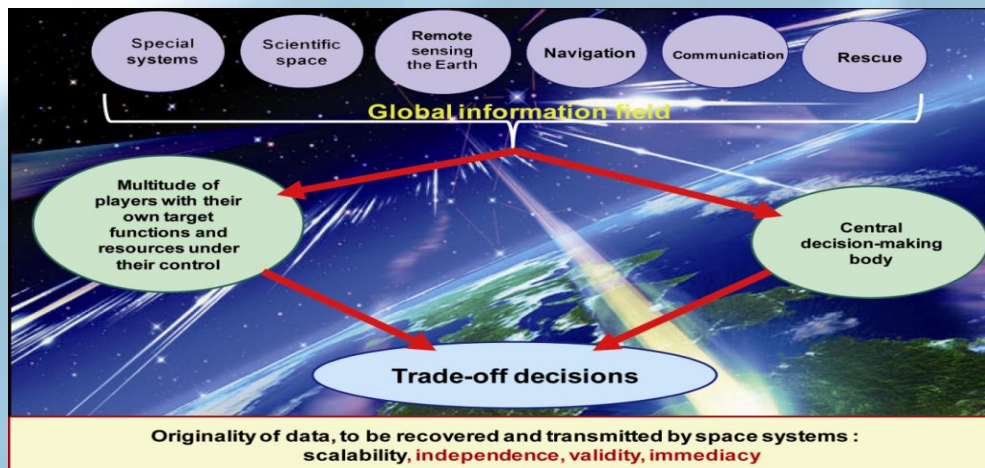


*Maintenance of geophysical, ecological and social-economic security in national, regional and global formats*

*Forecasting natural disasters and man-made catastrophes through its global and effective prediction based on consolidation and integrated application of space, airborne and ground-based facilities*

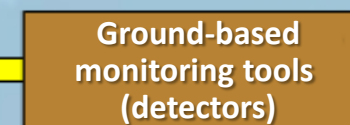
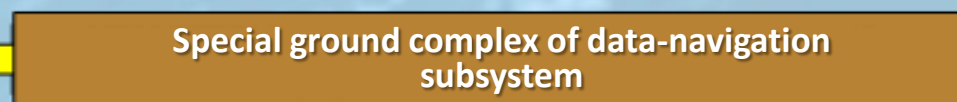
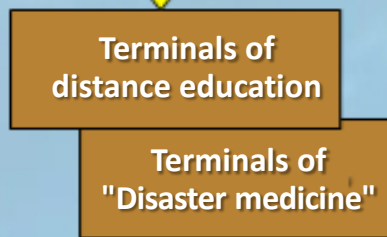
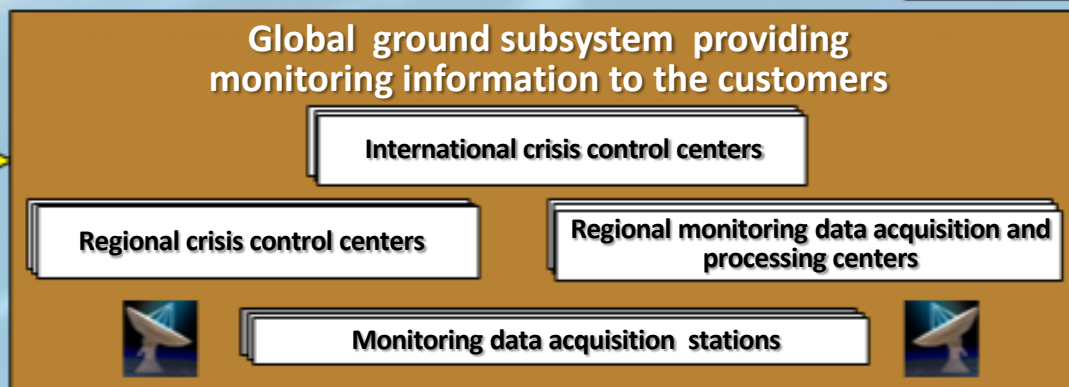
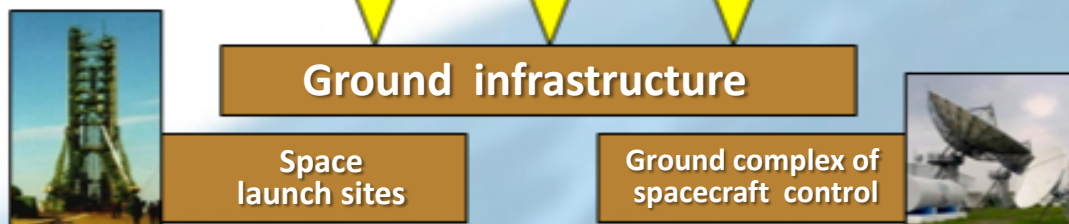
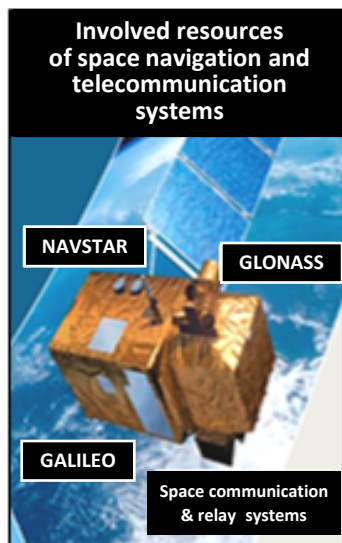
*Early warning about space threats (asteroids, space debris, etc.) due to utilization of informing, navigation, telecommunication resources all over the world*

*Auspices to settle global humanitarian issues (illiteracy via distant education, protection of cultural heritage, catastrophe medicine, etc.), gradual forming on this basis "global security informational field"*





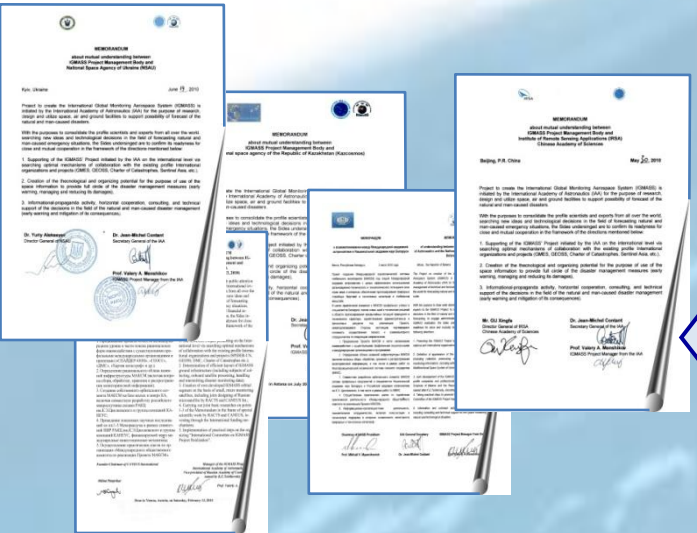
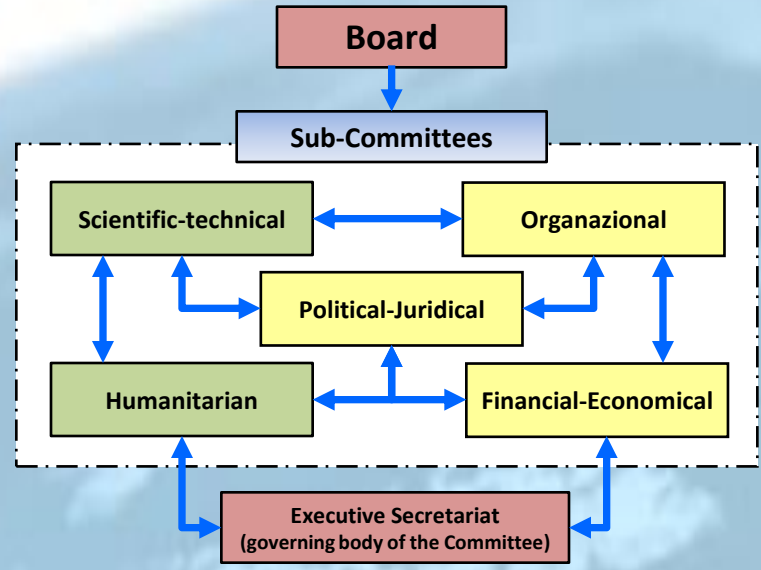
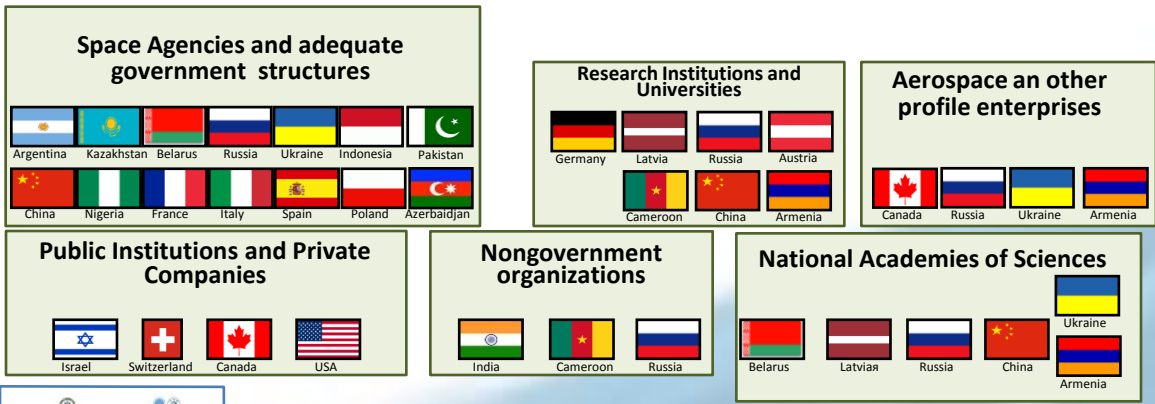
# IGMASS Generalized Structure





# International Committee on the IGMASS Project Implementation

One of the main results of the IGMASS Project promoting was establishing in July, 2010 its own governing body - “International Committee on the IGMASS Project Implementation” (ICPI) . Mainstream purpose of such step was drawing public attention to the Project at national, regional and international levels, consolidation of profile scientists and experts as well as enterprises for the IGMASS concept realization, searching both contemporary ideas, technical solutions , administrative and financial recourses for the system creation



**ICPI – non-government, public structure, which unifying representatives from 25 countries and two international organizations. During first working session of the Committee, which held in September, 2011 in Prague (Czech Republic) the ICPI Charter and plans of ICPI activity for the years 2011-2012 were adopted. In August 2011 ICPI was officially legislated (in September, 2012 – re-established) by the Ministry of Justice of the Russian Federation in juridical form of 'Noncommercial Partnership'. Since the year 2010 ICPI has already signed 97 MOU's about collaboration with profile national, regional and international organizations all over the world.**



# IGMASS Promotion at International Level

## **IGMASS presentations at profile interstate scientific forums**

Dnepropetrovsk, Ukraine (2007, 2009); Moscow, Korolev, Russia; Shanghai, China (2008); Versailles, France (2009); Rome, Italy; Haifa, Israel; Paris, France; Moscow and Kazan, Russia; Donetsk and Kiev, Ukraine; Beijing, China; Bonn, Germany; Buea, Cameroon (2010); Melbourne, Australia; Yerevan, Armenia; Madrid, Spain; St. Petersburg, Russia, Istanbul, Turkey, Nairobi, Kenya, Hanoi, Vietnam, Daejong, Korea (2011), Singapore; Moscow, Russia Yevpatoria Ukraine (2012); Beijing, China; Mamia, Romania; Minsk, Belarus; Moscow, Russia (2013)

## **Official presentation at International Academy of Astronautics (IAA)**

Glasgow, Scotland (2008)

## **Appointment of the IGMASS Project Manager (IAA) and IGMASS expert working group initiation**

Paris, France (2009)

## **Presentation of preliminary results of IAA working group**

Daejong, Korea (2009)

## **Initiation/current activity of the International Committee on the IGMASS Project Implementation (ICPI)**

Limassol, Cyprus (2009); Riga, Latvia; Prague, Czech Republic (2010); Madrid, Spain and Cape Town, South Africa (2011)

## **Approval of the IGMASS Project by the participants of profile political summits**

Washington, USA (2010); Yalta, Ukraine (2012); Minsk, Belarus; Alma-Ata, Kazakhstan (2013)





# IGMASS Project Presentations at UN Level



Организация Объединенных Наций  
 Генеральная Ассамблея  
 Distr.: Limited  
 12 April 2012  
 Original: Russian  
 A/AC.105/C.1/L.323

Комитет по использованию космического пространства в мирных целях  
 Научно-технический подкомитет  
 Пятидесятая сессия  
 Вена, 11-22 февраля 2013 года  
 Использование космических систем для предупреждения и ликвидации чрезвычайных ситуаций

**Проект создания Международной аэрокосмической системы глобального мониторинга как перспективная новая инициатива в сфере предупреждения и уменьшения последствий чрезвычайных ситуаций природного и техногенного характера**

Рабочий документ, представленный Российской Федерацией\*

*Резюме*  
 Инициатива относительно реализации проекта создания Международной аэрокосмической системы глобального мониторинга («ИГМАСС»)...

