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# **ANALYSIS OF MAGNETIC FIELD POLARIZATION PARAMETERS BEFORE AND AFTER KOYNA EARTHQUAKES**

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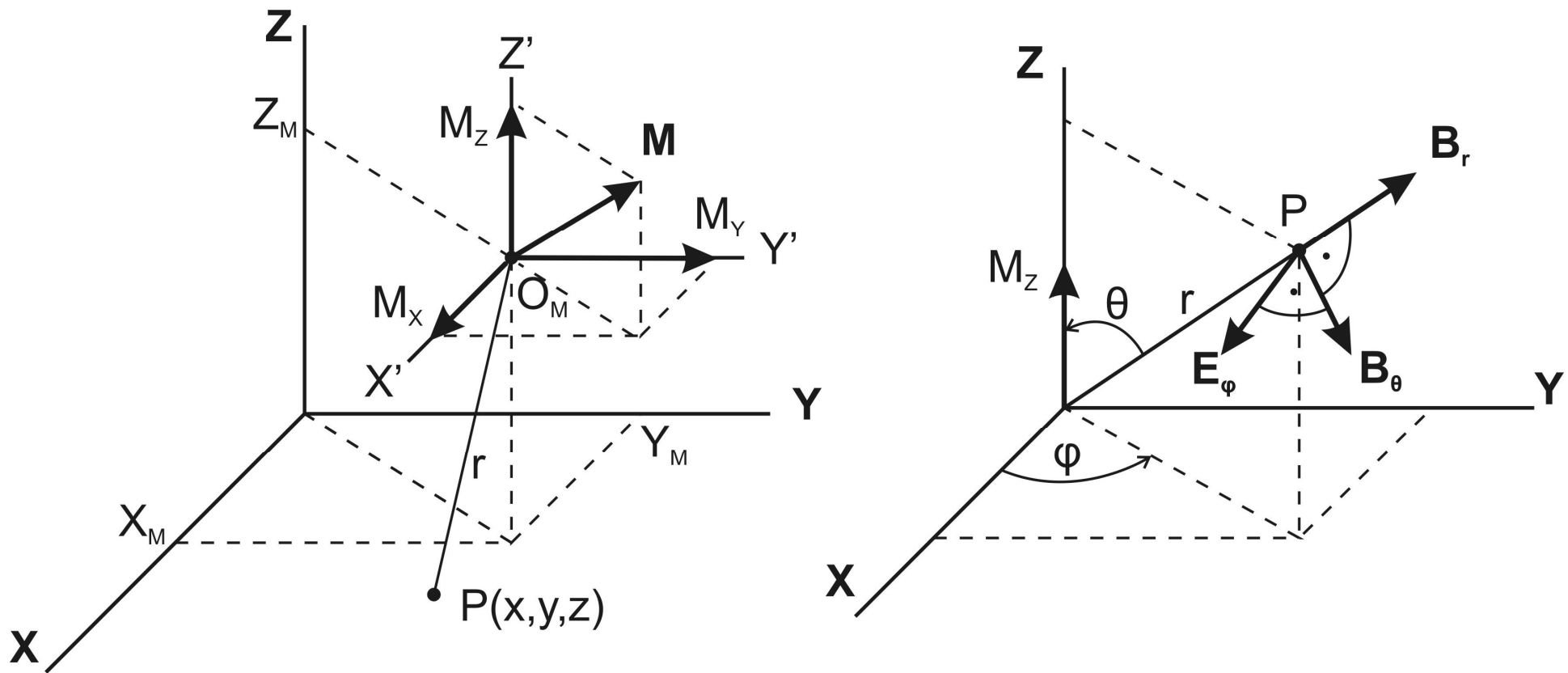
Measurement of natural magnetic field in ULF frequency band (0.001-10 Hz) is very perspective for study of the earthquake (EQ) precursors. One of magnetic field generalized representation is polarization ellipse (PE), which allows the simplifying of localization task for EQ electromagnetic (EM) precursor source.

For looking for precursor candidates the data from 3-component magnetometers LEMI-30, located in measuring sites near Kolhapur and Koyna (both are in Maharashtra, India) were taken. These sites have low enough magnetic interference and placed in seismo-active region. LEMI-30 magnetometers have a very low noise and work in frequency range 0.001-32 Hz. During observation time 1 April, 2006 – 5 June, 2006 two clustered EQs occurred: 1) April, 17 at 16.39.58.87 (M=4.7, h=10 km, 17.07 N, 73.69 E); 2) May, 21 at 20.29.00.29 (M=3.7, h=10 km, 16.9 N, 73.61 E). The distance to both measuring sites from EQ epicentres was in the range 30-89 km.

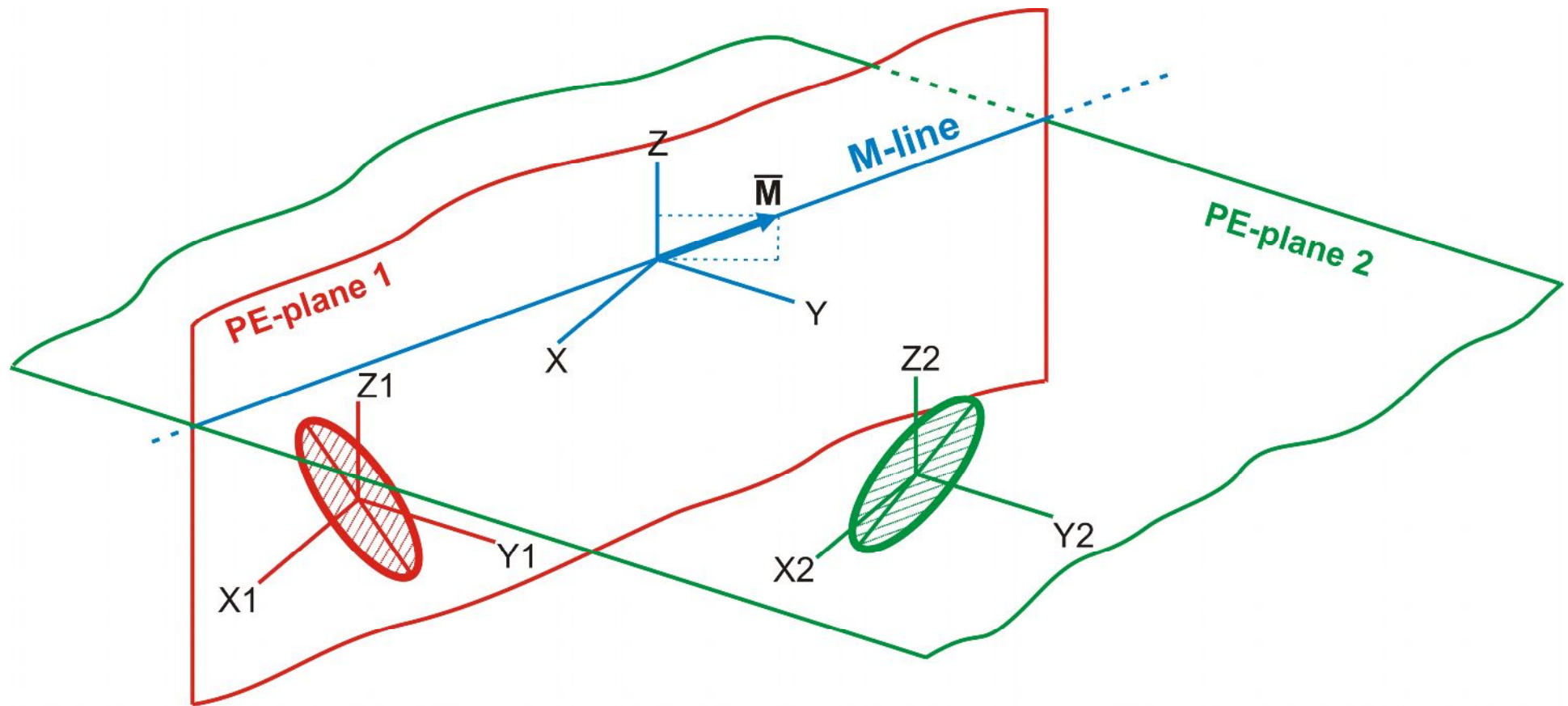
The wave form, dynamical Fourier spectra and polarization ellipse parameters of ULF magnetic field signals during period five days before and one day after EQ events have been analyzed. The results on looking for precursor candidates and analysis of signal peculiarities are given in the presentation.

