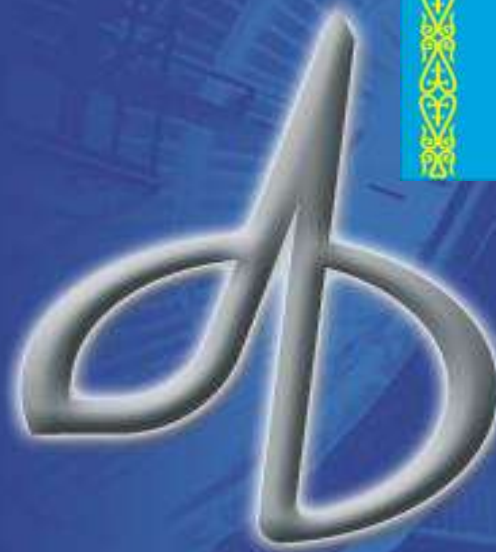


TEMPUS-CRIST Project,
October 24, 2011
Astana, Kazakhstan

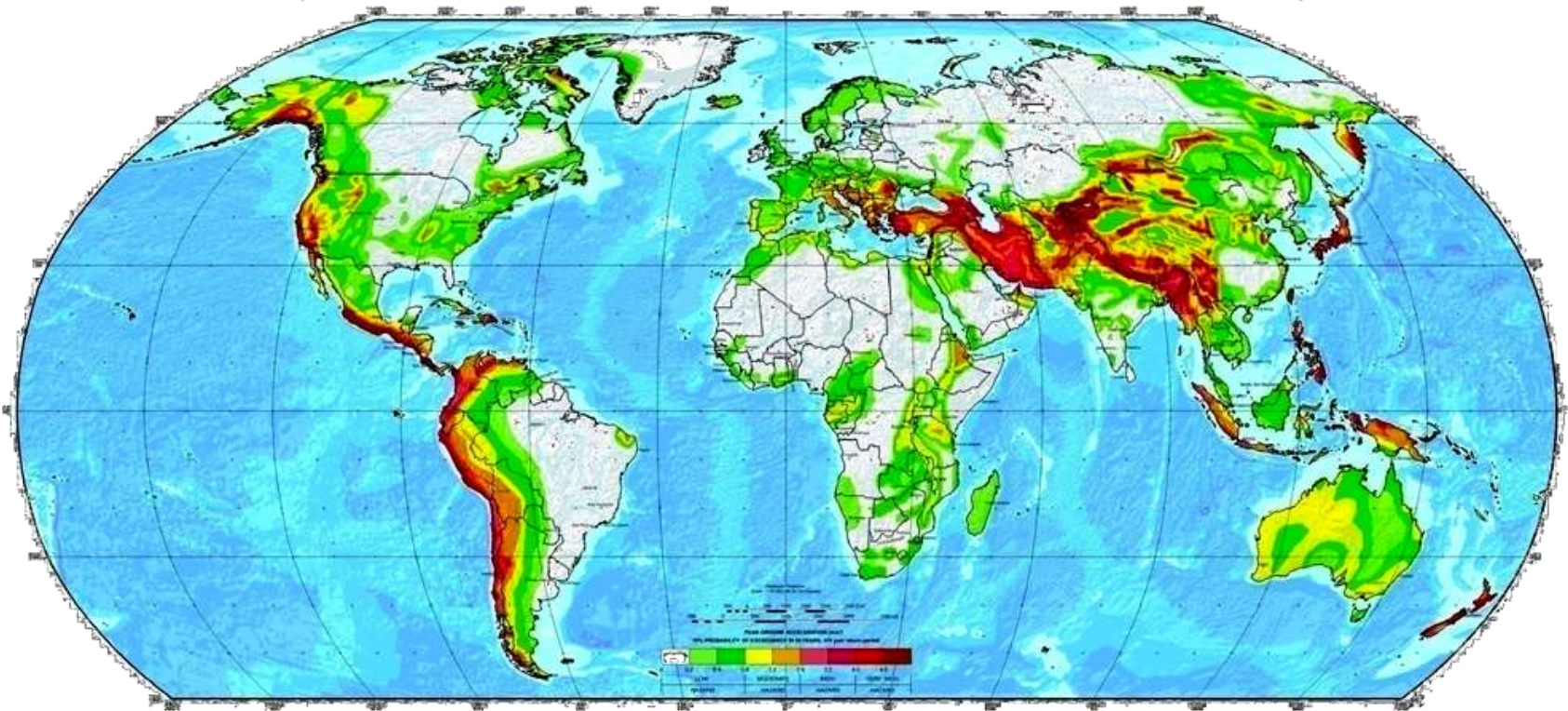


Velychko Sergey
Manager Business Development
Yuzhnoye State Design Office

YUZHNOYE
design office

**GLOBAL SPACE SYSTEM OF
SEISMIC ACTIVITY MONITORING**

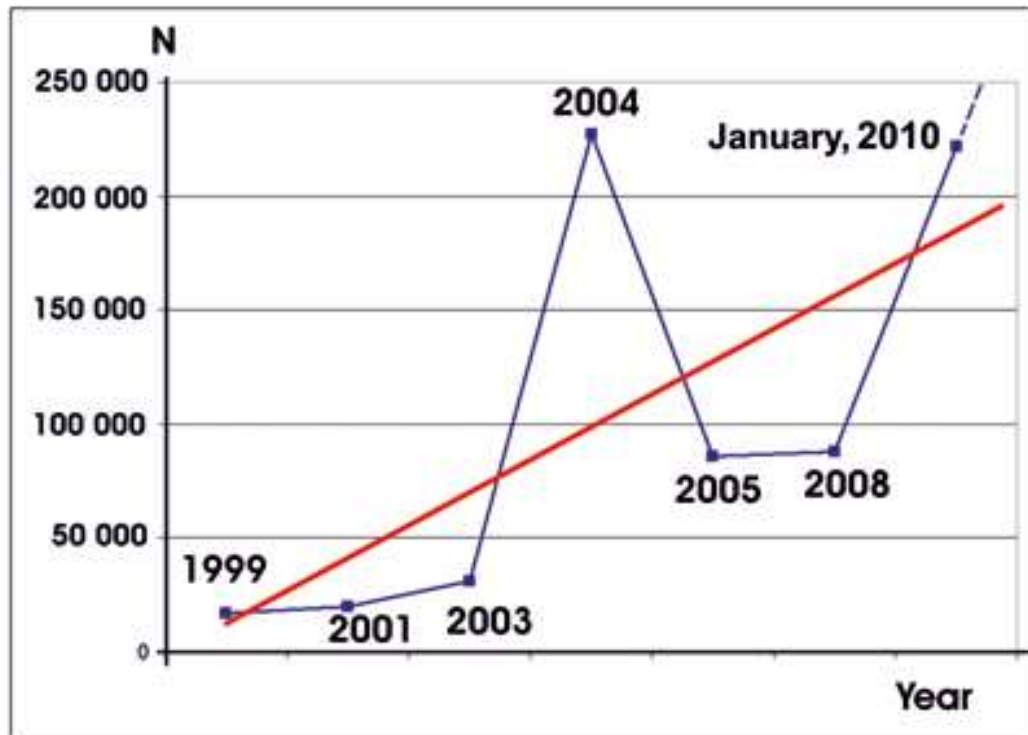
MAP OF SEISMIC ACTIVITY



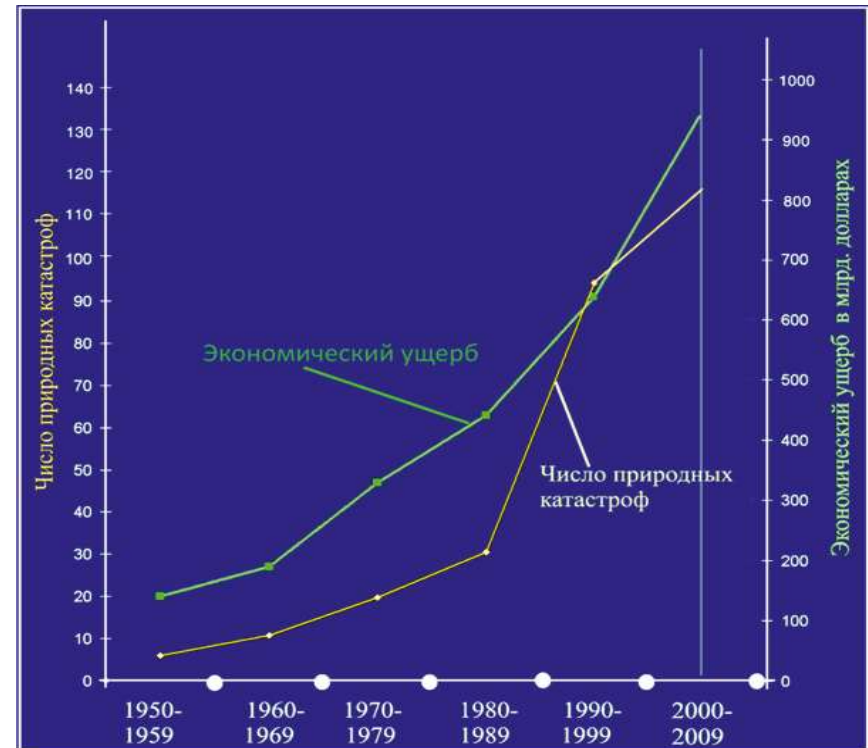
- **1/3 of Earth surface is earthquake-prone zone**
- **for the recent 50 years more than 1 million people in the world died of earth-quakes**

GLOBAL CHANGES OF EARTH SEISMIC ACTIVITY

For the recent 10 years the number of people died of the powerful earth-quakes increase in 8.6 times in comparison with the average index for the decade (during the previous 50 years).