United Nations  
 General Assembly  
 Distr.: Limited  
 12 April 2012  
 English  
 Original: Russian  
 A/AC.105/C.1/L.323

Committee on the Peaceful Uses of Outer Space  
 Scientific and Technical Subcommittee  
 Fiftieth session  
 Vienna, 11-22 February 2013  
 Space-system-based disaster management support

**Project to create the International Global Monitoring Aerospace System as a forward-looking new initiative in predicting and mitigating the consequences of natural and man-made disasters**

Working paper submitted by the Russian Federation\*

*Summary*  
 The Initiative to implement the International Global Monitoring Aerospace System (IGMASS) project has been actively promoted by Russian scientific and voluntary organizations for the past four years. The aim of the project is to establish an authoritative international mechanism that, using effective resources, makes it possible to alert individual countries and other global threats, including those potential natural and man-made disasters and other global threats, including threats originating in space. Activities being considered for possible implementation under the IGMASS project include monitoring of the geophysical environment (space weather) and early warning of asteroid and comet hazards and threats posed by space debris.

\* The present document was made available as a conference room paper at the forty-ninth session of the Scientific and Technical Subcommittee of the Committee on the Peaceful Uses of Outer Space (A/AC.105/C.1/2012/CRP.23).

V.12-52407 (E)  
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In 2010-2011, number of the IGMASS Project presentations were made on the UN level: six times at United Nations Committee on the Peaceful Uses of Outer Space (COPUOS) and its Scientific and Technical Subcommittee and two times at United Nations Economic and Social Commission for Asia and the Pacific (ESCAP).

**At 49<sup>th</sup> COPUOS Scientific and Technical Subcommittee session, Russian Federation has presented Working Paper (A/AC.105/C.1/2012/CRP.23 dated 07.02.2012): «Project to create the International Global Monitoring Aerospace System as a forward-looking new initiative in predicting and mitigating the consequences of natural and man-made disasters».**



# IGMASS Project and Strategic Defence of the Earth Concept



## IR Feature

INTERNATIONAL GLOBAL MONITORING AEROSPACE SYSTEMS

### Toward Collaboration in The Defense of Mankind

by Benjamin Deniston, Pavel Penev, and Jason Ross

Sept. 14—Currently, mankind lives on only one planet. We are all subject to similar threats: threats that do not distinguish among nations, religions, political parties, or social classes. Irregular solar activity, earthquakes, volcanic eruptions, floods, asteroid and comet impacts—these events don't contemplate national boundaries before they strike. So why should we, when defending ourselves from them?

This was the issue underlying a three-day scientific conference, "Space and Global Security of Humanity," held in Yevpatoria, Ukraine, Sept. 3-6, 2012, bringing together scientists from mainly Russia and Ukraine, with attendees from Kazakhstan, Belarus, Germany, and Canada. The only U.S. participation came from two representatives of the LaRouche Policy Institute, Benjamin Deniston and Jason Ross, who presented the leading political, economic and scientific work of Lyndon LaRouche's movement in the United States. The conference was sponsored by a number of large Russian, Ukrainian, and international organizations, but centered around



The conference book, *Space and Global Security of Humanity*, addressed the three-day conference.

this particular SDE proposal his original 1983 program was Defense Initiative (SDI). Lyd societies have very publicly a most recently in the 68-page *Strategic Defense of Earth*. IGMMASS is a proposed

Russian Academy of Cosmonautics and the company. 2. See "As World War III, 2011." <http://www.larouchepolicy.com>

the acti Global M tems org. Altho has exist ticular co text of H of Earth 2011, a i between Russia in tems and from the teroid an

kind is directly tied to the unique power of the human mind to create new synthetic sensory systems, expanding its domain of action. IGMMASS expresses a potential to consciously integrate and expand the powers of the human mind to a degree never before realized.

As the global nature of these threats illustrates—it would only take one large long-period comet to wipe out human civilization in a single impact—the continued existence of the human species depends upon casting aside our reliance upon our simply biological sense perceptions, and moving into a science-driven program to expand the power of the mind to sense and to act, all around the Earth and throughout the Solar System. As will become clear below, this means understanding the Earth as an integrated part of the Solar System, not one floating in empty space, but intimately connected through various processes which we can now come to understand for the purposes of forecasting extreme events, and, even if in a limited degree at first, begin to control.

Such international collaboration in the defense of all mankind is not just a "nice" policy, but is of profound significance for the advancement of humanity as a whole. Seen from a historical vantage point, this becomes a potential coming-of-age test for humanity: Can nations come together to overcome the existential challenges posed to all mankind?

#### The Context

At the IGMMASS conference, the political and economic crises currently facing the world were not overlooked by the participants. While some aspects were touched upon anecdotally in a few presentations, Jason Ross of the LaRouche Policy Institute was the most clear in addressing this reality. Citing the immediate danger of President Obama and his backers in the British Empire taking the world to the brink of thermonuclear war, Ross made clear that this is not the desire of the majority of Americans, and that there is extremely significant opposition, led by LaRouche and top levels of the U.S. military institutions, to Obama's British



A Special Report available at <http://www.larouchepolicy.com/SDE>

commensurate with the cost to act. The new scientific and technological oped in a true science-driven program by creating completely new capital economy, ones which simply didn't new platforms for the economy as understood on the basis of local prements that these programs "cost too "cannot be afforded" are simply arbitrary, we cannot afford not to pursue

This view of IGMMASS and planetary warfare from the perspective of a science of physical economics was well received by the audience, and was followed up by the second LaRouche Policy Institute representative, Benjamin Deniston, who elaborated on what types of science-driven programs will provide the greatest benefits in both improving mankind's defense against potentially hazardous asteroids and comets, and generating economic growth. Focusing on LaRouche's concept of energy-flux density, Deniston showed that the next revolution in our ability to act in deep space will necessarily come with the developments associated with nuclear fission and fusion propulsion systems. These do not simply provide a power source, but express an entirely new stage of the economic power of mankind, a new economic platform, which will uphold the entire physical-economic capability of the human species, in-

cluding the crucial issue of an expanded capability to defend against the threats of asteroids and comets.

Stimulating a fair amount of side discussion about these political and economic considerations, this pair of presentations provided an important contribution from the United States, in the midst of what was already a very high-level and provocative conference.

About 35 scientists made presentations on various aspects of the IGMMASS program and related activity over the three-day event. The keynote was delivered by Prof. Anatoly Perminov, former head of the Russian Federal Space Agency (Roscosmos), and current chairman of the International Committee on the IGMMASS Project Implementation.<sup>2</sup>

#### What Is IGMMASS?

Perminov clarified the objectives of the IGMMASS program, with a strong emphasis on moving towards a global forecasting capability to provide early warning of threats. The full range of disasters monitored as part of IGMMASS includes:

- industrial accidents, disasters, and catastrophes
- anomalous solar activity, space debris, asteroid and comet dangers
- earthquakes, tsunamis, volcanic activity
- natural fires
- landslides, mud flows, avalanches
- floods and droughts
- dangerous weather

To monitor these events themselves, and various forms of early signals which may precede some of them (precursors), many different parameters are to be continuously observed and measured (atmospheric disturbances, space debris in low-Earth orbit, vibrations in the Earth's crust, shifts of the Earth's surface, precipitation, water levels, general atmospheric conditions, cloud cover, etc.). For this purpose, numerous land-, air-, and satellite-based systems from various nations will provide the measurements of these parameters, feeding all the information into centralized data centers where it can be integrated, cross-compared, and ana-

2. Perminov is also the vice president of the International Academy of Astronautics and the deputy design general director general of the company Russian Space Systems.

October 5, 2012 IR



Anatoly Perminov (right), former head of Roscosmos, attended the conference. Here he is shown on Oct. 2, 2009 with NASA Administrator Charles Bolden, at Mission Control Center in Krasnodar, Russia, after a successful Dstion.

#### BOOKS

### Protecting the Planet Through International Space Cooperation

By William Jones

#### Global Aerospace Monitoring and Disaster Management

Valery A. Menchikov, Anatoly N. Perminov, and Yuri M. Ulichich  
New York: Springer, 2012  
— Hardcover: 322 pp., \$179

This work is a comprehensive treatment of the utilization of space assets in order to protect mankind from a variety of threats, both from the Earth and from space. At the same time it is a rallying cry for a major mobilization of all the space assets deployed by many nations in the world into a comprehensive system of protection, against threats such as earthquakes and volcanoes, as well as more long-term threats such as asteroids and comets.

Mankind is often faced with major shocks coming from Nature. Recent events such as Hurricanes Sandy and Katrina, as well as the devastating tsunami that erupted in the Pacific in 2004, caught the world by surprise—and resulted in tremendous loss of life and property. By the time the population is able to see or hear the effects of the threat, it is already upon them, leaving them with no option but to seek cover—if possible—and hope for the best. And yet man's ability to "see" and "hear" such threatening phenomena has long outgrown the limited abilities of our five senses alone.

In particular, since the dawn of the space age, we have created a new space-based "sensarium" which allows us to "see" and "hear" far beyond our limited physical sensory organs. In fact, there is not an area of the globe which is not under almost con-

stant observation by some form of satellite capability, scanning the atmosphere, surveying the lands and the seas, and even, in the case of remote sensing satellites, penetrating beneath the surface of the Earth. In addition, there are satellites and telescopes placed to look out into the universe, and other, more ominous threats to our planet Earth.

This book represents a comprehensive treatment of the wide variety of threats facing mankind, and outlines the various ways in which space assets can protect, possibly prevent, or at least reduce the damage wrought by all types of natural catastrophes, whether from the Earth or from the seas. The authors, Anatoly Perminov, Valery Menchikov, and Yuri Ulichich, are all key players in the project which the book is promoting, the International Global Monitoring Aerospace System (IGMASS) project. Anatoly Perminov is the former head of Roscosmos, the Russian space agency; Yuri Ulichich is the Deputy General of the Russian GONGASS, Global Space Navigation System; and Valery Menchikov is the chairman and chief promoter of the IGMMASS project and the vice-chairman of the K. E. Tsiolkovsky Academy of Cosmonautics. While the project has been initiated primarily by Russian and Ukrainian space scientists within the context of the UN and international space organizations, and has its origin in the specific Russian experience in space exploration and space utilization, its realization is of importance for all Mankind.

