



RSS

JSC “Russian Space
Systems”

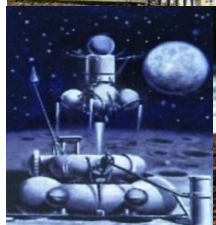




Historical Heritage

The enterprise participated in development of

- on-board control and telemetry radio complexes for manned and cargo vehicles «Vostok», «Souz», «Progress», «Buran», orbital space stations «Salyut», «Mir», ISS, spaceports «Baikonur», «Plesetsk»
- systems for radio control of long-range missiles
- automated complexes for control the satellites in near, medium and deep space
- search & rescue space system COSPAS-SARSAT
- satellite communications and relay systems (S/C «Express», «Luch»)
- S/C control systems and scientific equipment for space exploration (programs «Moon», «Venus», «Mars», «Cosmos», «Intercosmos», «Venus – Comet Halley», «Phobos», «Astron», «Granat», «Interbol», «Spectr»)
- , “Sea Launch” Project and Mission Control Center
- radio systems for global positioning «Sphera»
- radio technical complex for Global Navigation Satellite System GLONASS
- radio telemetry complexes for all Earth remote sensing satellites («Resurs», «Ocean»)
- ship-based, floating command-communication-and telemetry radio complexes





Participation in International Projects

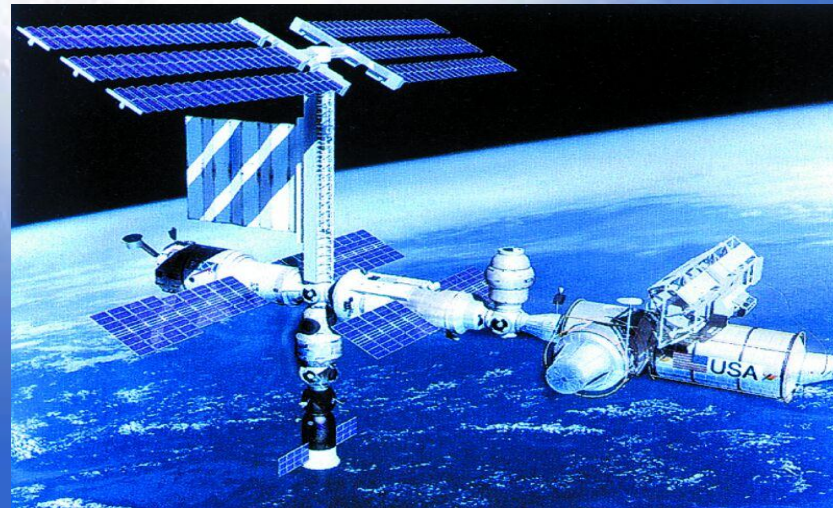
Development of Odyssey Launch Platform for “Sea Launch” Project

International programs of space exploration «Astron», «Granat », «Interbol», «Spectr»

International search & rescue COSPAS-SARSAT system

Creation of the International Space Station

Launch of “Soyuz 2” launcher from Kourou spaceport (French Guiana)





RSS Experience in earthquake-related observations

- In 2007 year a pilot project on the comprehensive diagnosis of earthquake precursors on Sakhalin Island was carried out.
- As project integrator RSS was responsible for project management and monitoring of ionosphere EC distribution, GPS-TEC variations, cloud structures and number of other supplied parameters

