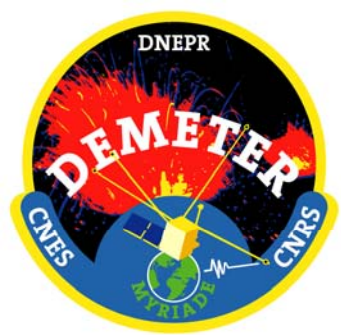# STATISTICS ON THE ELECTRON TEMPERATURE RECORDED BY THE SATELLITE DEMETER DURING SEISMIC ACTIVITY

Michel Parrot

LPCE/CNRS Orléans, France
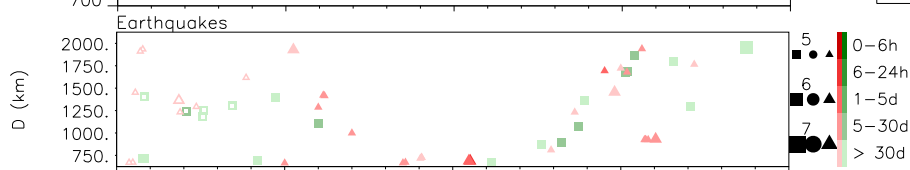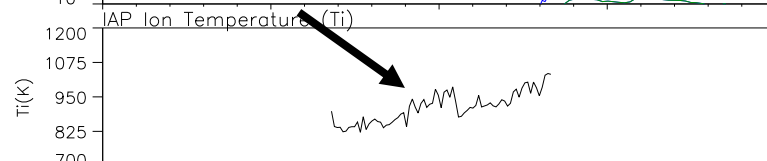
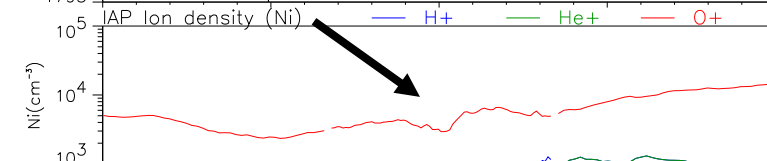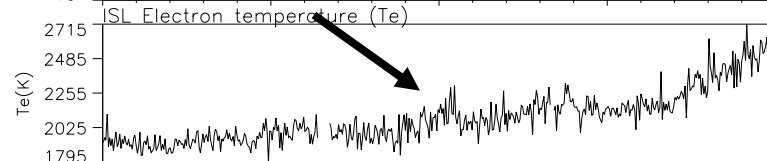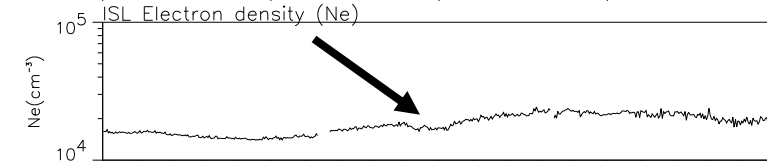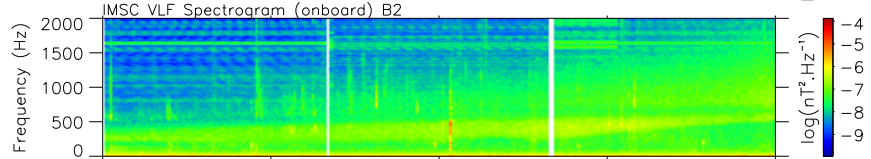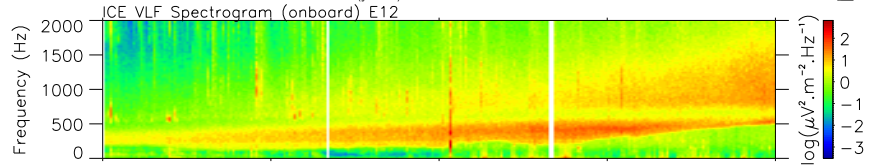# OUTLINE

- Particular events

- The statistical analysis

- Conclusions

DEMETER   Date (y/m/d): 2007/07/15   Orbit: 16202_1
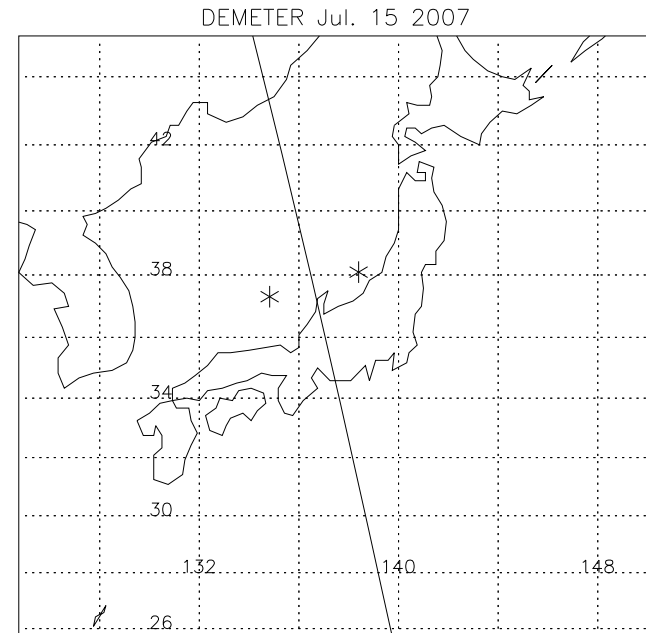
July 16, 2007
01:13:22 UT
37.57°N, 138.5°E
M = 6.6
d = 10 km

12 heures avant

EMSEV - DEMETER 2008

13 June 2008
23:43:46 UT
Lat 39.103°
Long 140.668°
d = 10 km
M = 6.8

2.5 days before

DEMETER June 11 2008

48.

44.

40.

36.

32.