Space has affected every nation on Earth. Even the poorest nations in Af-



rica or Asia are supported by satellite communications or satellite monitoring. While the actual space-faring nations are still limited in number (although the number is growing), there is hardly a nation on the face of the Earth that has not become a space-using nation.

And yet these capabilities remain largely limited to the needs and the requirements of their purchasers or end-users. If they were brought together into a single collaborative network, they would represent a capability for mankind which would be far more powerful than the simple sum of its parts.

The goal of the IGMMASS project is to combine the various space-faring nations of the need to bring together their capabilities into a coordinated network. As the introduction to the book states: "The creation of a visible international mechanism for efficient forecasting and early warning against dangerous natural and man-made phenomena that pose planetary-scale danger is high on the agenda. It is time to seriously state that modern and maximum efficient warning against impending emergencies of spaces of natural or artificial origin, can be provided only on the basis of

21<sup>st</sup> CENTURY SCIENCE & TECHNOLOGY  
FALL/WINTER 2012-13 [www.21centurysciencetech.com](http://www.21centurysciencetech.com) \$20.00

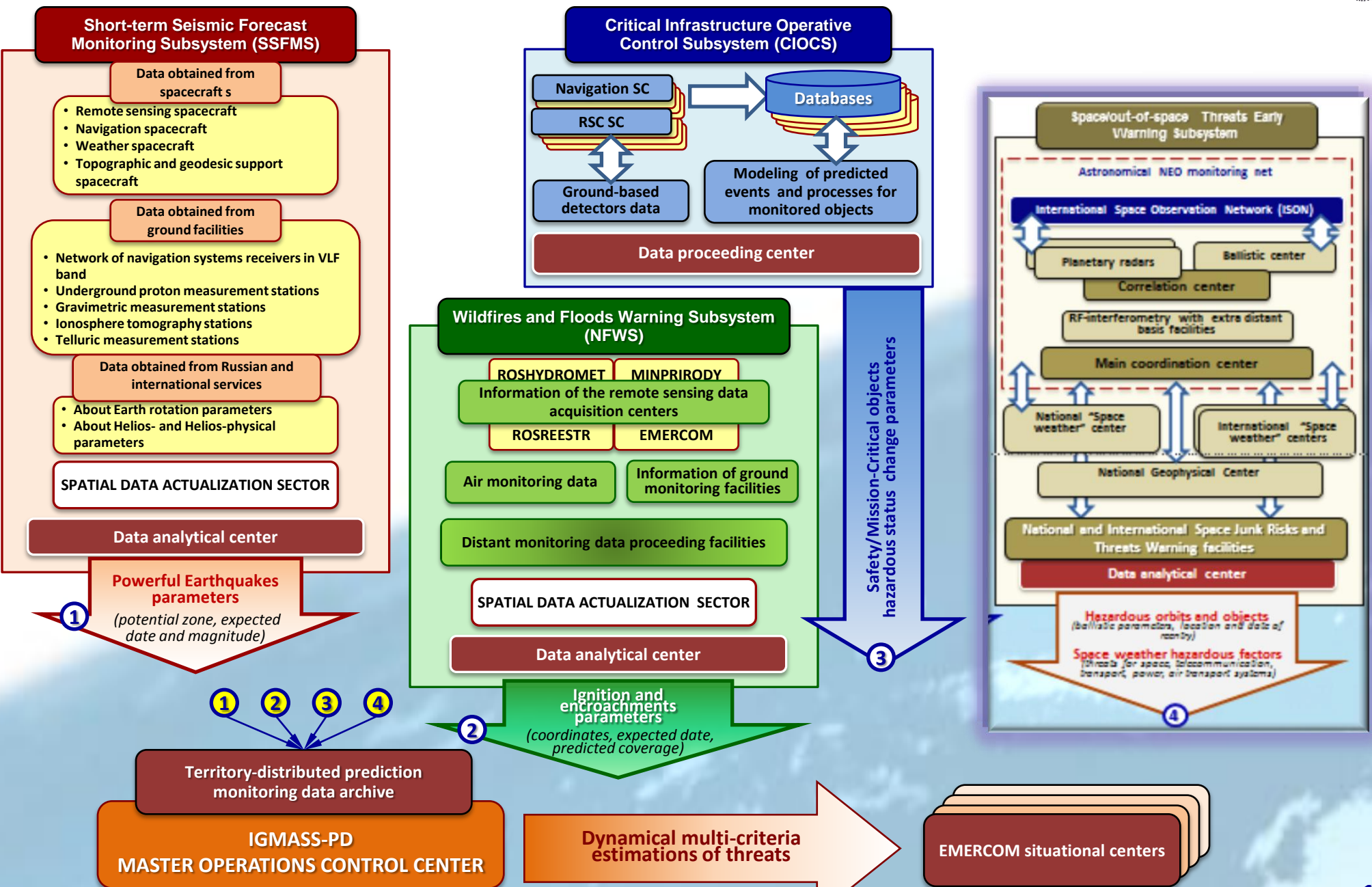
### Planetary Defense

• Energy Flux Density • U.S. Fusion Report





# IGMASS-PD Project in Russia: operation structure





# Global Outer Space Risks and Threats



On October 8, 2009, an unnoticed asteroid approached the Earth and burst in the upper atmosphere (15-20 km.) over South Sulawesi province (Indonesia). According NASA, this fatal destruction of 10m-size stone object, which entered dense atmosphere at the speed of more than 20 km/sec, emitted energy equivalent to 50 thousands tons of TNT (three times more powerful than Hiroshima's nuclear blast).

Today we know about number of asteroids and comets approaching our planet (for example, 99942 "Apophysis", 1997VRZ, 1994 WK12), which could trigger off global catastrophe if they fall down on the Earth.

Such recent event took place over Russian territory on 15<sup>th</sup> February, 2013 (known as Chebarkul' or "Chelyabinsk" meteorite).

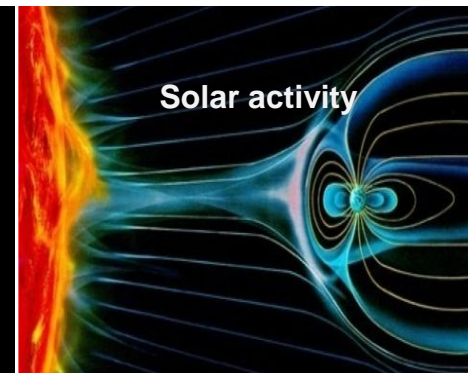
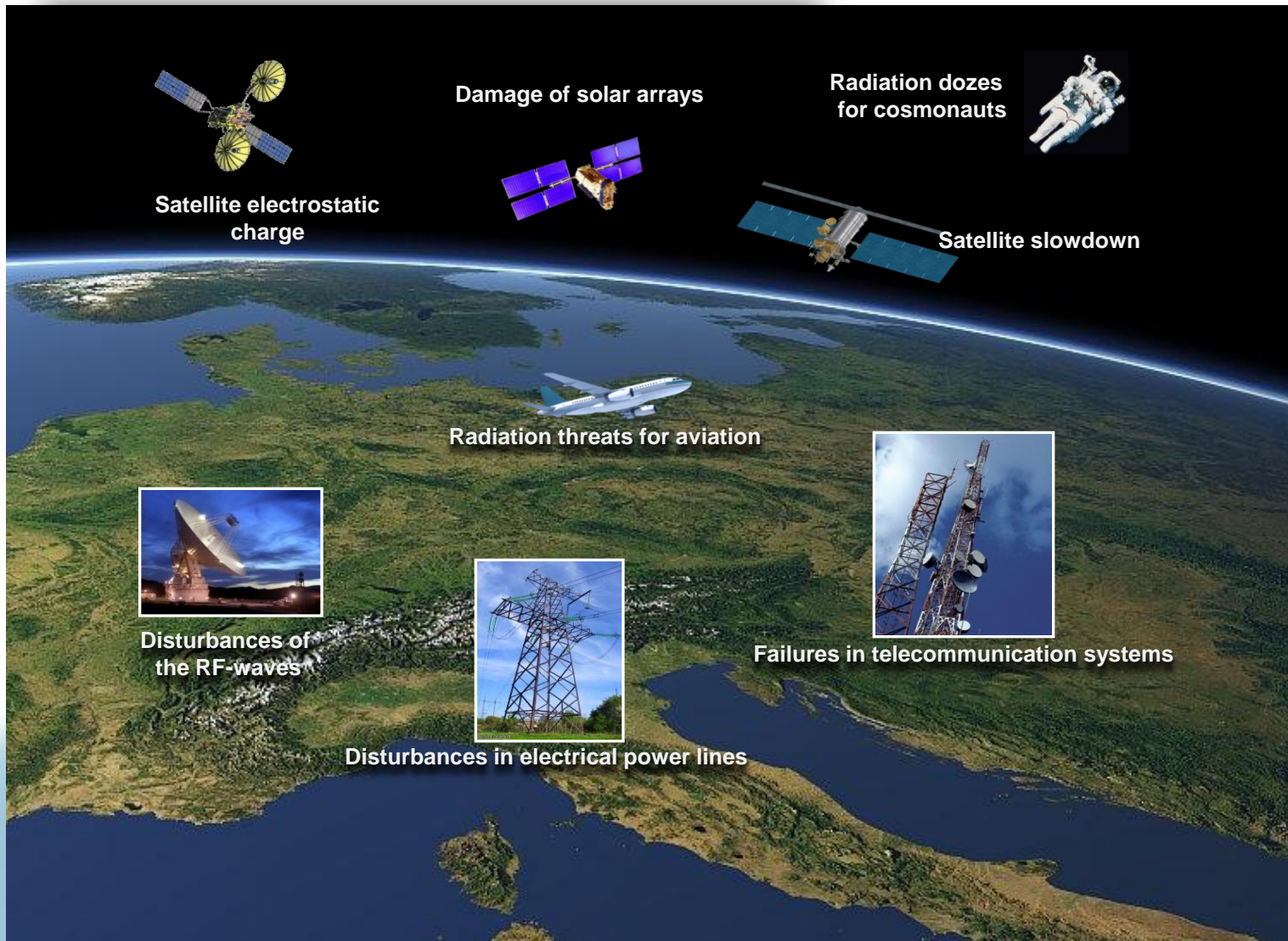


Other problem – "space debris" - is well-recognized as a potential global-level one. Even if the current population of artificial objects in LEO does not imply immediate and exceptional hazard, however debris collision risk grows constantly due to "Kessler's effect" and could overturn into real threat for world space activities soon.





