

Earthquakes Precursors Monitoring Using of Space Based Methods of Observations of the Earth

N.N. Novikova, L.A. Pakhomov, L.A. Doda, I.A. Gorlach, T.G. Kurevlyeva

Research Centre for Earth Operative Monitoring (NTs OMZ) 51, building 25, Dekabristov St., Moscow, 127490, Russia
ntsomz@ntsomz.ru

Abstract – Information technologies used in the Scientific Center of Operative Monitoring of the Earth allow extracting, to process and analyzing space-based lithosphere-atmosphere-ionosphere structures for monitoring and forecasting of earthquakes. The date and place of possible earthquake for the first step can be calculated according to the correlation between the phenomenon of seismic-gene specific Solar processes activity and the event of earthquake on the Earth in two or three weeks. The second step is to precise forecast by satellite monitoring of geothermal effects, specific cloud tracers over activated by the Sun seismic zone and of electron plasma concentration anomalies in the ionosphere. The examples of earthquakes forecasts in Japan are demonstrated in this paper.

Keywords: space monitoring, earthquake consequences, forecast, cloud clusters.

New spacecrafts (SC) like “Compas-2”, “Vulkan”, “Sich-1M”, “Quakesat”, “Demeter” et al., let us find necessary data base to research earthquakes (EQ) formation mechanisms, and the forecasting parameters data base in geophysical fields with more details. The main program, conceptual model and methods of monitoring and forecasting of seismic hazard events developed in the Scientific Center of Operative Monitoring of the Earth (NTs OMZ) may permit to use as old spacecraft data and new multifunctional special measurement complex SC data.

Different satellite databases were used to determine features of the geophysical fields of the Earth envelopes before, during, and after earthquakes. The knowledge databases consist of information about the Sun process activity, the atmosphere cloud cluster tracers of the earth's crust breaks (ECB), the ionosphere energetic parameters.

The method of approach of the problem for prediction and monitoring EQ precursors is rests on the patterns of relationship between the Sun specific process activity in the active areas with coronal holes and EQ event in 14 or 22 days after this specific activity parameter complex. We consider that there is the moment of the EQ launching process. The possible EQ may strikes with high probability in the seismic active zones with anomalous hazard geophysical parameter values (over background threshold values) if these zones will be in the geomagnetic meridian plane run across under-Solar point at the moment of maximum variations of the Earth magnetic field. It was found that the sequence of EQ has been generated in the plane of similar meridians. Therefore, the most probable prediction factors are in the areas of similar plane and the prediction factors monitoring should be

organized there first of all. That is to say, seismic monitoring Spacecrafts should be equipped by the Earth electrical and magnetic fields variation sensors and processed with satellite inclination about 79°.

Data base of 606 EQ events with magnitude values M6.0+, registered by catalog NEIC during last 5 years (period from 2000 to 2004), was examined. The results pointed that in 83 % of EQ events were realized at the date and in the “seismic effective magnetic meridians” in accordance to our consideration, presented above.

To precise the EQ forecast over conjunction areas of the Earth magnetic longitude belts with seismic active zones (lithosphere plate boundaries, breaks, morpho-structural blocks) we used also addition EQ predictors:

- geothermal anomalies with radiogen emission (for example radon emission) in lithosphere (P1);
- cloud tracer clusters over break contours and other morphostructural elements (P2) in the atmosphere
- variations of electron plasma concentrations and attendant electromagnetic effects (P3) in ionosphere.

Also it was found from previous experience - the correlation between the set of parameters P1-P3 may be determined by the mechanism of hazardous EQ launching. That is why simultaneous observation and sensing of all EQ precursors in lito-atmo-ionosphere are impotent and advisable. The experimental equipment complex (EEC) of “Vulkan” and “Sich-1M” SC has been mounted for the measurements in these Earth envelopes concurrently. And without the detail data base from similar SC now NTsOMZ should integrate space images and geophysical data, received by SCs with different spatial and temporal resolution (for example by “Terra” “Aqua” “NOAA” “Meteosat” “Meteor-3M” “Goes”) during analysis and forecasting of regional and global seismic conditions. There are several seismic hazardous regions in Russian Federation (Kuriles-Khamchatka zone) and in the world – in Japan, in Taiwan, in USA (California), in Turkey, in Iran and etc., where it's necessary to monitor of many geophysical parameters.

Author's point of view to the problem of the EQ forecasting and monitoring, as we present above, may help us to search for EQ precursors with more effective results. This investigation of the existing seismic-magnet meridian, the sequence of EQs along the seismic meridian, the EQ trigger initiation by the Sun process activity may changes strategy of seismic monitoring of EQ precursors as principal. The areas of new additional EQ precursors search should be, for the first, inside of the contours of the most favorable magnet meridians.

The realization of the search will have to create new equipments and new SCs.