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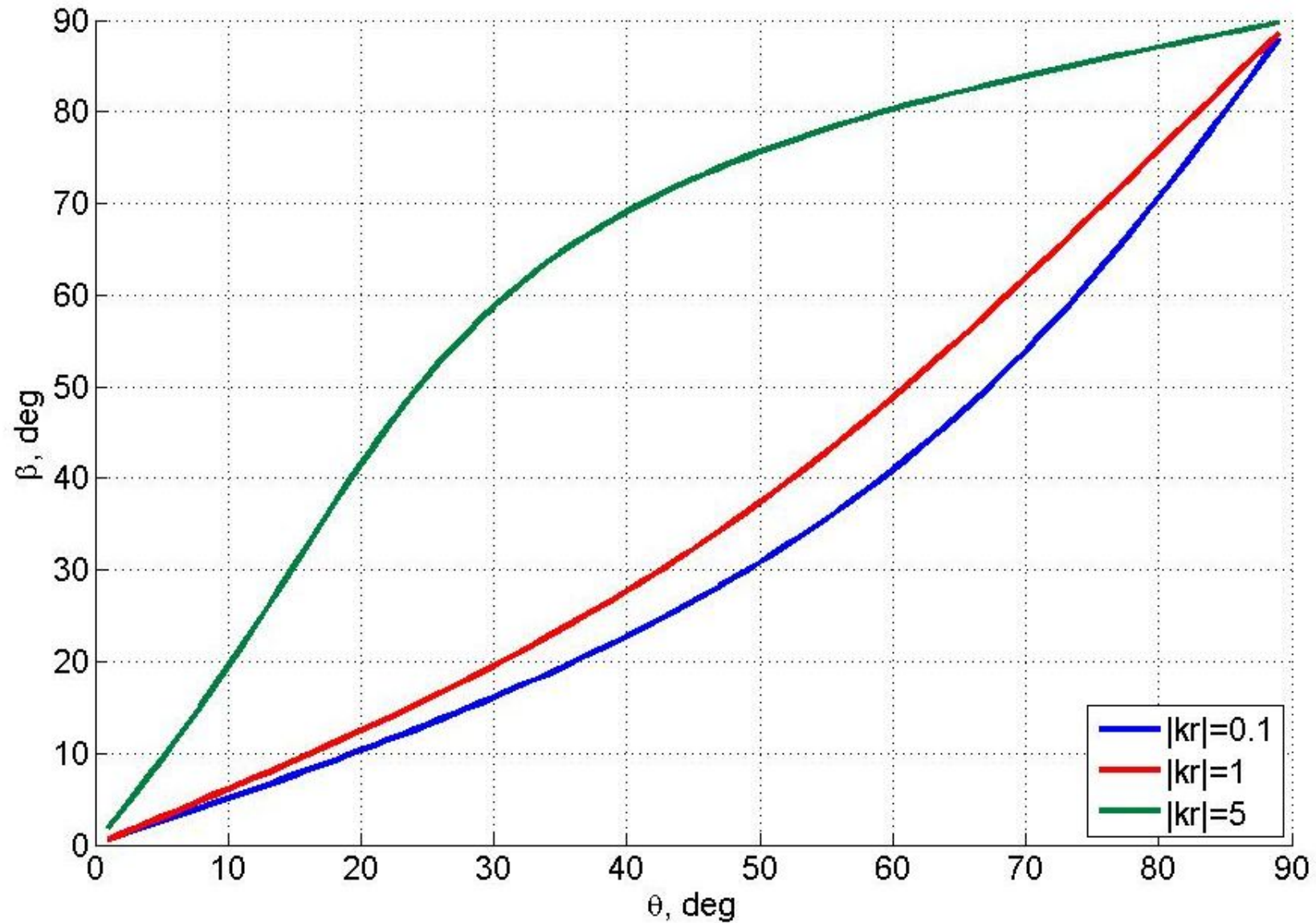
# Magnetic dipole source and components of EM field