# 'Space Weather' Impacts on the Engineering Systems



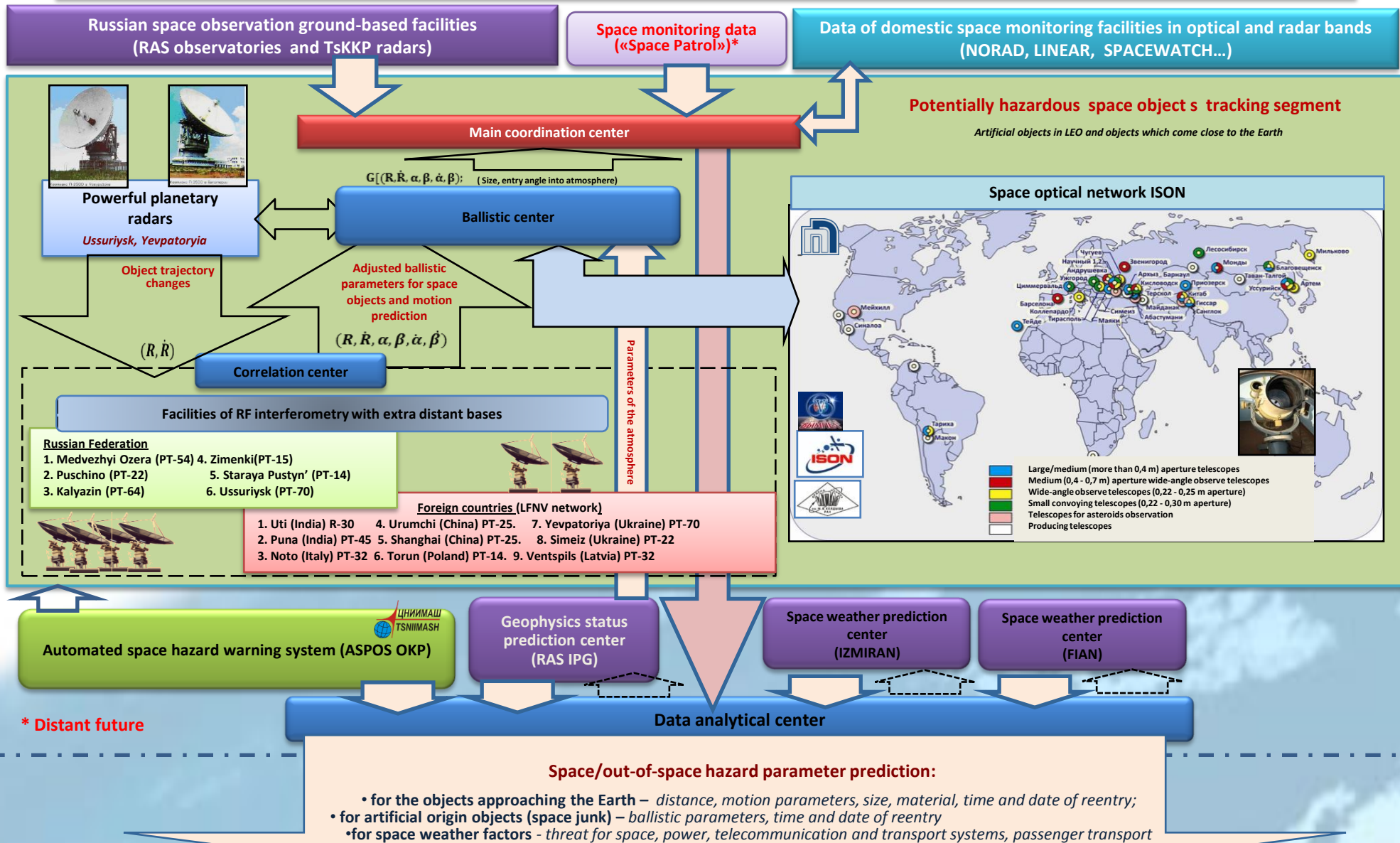




# Global Outer Space Risks and Threats Management



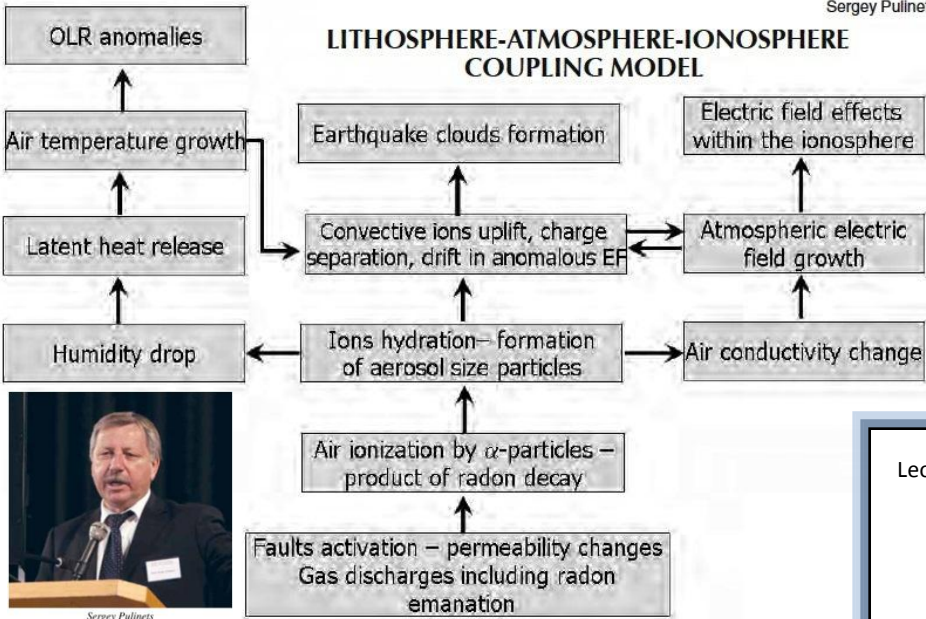
## Space/Out-of-space Threats Early Warning System



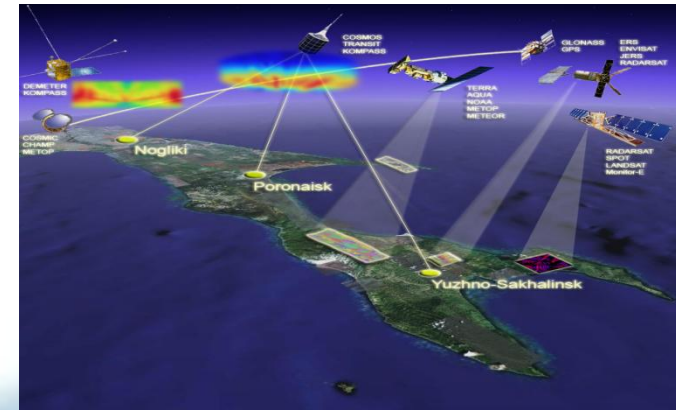
\* Distant future

Sergey Pullnets

## LITHOSPHERE-ATMOSPHERE-IONOSPHERE COUPLING MODEL

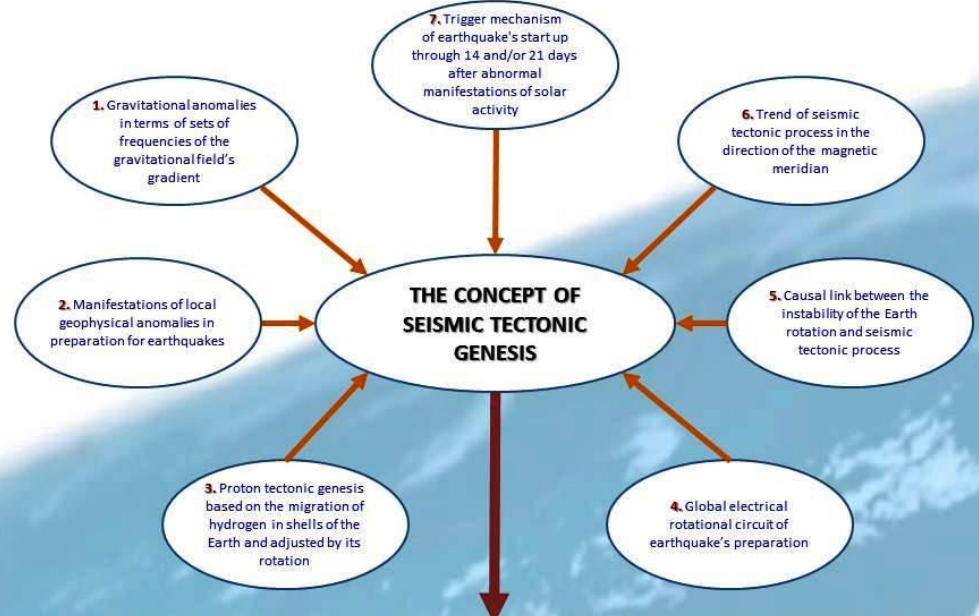


Sergey Pullnets

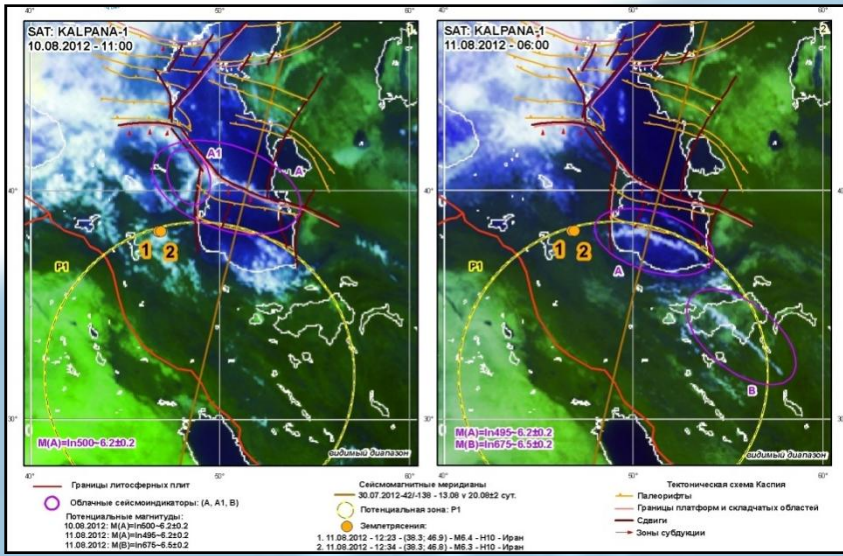


Leonid Doda

## The Seismo-Tectogenic Conception (Research Center for Earth monitoring, JSC "Russian Space Systems")



Solutions of critical geophysical tasks (earthquakes forecasting/early predicting)