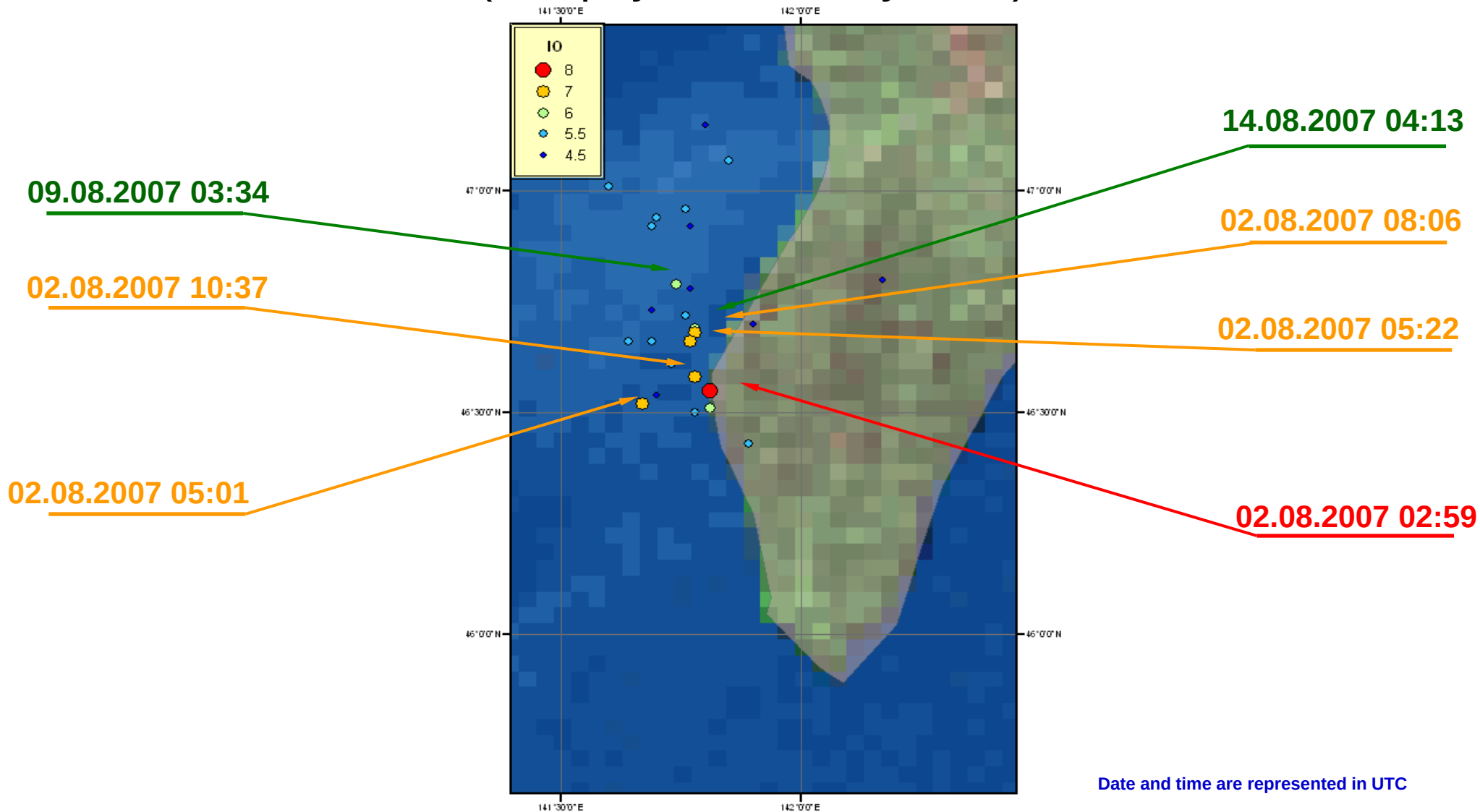


Why did we choose Sakhalin Island?

- Permanent seismic activity of the different intensity
- Meridional island orientation
- Ionosphere tomography network already deployed and functioning
- There is IGS GPS station in Yuzhno-Sakhalinsk
- Existing seismic stations network
- Possibility of the international cooperation in ionosphere tomography network widening together with Japan



Seismic Activity near Sakhalin Island (Russia) 08.2007 (Geophysical Survey RAS)