132   140   148
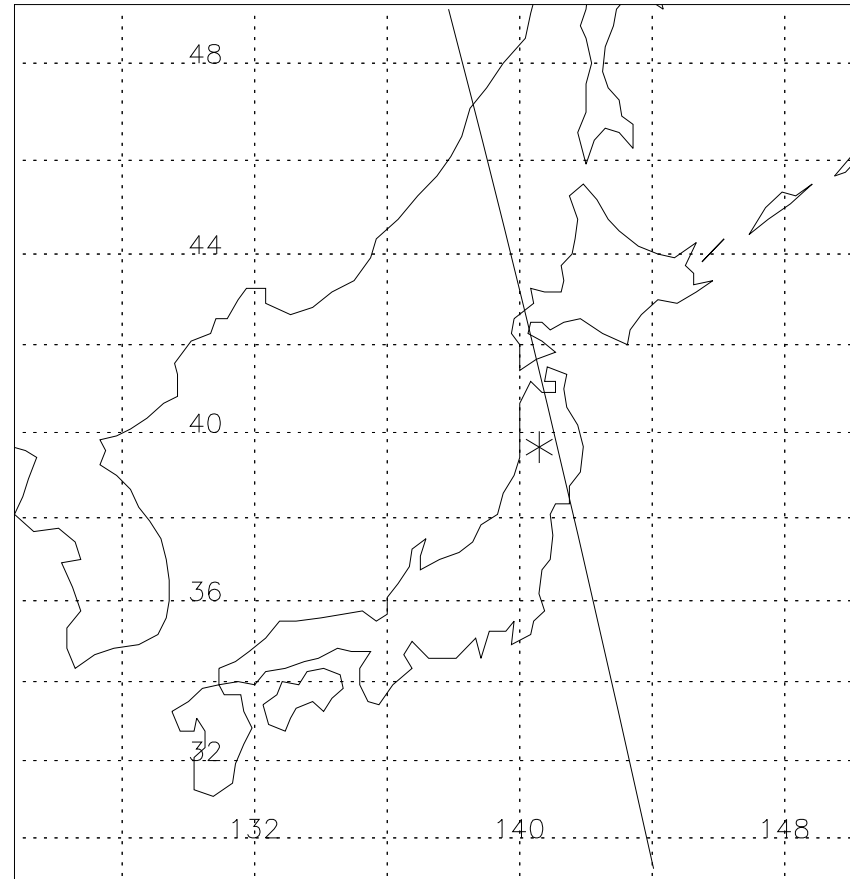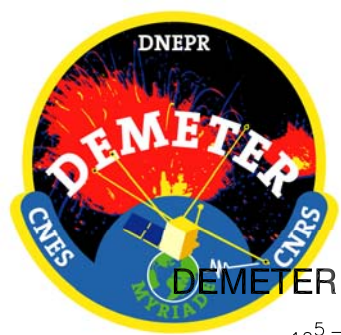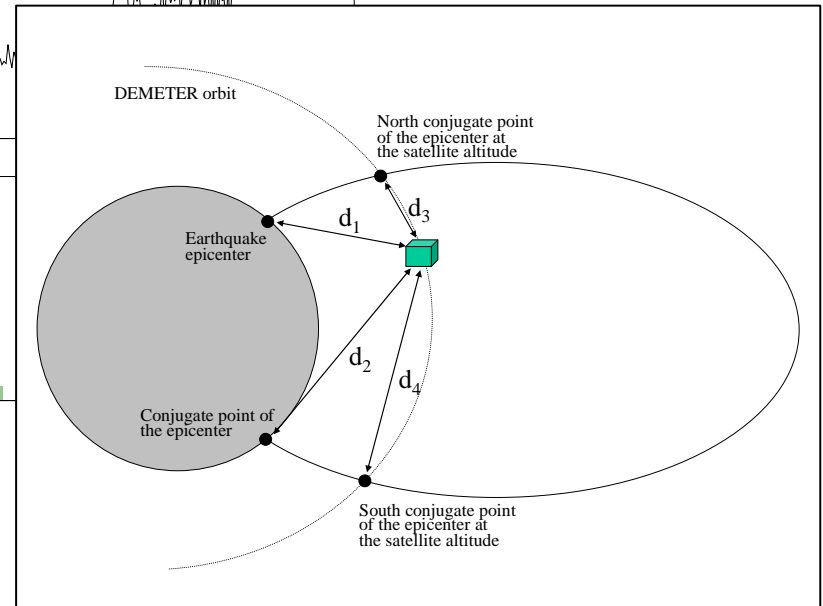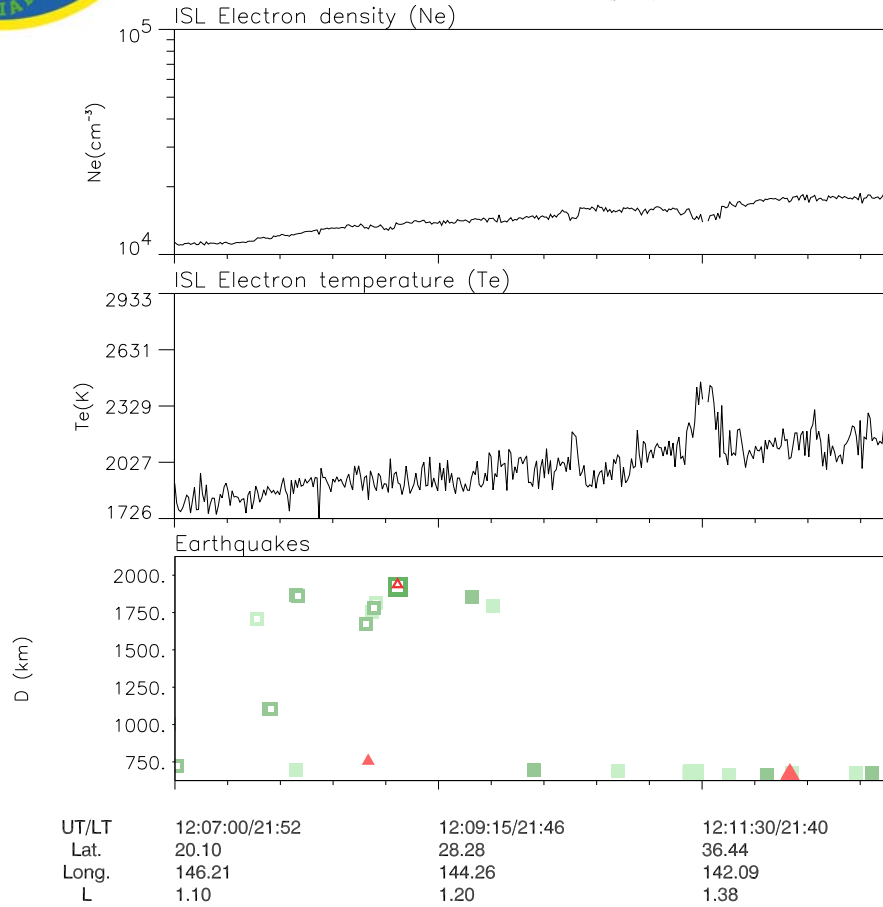
EMSEV - DEMETER 2008
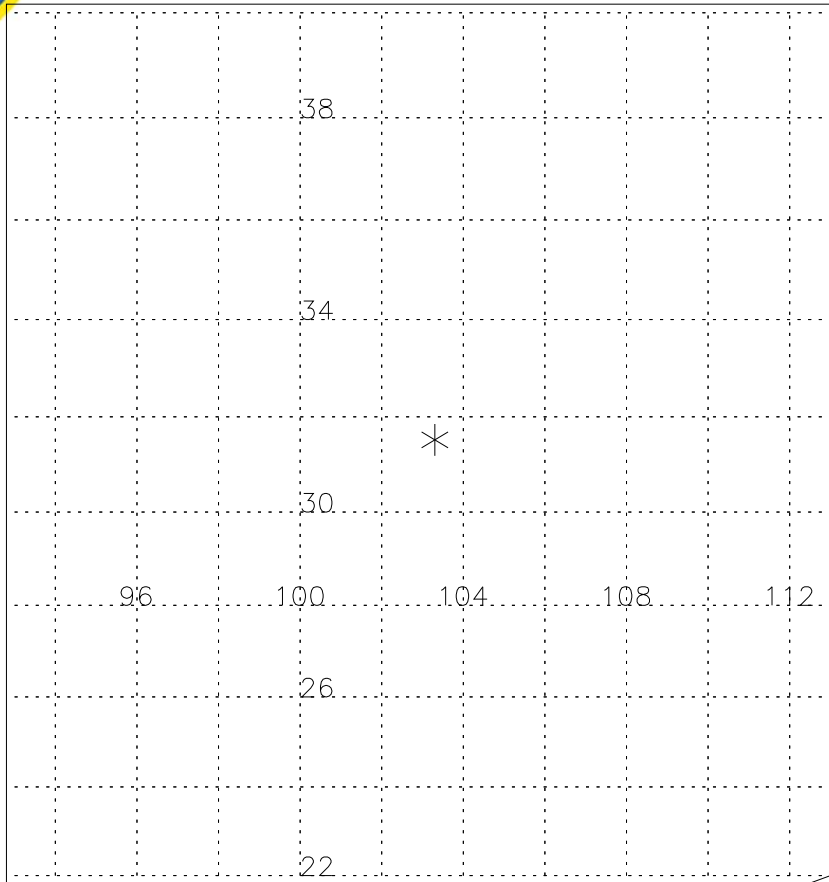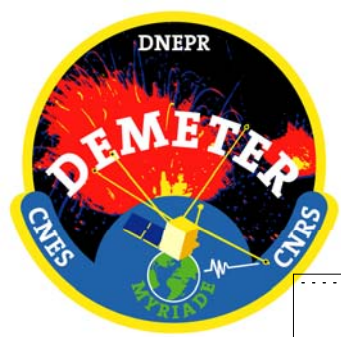
EMSEV - DEMETER 2008