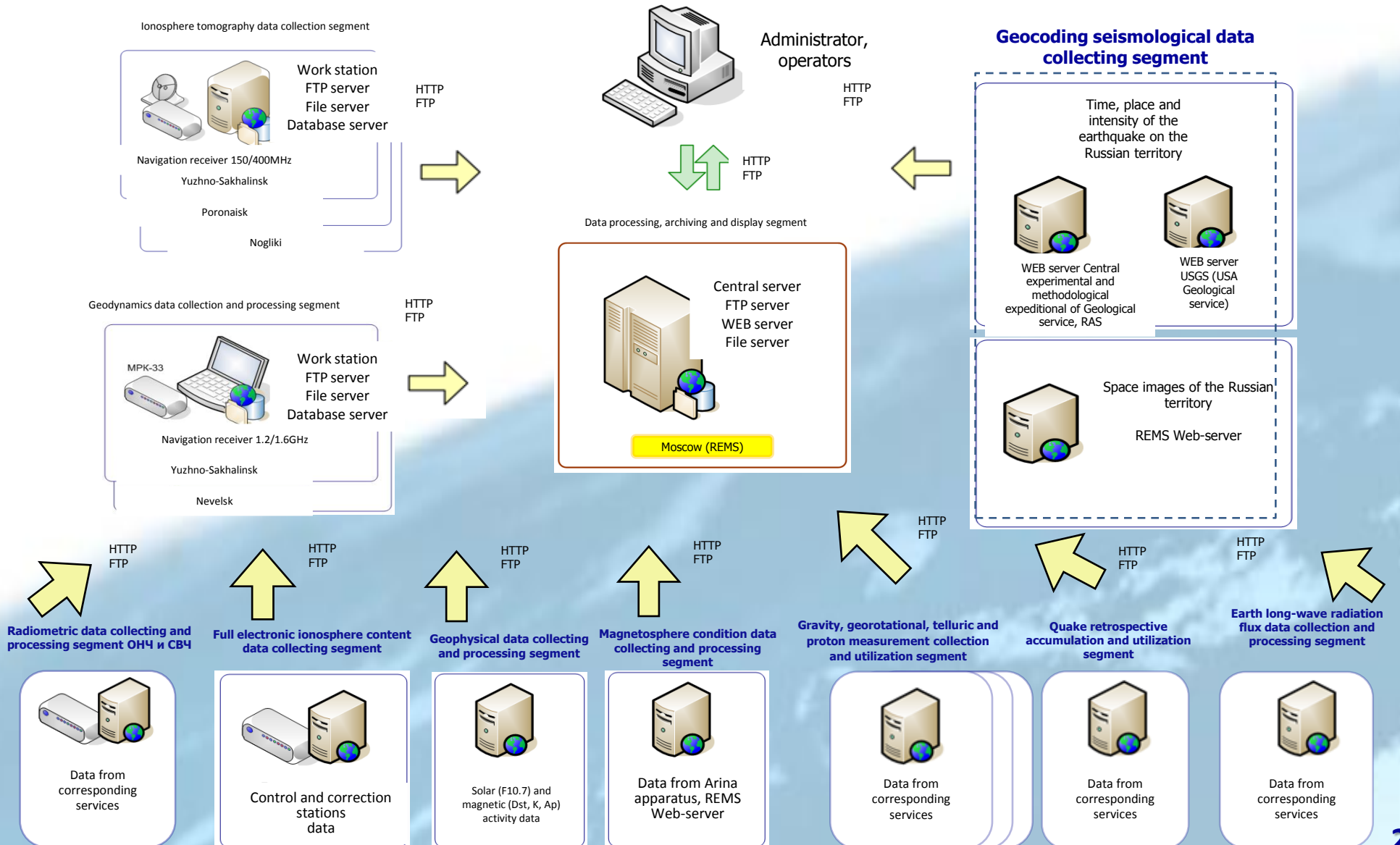


# Experimental Section of Seismic Forecast Monitoring (ES SFM): Structural Layout

(under auspicious of Research Centre for Earth Operative Monitoring, JSC "Russian Space Systems")



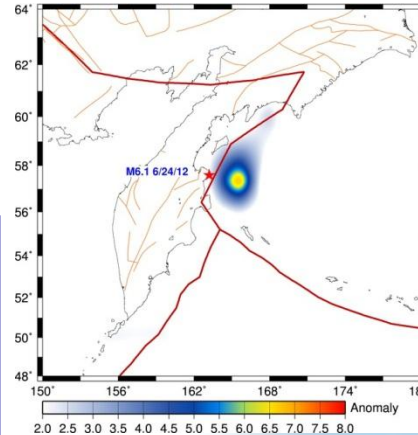
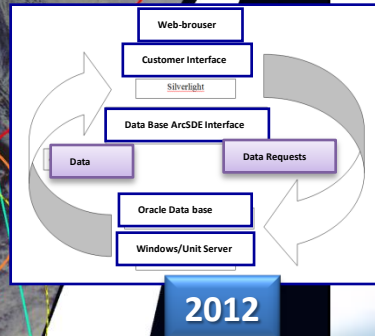
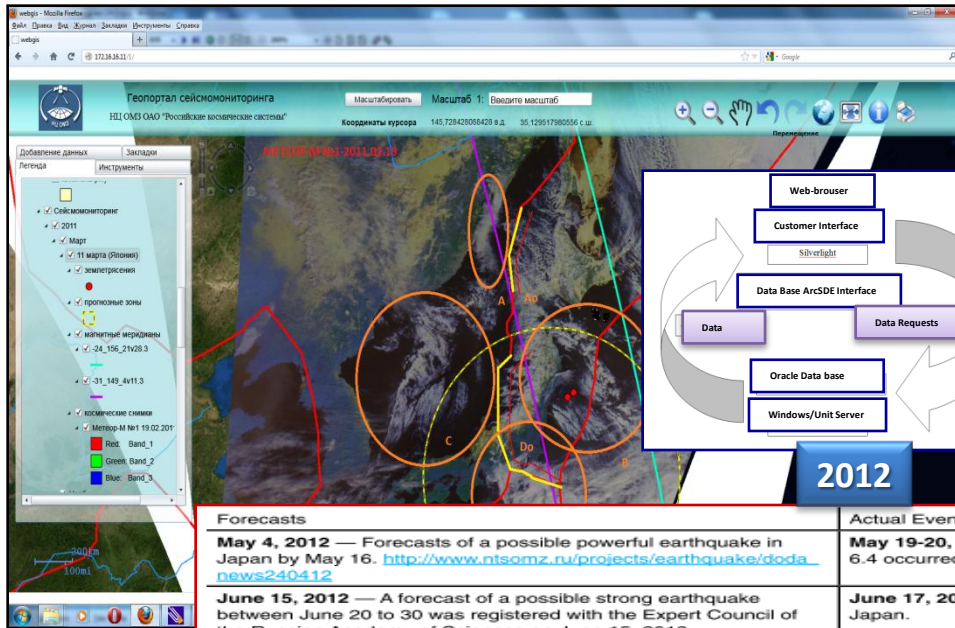
## Project ES SFM may become a functional SFM-subsystem being a part of the (IGMASS)







# Recent results of Powerful Earthquakes Prognoses for the Years 2012-2013



Daily anomalous map over Kamchatka, June 19, 2012 Earthquake alert was issued on June 21 (-3 days). Alert was updated on June 23 A M6.1 did occur on June 24, 2012 (with red star)

## Letter from L.N. Doda to the Russian Expert Council on Earthquake Forecasting and Evaluation of Seismic Dangers

В РОССИЙСКИЙ ЭКСПЕРТНЫЙ СОВЕТ ПО ПРОГНОЗУ ЗЕМЛЕТРЯСЕНИЙ И ОЦЕНКЕ СЕЙСМИЧЕСКОЙ ОПАСНОСТИ

От члена РЭС Доды Леонида Николаевича  
Тел.: 800-000-00-00, e-mail: [ldoda@ntsomz.ru](mailto:ldoda@ntsomz.ru)

Уважаемый Александр Иванович!

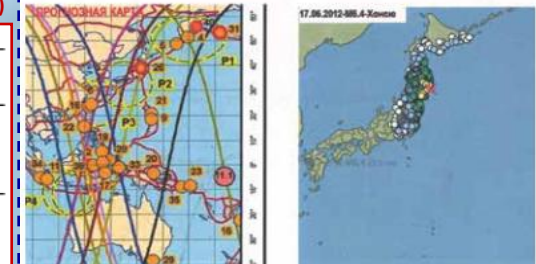
Прошу зарегистрировать и дать экспертную оценку следующему комплексному прогнозу: до 4 июля 2012 г. в одной из потенциальных зон, представленных на прилагаемой сейсмопрогнозной карте в виде желтых овалов, возможно землетрясение с магнитудой M6.5-7.0 ( $\pm 0.2$ ). Вероятные даты указаны в условных обозначениях сейсмомеридианов в легенде карты, пересекающих указанные зоны. Высота вероятности подобного ЗМТ в Японской зоне и на Камчатке с магнитудой M6.0+.

Прогнозная карта на июль 2012 г. в комплекте с облачными сейсмограммами отправлены Вам по электронной почте 15 июня.

*Л. Дода*  
Л. Дода  
15.06.2012

Реализация: 1.17.06.2012-20:32-(38,9;141,9)-M6,4-H32-вост. Хонсю

2.24.06.2012-03:15-(57,6;163,0)-M6,1-H17-с/в Камчатка



An earthquake forecast from L.N. Doda of the Research Center for Earth Monitoring, June 15, 2012. Translation of the letter: "Kindly record the following integrated forecast and provide an expert evaluation of it: An earthquake with magnitude M6.57.0 ( $\pm 0.2$ ) is possible before July 4, 2012 in one of the potential zones shown on the attached seismic forecast map in the form of yellow ovals. The likely dates have been indicated in the map legend by notations corresponding to where the seismic meridians intersect the indicated zones. There is a high probability of such an earthquake with magnitude M6.0+ in the Japanese zone, and on Kamchatka. "The forecast map for June, 2012, and the composite with cloud seismic indicators were e-mailed to you on June 15." Realization: 1. June 17, 2012-20:32-(38.9; 141.9)-M6.4-H32-Eastern Honshu

### Forecasts

**May 4, 2012** — Forecasts of a possible powerful earthquake in Japan by May 16. [http://www.ntsomz.ru/projects/earthquake/doda\\_news240412](http://www.ntsomz.ru/projects/earthquake/doda_news240412)

**June 15, 2012** — A forecast of a possible strong earthquake between June 20 to 30 was registered with the Expert Council of the Russian Academy of Sciences on June 15, 2012. [http://www.ntsomz.ru/projects/earthquake/doda\\_news240412](http://www.ntsomz.ru/projects/earthquake/doda_news240412)

**July 6, 2012** — A forecast was registered with the Council of Experts of the Russian Academy of Sciences warning of "an earthquake with magnitude 6.8 ( $\pm 0.2$ ) ... on Kamchatka ... or deep in the Sea of Okhotsk with a greater magnitude" most likely between July 20 and 30. The forecast also indicates the likelihood of a July earthquake in Japan. <http://www.ntsomz.ru/projects/earthquake/eq27072012>

**July 31, 2012** — A letter extending the July 6 forecast to August 17 was submitted to the Council of Experts. <http://www.ntsomz.ru/projects/earthquake/eq27072012> p. 16.

**December 3, 2012** - a forecast about possible powerful earthquake with magnitude more than 7.0 till December 15 on East or West side of Philippine plate (22-37°N), Japan → days. [http://www.ntsomz.ru/files/art\\_qlsa.docx](http://www.ntsomz.ru/files/art_qlsa.docx)

### Actual Events

**May 19-20, 2012** — Three earthquakes of magnitudes 5.9, 5.9, and 6.4 occurred on Honshu island, Japan.

**June 17, 2012** — Magnitude 6.4 earthquake on Honshu island, Japan.

**June 24, 2012** — Magnitude 6.1 earthquake on Kamchatka

**July 20, 2012** — Magnitude 6.1 and 5.8 earthquakes in southern Kamchatka.

**Aug. 17** — Magnitude 7.7 earthquake in the Sea of Okhotsk (between Kamchatka and the mainland) 625 km deep.

**December 7, 2012** - magnitude 7.3 earthquake on the Pacific Seashore of Honshu Island, Japan

## 2013

**September 9, 2013** – forecast about possible earthquake with a magnitude M7, 1+ in the range of 42-30 ° Northern latitude on the Southeastern border of the Okhotsk plate or framed Filipino plate, including Taiwan Island prior to 25.10.2013