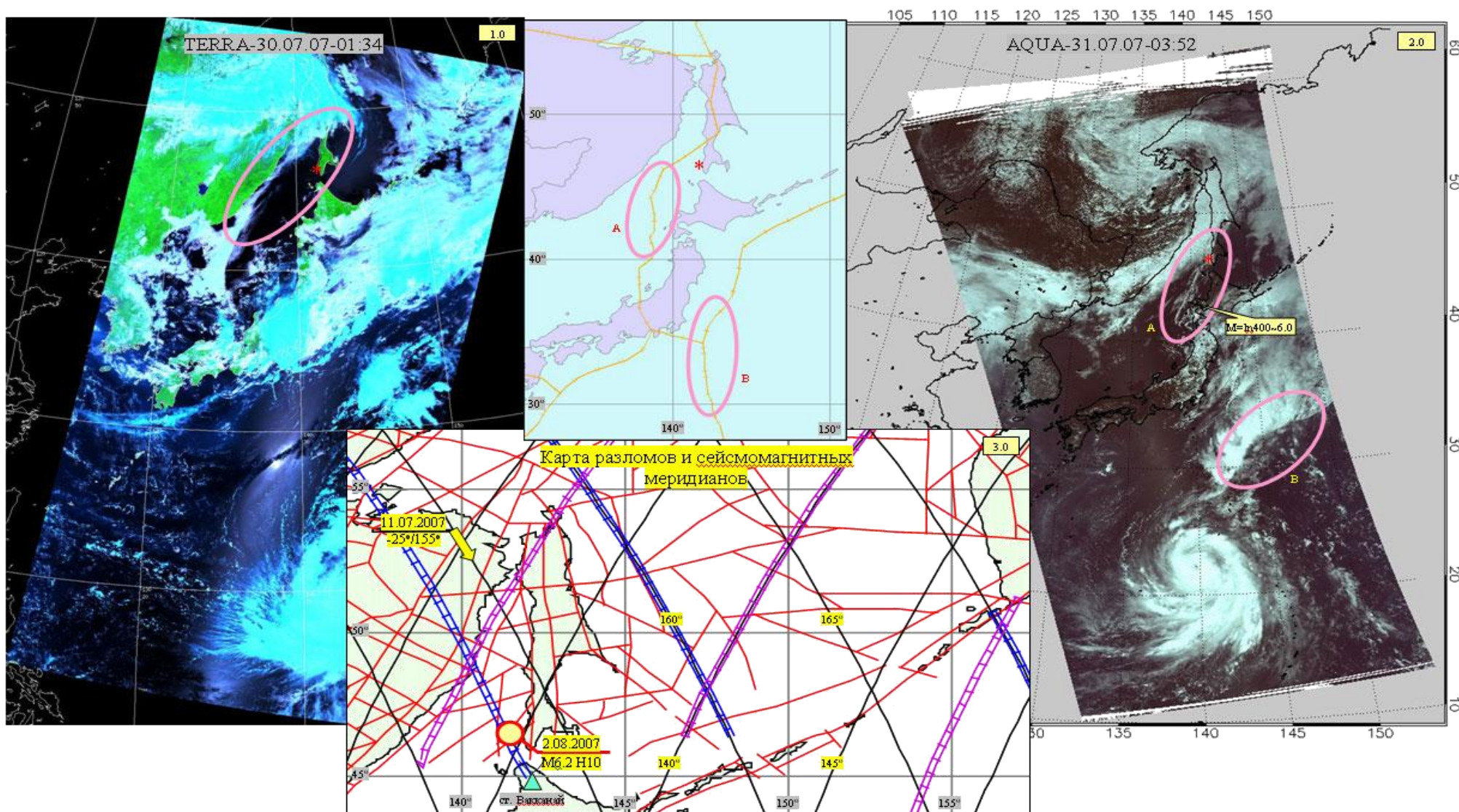
Anomaly Phenomenon in Different Media (21.07.2007 - 03.08.2007)

Parameters	22.07.2007	30.07.2007
Air temperature anomalies	not revealed	revealed
Air relative humidity anomalies	not revealed	revealed
Sea surface temperature anomalies	revealed	revealed
Surface temperature anomalies	revealed	revealed
Ionosphere TEC anomalies	not revealed	revealed
Ionosphere electron concentration anomalies	revealed	revealed

These research parameters variations has forerun the earthquake event 02.08.2007 at 02:37 UTC and epicenter location: 46.68°N, 141.77°E, IO 7-8