Sichuan
12 mai 2008
06:28:00 UT
Lat 30.989°
Long 103.329°
d = 10 km
M = 7.9

EMSEV - DEMETER 2008

Geographical distribution of the day electron density
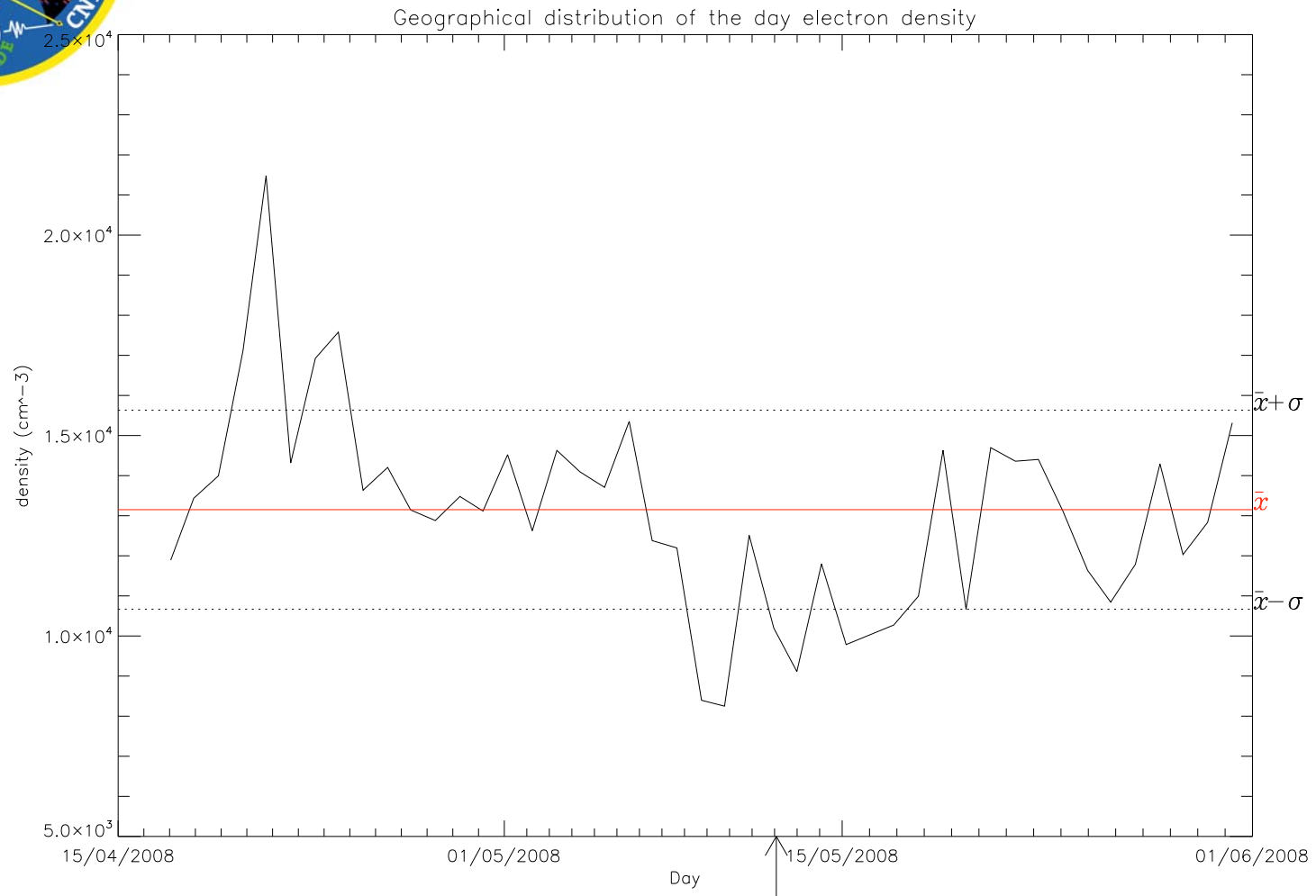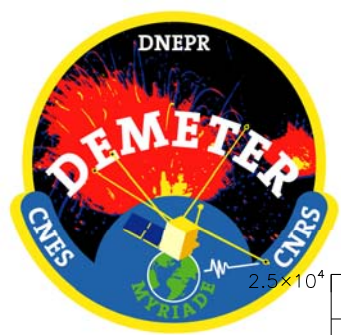
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Statistic with the electron temperature

EMSEV - DEMETER 2008

3 years of DEMETER data

Seismic data is organized by

- M > 4.8
- Land / under sea
- Aftershocks have been removed

Ionospheric data is organized by

- Magnetic local time
- Geographic positions
- Kp
- Months
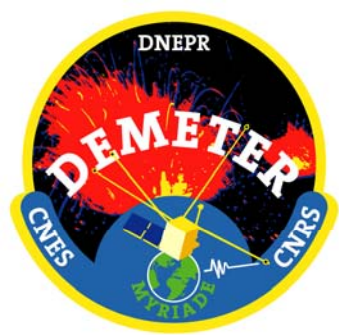
ISL Te – Electron temperature & seismic activity influence
Global map activity – Period: 11/2005 to 11/2005 (Daylight)
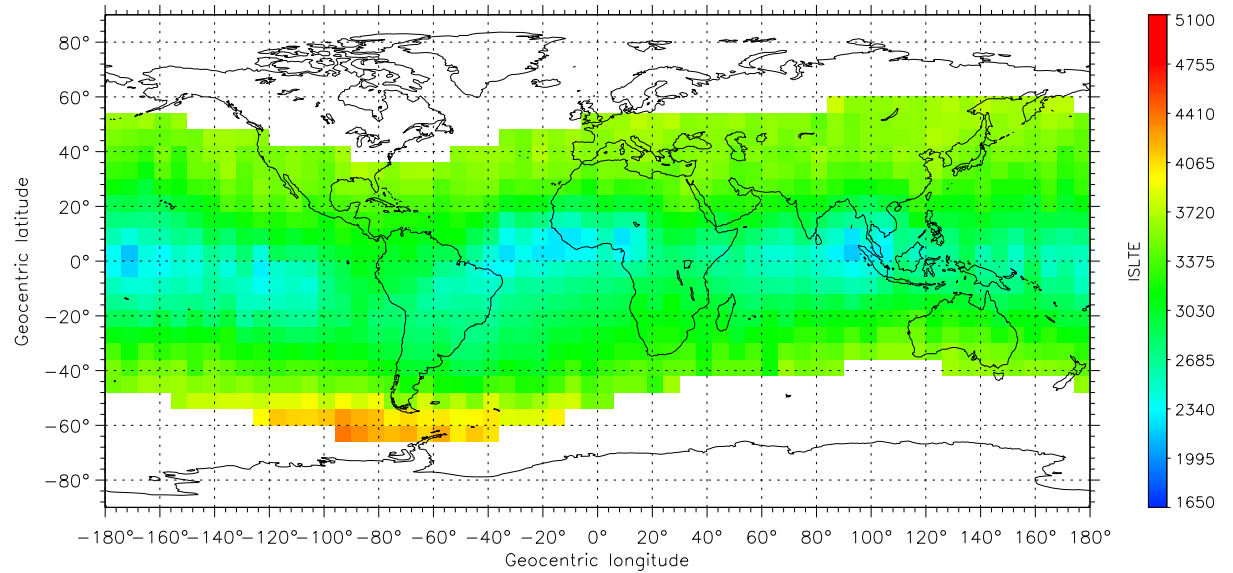
ISL Te – Electron temperature & seismic activity influence
Global map activity – Period: 07/2006 to 07/2006 (Daylight)