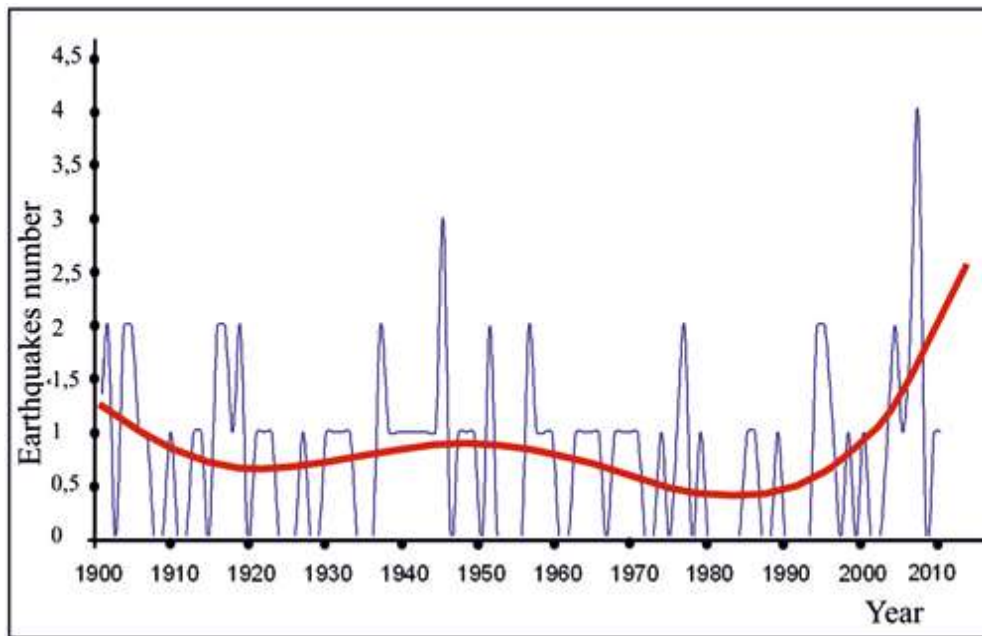
The number of people died of the powerful earth-quakes for the period from January 1999 to January 2010 years



The number of natural disasters and economical damages for the period 1950-2009 years

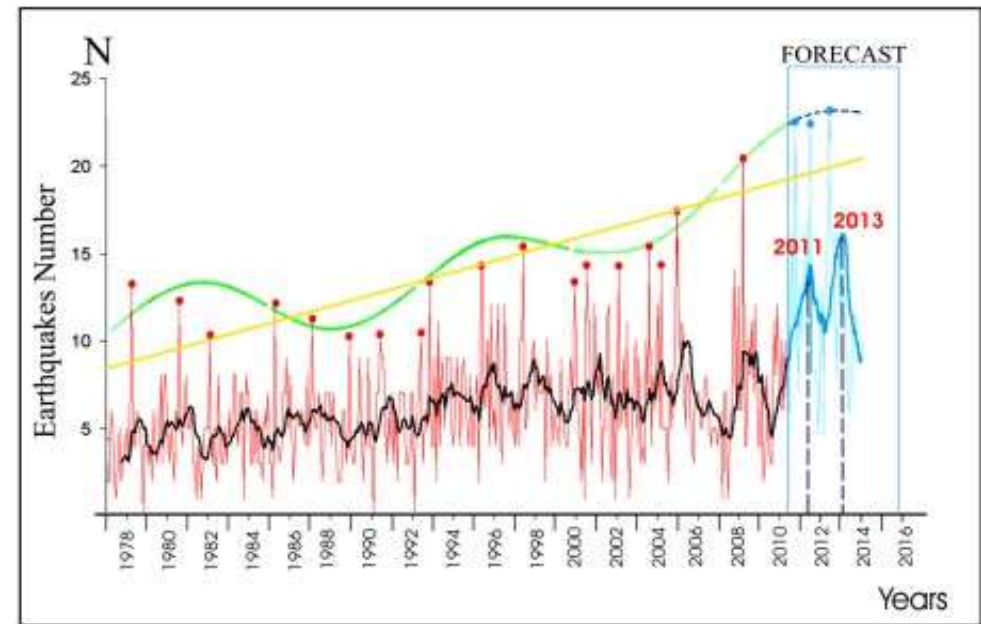
GLOBAL CHANGES OF EARTH SEISMIC ACTIVITY

Dynamics of Earth seismic activity



- The number of earth-quakes from $M > 8$
- schedule of annual earth-quakes;
- polynomial trend of sixth degree.

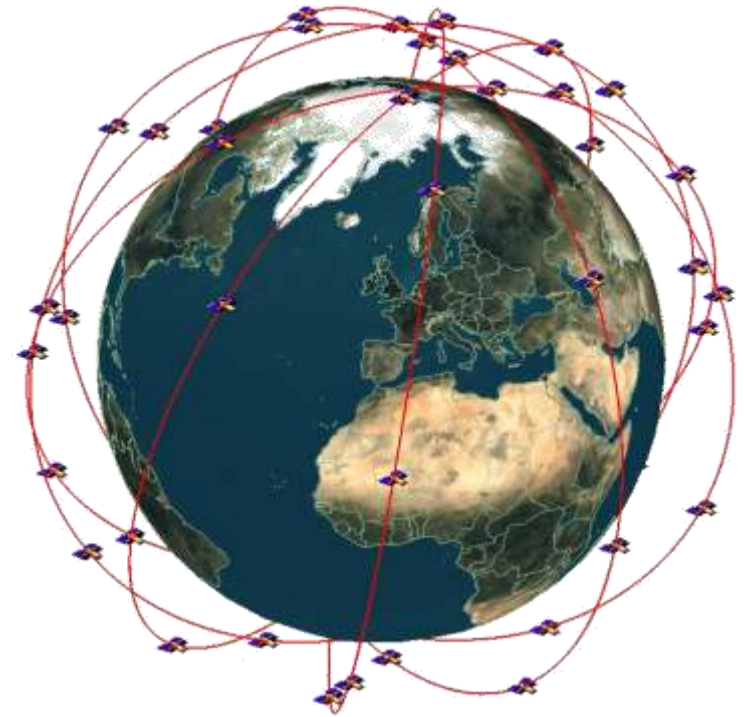
Long-term forecast of Earth seismic activity dynamics