Anomaly Cloud Structures

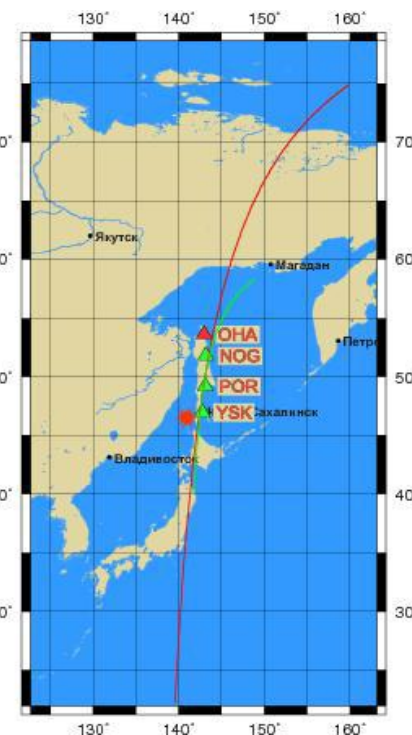
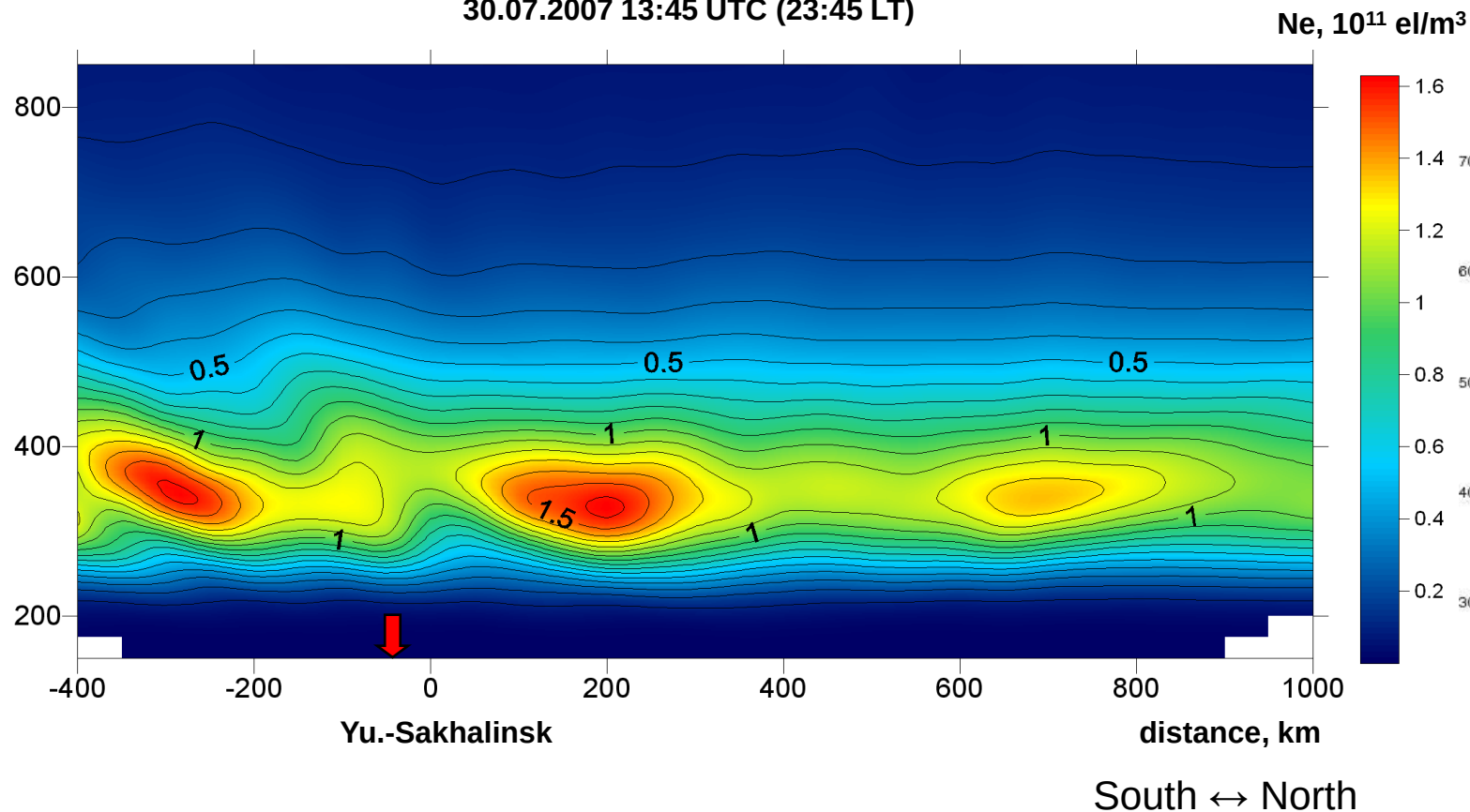
30.07.2007 and 31.07.07





