The Kiev Intermagnet data and some preliminary results in the framework of INRNE, BAS geomagnetic and earthquake monitoring

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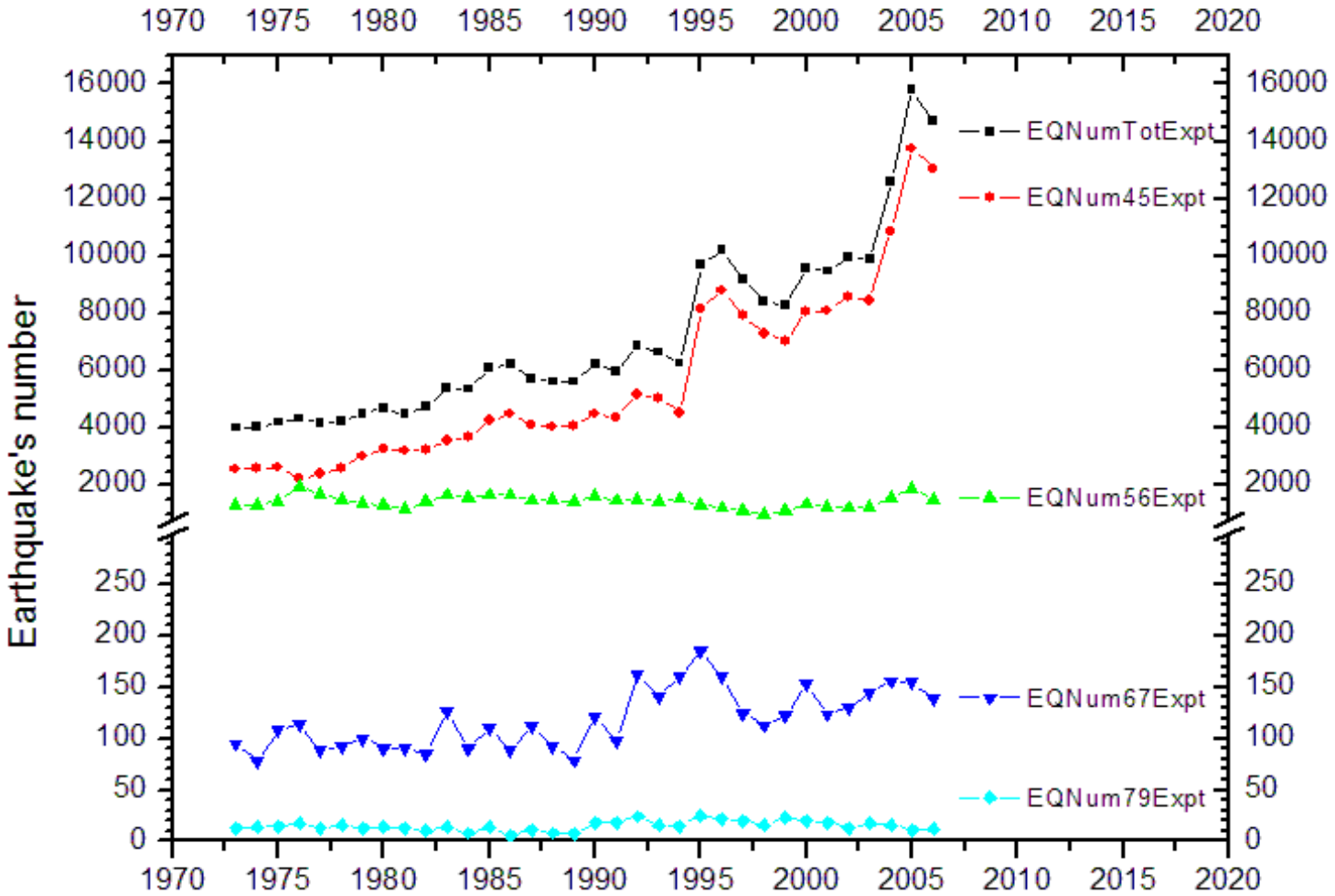
- The “when, where and how” earthquake prediction problem is not solved but actual problem for a long time.

- The official science state now that this problem is not solvable for the today level of knowledge.

[Main, Debate in *NATURE,* http://www.nature.com/nature/debates/earthquake/equake_contents.html*, 1999*]

- Reassessment of earthquake pessimism.

- But for somebody now we have enough data and knowledge for starting the complex experimental and theoretical research of the problem. It is actual in the time when there is clear trend of World seismic increasing.