# Formation of M-line at two PE-planes intersection

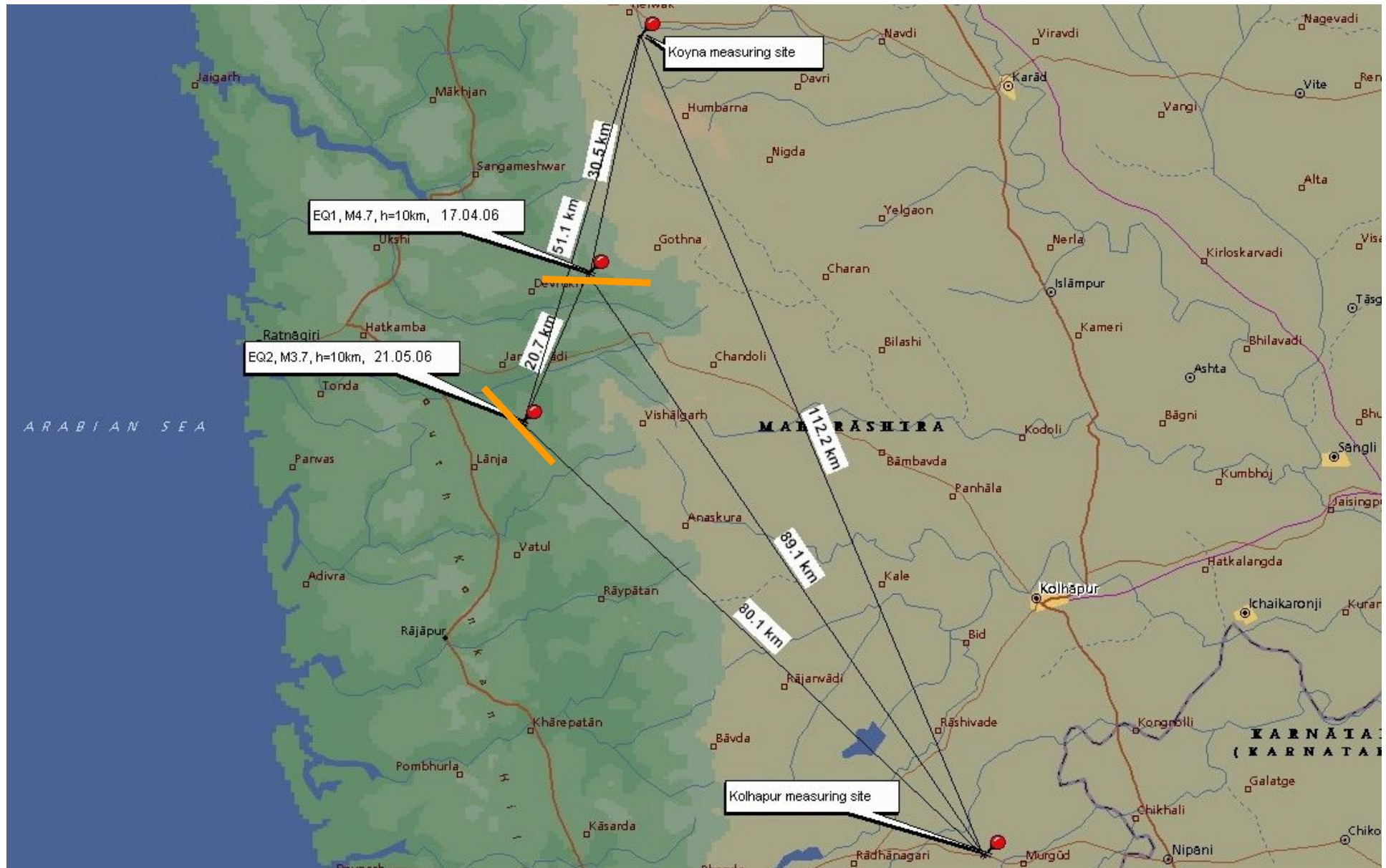


# PE major axis deviation from direction to M-source

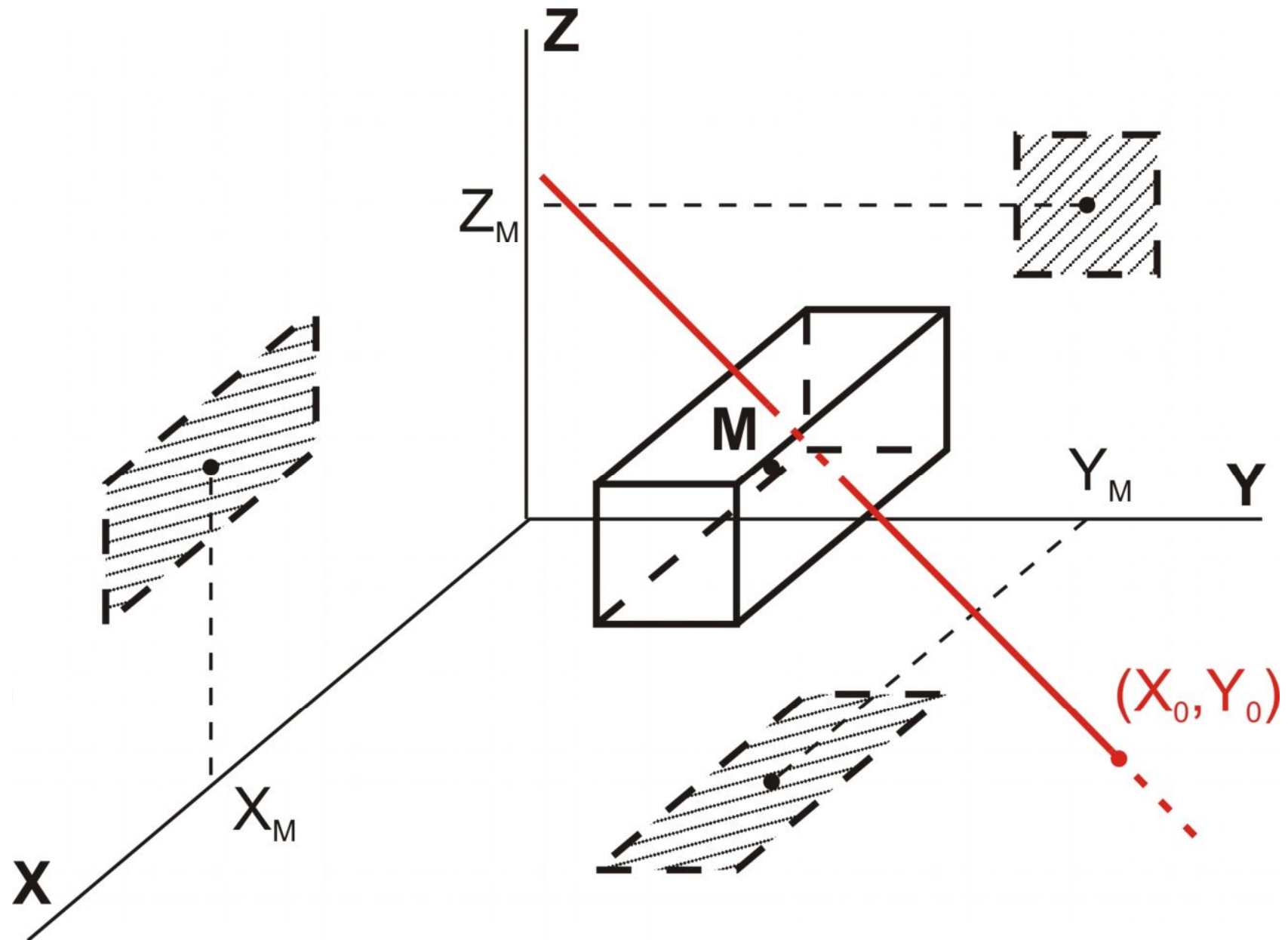




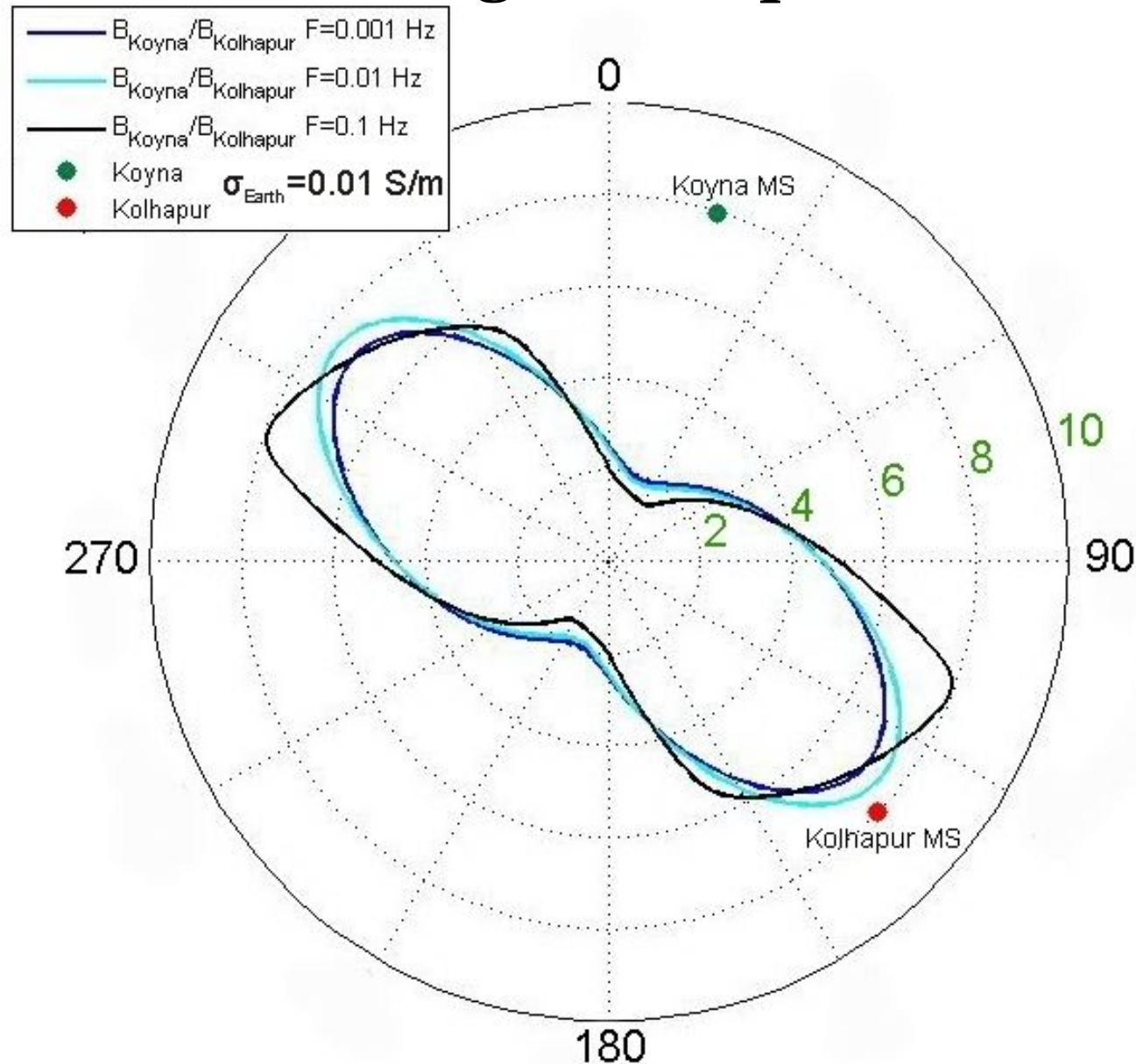
# EQ events in Koyna-Kolhapur region



# Configuration of M-area



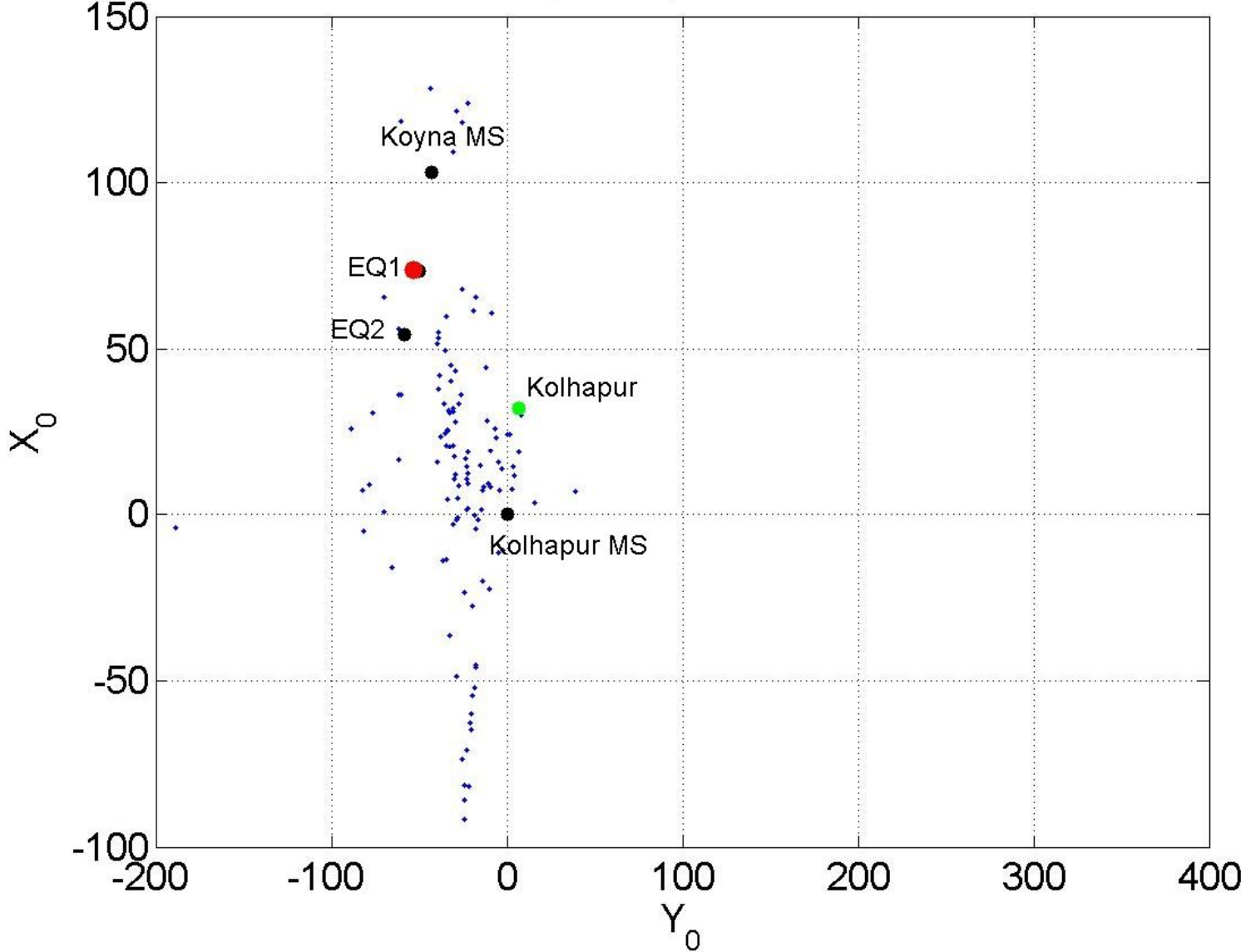
# Koyna/Kolhapur PE major axes ratio against direction of magnetic dipole moment