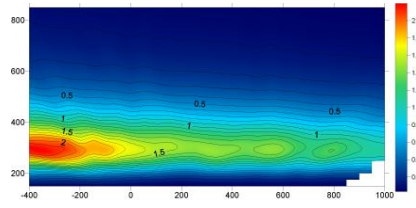
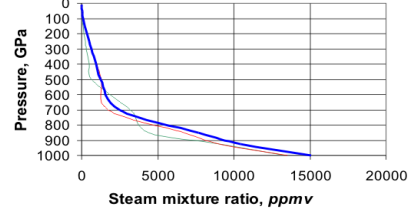
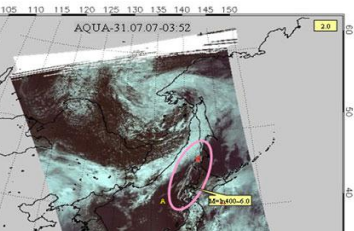
Ionosphere electron concentration variations 30.07.2007 13:45 UTC (3 days before event)

30.07.2007 13:45 UTC (23:45 LT)





Specific contribution to the PRE-EARTHQUAKES

Product	Electron concentration maps	Humidity profiles	Anomaly cloud structures
Preview			
Data source/sensor	150/400 MHz radiobeacons on satellites like COSMOS-2414, FORMOSAT-3 e.t.c. and ground receivers chain	Radiometer MTVZ-GYa on Meteor-M	MSU-MR radiometer onboard Meteor-M Other satellites/spectrometers ?
Data coverage	Sakhalin Island 01.2007-03.2009, Since 03.2011	Sakhalin, Tukey, Italy, Kaliningrad 01.2010 – 2011 Calibration stage??	Europe (Tukey, Italy???)