The number of World earthquake with Mag>4,4-5,5-6,6-7,>7

Data Source: **http://wwwneic.cr.usgs.gov/neis/bulletin/**

- Electromagnetic Studies of Earthquakes and Volcanoes (EMSEV), Inter Association Working Group, IUGG http://vanpc04.iord.u-tokai.ac.jp/emsev/ ,

- World Agency of Planetary Monitoring and Earthquake Risk Reduction, Geneva, Switzerland, Director Prof. Max Wyss

- From 1989 the possible connection between geomagnetic variations and incoming earthquake is researching in INRNE. Mavrodiev S.Cht., Thanassoulas C., **Possible correlation between electromagnetic earth fields and future earthquakes,** INRNE-BAS, Seminar proceedings, July 23- 27, 2001, Sofia, Bulgaria, ISBN 954-9820-05-X, 2001

- From January 2007 IGPh NASU (Kiev) Ukaraina included in INRNE, BAS gemagnetic and earthquake monitoring.

- Now Ukraine has 4 geomagnetic observatories: Kyiv - KIV (50.7ºN, 30.9ºE), Lviv – LVV(), Argenina islands – AIA(65.25ºN, 295.75ºE), Odessa – ODE (46. 6N, 30.9E) and several seismic stations.
  They have different level of preparedness for inclusion in complex regional monitoring NETWORK „PrEqTiPlaMagInt collaboration». At the moment the data from 3 station are available: Kyiv, Lviv and Makarov. Digital records of 1 Hz 3 component geomagnet field with accuracy 1nT have been made every 72 hours and transferred to INTERMAGNET network database.

- In case of additional funding and delivering the needed equipment there is possibility of inclusion of 5 monitoring station: Odessa, Korez (50.6N, 27.2E), Yalta, Zmeini Island and Ukrainian Antarctic base “Acad. Vernadski”


EMSC
Brussel
Germany
Paris
(Warsaw)
Warszawa
(Prague)
Praha
Czech Republic
(Kiev)
Kyyiv
Ukraine
(Berne)
Liechtenstein
Bratislava
Slovakia
Budapest
Hungary
Chisinau
Ljubljana
Zagreb
Croatia
Romania
Monaco
San Marino
(Belgrade)
Beograd
(Bucharest)
Bucuresti
Sarajevo
Serbia
Italy
(Rome)
Roma
Podgorica
Sofiya
Bulgaria
(Sofia)
Skopje
Macedonia (FYROM)
Albania
Georgia
T'bilisi
Armenia
Yerevan
Istanbul
Ankara
Greece
Tunis
Izmir
Turkey
Athinai
(Athens)
Valletta
Tunisia
Nicosia
Syria
(Beirut)
Bayrut
Dimashq
Iraq
West Bank
Hypocentral depth (km)
0 40 80 150 300 500
Bullet size is relative to the magnitude.
Map Data © 2006 AND
© 2006 Europa Technologies
Image © 2006 TerraMetrics
Image © 2006 NASA
Google
Pointer 42°23'12.76" N 26°01'12.41" E
Streaming 100%
Eye alt 2933.57 km

Geomagnetic quake

Geomagnetic filed F(H,D,Z), JAGA-kod observatorii Kiev KIV:
Lat 50.7N, Lon 30.30E, Alt 58, 60 samples per minute, accuracy 0.1nT, Internet data exchange

Second time scale
Hi,Di,Zi, i=1,…,n, n=60

Minute time scale
Average minute H, D and Z values, with SD for every component (based on second data)

$$H_m = \sum_{i=1}^{n} H_i / 60 \qquad \sigma_{Hm} = \sqrt{\frac{\sum_{1}^{n} (H_i - H_m)^2}{n-1}}$$

$$D_m = \sum_{i=1}^{n} D_i / 60 \qquad \sigma_{Dm} = \sqrt{\frac{\sum_{1}^{n} (D_i - D_m)^2}{n-1}}$$

$$Z_m = \sum_{i=1}^{n} Z_i / 60 \qquad \sigma_{Zm} = \sqrt{\frac{\sum_{1}^{n} (Z_i - Z_m)^2}{n-1}}$$

$$Sig_m = \sqrt{\sigma_{Hm}{}^2 + \sigma_{Dm}{}^2 + \sigma_{Zm}{}^2} / 3$$

n=1, ……60. m=1,….1440.