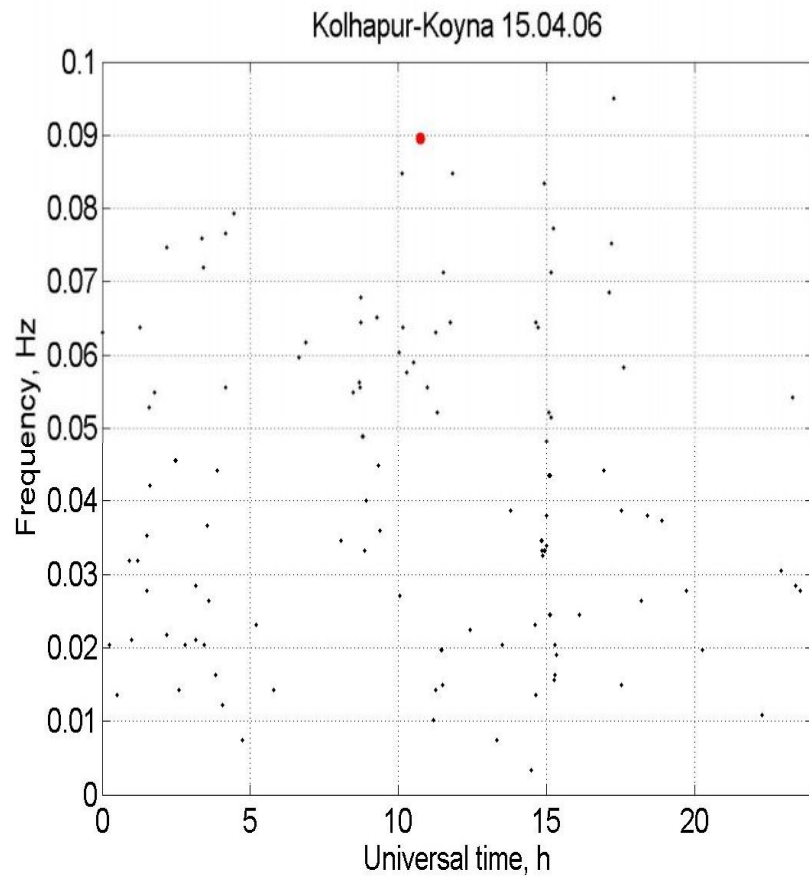


# Distribution of M-line intersection points on horizontal plane for 15 April 2006

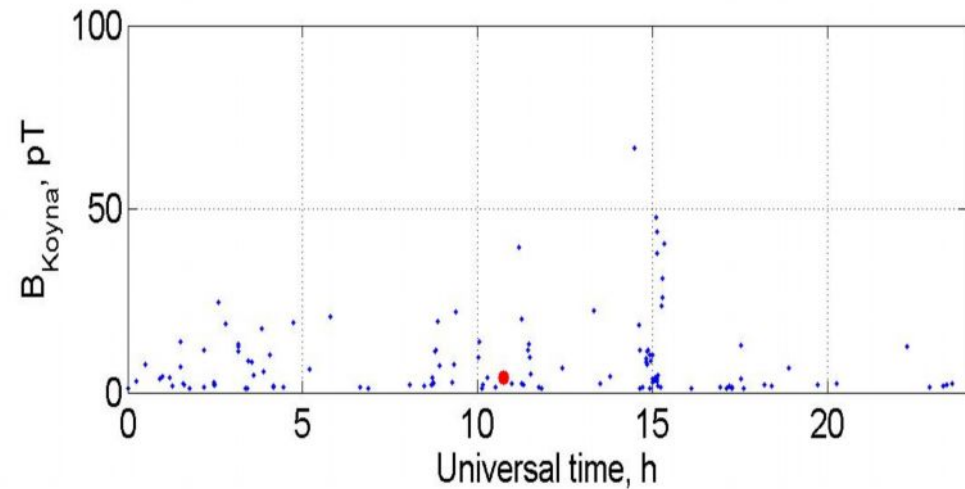
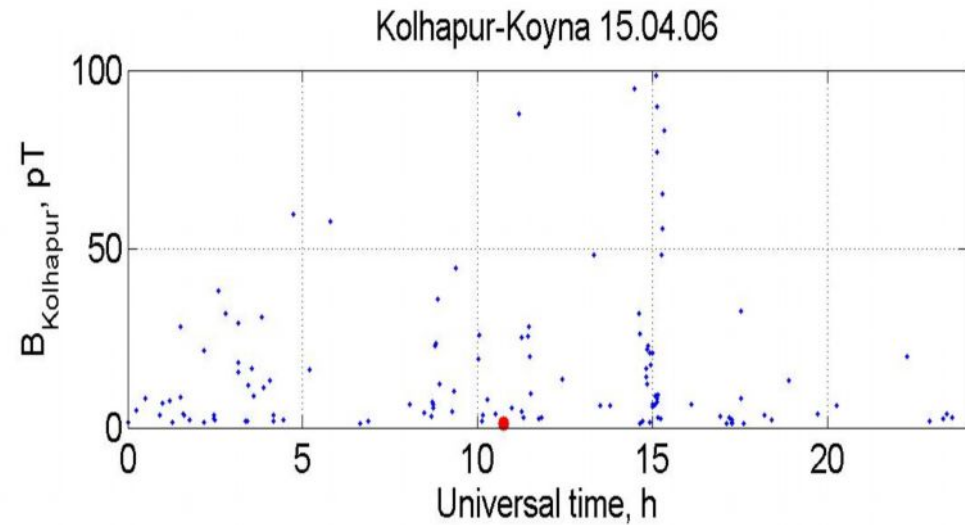
Kolhapur-Koyna 15.04.06