- Monthly number of earth-quakes from $M > 6,5$
- (1976 - 2010 years) with forecast till the 2015 year
- (based on alternating trend)

ADVANTAGES OF SPACE OBSERVATION USE

- **wide range of earth-quake precursors observation with the help of complexing of space and ground measurements;**
- **global nature of research;**
- **common data base of the observed geophysical parameters;**
- **insurance of scientific break-in in the research of physical events domain, related with the seismic activity and others.**



RESEARCH OF EARTHQUAKE PRECURSORS WITH THE HELP OF SPACE OBSERVATIONS

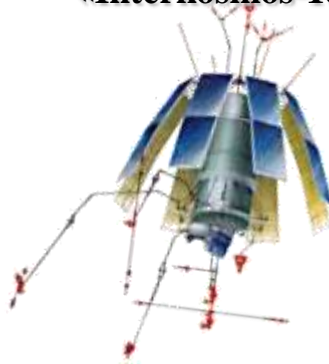
Heritage of Yuzhnoye SDO in the development of monitoring space systems.

«Oreol-3»



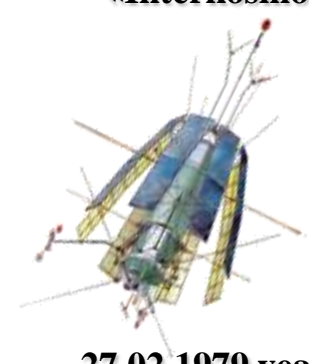
21.09.1981 year

«Interkosmos-18»



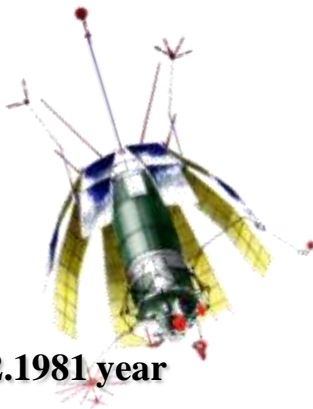
24.10.1978 year

«Interkosmos-19»



27.02.1979 year

«Interkosmos-21»



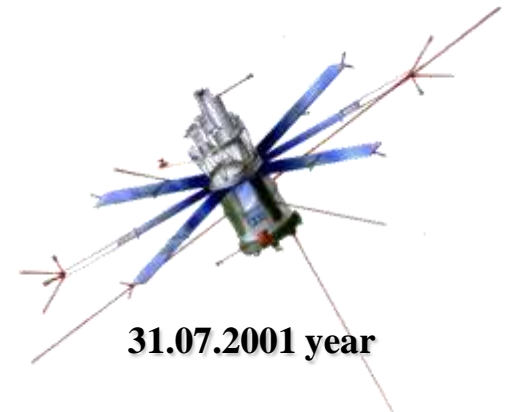
06.02.1981 year

«AUOS-CM-KI»



02.03.1994 year

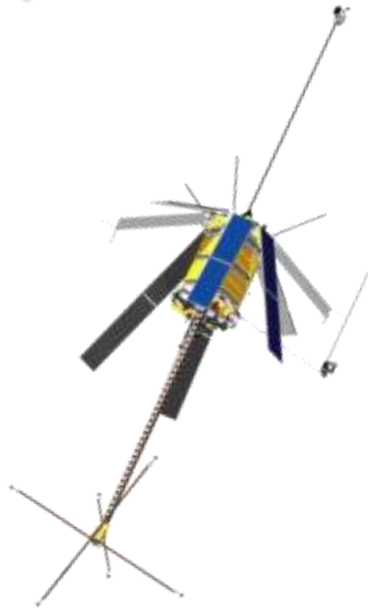
«AUOS-CM-KF»



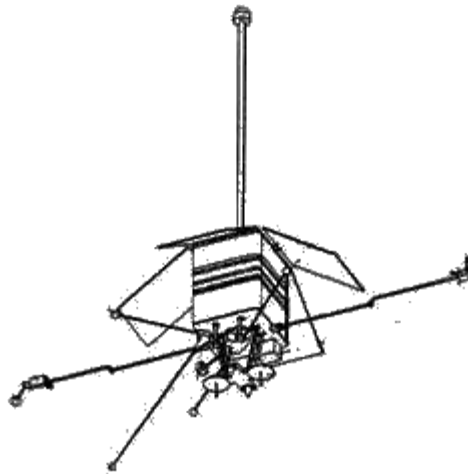
31.07.2001 year

SATELLITES OF SPACE COMPLEX “EARTHQUAKE PRECURSORS”

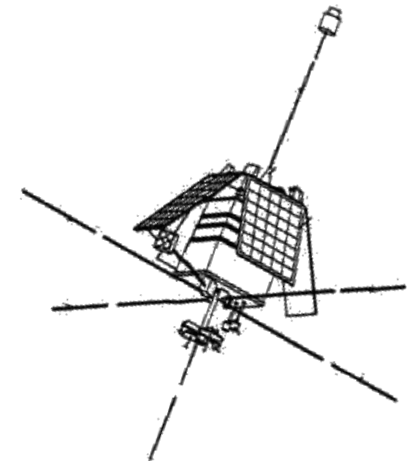
The most efficient way for research is global space monitoring of changes in the ionosphere, magnetosphere and in the Earth crust, related with the seismic activity.