EMSEV DEMETER 2008

ISL Te − Electron temperature & seismic activity influence
Global map activity − Period: 11/2005 to 11/2005 (Night)
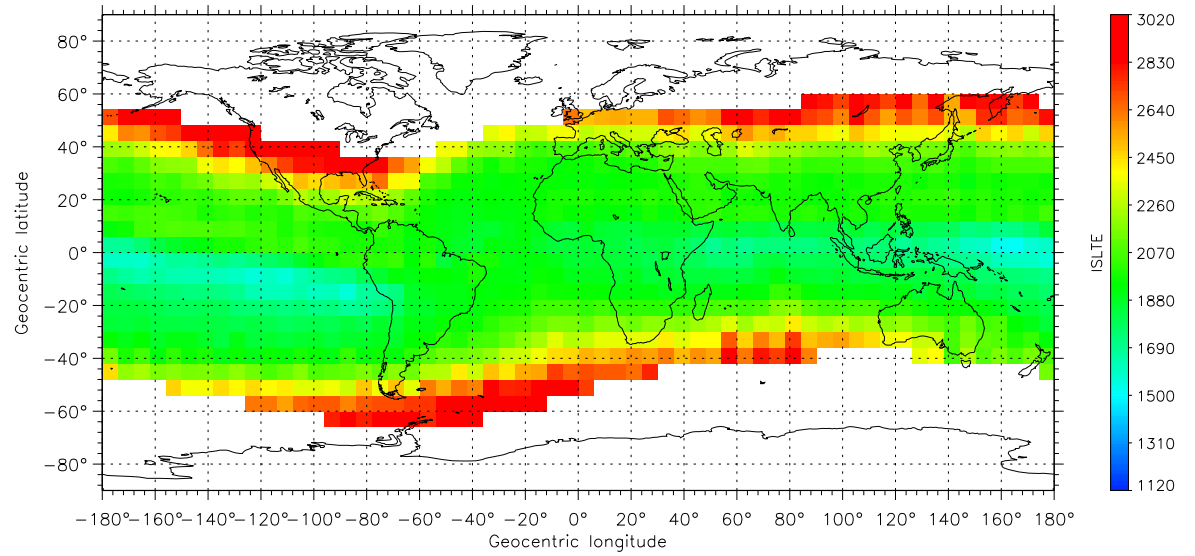
ISL Te − Electron temperature & seismic activity influence
Global map activity − Period: 07/2006 to 07/2006 (Night)
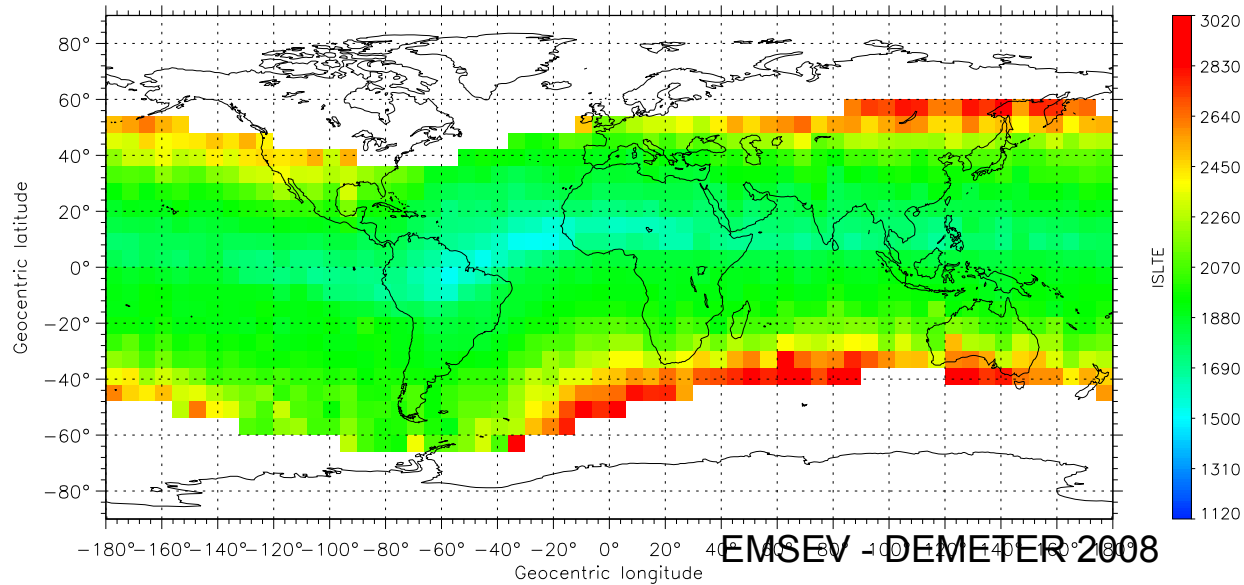
EMSEV - DEMETER 2008
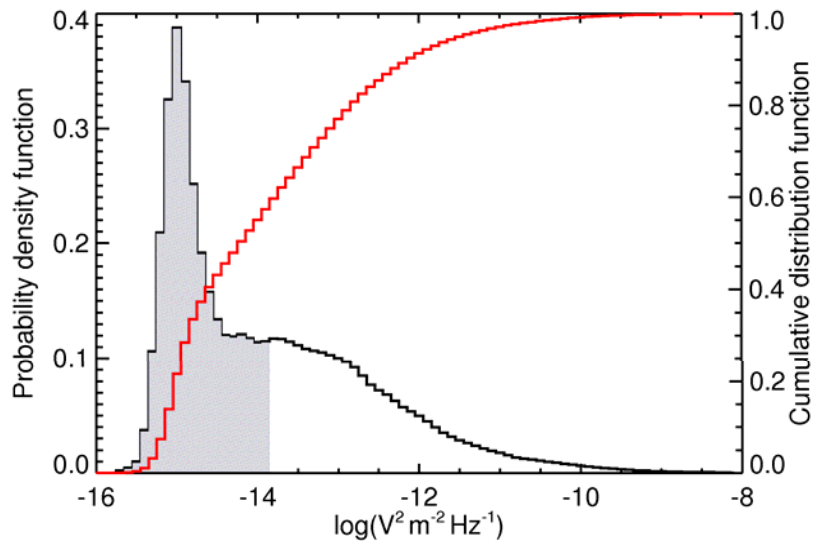
Probability density function
of the wave intensities
in a bin
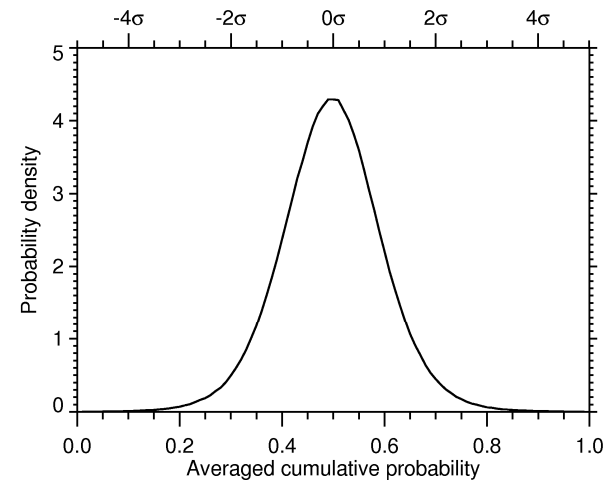
Application of the central limit theorem