Day time scale

Average day H, D and Z values, with SD for every component (based on minute data)

$$H_D = \sum_{m=1}^{1440} H_m / 1440 \qquad \sigma_{H_D} = \sqrt{\frac{\sum_{1}^{1440} (H_m - H_D)^2}{m-1}} \qquad (\sigma_{H_m})_D = \sum_{m=1}^{1440} \sigma_{H_m} / 1440$$

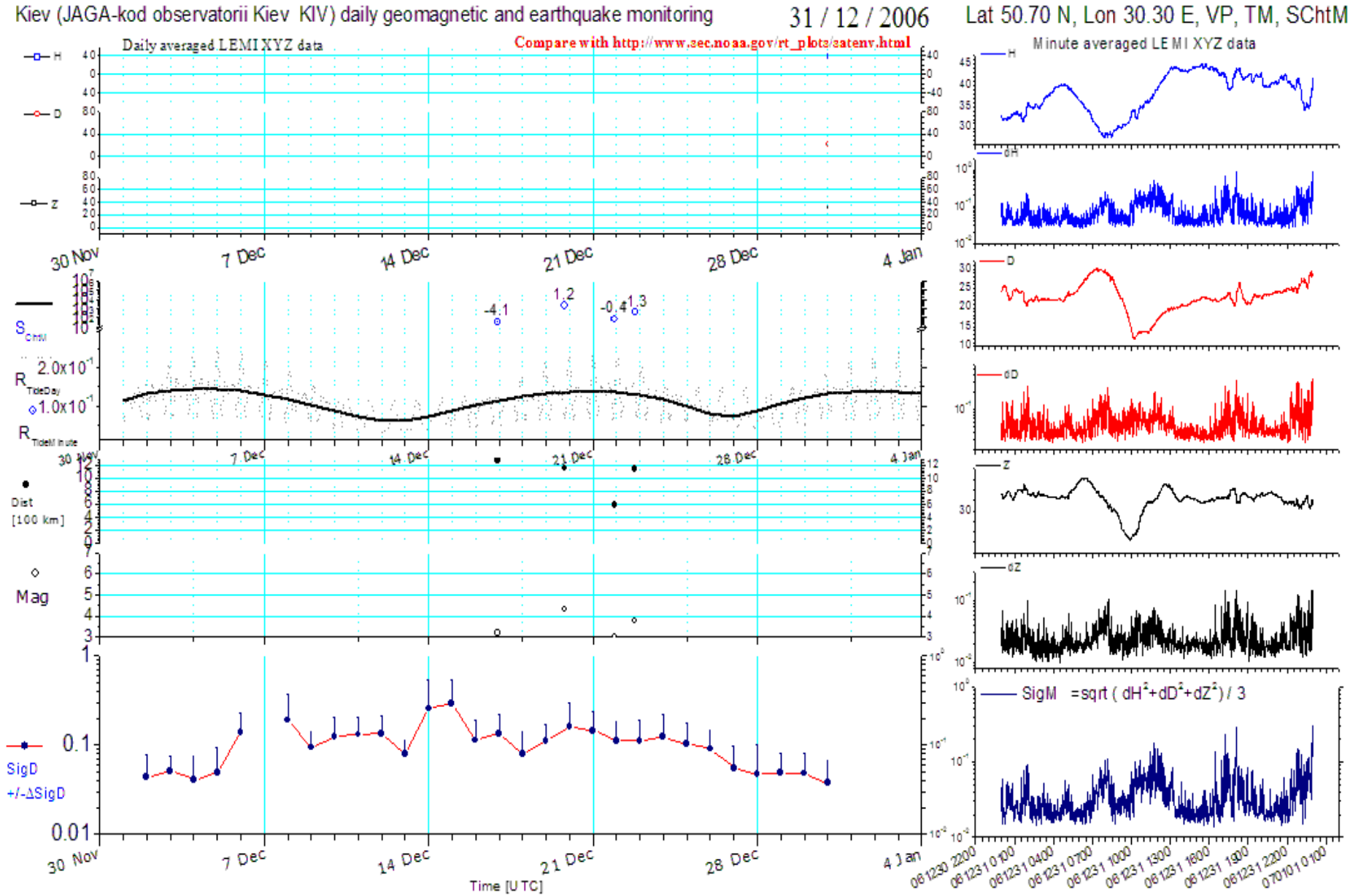
$$D_D = \sum_{m=1}^{1440} D_m / 1440 \qquad \sigma_{D_D} = \sqrt{\frac{\sum_{1}^{1440} (D_m - D_D)^2}{m-1}} \qquad (\sigma_{D_m})_D = \sum_{m=1}^{1440} \sigma_{D_m} / 1440$$

$$Z_D = \sum_{m=1}^{1440} Z_m / 1440 \qquad \sigma Z_D = \sqrt{\frac{\sum_{1}^{1440} (Z_m - Z_D)^2}{m-1}} \qquad (\sigma_{Z_m})_D = \sum_{m=1}^{1440} \sigma_{Z_m} / 1440$$