As an illustration we present the prediction of EQ in Japan in

September 2003 (Fig. 1). Japan seismologist (on the base of seismic land station measurements) predicted the EQ with magnitude M7.2 at Kanto place on 16-17 of September 2003. And the concern "Toshiba Space Systems" leadership was

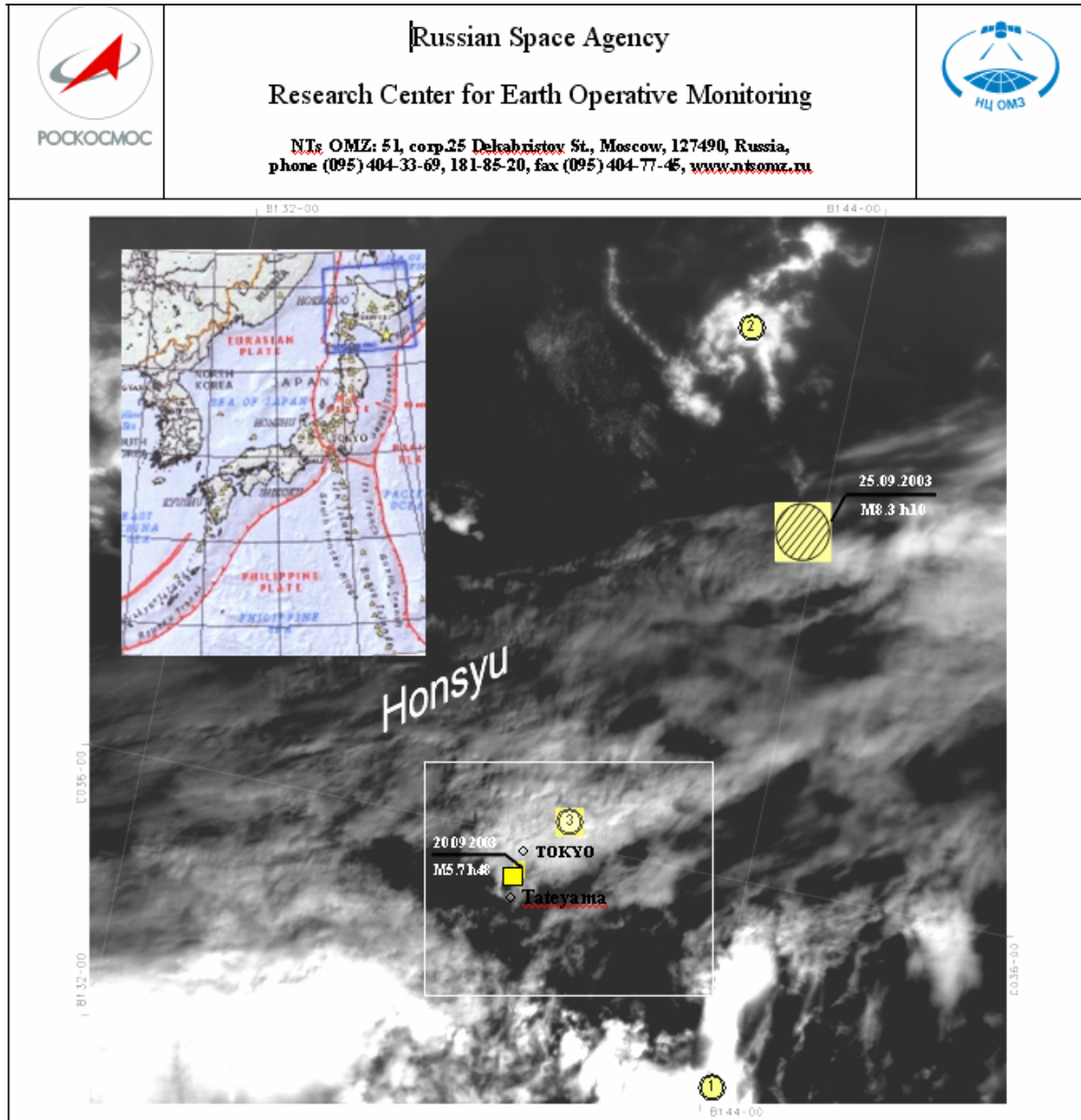


Figure 1. Cloud break tracer clusters before Japanese earthquakes on 20-25.09.2003.

alarmed at the news of future earthquake. They asked help with monitoring of this hazardous zone from different seismological services and institutes in Russia including NLS OMZ beforehand. Since 12 September by specialists of NLS OMZ it was settled a program of the EQ monitoring

and predicting. In accordance with the method (presented above) the information of mid and high spatial resolution of "Meteor-1M" help us to precise the forecast of the EQs. The EQs date of our forecast was, to a first approximation, 18-20 of September or/and 27±3 days of September.

The more exact EQ localizations were found by satellite images, one of them is presented in Figure1, over 3 areas of Hokkaido, where at the second date we expected more intensive EQ. The cloud break tracer clusters are seen as signature 1-3. Hazardous EQ with M8.3 was taken place near the forecasting area 2 on 25.09.2003, and EQ with less intensity (area 3 in Fig.1) near Tokyo - on 20.09.2003.

The Japanese forecast scored only with magnitude M5.7 on 20.09.2003.

These and previous co-operative efforts in forecasting of damage EQ situations made it clear, that all special services all over the world should work in collaboration.