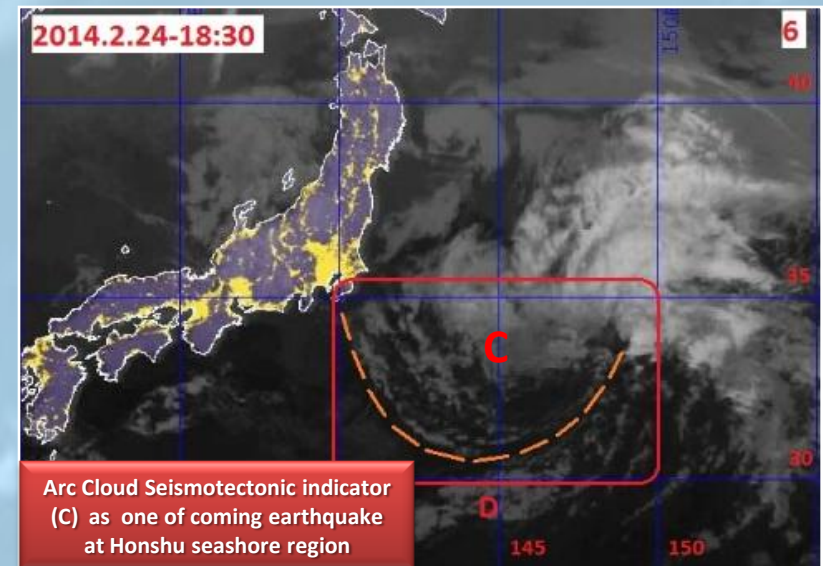
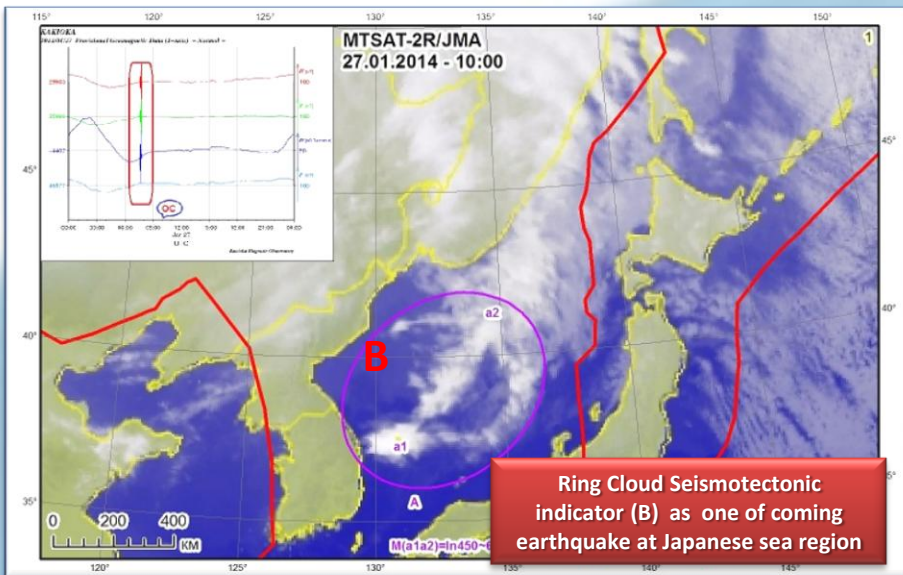
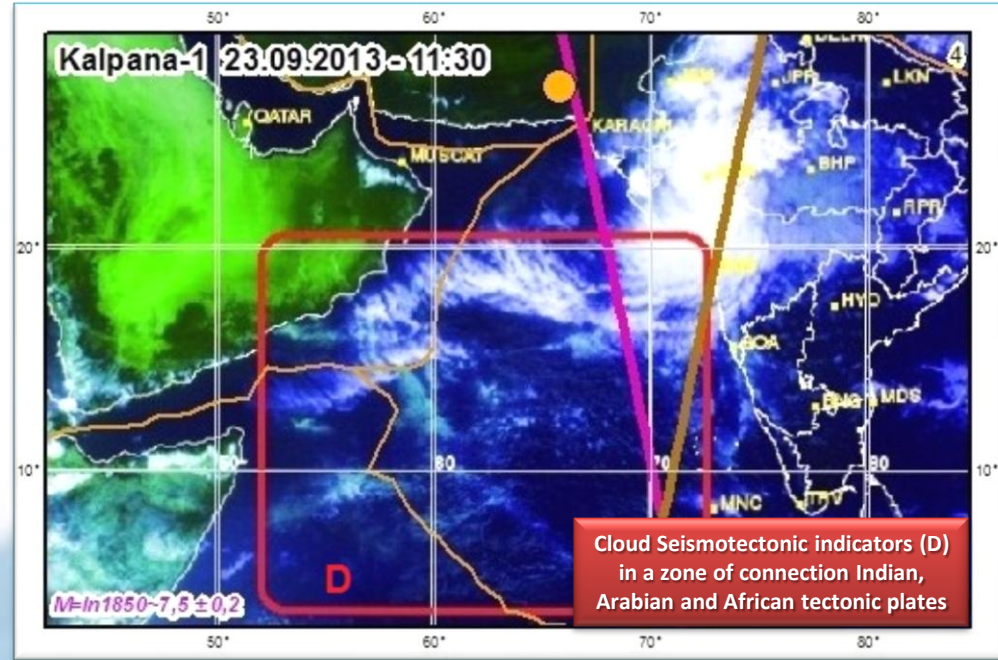
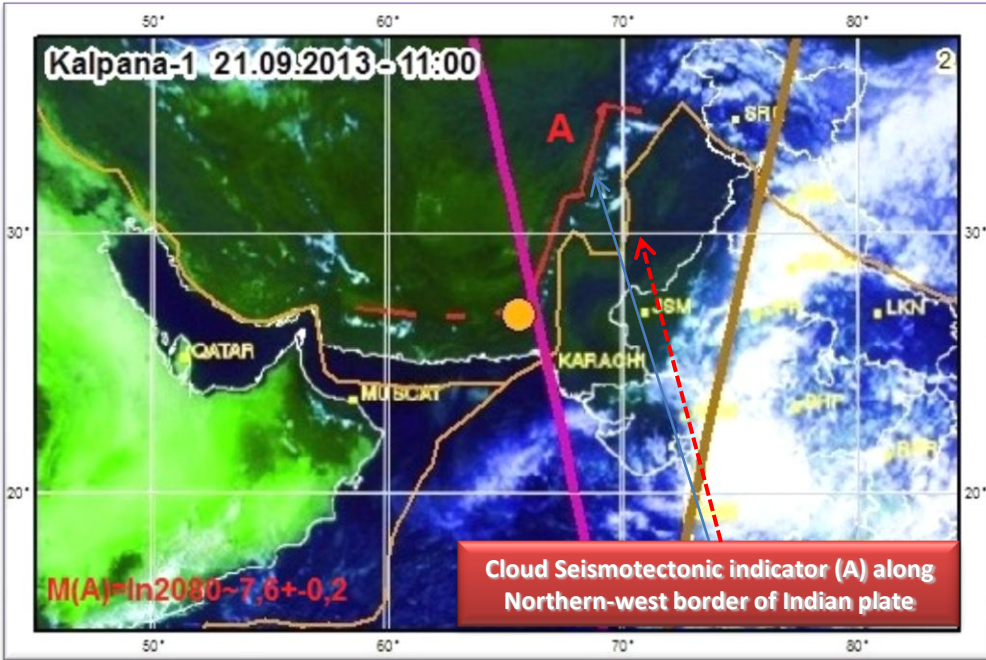
**October 15, 2013** – M7.1 earthquake on Bohol Island, **October 25, 2013** - M7,1 earthquake at 320 km off the east coast of Honshu Island

As October 2013, there were seven successful predictions of earthquakes with M6.5 + (at one pass seismic event 02/02/13), of which the four most powerful (with magnitudes M6.7/6.9/6.8/6.9) coincide for all forecast parameters

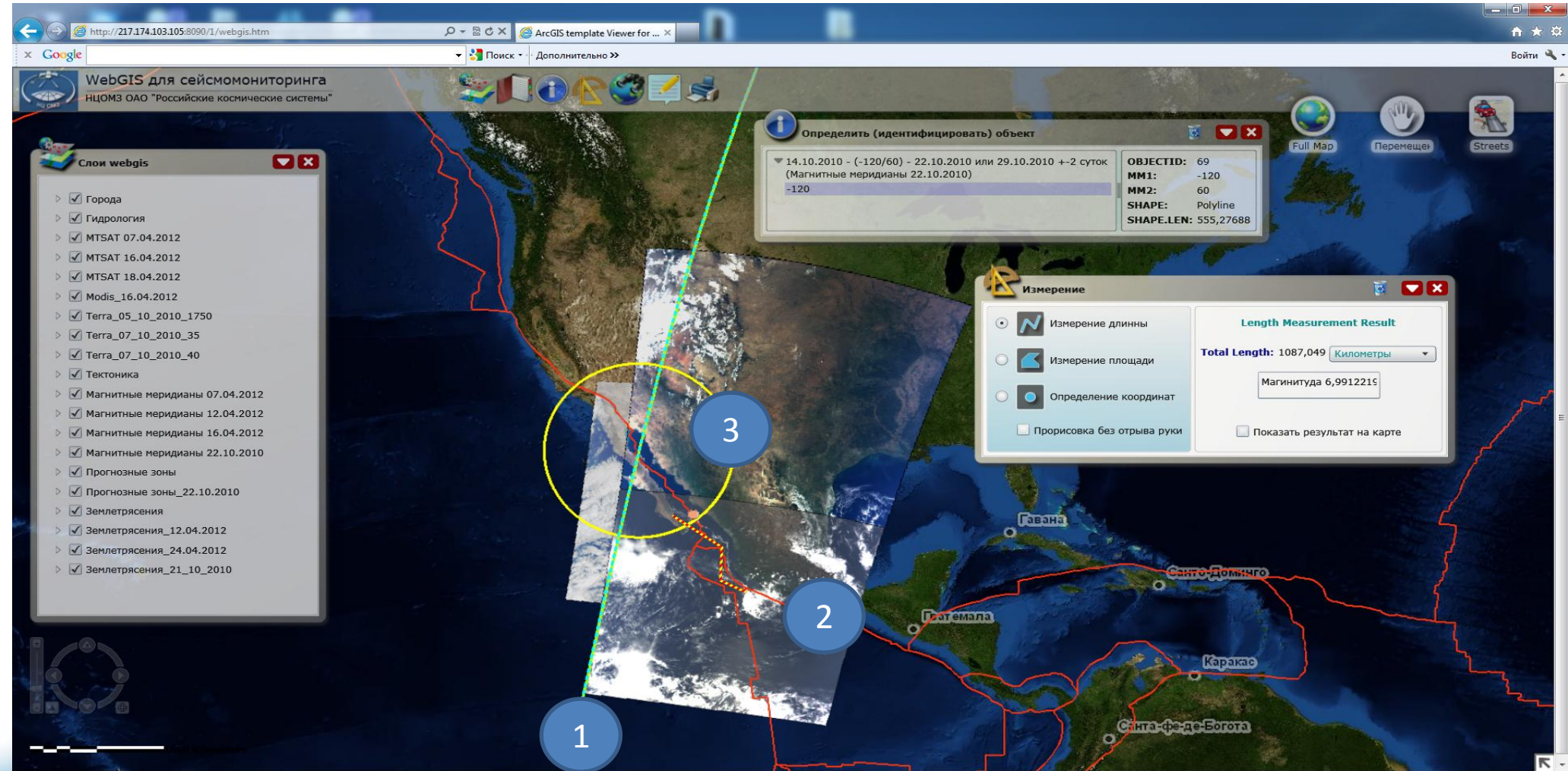




# Some Resent Powerful Earthquake Prognoses







Seismic Prediction GIS-portal, created in the Research Centre for Earth Operative Monitoring, JSC "Russian Space Systems", is based upon three standard monitoring products : «1» – seismic-magnetic meridian; «2» – composite of seismo-tectonic indicators (CSTI) and borders of tectonic plates; «3» – potential zone of earthquake (EQ) including EQ date and magnitude. **The seismic forecast strategy is rather simple: the probability of EQ occurrence with magnitude of greater than 6 is assessed using the techniques developed and geophysical data obtained for each 2-3 weeks in advance.** More accurate magnitudes are determined by CSTI, detected in satellite images.