EMSEV - DEMETER 2008

Superposed epoch method

Time of EQ
26 June 2007
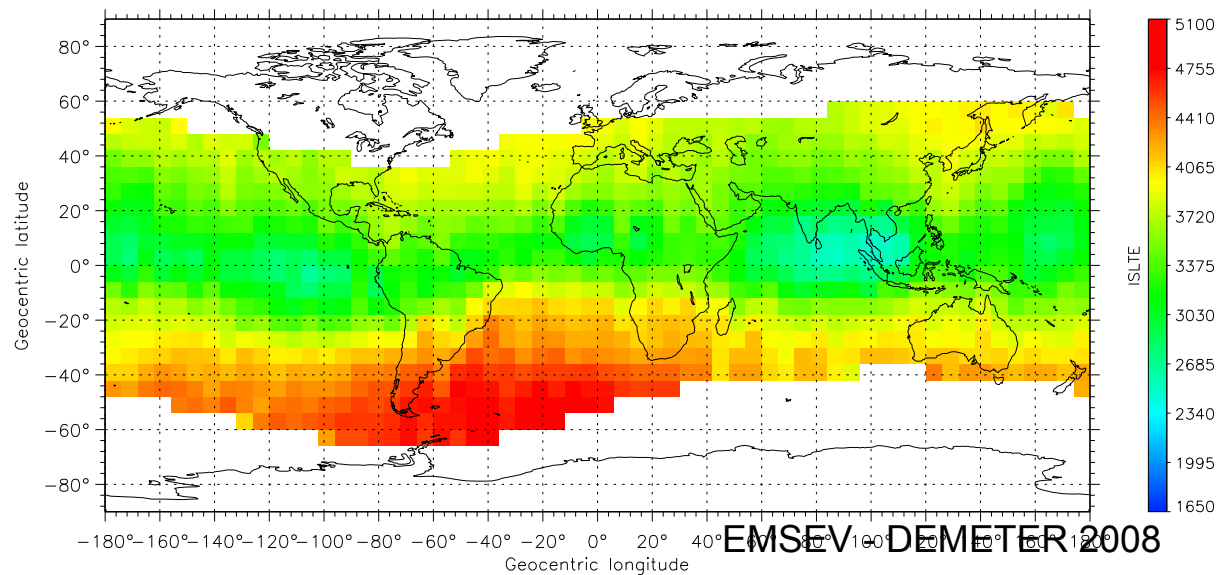00:30:00 UT

METHODE DES EPOQUES SUPERPOSEES

10 Hours before
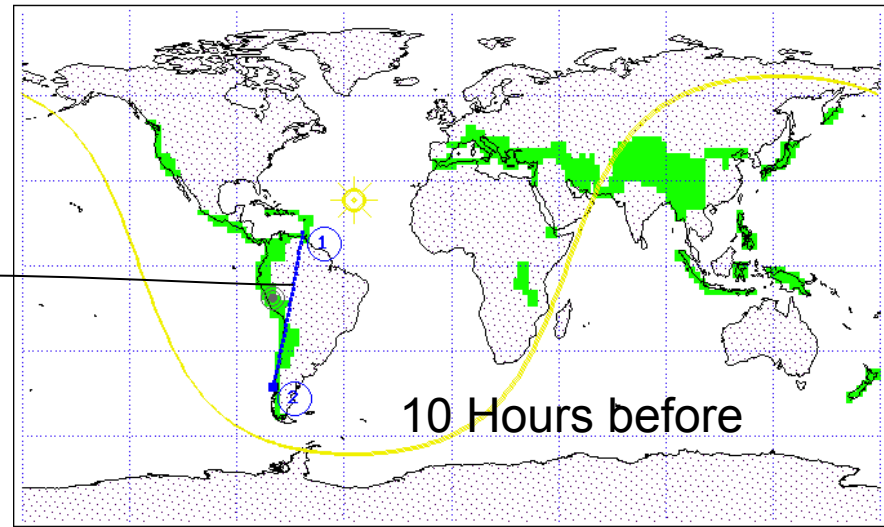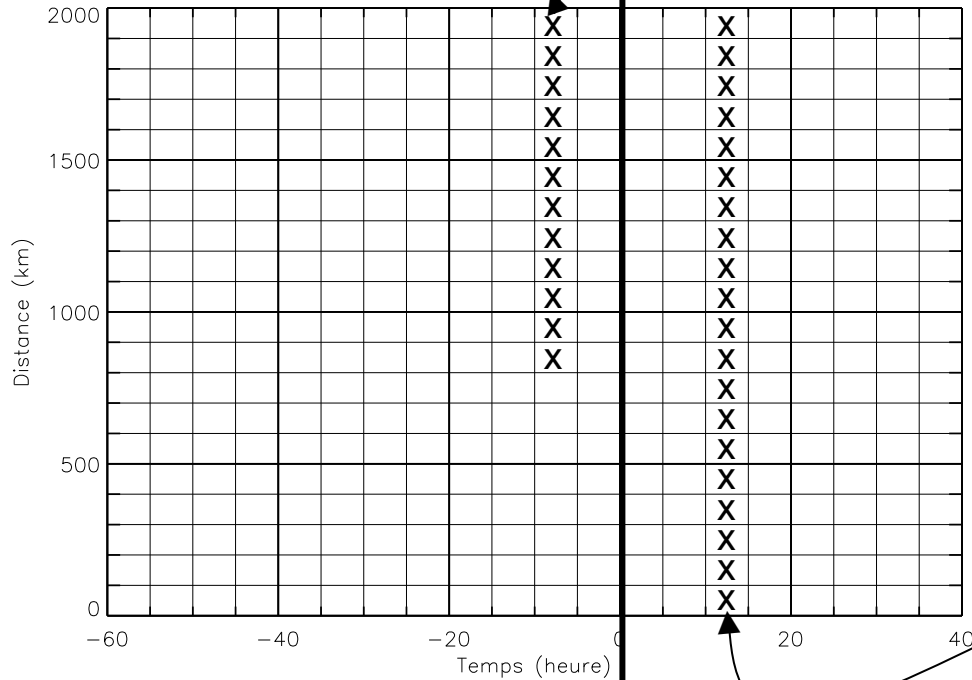
lat 23.4 lon 319.3

① 2007-06-25 14:30:00.000
② 2007-06-25 14:45:00.000

14 Hours 30 after
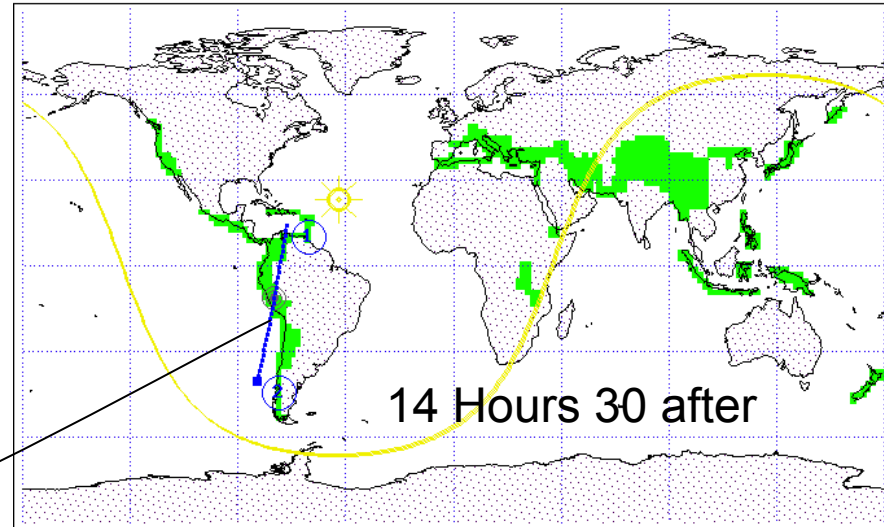
lat 23.4 lon 311.9

① 2007-06-26 15:00:00.000
② 2007-06-26 15:15:00.000

EMSEV - DEMETER 2008

ISL Te − Electron temperature & seismic activity influence
− Seismic activity influence − Real seisms__Night_200408_200708