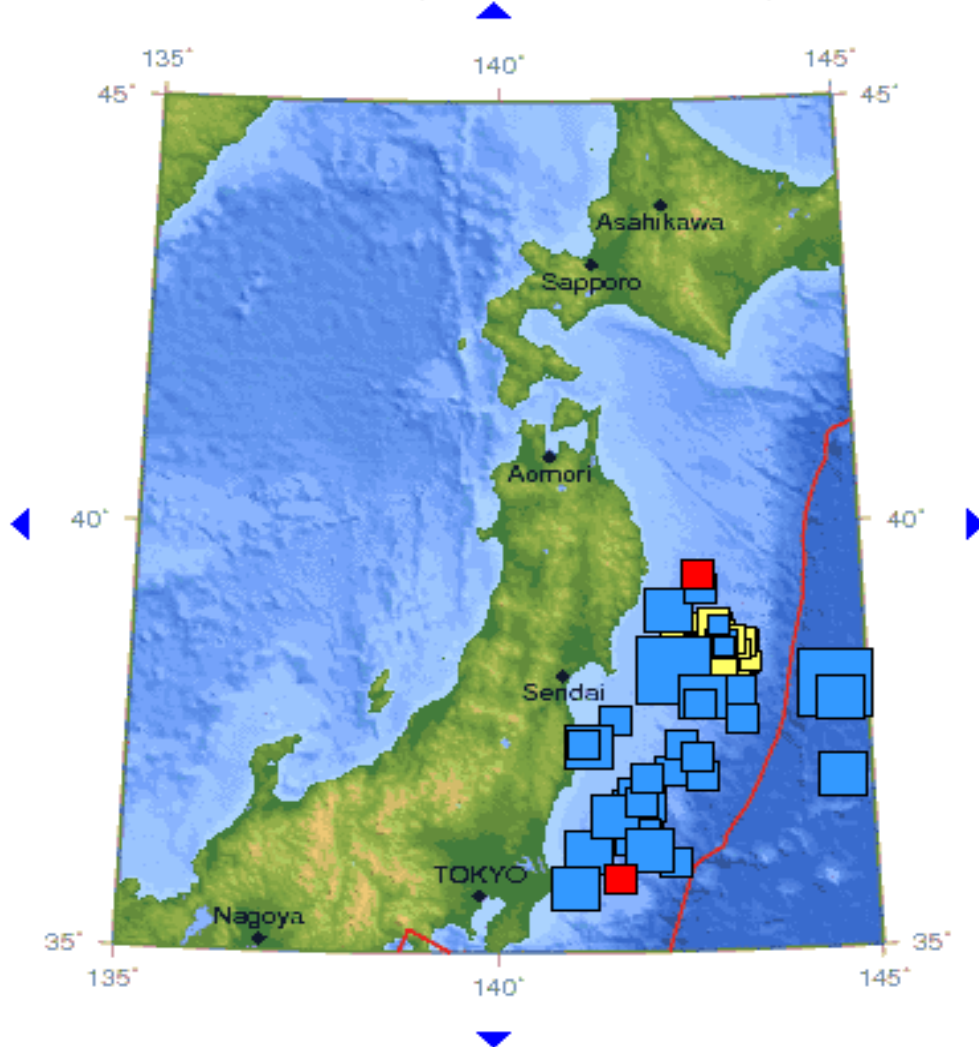


Specific contribution to the PRE-EARTHQUAKES (continuous)

Product	Electron concentration maps	Humidity profiles	Anomaly cloud structures
Production frequency	5-10 maps for day	1 profile for day for region	0-1 detection for day
Data processing technique	Automated technology of ionosphere tomography Anomalies detection algorithm not realized yet	Radiometric data conversion.	Visual detecting cloud structures, conforms to crustal faults.
Output format	Electron density values (with height and latitude per value, and some metadata) stored in NetCDF and CRD. May be converted in any proposed format.	Processed data stored in ASCII files. May be converted in any proposed format.	Raster image with highlighting of detected structures by oval marks.