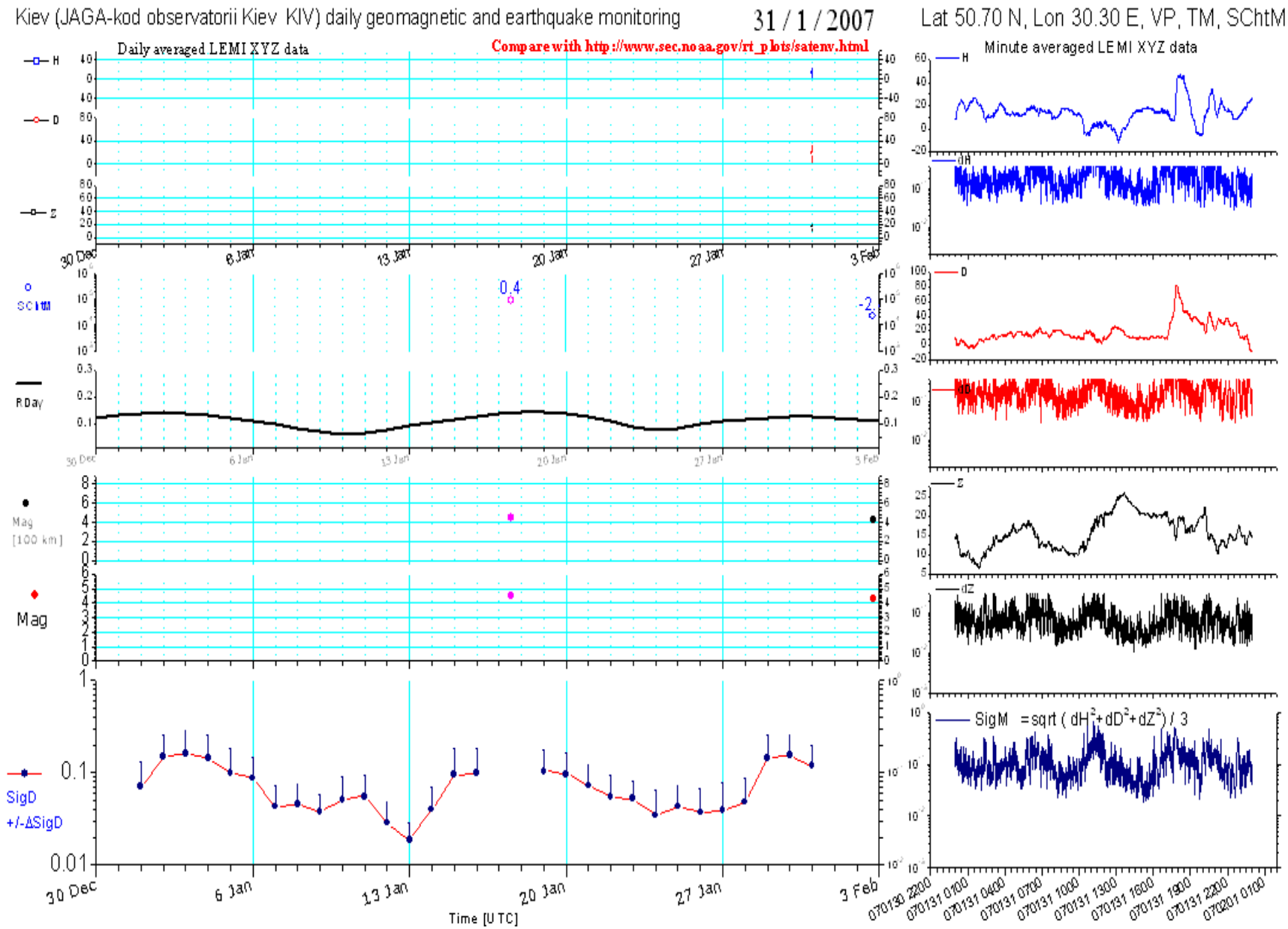
$$Sig_D = \sqrt{\sigma_{H_D}{}^2 + \sigma_{D_D}{}^2 + \sigma_{Z_D}{}^2} / 3 \qquad \sigma_{Sig_D} = \sqrt{\frac{\sum_{1}^{1440} (Sig_m - Sig_D)^2}{(m-1)}}$$

m=1,…..1440;
D=1, ….31.