All
land
EQs
with
M > 4.8
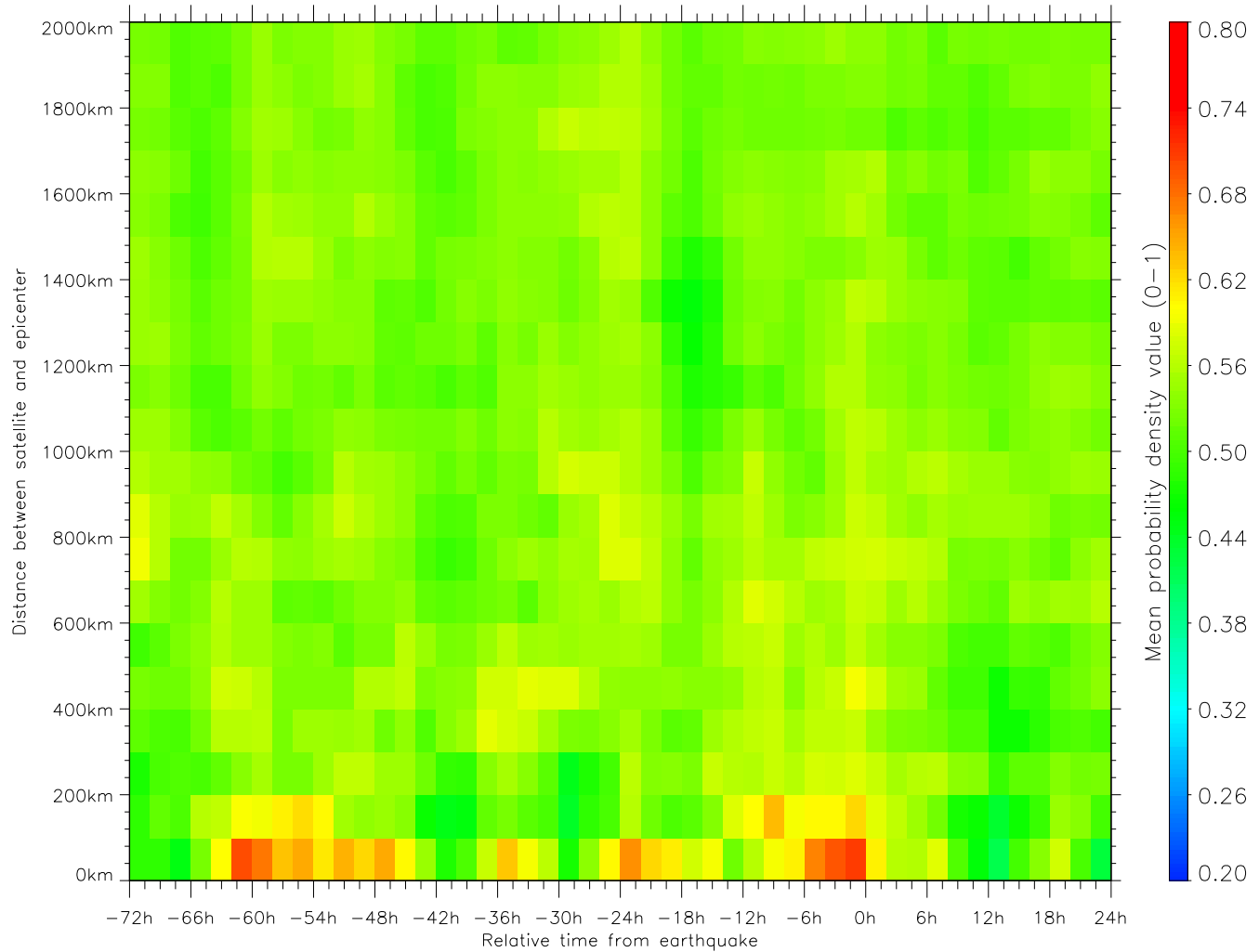
number of seisms: 1623

EMSEV - DEMETER 2008

All
land
EQs
with
M > 4.8

ISL Te − Electron temperature & seismic activity influence
− Seismic activity influence − Real seisms__Night_200408_200708

number of seisms: 1623
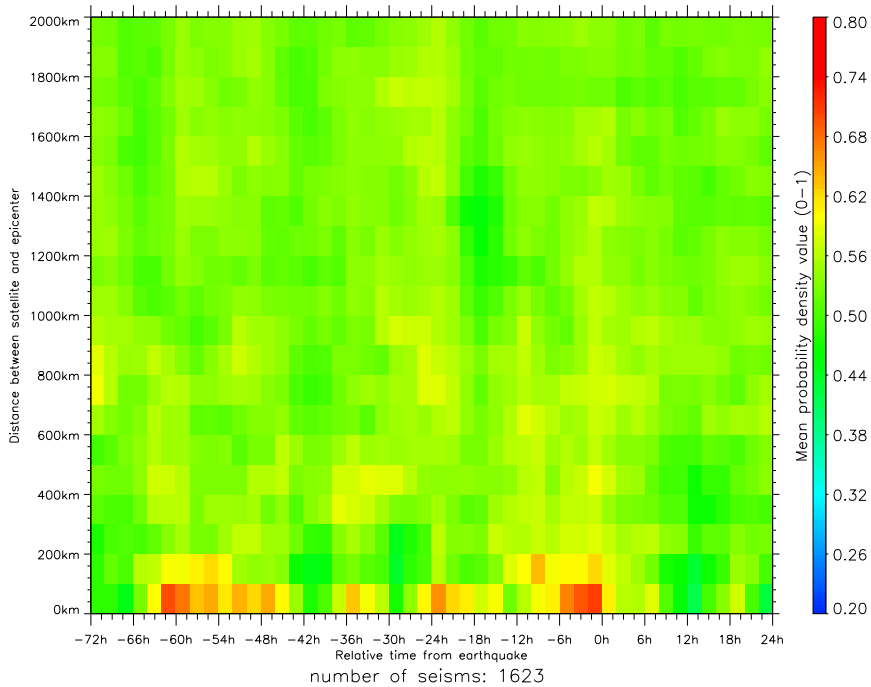
All
EQs
with
M > 4.8

ISL Te − Electron temperature & seismic activity influence
− Seismic activity influence − Real seisms__Night_200408_200708

number of seisms: 4552
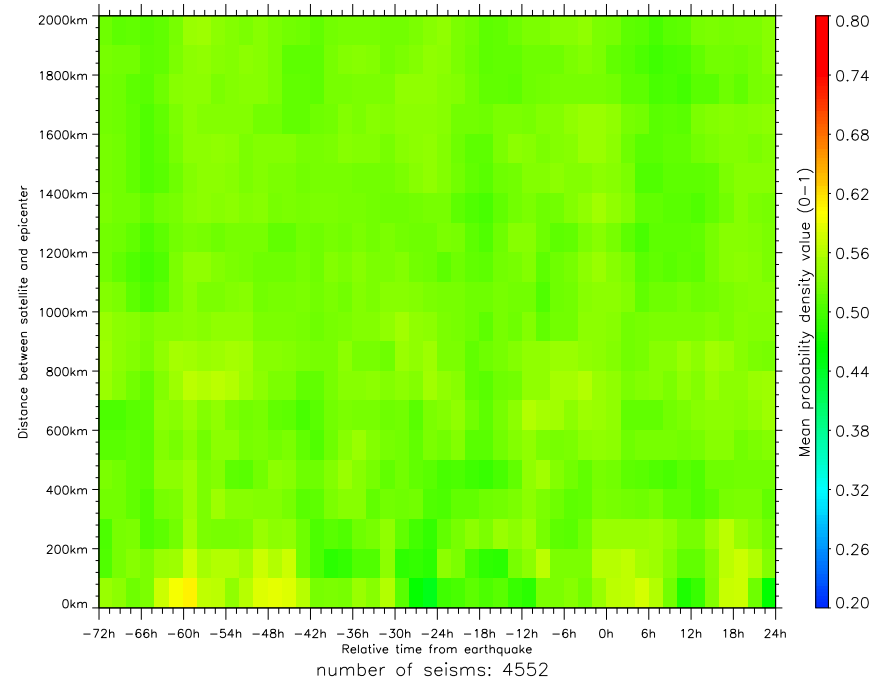
EMSEV - DEMETER 2008