# Distribution of M-lines against time, frequency and magnetic field intensity for 15 April 2006

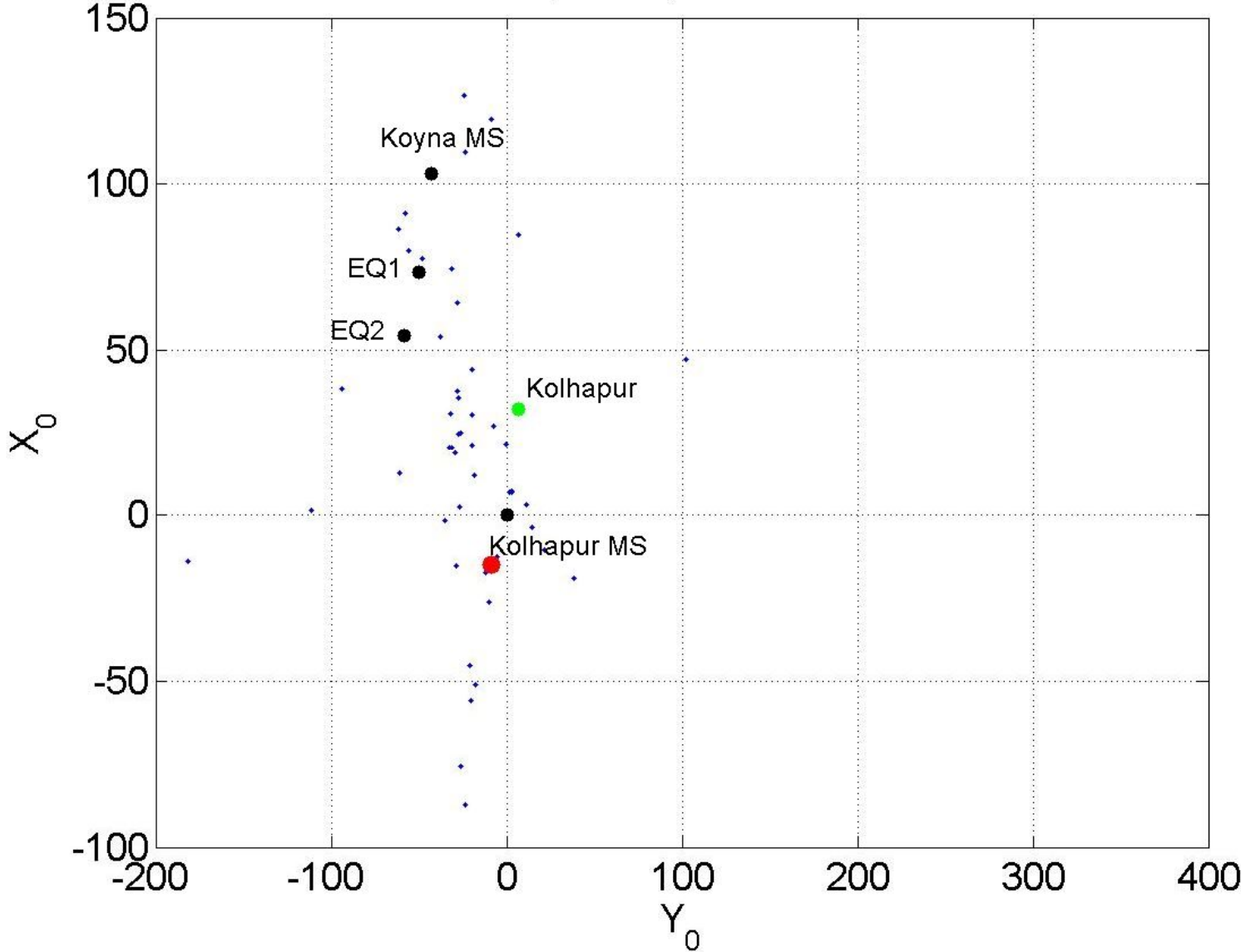


**Kp=4.3**

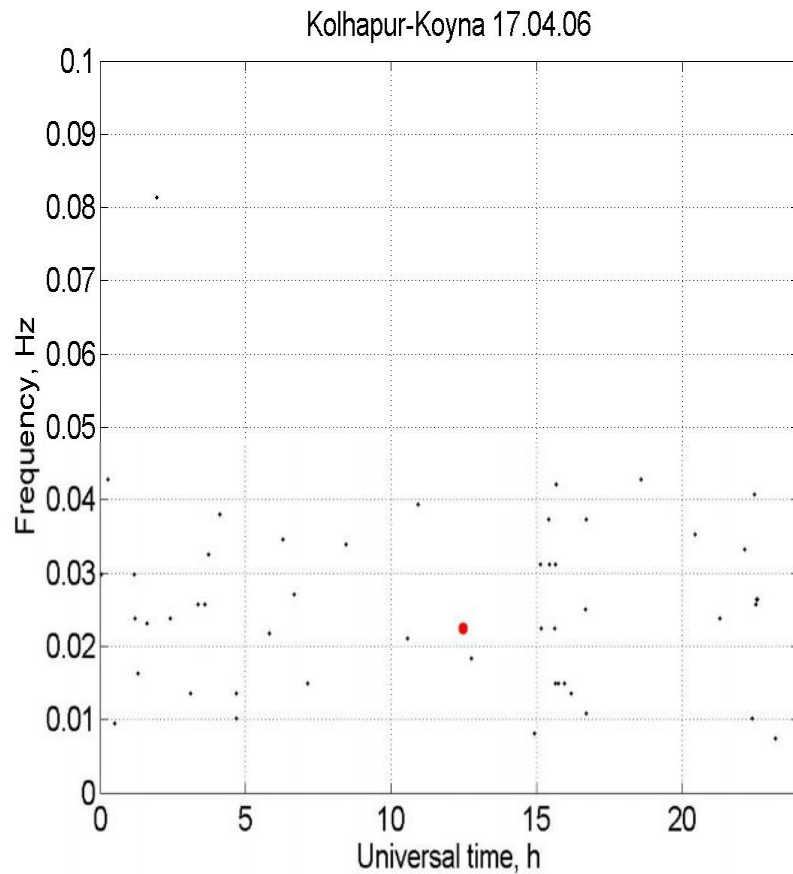


# Distribution of M-line intersection points on horizontal plane for 17 April 2006

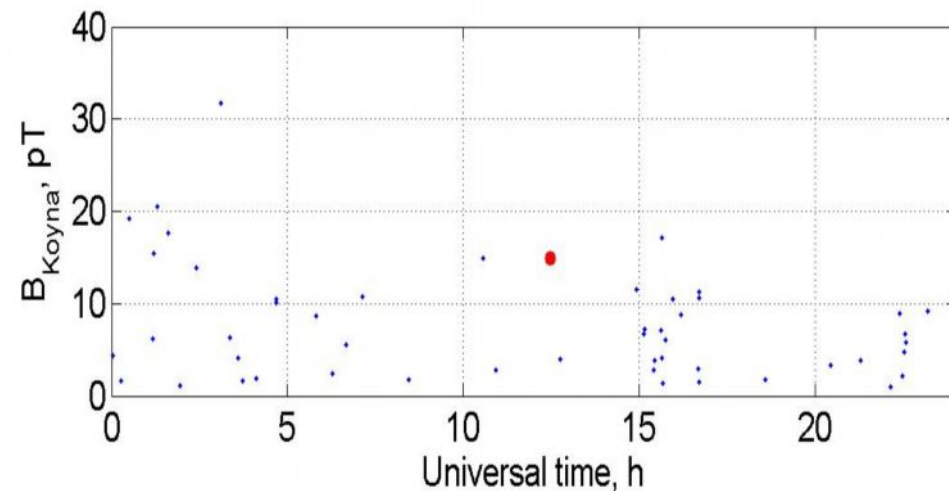
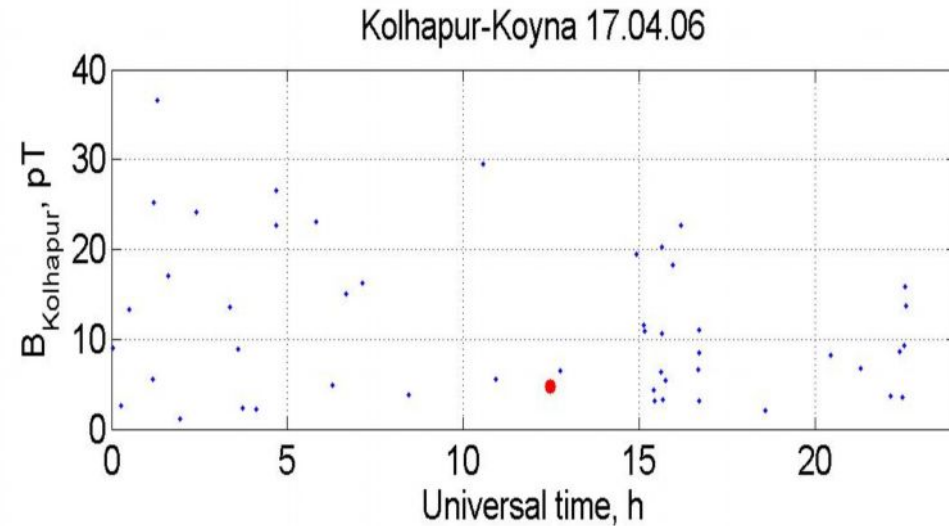
Kolhapur-Koyna 17.04.06