Main satellite



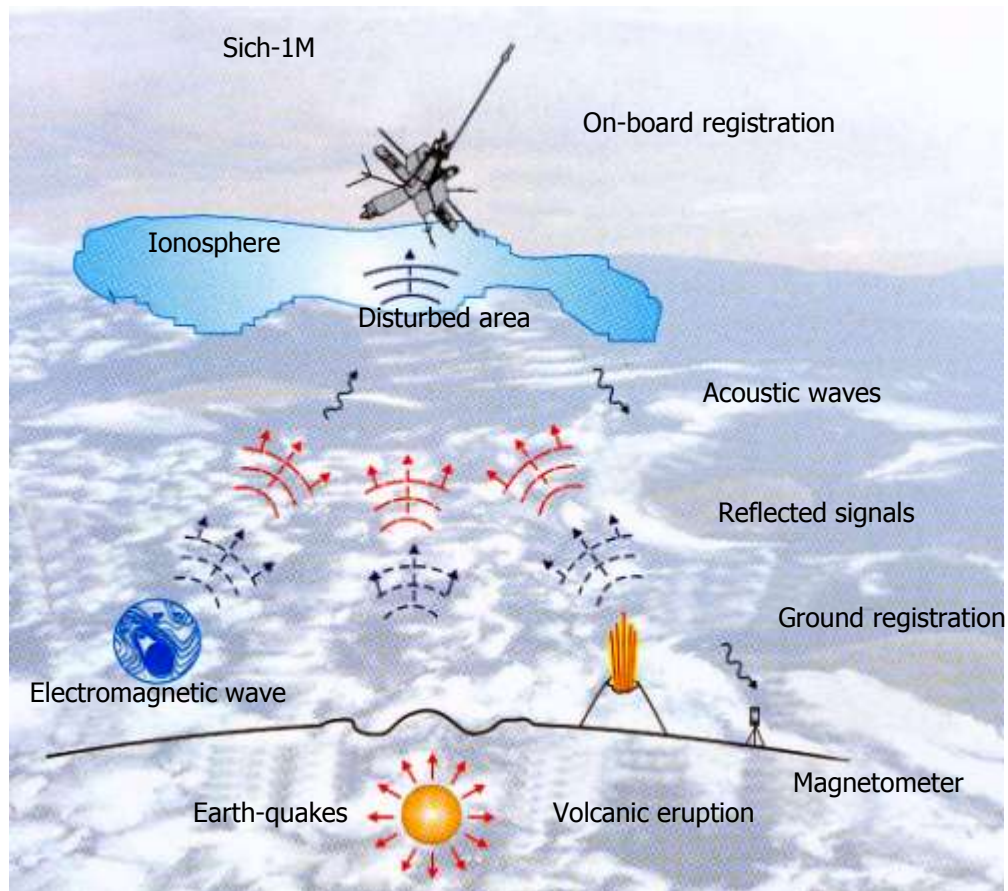
Sub-satellite



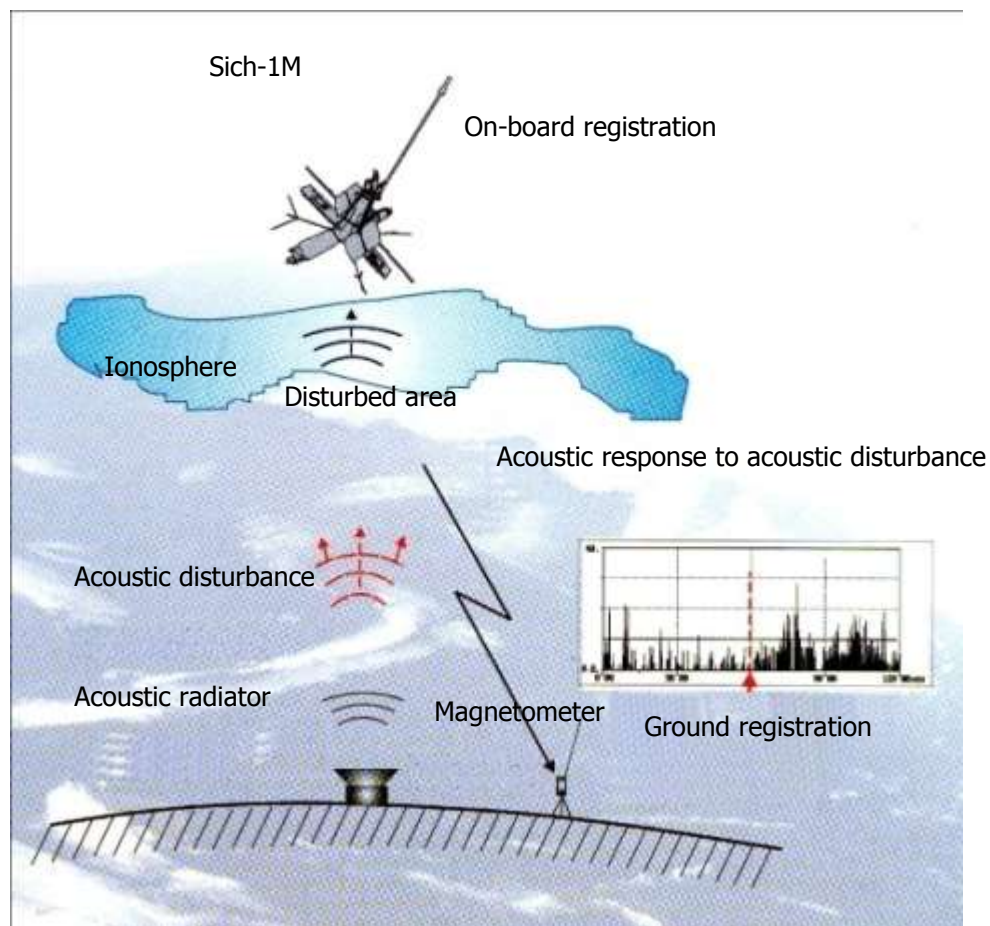
Sub-satellite

PROJECT CONCEPT “VARIANT” OF SPACE SYSTEM «SICH-1M»