All
land
EQs
with
M > 4.8

random

ISL Te − Electron temperature & seismic activity influence
− Seismic activity influence − Real seisms__Night_200408_200708
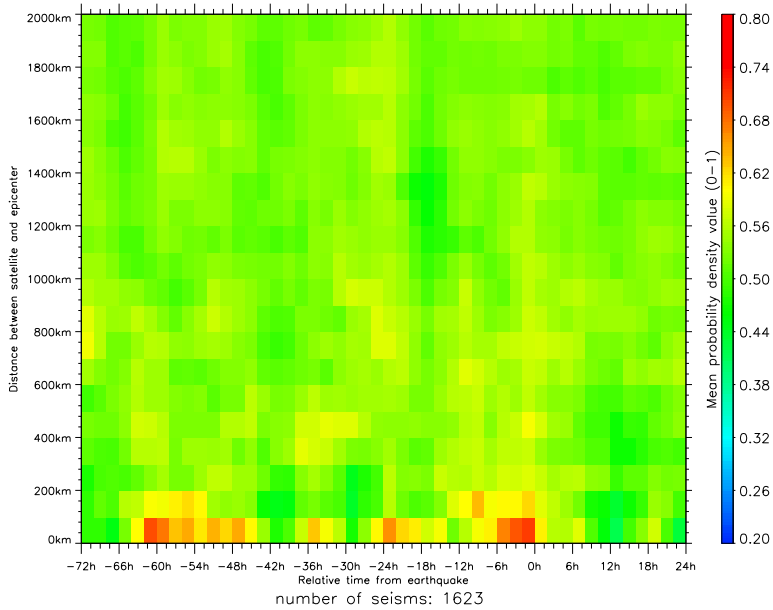
ISL Te − Electron temperature & seismic activity influence
− Seismic activity influence − Random seisms__Night_200408_200708
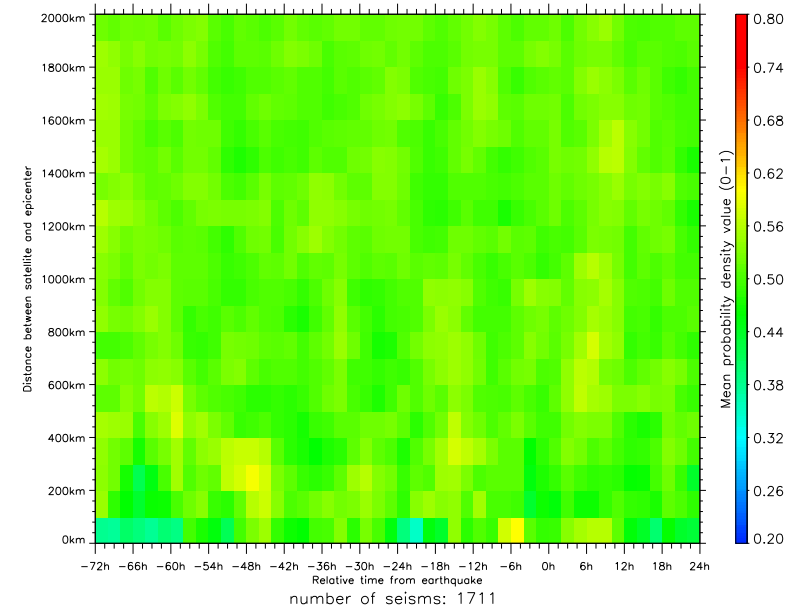
number of seisms: 1623

number of seisms: 1711

EMSEV - DEMETER 2008

ISL Te − Electron temperature & seismic activity influence

− Seismic activity influence − Real seisms__Night_200408_200708

- 5 days

number of seisms: 1744

EMSEV - DEMETER 2008
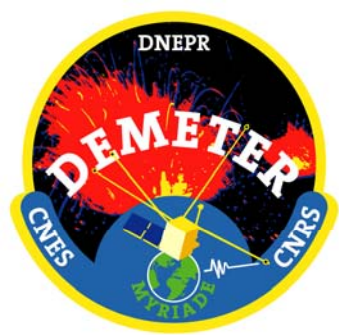
IAP Ti – Ion Temperature & seismic activity influence
– Seismic activity influence – Real seisms__Night_200408_200708