# Distribution of M-lines against time, frequency and magnetic field intensity for 17 April 2006

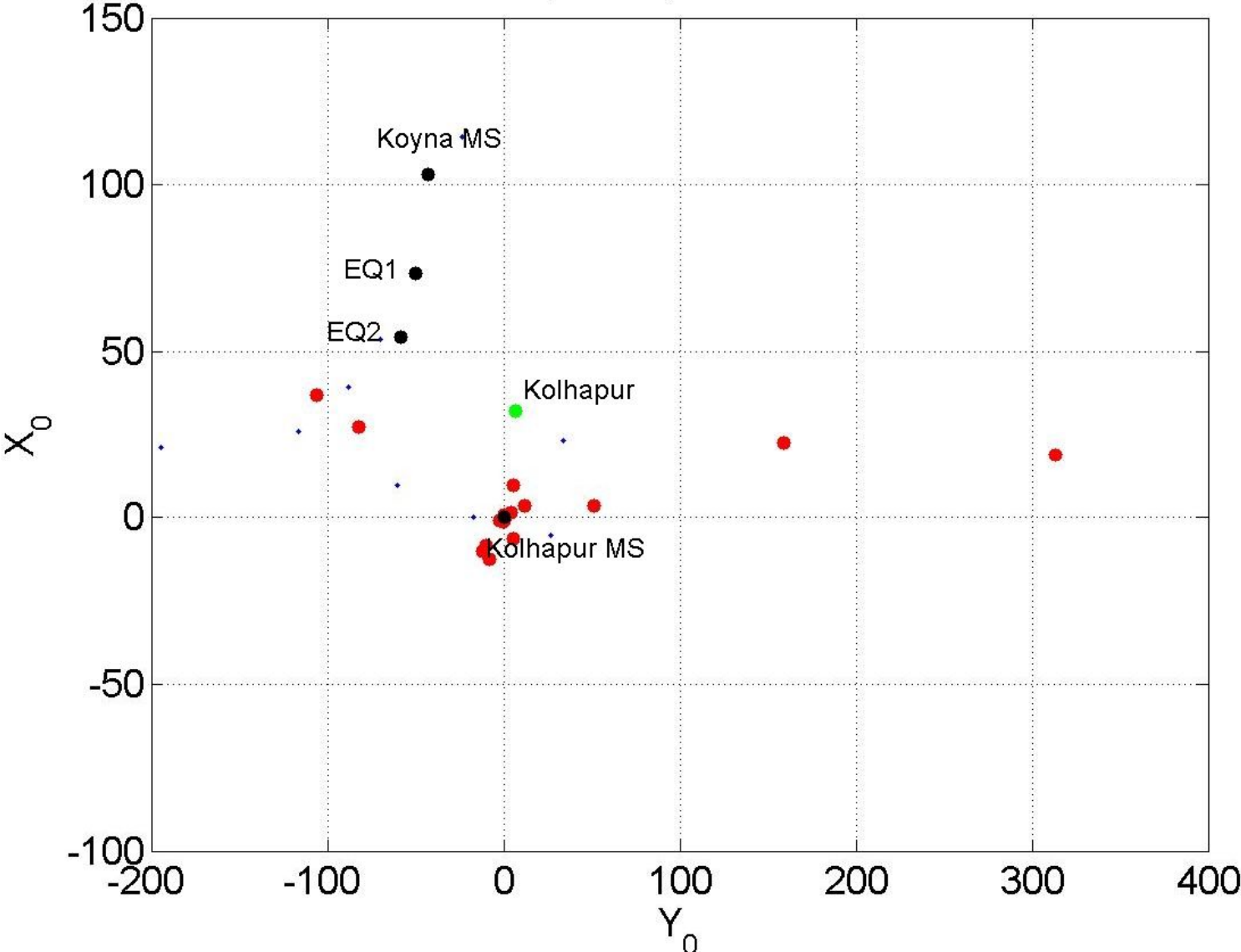


**Kp=0.3**



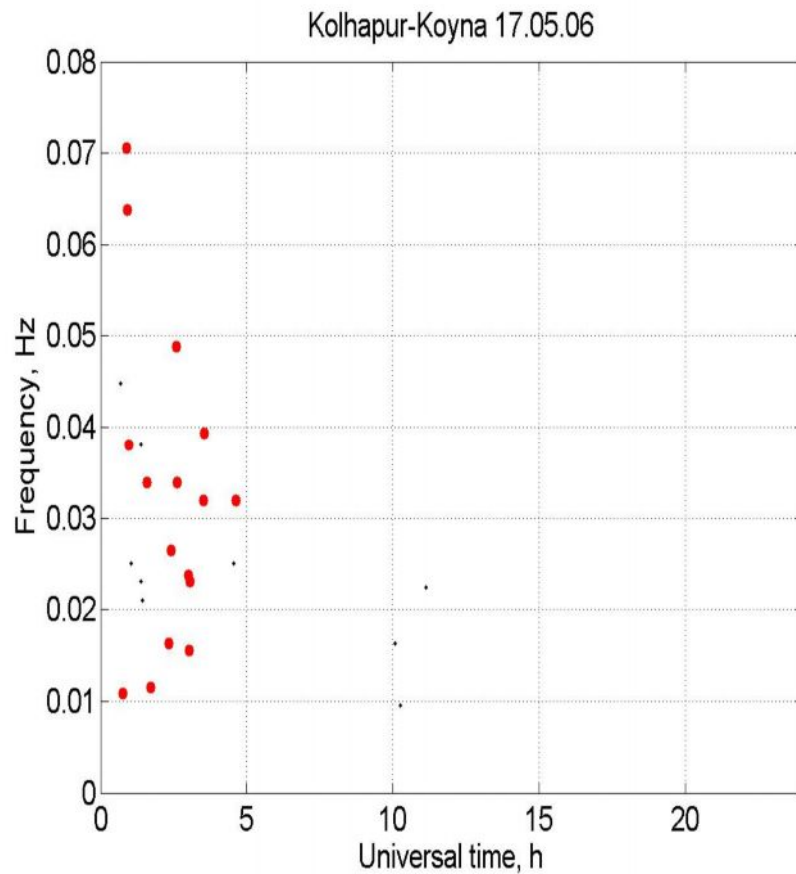
# Distribution of M-line intersection points on horizontal plane for 17 May 2006

Kolhapur-Koyna 17.05.06

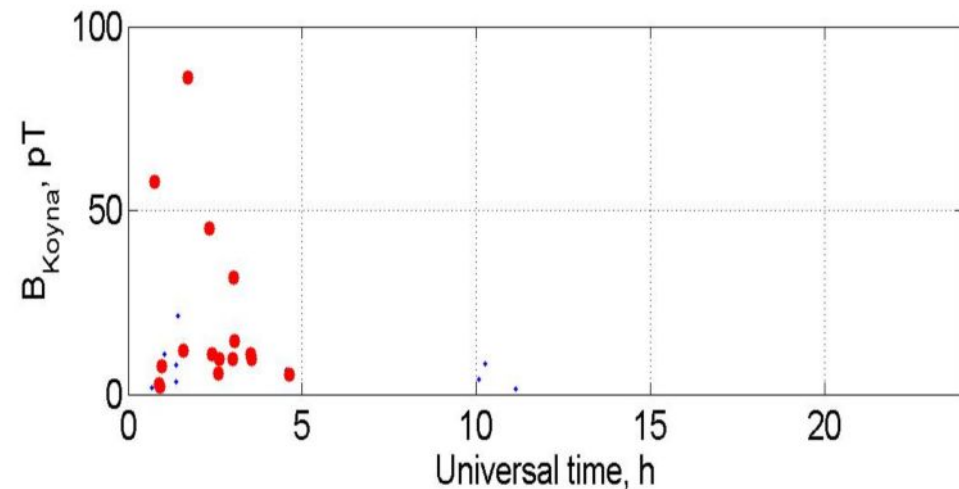
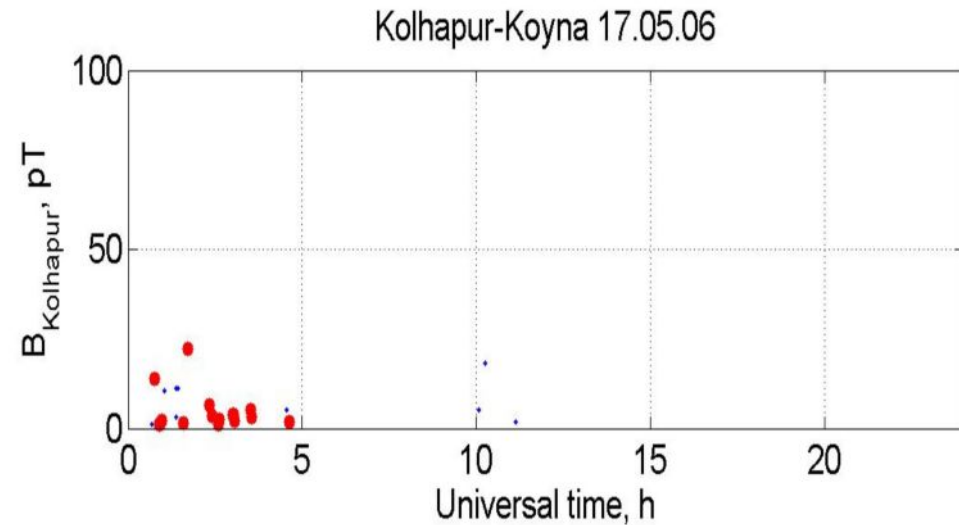