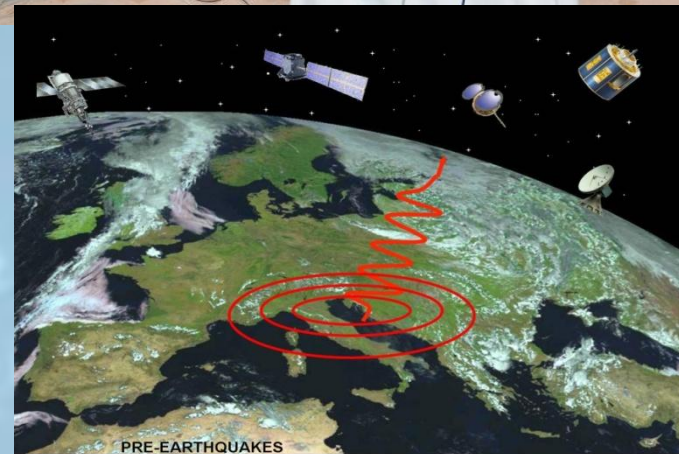




# About Prospects of the IGMASS Project Key Technologies Implementation within FP7 EU Program



During the period from the 17<sup>th</sup> to 20<sup>th</sup> of September, 2012 a final meeting of the PRE-EARTHQUAKES project participants took place in the city of Yuzhno-Sakhalinsk (Russia). The PRE-EARTHQUAKES Project (Processing Russian and European Earth observations for Earthquake precursors studies) is a collaboration between Russian and EU scientists in the field of processing satellite earthquake precursors monitoring data within the 7<sup>th</sup> EU framework program. Since 2011 the international cooperation of scientists has been performing studies of earthquake precursors in various environments focused at development of short-term forecasting methods.





# IGMASS-PD Functional Subsystems



## Short-term Seismic Forecast Monitoring Subsystem (SSFMS)

### 1 Space facilities

**ERS satellites**  
*Resurs-DK, Resurs-P, Kanopus-V, Arkon-2M, BelKA, Sich-2, ALLAS, Terra/Aqua, RapidEye, COSMO-SkyMed, TerraSAR-X, TanDEM-X, IRS-1C/1D etc.*

**Weather satellites**  
*Meteor-M, Electro-L, NOAA, EOS, GOES, MetOp-1, NPP, NPOESS*

**Other satellites as request**

**Navigation satellites**  
*GPS/GLONASS/Galileo*

**Advanced multifunctional special earthquake monitoring cub-sats' constellation**

### 2 Ground-based monitoring and measurement facilities



**Subterranean proton measurement stations**  
 (Petropavlovsk-Kamchatskiy)

**Electro-telluric measurement stations**  
 (Japan, Kakioka, Memanbetsu, Kanoya; Greece, Athens, Pyrgos)

**Net of 9-channel gravimetric stations**  
 (Tula State University, Tula city)

**Ionosphere tomography stations**  
 (Sakhalin Island, Kamchatka Peninsula)

**Ionospheres' measurement stations**  
 (Kamchatka Peninsula)

### 3 Data obtained via WEB-NET from Russian and international organizations, institutes and services

**Russian Federation**

- Prognostic Data Center (RAS IEP, Moscow)
- Institute of Mathematic Theory and Earthquake Forecasting (RAS, Moscow, Russia)
- Coordination Forecasts Center (RAS IEP, Moscow)
- RAS geosphere dynamics institute (Moscow)
- Applied geophysics institute (Moscow)
- RAS Institute of the Earth crust (Novosibirsk)
- IZMIRAN Geophysical status prediction center (Troitsk)
- Russian Earthquake Prediction and Seismic Hazard Assessment Expert Council (Moscow)
- World center of the solid Earth data (Moscow, Russia)
- RAS Mountain institute (Perm',)
- Volcanology and seismology institute (Petr.-Kamch.)
- Marine geology and geophysics institute (Yu.-Sakhalinsk)
- Cosmometeotectonica center (Petr.-Kamch.)

**CIS countries**

- Geophysical research center, Kazakhstan
- Geophysical monitoring center, Academy of Sciences, Belorussia
- Seismology institute, Kyrgyzstan
- Experimental seismology center, Moldova
- Republican center of Seismology Service, Azerbaijan
- National seismic protection service, Armenia
- Seismology institute, Uzbekistan
- Seismic monitoring network, Tadzhikistan

**Profile International organizations**

- International seismology center
- IMS
- USGS NEIC
- IRIS
- ORFEUS
- Academy of Disaster Reduction and Emergency Management (ADREM, China)
- PNSN
- European database of seismic hazardous locations
- EMSC
- KOERI, Turkey
- ESC
- Paris Observatory's Earth Rotation Service (France)

1 2 3

**SPATIAL DATA ACTUALIZATION SECTOR**

**Baikal Regional Research and Information Center**  
 (Irkutsk city, Russia)

**Main Research and Information Center (Moscow)**

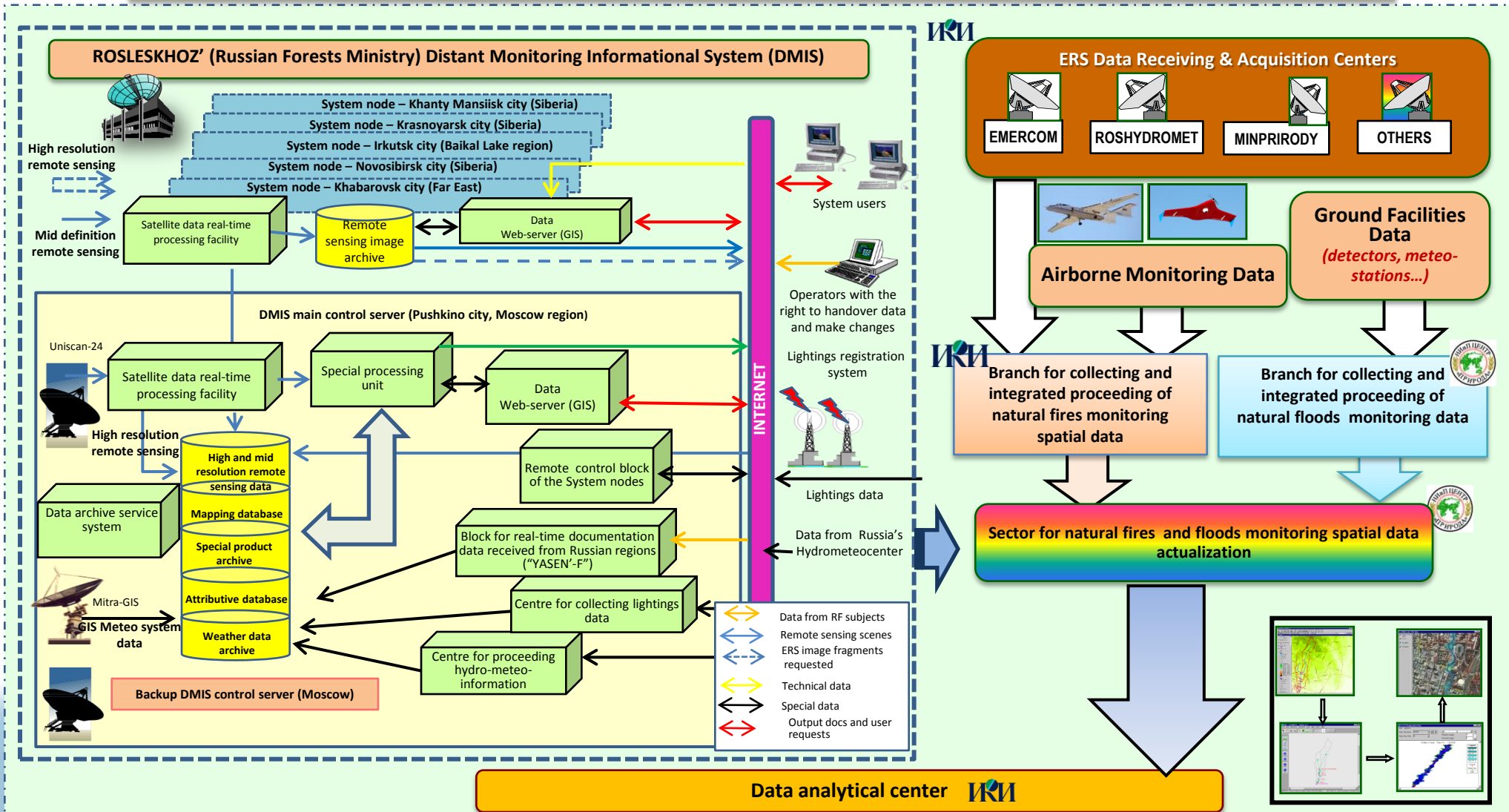
Coming powerful earthquakes parameters (location, time, magnitude) and estimation of risks and threats for subsequent natural disasters (volcanic eruptions, tsunami etc.)

**Far East Regional Research and Information Center**  
 (Petropavlovsk Kamchatskiy city, Russia)

$$F(R(\varphi, \lambda), t, M_{\dots}, P_{\sigma})$$



## Wildfires and Floods Warning Subsystem (WFWS)



- Indicators of natural fires and floods hazard
- Estimation of hazard level for fire and flooding dangerous regions
- Definition of possible ignition and floods parameters  
(coordinates, expected date, predicted coverage)

## Critical Infrastructure Operative Control Subsystem (CIOCS)

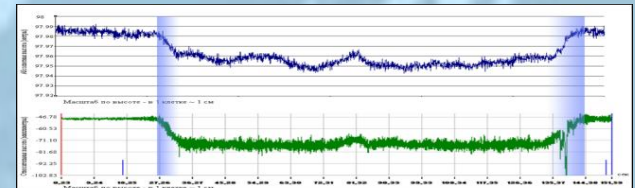
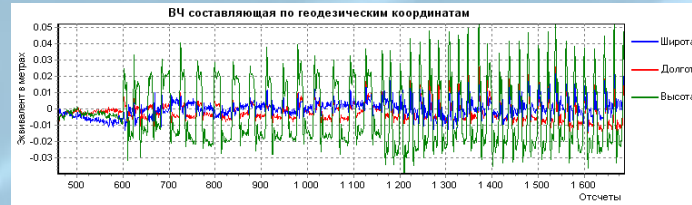
Data from ground detectors



Models of the events predicted for monitored objects



Water Supply Sensors	Security Alarm System and video control System	Gas Control Sensors	Thermo Supply Control Sensors	Energy Supply Control Sensors	Fire Alarm Sensors	Air Conditioning Sensors	Parameters Measurement Level
							Level of RTM Data Collecting and Proceeding (SCADA System)
<ul style="list-style-type: none"> <li>Data Bases of on-line information</li> <li>Data Bases of Critical Objects Digital Information and surrounding territory</li> <li>Archive Data Base</li> </ul>				<ul style="list-style-type: none"> <li>Data Bases of information coding &amp; Classification</li> <li>Data Bases of Model and Scenarios</li> <li>Data Base of the objects Security Passes</li> </ul>			Level of Documenting and Archiving
							Level of Situation Modeling
							Level of Decision making Data Supporting