First Kiev results

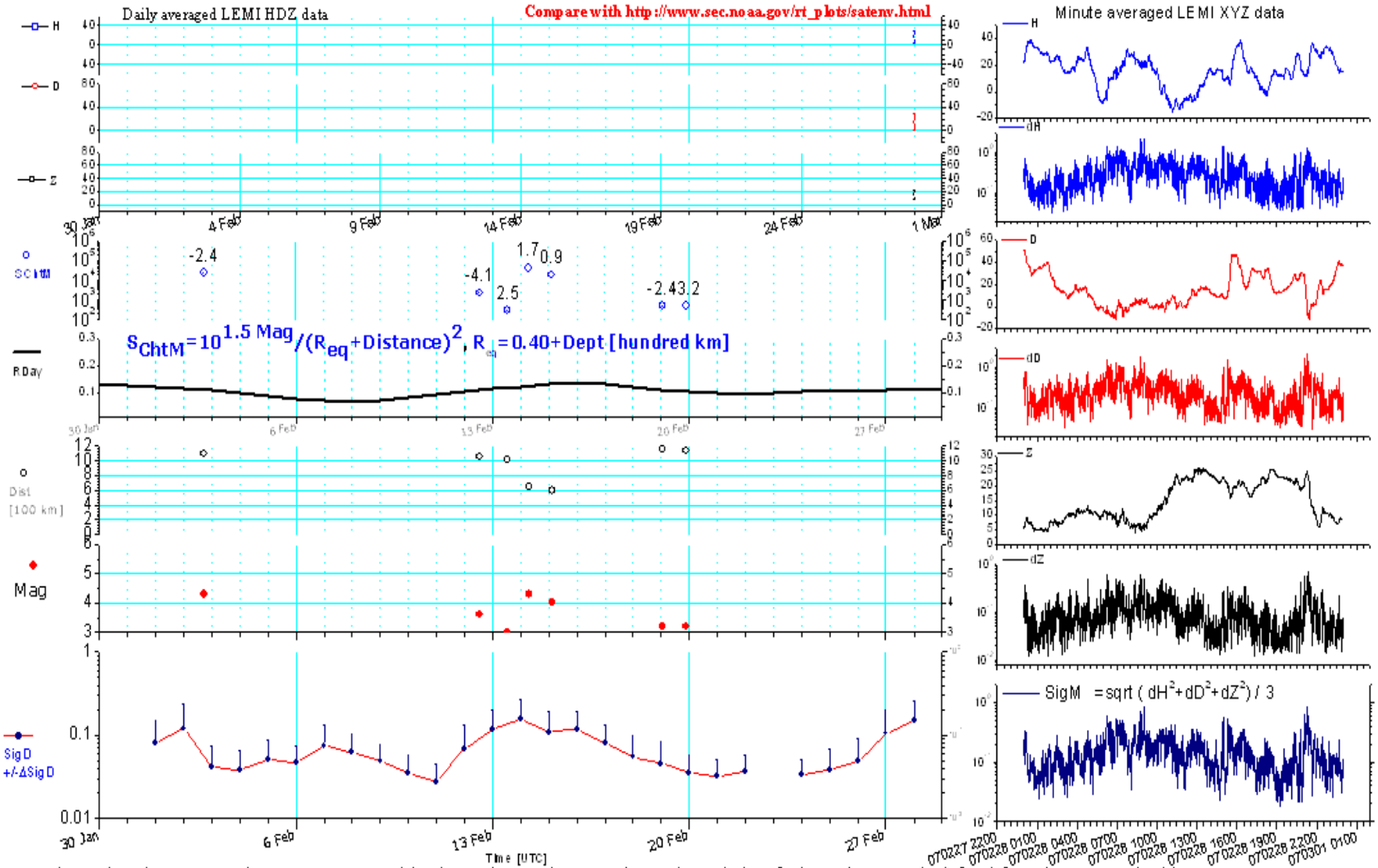


The earthquake precursor (geomagnetic quake) is jump of Sig biger then 10%. The approximate time window for incoming event is defined from the next Tidal potential (Venedikov et al model): in minimum ± 1day and in maximum ± 2 days. EQ data from http://wwwneic.cr.usgs.gov/neis/bulletin/ and from GPhI,BAS,Sofia. Reliability time control http://www.emsc-csem.org/. SChtM>200, Mag>3, Distance< 800 km.