**Research of the terrestrial effects
influence on the ionosphere**

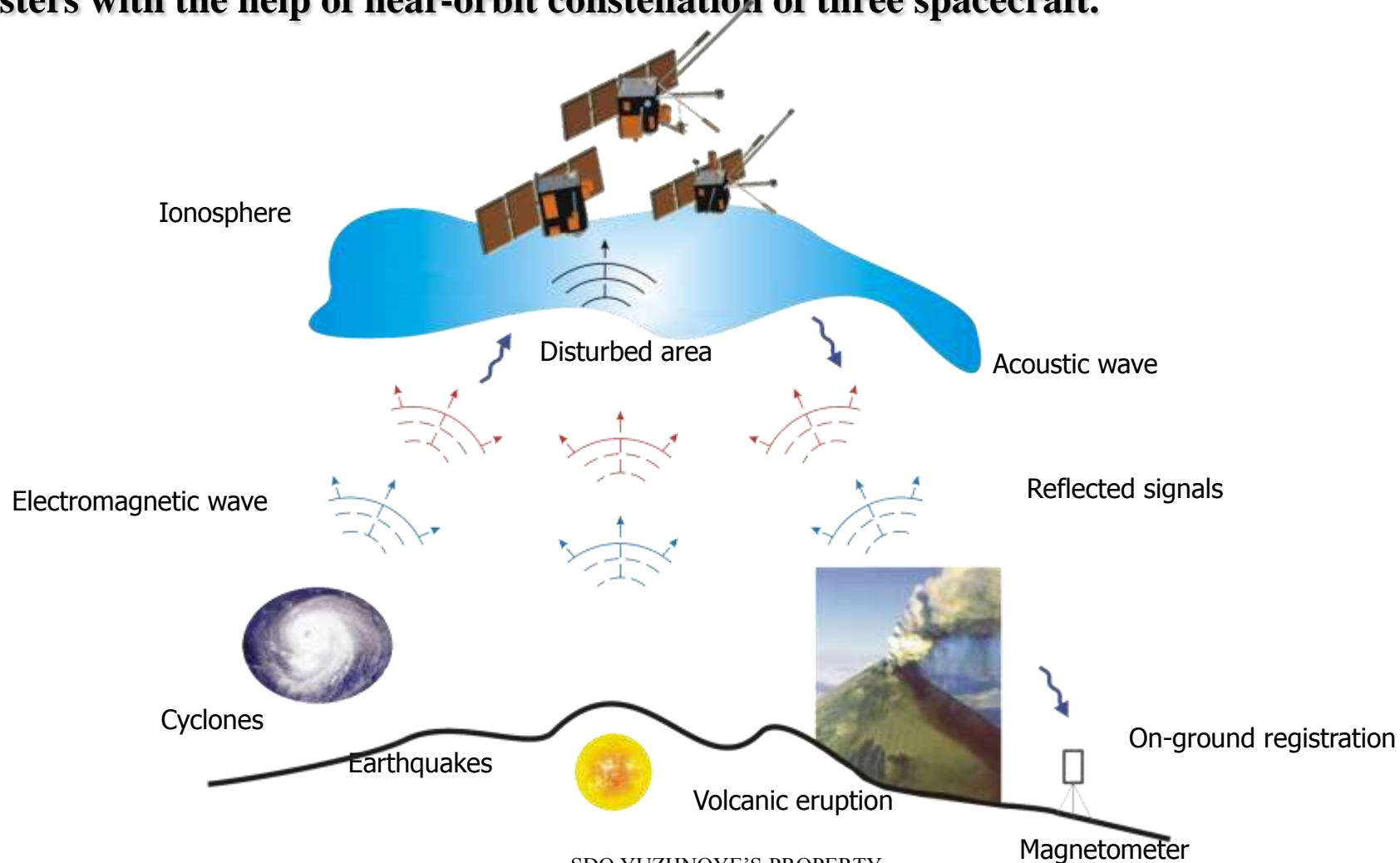


**Ground-space experiment on research of acoustic
channel of litospheric-ionospheric links**



CONCEPT OF SPACE SYSTEM

Conducting of scientific experiments on forecasting and diagnostics of man-caused and natural disasters with the help of near-orbit constellation of three spacecraft.