# Distribution of M-lines against time, frequency and magnetic field intensity for 17 May 2006

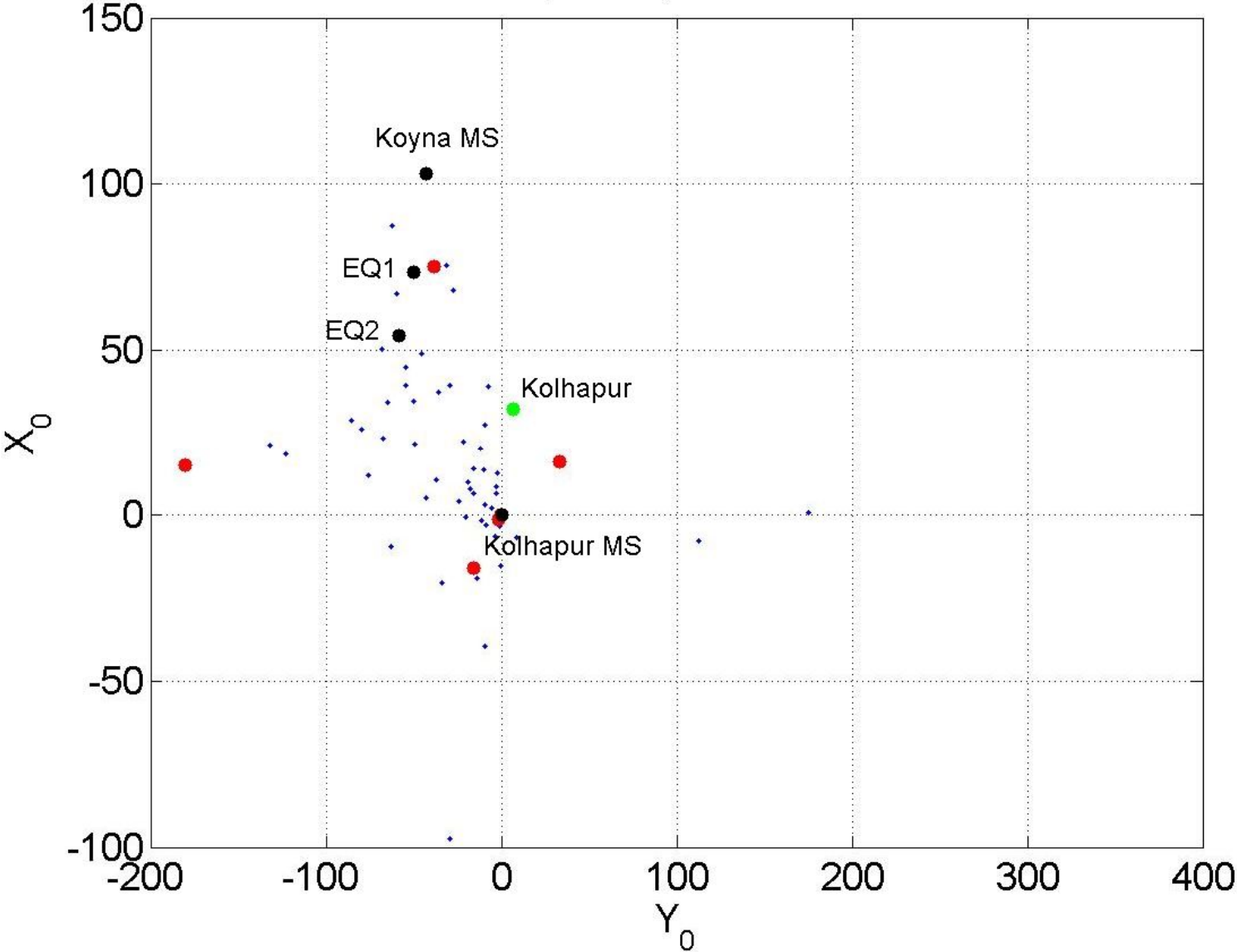


**Kp=1.3, 1.7**

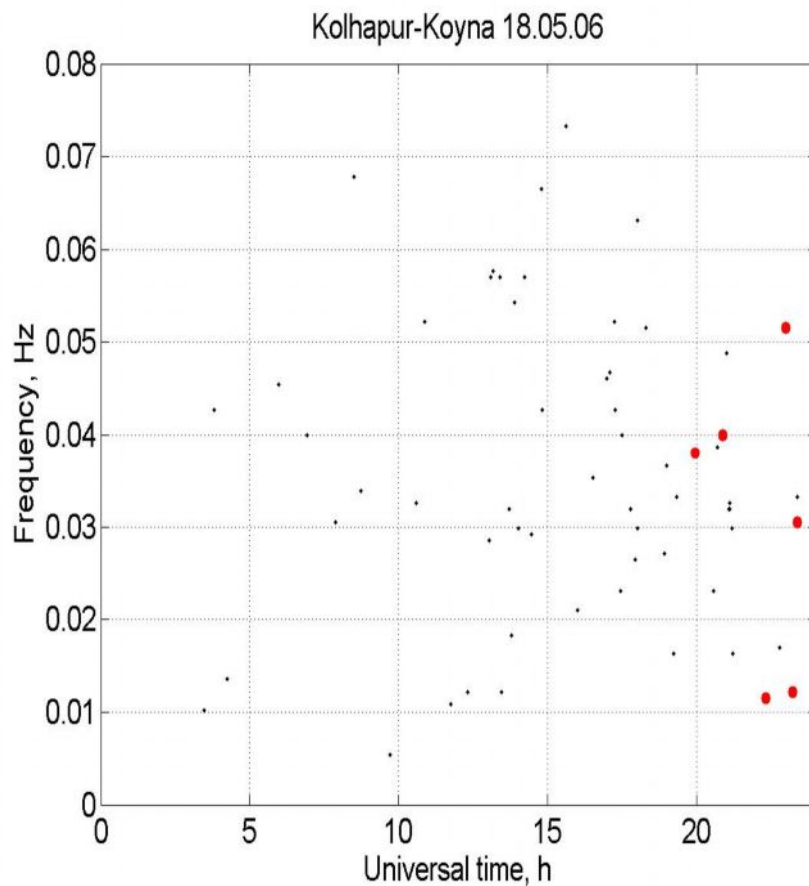


# Distribution of M-line intersection points on horizontal plane for 18 May 2006

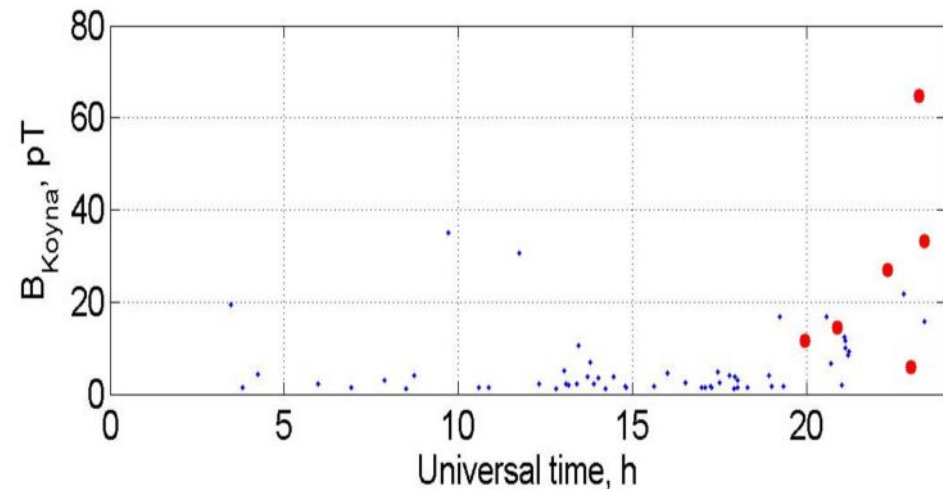
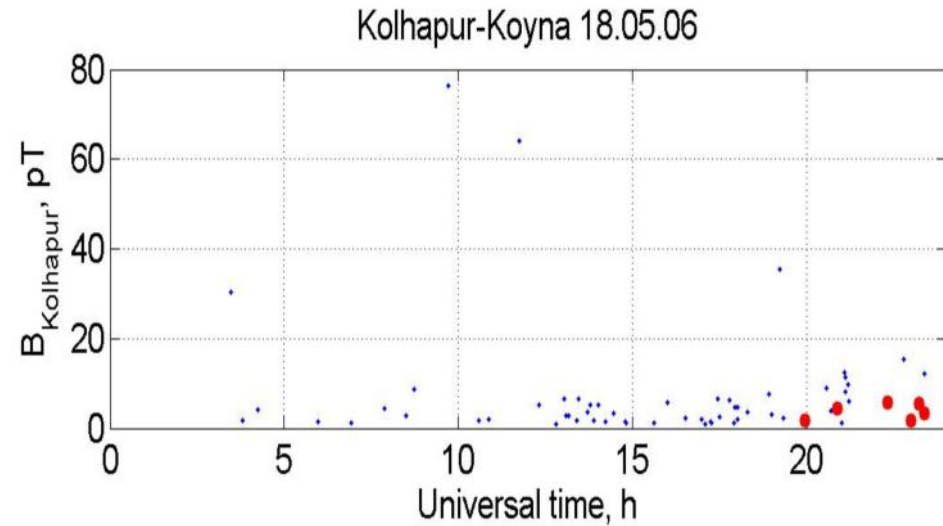
Kolhapur-Koyna 18.05.06