All land EQs with M > 4.8

number of seisms: 1620

EMSEV - DEMETER 2008
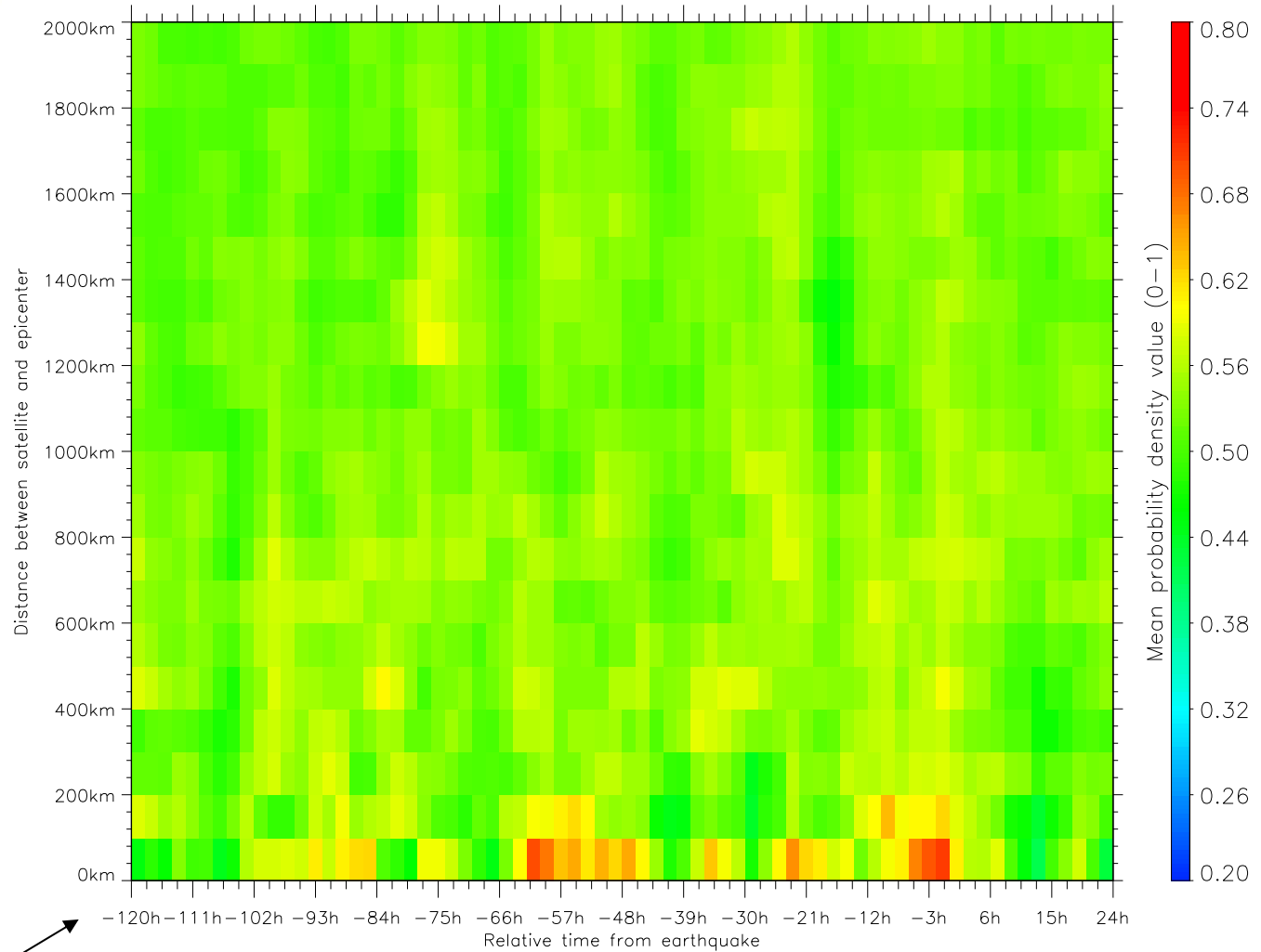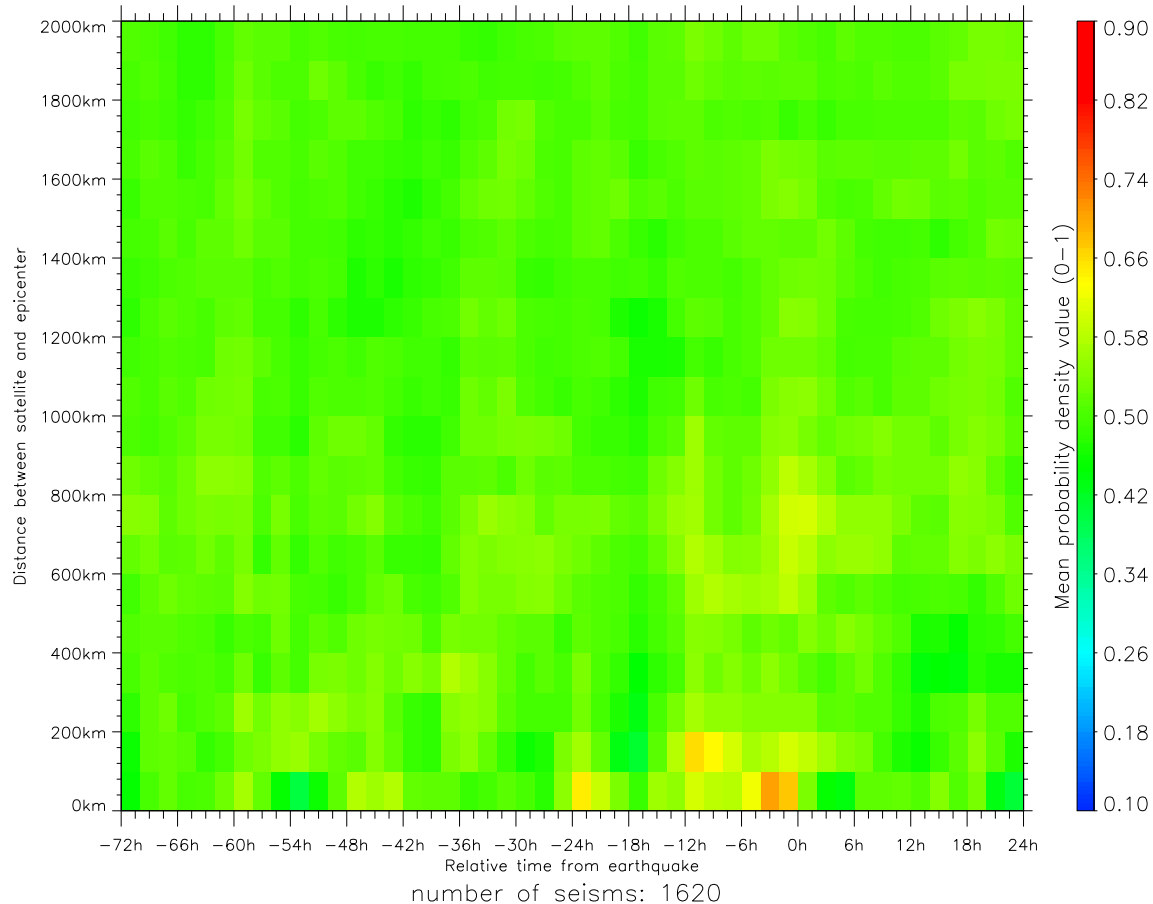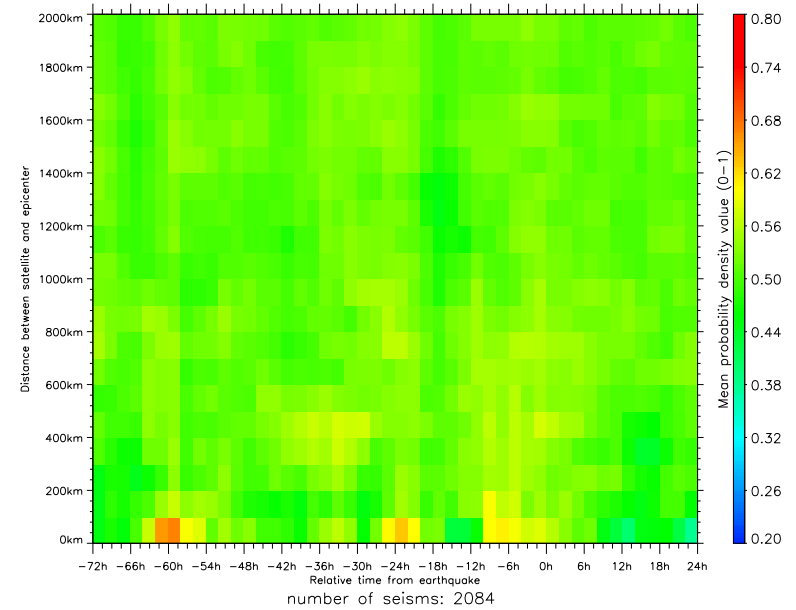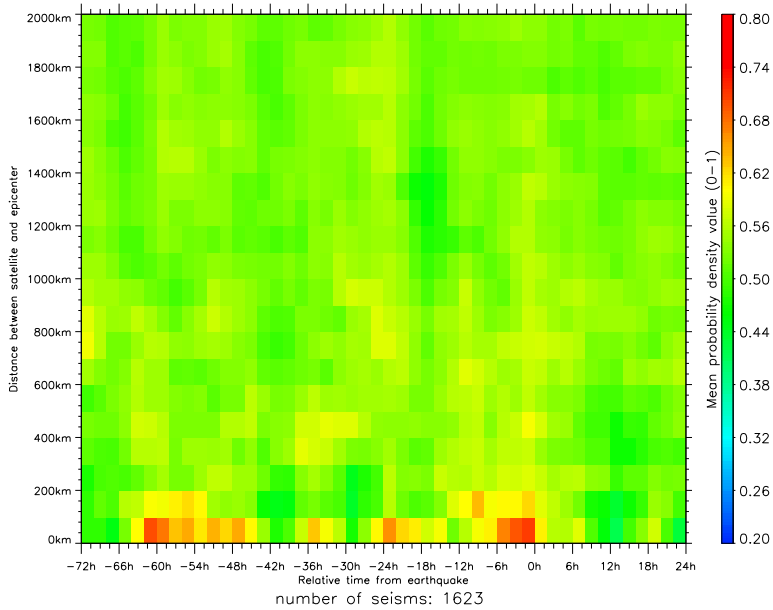
All
land
EQs
with
M > 4.8

36 months

46 months

EMSEV - DEMETER 2008
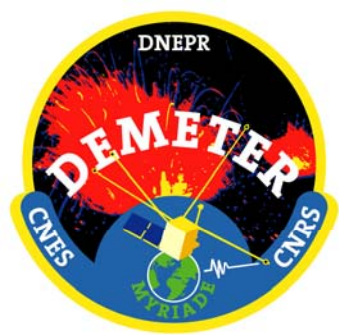
Conclusions (1/3)

The main points revealed by the statistical studies are:

-The values of the parameters when the satellite is far from the earthquakes are similar to the values obtained when a random data set of events is used. Therefore this study shows that there is an influence of the seismic activity on the electron temperature at an altitude of 700 km before the earthquakes.

-The perturbations are observed until 2.5 days before the earthquakes.

-The perturbations are real but they are weak and only statistically revealed. Up to now nothing can be said about the possibility to predict earthquakes with the analysis of the electron temperature.

- A weaker effect is seen for the ion temperature

Conclusions (2/3)

Statistical analysis are in progress with other parameters:

- Electromagnetic waves
- Whistler dispersion
- Energetic particles
- VLF Transmitters

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Conclusions (3/3)

Future work:
- Define the criteria which caracterize an anomaly
- Search of this anomaly in the whole data set
- Determine the rates of true detections, false alarms, and missing detections