Map of Japanese earthquakes in March 2011

Fri Mar 11 10:10:53 UTC 2011
64 earthquakes on this map



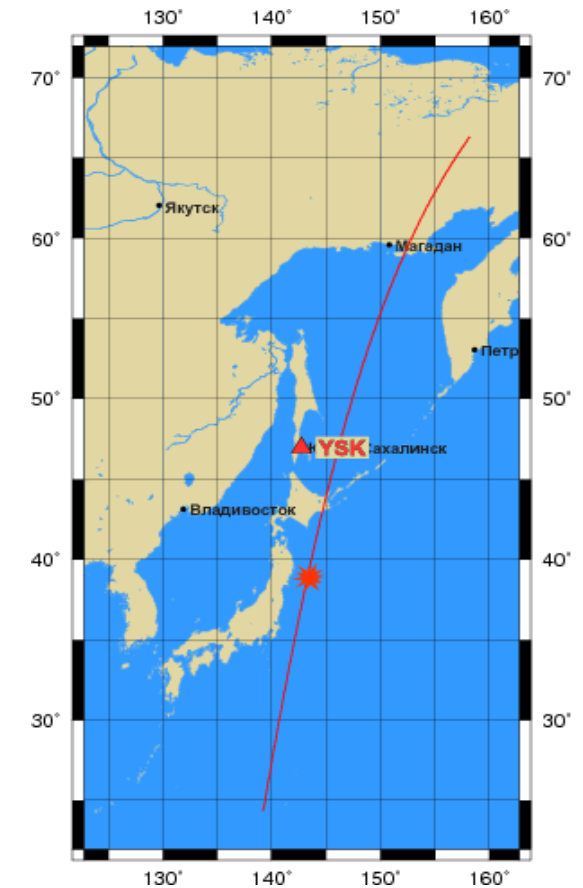
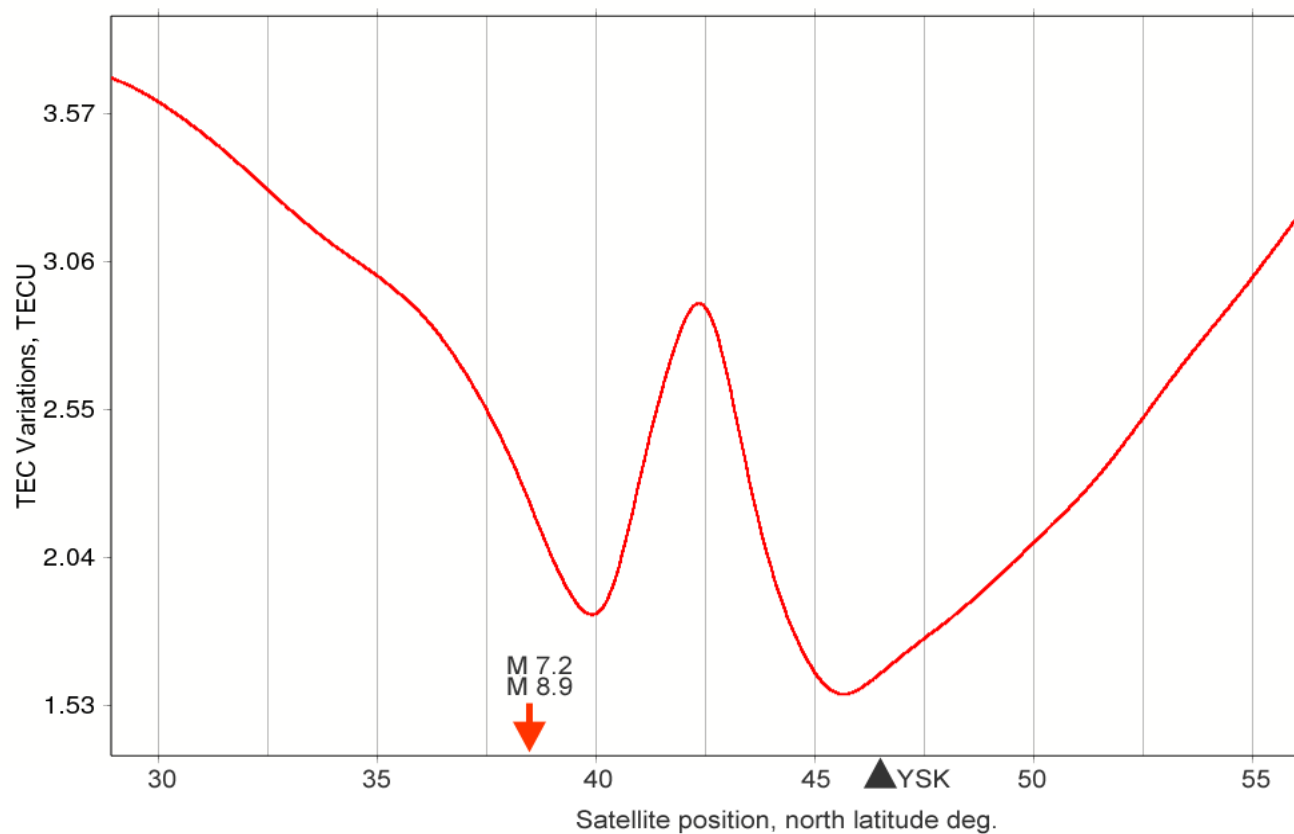
First strong earthquake
09.03.2011 at 2:45