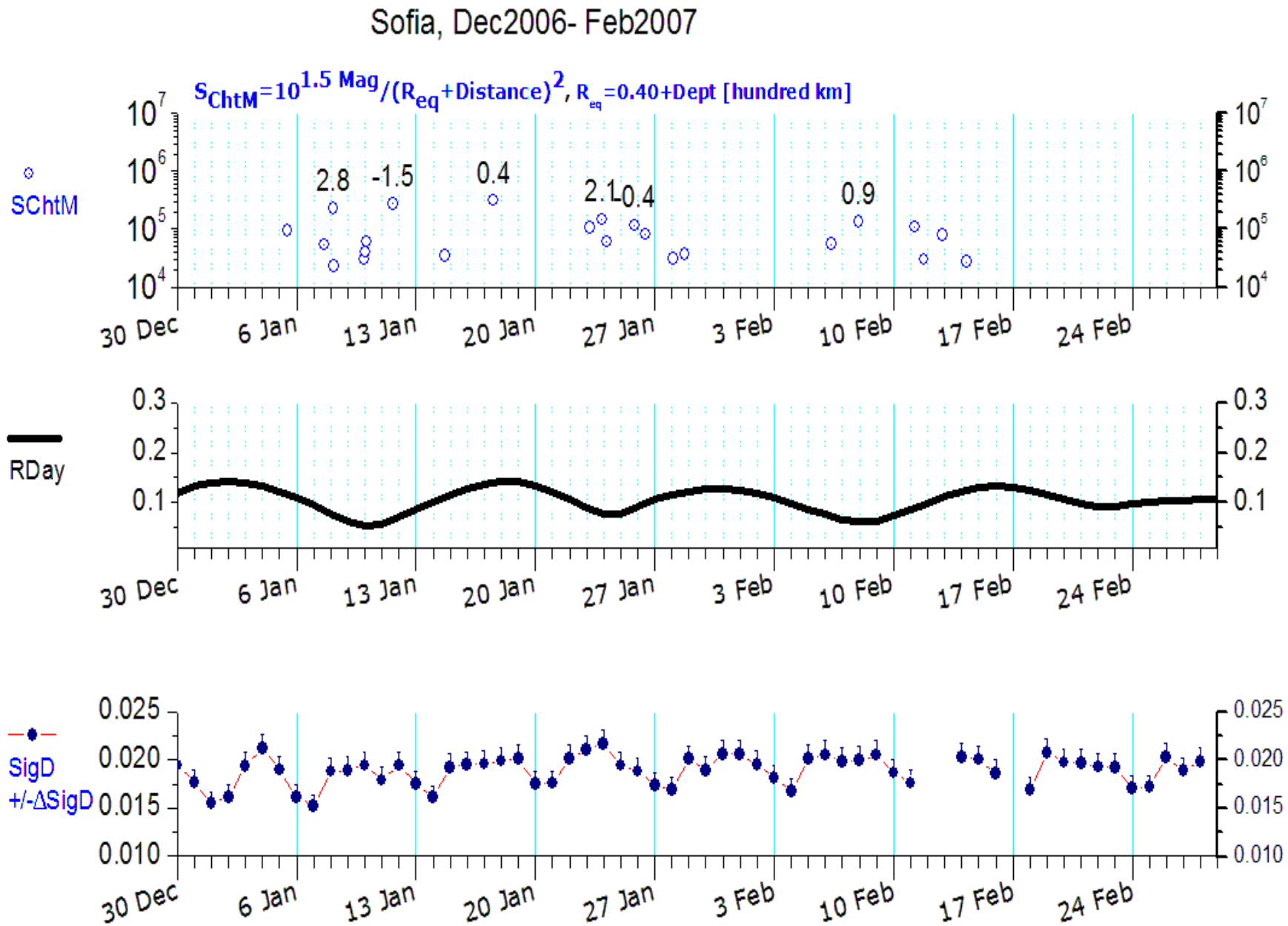


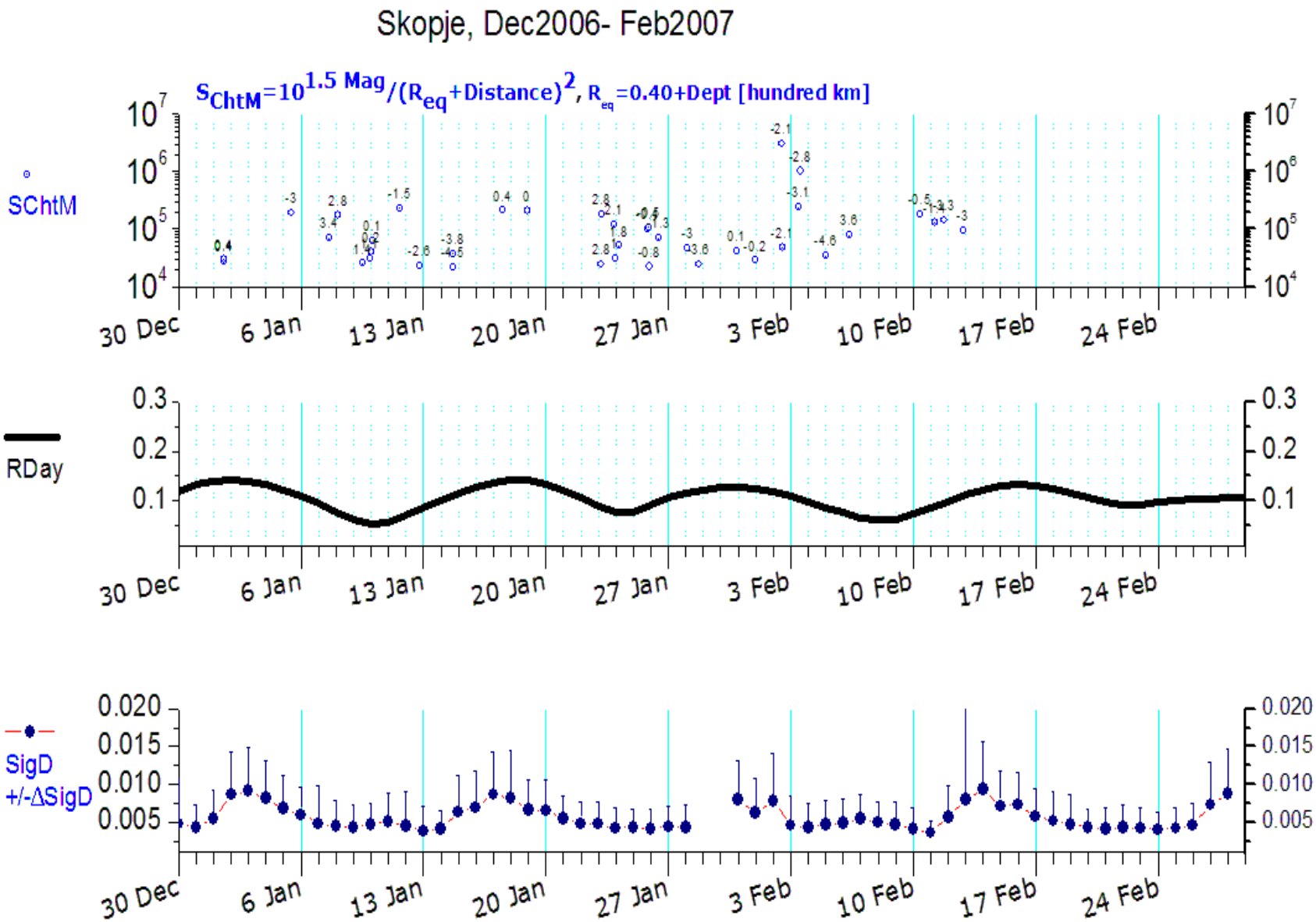
The earthquake precursor (geomagnetic quake) is jump of Sig biger then 10 %. The approximate time window for incoming event is defined from the next Tidal potential (Venedikov et al model): in minimum ± 1day and in maximum ± 2 days. EQ data from http://wwwneic.cr.usgs.gov/neis/bulletin/ and from GPhI,BAS,Sofia. Reliability time control http://www.emsc-csem.org/. SChtM>200, Mag>3, Distance< 800 km.