MAIN TASKS OF THE SYSTEM

- **search, detection and investigation of ionosphere disturbances, caused by Earth seismic activity;**
- **research of physical mechanisms of interaction in the system: “Earth crust-atmosphere-ionosphere-magnetosphere”;**
- **development of satellite monitoring principles of ionosphere aspects for earth-quakes forecast;**
- **control of seismic activity and earth-quake forecast;**
- **recommendations for action in the critical situations.**

COMPOSITION OF SPACE SYSTEM

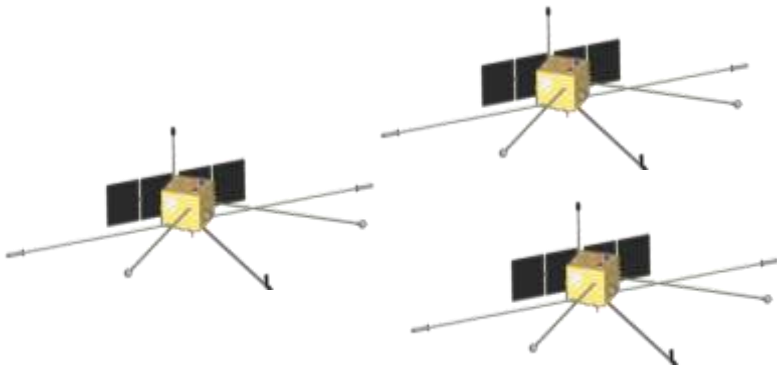
- **space segment;**
- **means of deployment and support of system space segment;**
- **ground control complex;**
- **ground data complex;**
- **network of ground test sites.**

SPACE SYSTEM BASED ON SPACECRAFT CLUSTER FOR MULTIPOSITION MEASUREMENTS (AS ONE OPTION)

Cluster consists of three spacecraft with identical composition of scientific equipment on the circular near-polar orbit, altitude 450 km.

In the horizontal plane satellites form triangle or linear configuration.

Mutual disposal of satellites could be from several dozens to several hundreds kilometers.



Wave probes
Electric probes
Langmuir probe
Sensor of neutral particles
Ferro probe magnetometer of steady field
System of data acquisition
Data transmission system

Mass of spacecraft, kg	~170
Orientation	three-axis active
Maximal power, power supply subsystem, Watt	465
Period of active operation, years	5

SPACE SEGMENT

Space segment of space system represents a constellation of 6-8 spacecraft clusters (18-24 spacecraft).

Structure of constellation (number of orbit planes and its inclination) will be determined upon the results of experimental stage of space system development.

Initial stage of space system development is planned to perform based on the orbital constellation of 3 spacecraft (one spacecraft cluster) which are in one plane and launched by one launch-vehicle.

Spacecraft are designed on the basis of tested in the outer space subsystem and solutions, which allow to reduce costs on development of space system and create unified space platform for space segment.

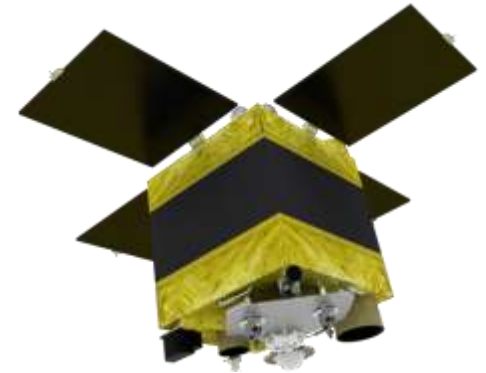
Complex of scientific equipment for solving tasks of space segment is formed by international cooperation of organizations based on instrumentation complex of existed and under development Projects.

SPACE SEGMENT

SDO YUZHNOYE'S HERITAGE IN DEVELOPMENT OF SPACE SYSTEM

Yuzhnoye SDO proposes to use microsatellite platform of “Sich-2” as a base space platform of wide application.

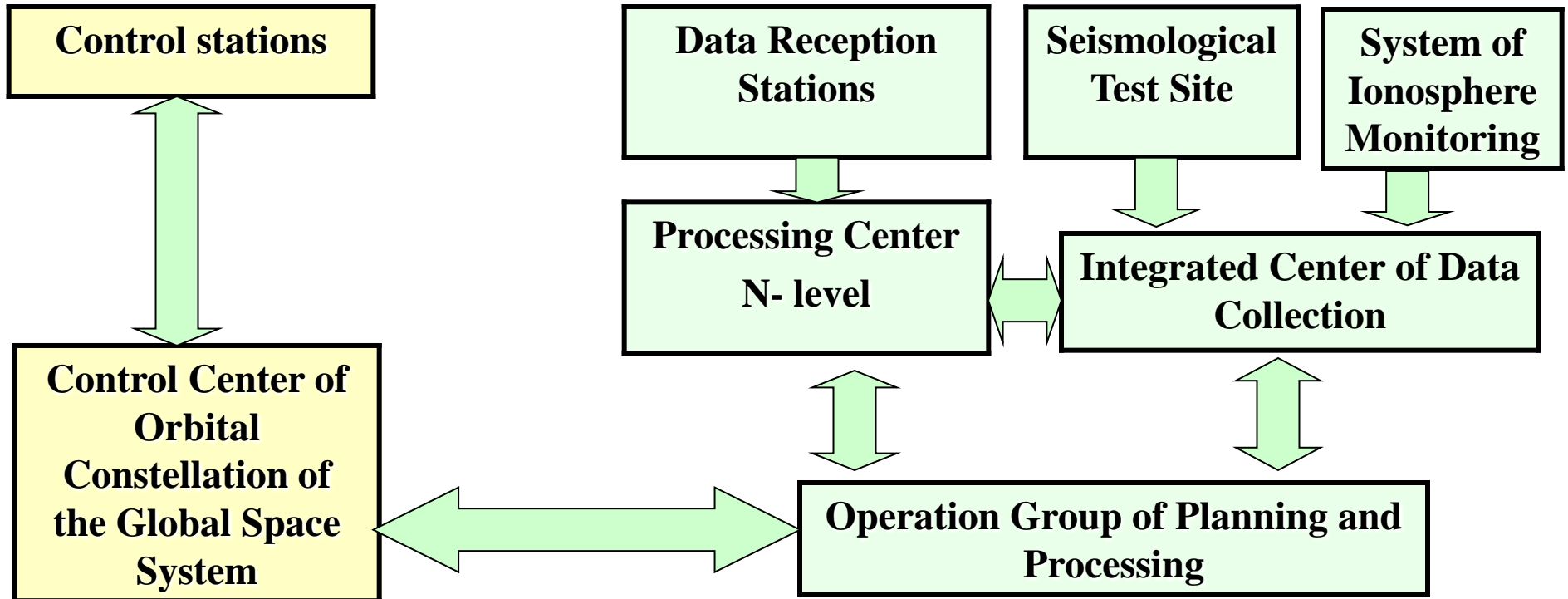
Platform passed final adjustment in conditions of outer space on satellite “Egypsat-1” (launched on April 17, 2007) and Ukrainian satellite “Sich-2” (launched on August 17, 2011)