M7.2, N 38.424, E142.836

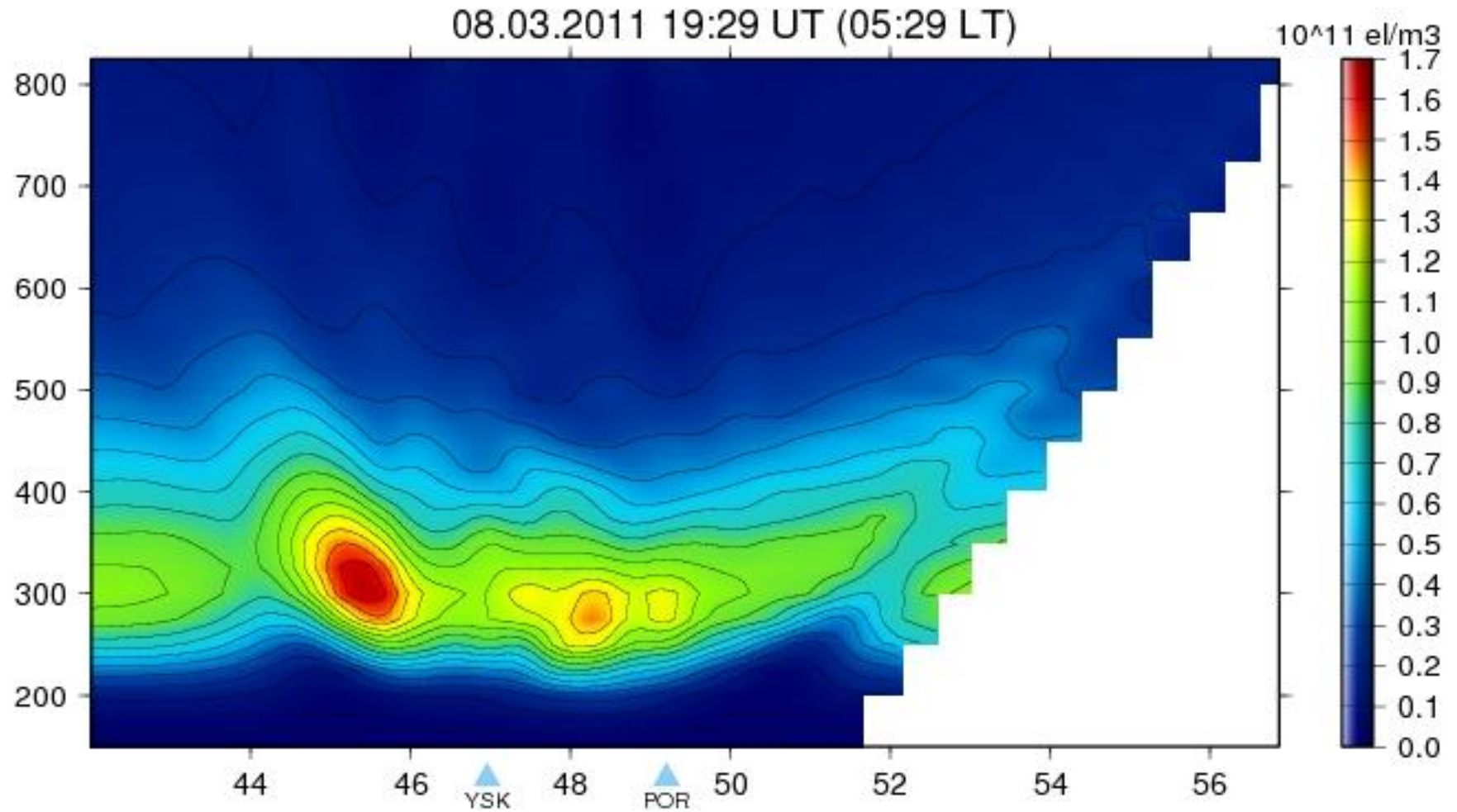
Strongest was
11.03.2011 at 5:46

M8.9, N 38.322, E 142.369

Relative TEC distribution anomaly registered 7 hours prior set of march 2011 Japanese earthquakes



Ionospheric tomography reconstruction 08/03/11





Thank you !!!