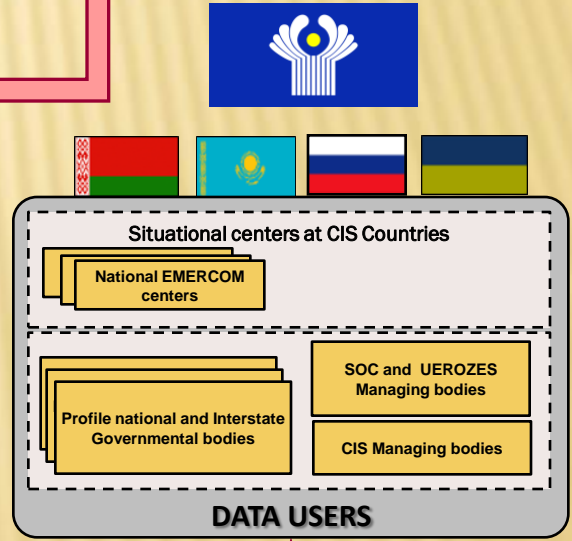
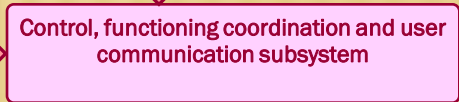
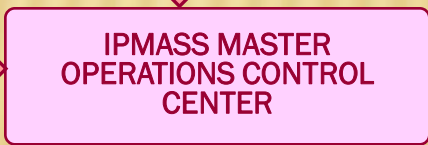
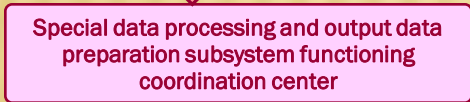
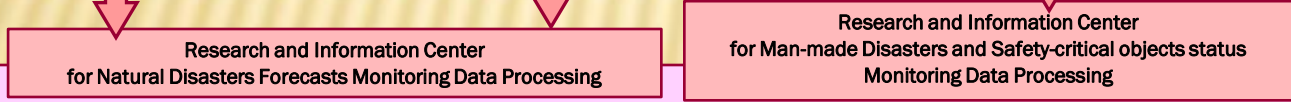
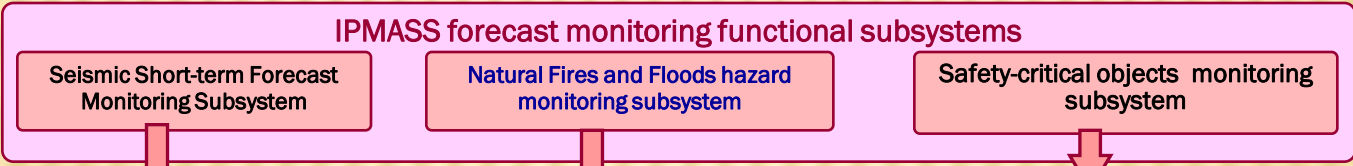
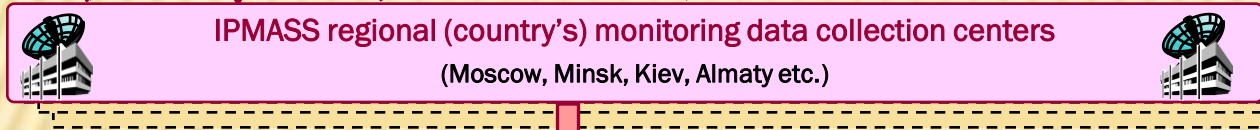
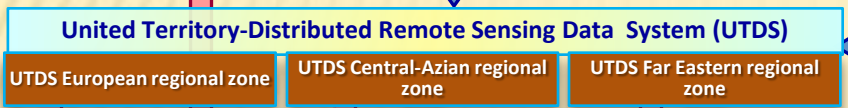
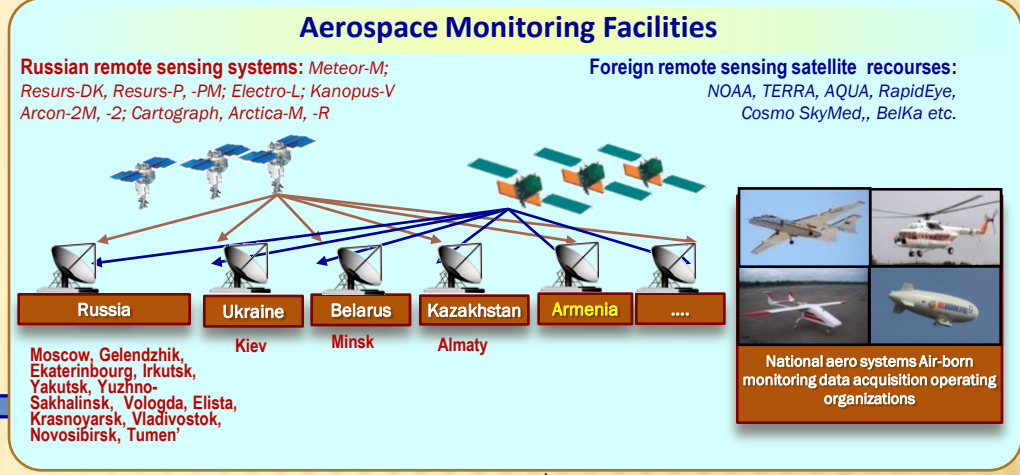
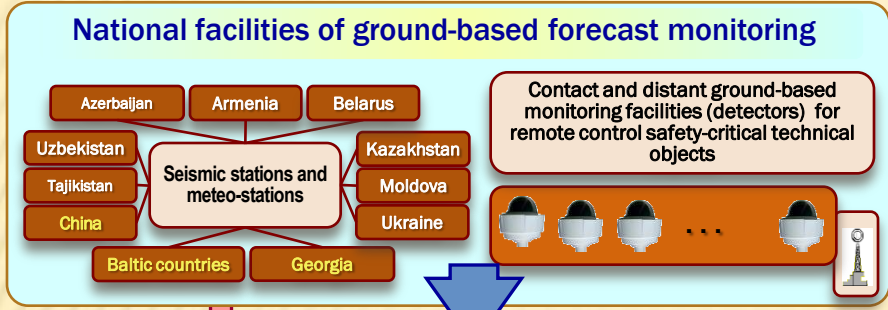


Data analytical center (Russian Space Systems)

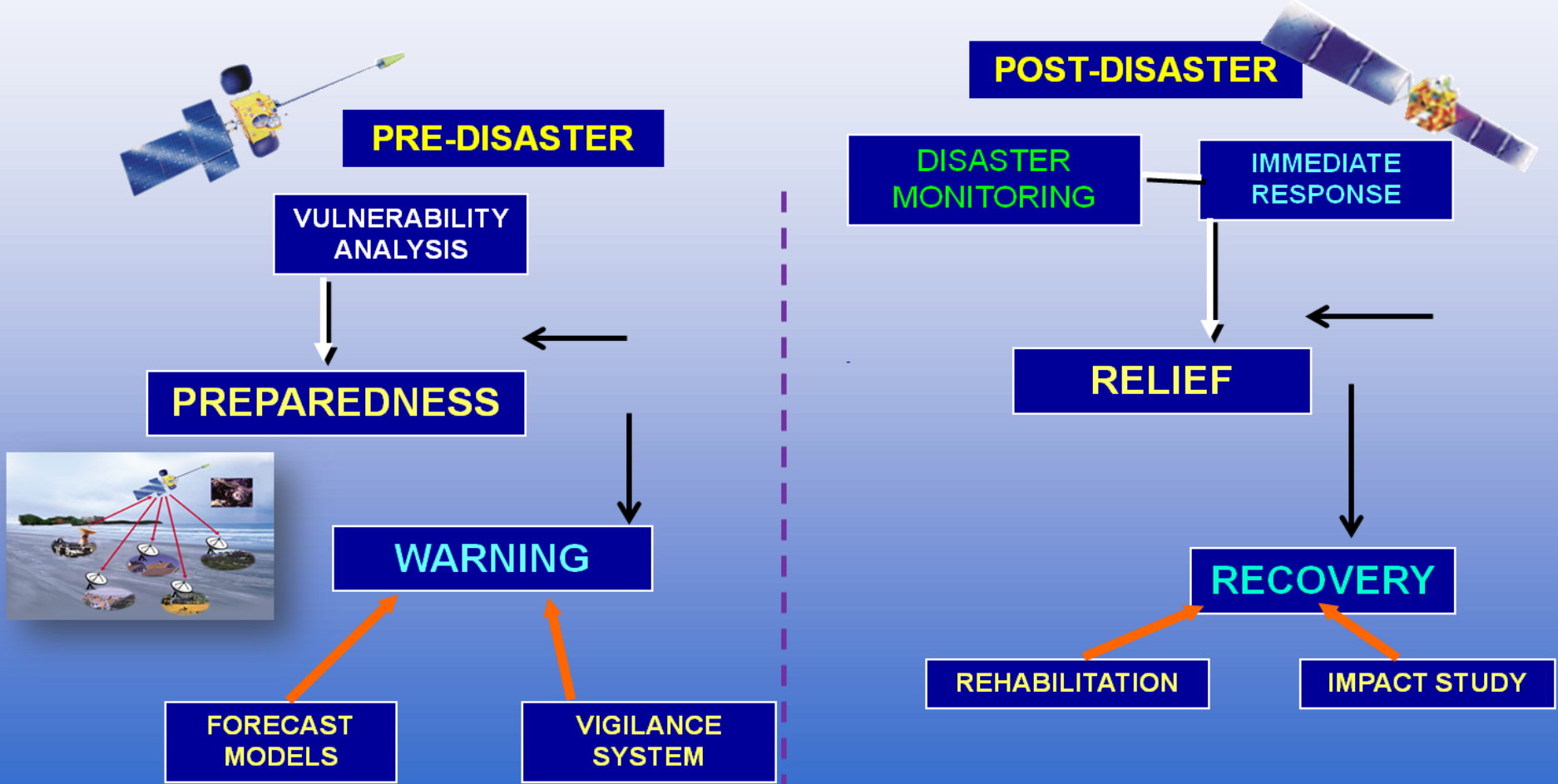
Parameters of critical and hazardous changes in the monitored object statuses



# Integrated Prognostic Monitoring Aerospace System (IPMASS) Project as IGMASS Piloting Design Version for CIS Countries



**Goal: Timely and reliable information to right people at right time through all phases of Disaster Management**



**Paradigm Shift from Relief & Recovery to Disaster Preparedness**





# Participation Indian Companies in PD IGMASS Project:



- Scientific **research and results** in the field of forecasting disasters, which are more specific for India (earthquakes, forest fires, floods) and detecting **early signs of industrial accidents** of critical objects;
- Formation of **working groups consisting of specialists both countries** on key areas of prediction monitoring in order to exercise interaction between space system operators and shared use of data from Russian and Indian spacecraft;
- **Integration of informational resources** for the purpose of exercising key technical solutions which may be realized in the framework of IGMASS (development of forest fire diagnosis technologies, creation of critical object monitoring subsystems and high-accuracy control of engineering constructions using GLONASS/GPS and etc. technologies);
- **Designing** of specialized forecasting monitoring on-board facilities, creation, expansion and management of specialized **small spacecraft** constellations, complex processing of prediction monitoring data;
- **Collaboration** within framework of existing International projects and programs



## IGMASS capabilities for India

**IGMASS could provides solutions for a wide range of tasks, including:**

- Development of the integrated monitoring data base;
- Monitoring of earthquake precursors;
- Prediction, detection and monitoring of forest and peat fires;
- Monitoring of the river and sea floods;
- Monitoring of avalanche hazardous areas;
- Monitoring of dangerous geological phenomena;
- Prediction (warning) of accidents in oil and gas pipe-lines, detection and mapping of the leaks;
- Monitoring of the contaminants spreading around industrial areas, at oil and mineral resource mining zones;
- Land surveying, cadaster, real-time topographic monitoring, development of photo-maps and photo-plans.







*The IGMASS Project provides unique opportunity to unify efforts of the world community to develop new joint strategy of peaceful space exploration, which is focused on providing secure and sustainable development of the Europe as well as whole Humanity*

For more information about IGMASS, please contact to International Committee on the IGMASS Project Implementation (ICPI):

**JSC Russian Space Systems , 53, Aviamotornaya st., Moscow, Russian Federation, 111250**  
**tel: +7 (495) 539-41-15 fax: +7(495) 673 -21-32 e-mail: [IGMASS@mail.ru](mailto:IGMASS@mail.ru)**

**Prof. Anatoly N. Perminov – ICPI Chairman**  
**Dr. Sergey V. Cherkas – ICPI Executive Secretary**