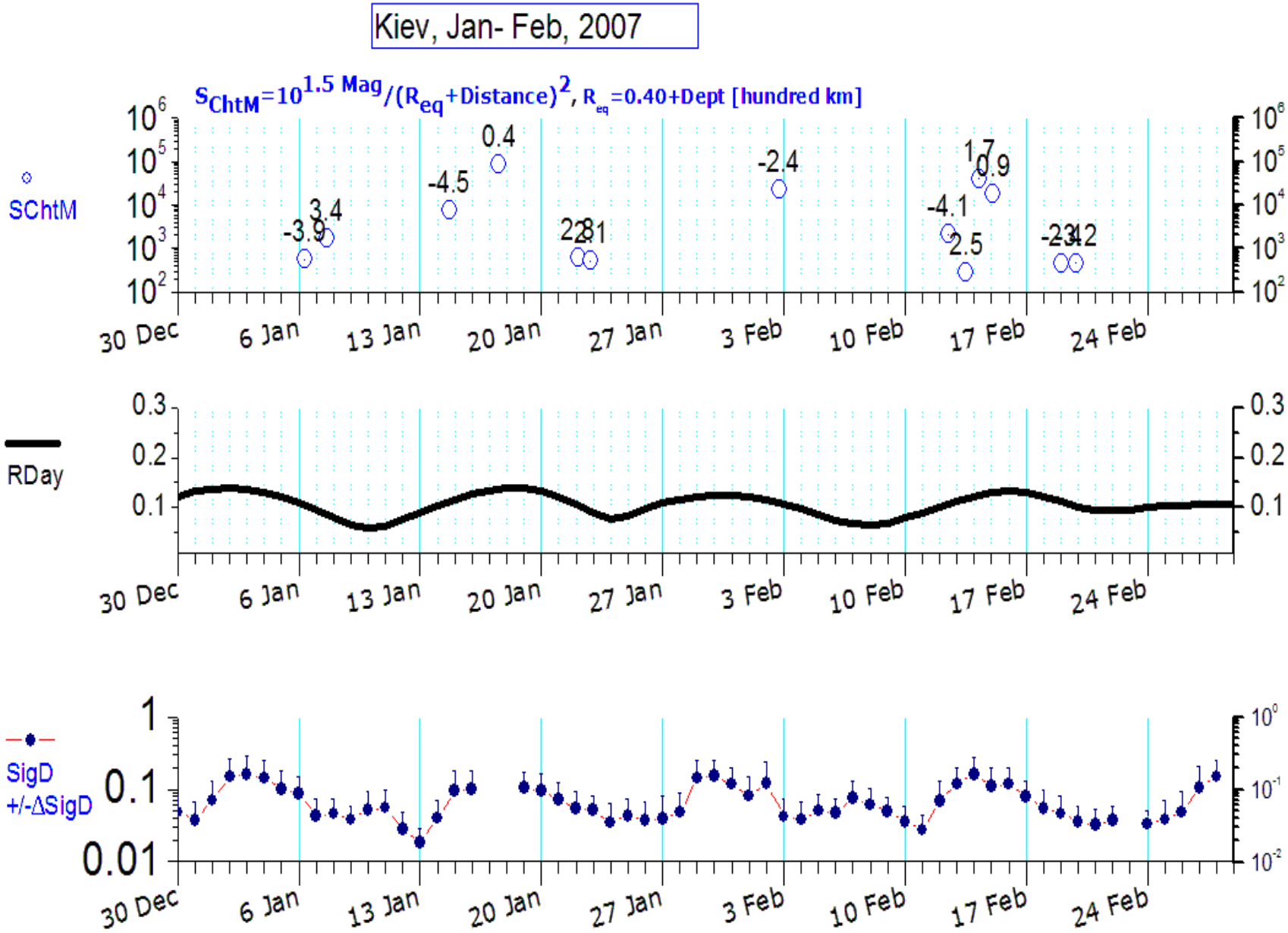
Kiev (JAGA-kod observatorii Kiev KIV) daily geomagnetic and earthquake monitoring 28 / 2 / 2007 Lat 50.70 N, Lon 30.30 E, VP, TM, SChtM



The earthquake precursor (***geomagnetic quake***) is Sig ?% jump. The approximate time window for incoming event is defined from the next Earth Tide extremum (Dennis Milbert source): in minimum ±1 day and in maximum ± 2 days. EQ data from **http://www.neic.cr.usgs.gov/neis/bulletin/**. Reliability time control **http://www.emsc-csem.org/**. S_{ChtM}>2e4, Mag>3, Distance< 800 km. The index of SChtM is the time difference between local Tide extremum and Eq time


Sofia, Dec2006- Feb2007
$S_{ChtM}=10^{1.5\ Mag}/(R_{eq}+Distance)^2$, $R_{eq}=0.40+Dept\ [hundred\ km]$
SChtM
2.8
-1.5
0.4
2.1
0.4
0.9
RDay
SigD
+/-ΔSigD
30 Dec
6 Jan
13 Jan
20 Jan
27 Jan
3 Feb
10 Feb
17 Feb
24 Feb


Skopje, Dec2006- Feb2007
$S_{ChtM}=10^{1.5\ Mag}/(R_{eq}+Distance)^2$, $R_{eq}=0.40+Dept\ [hundred\ km]$
SChtM
RDay
SigD
+/-ΔSigD
30 Dec
6 Jan
13 Jan
20 Jan
27 Jan
3 Feb
10 Feb
17 Feb
24 Feb


Kiev, Jan- Feb, 2007
$S_{ChtM}=10^{1.5\ Mag}/(R_{eq}+Distance)^2$, $R_{eq}=0.40+Dept\ [hundred\ km]$
SChtM
RDay
SigD
+/-ΔSigD
30 Dec
6 Jan
13 Jan
20 Jan
27 Jan
3 Feb
10 Feb
17 Feb
24 Feb

Conclusions

For Sofia and Skopje data the signal for geomagnetic quake if the 10% jump.

The new definitions of simultaneously condition for Kiev, Skopje and Sofia will be established after at least some months and will depend from geology, latitude and ”effective” distance from the nearest faults.

PrEqTimPlaMagInt collaboration

Thank you for attention!