GROUND SEGMENT

GROUND CONTROL COMPLEX

GROUND DATA COMPLEX



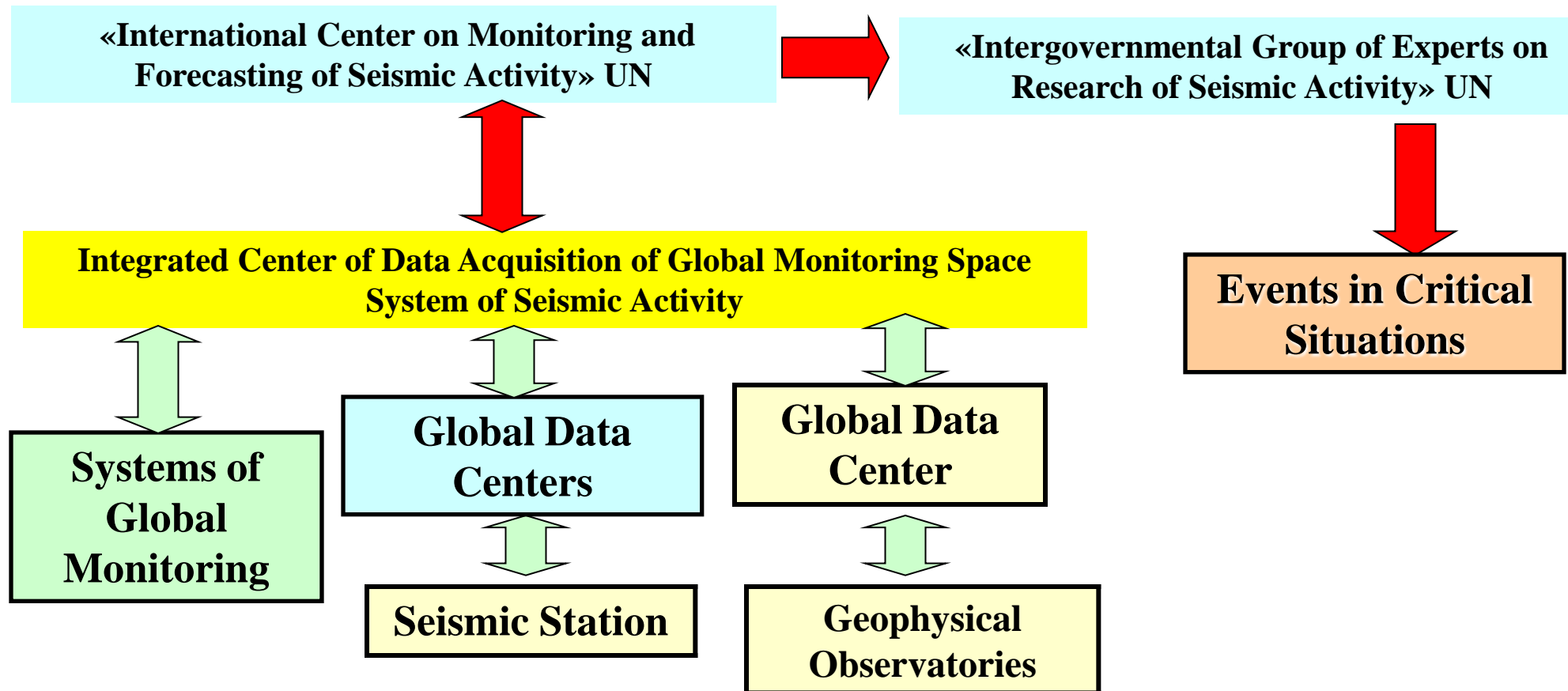
MEANS OF DEPLOYMENT AND SUPPORT OF SPACE SEGMENT



LV Dnepr



INTERACTION OF GLOBAL SEISMIC ACTIVITY MONITORING SPACE SYSTEM WITH DATA AND DECISION MAKING CENTERS



THANK YOU !

CONTACT INFORMATION:

Velychko Sergey

**Manager Business Development
Yuzhnoye State Design Office**

E-mail: space@yuzhnoye.com

Tel: +38 056 770 04 47

Fax: +38 056 770 01 25