# Distribution of M-lines against time, frequency and magnetic field intensity for 18 May 2006

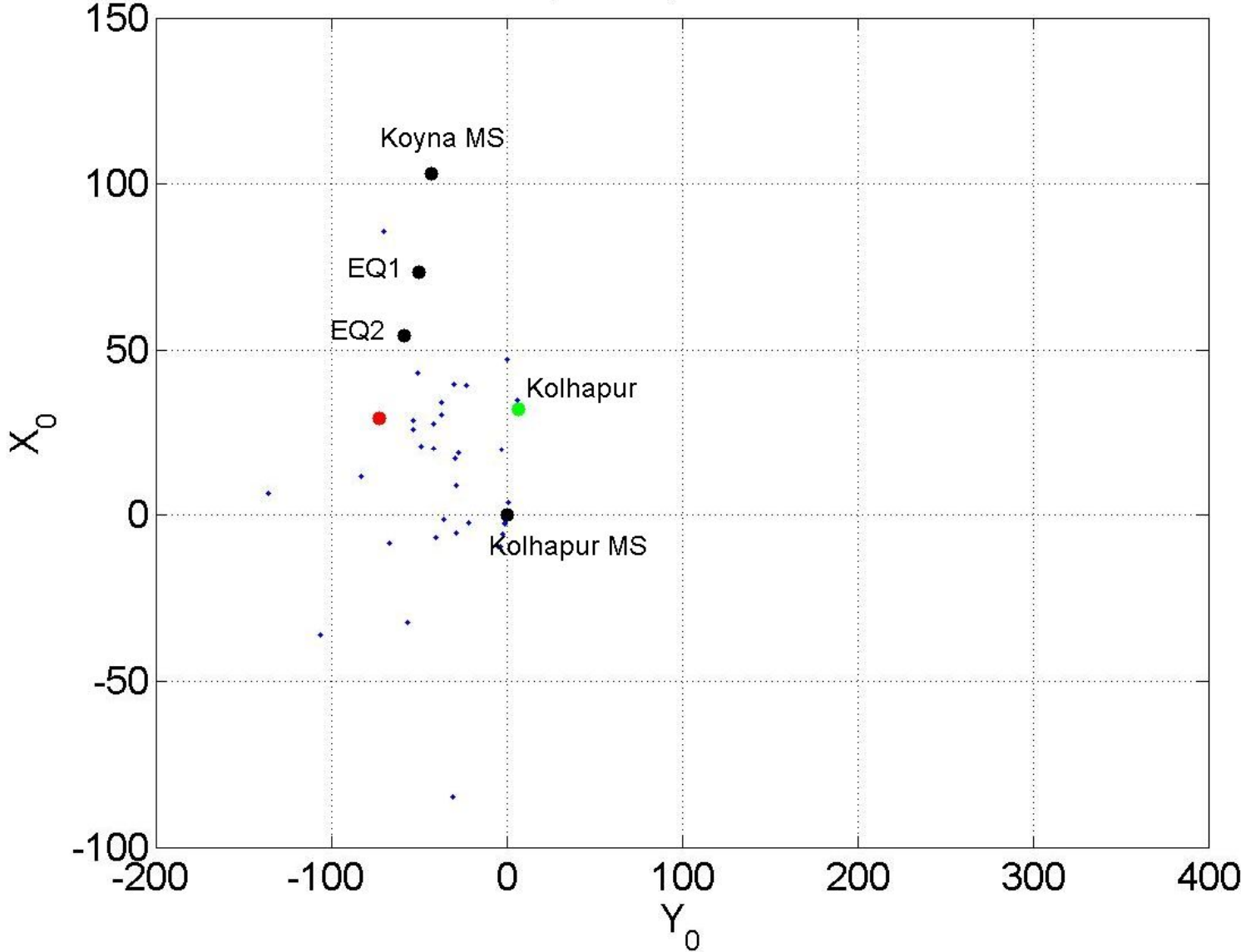


**Kp=3.7, 2.3**

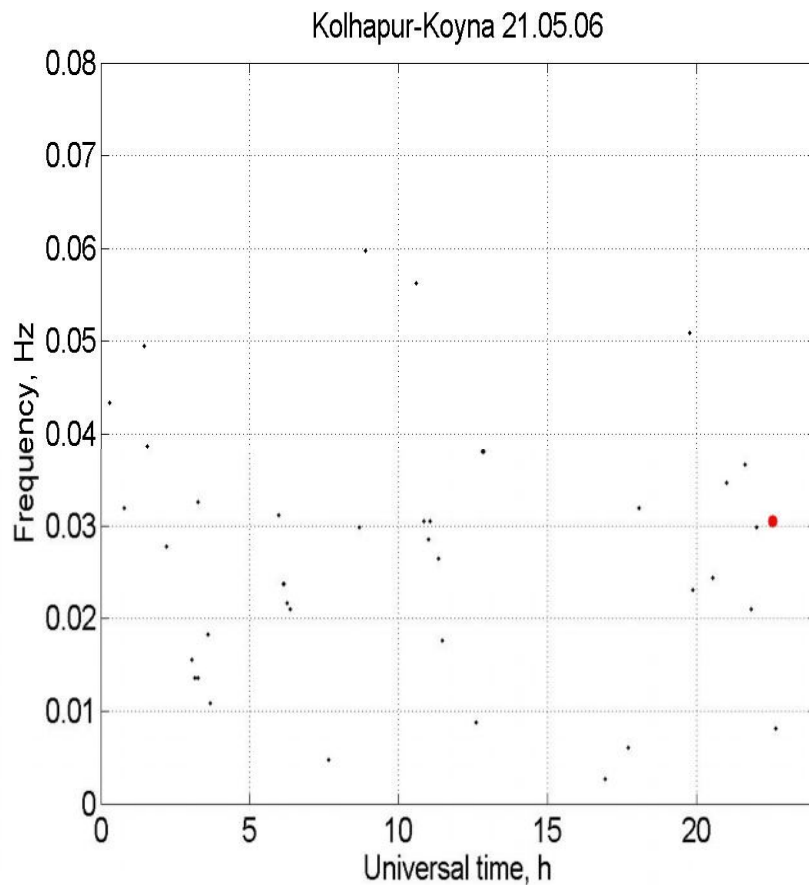


# Distribution of M-line intersection points on horizontal plane for 21 May 2006

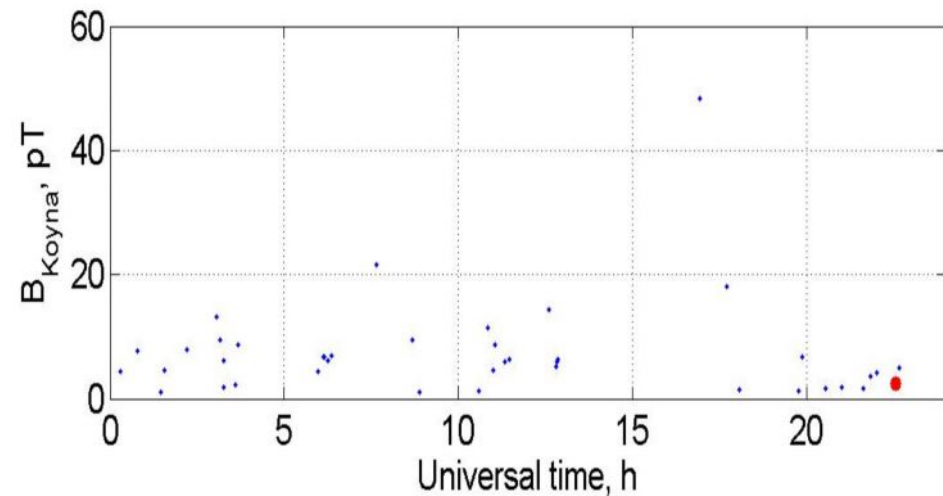
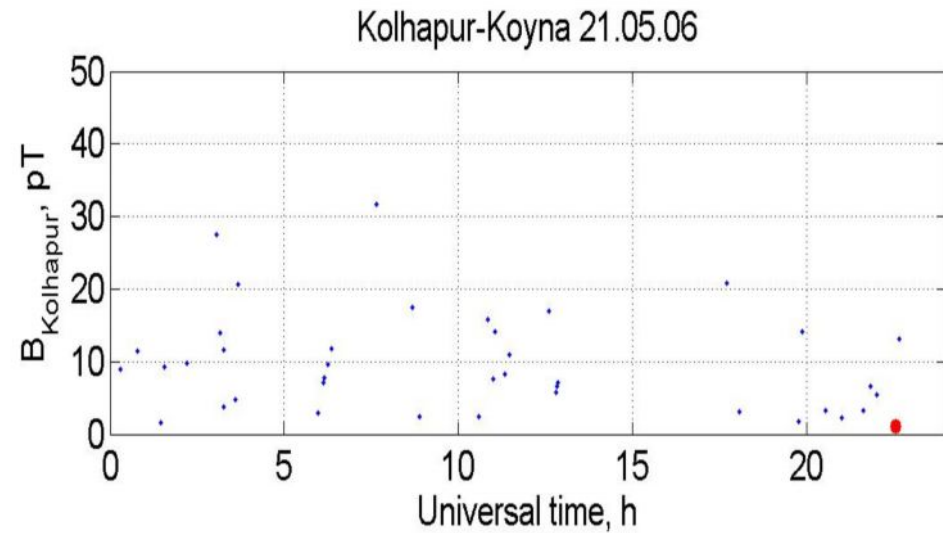
Kolhapur-Koyna 21.05.06



# Distribution of M-lines against time, frequency and magnetic field intensity for 21 May 2006

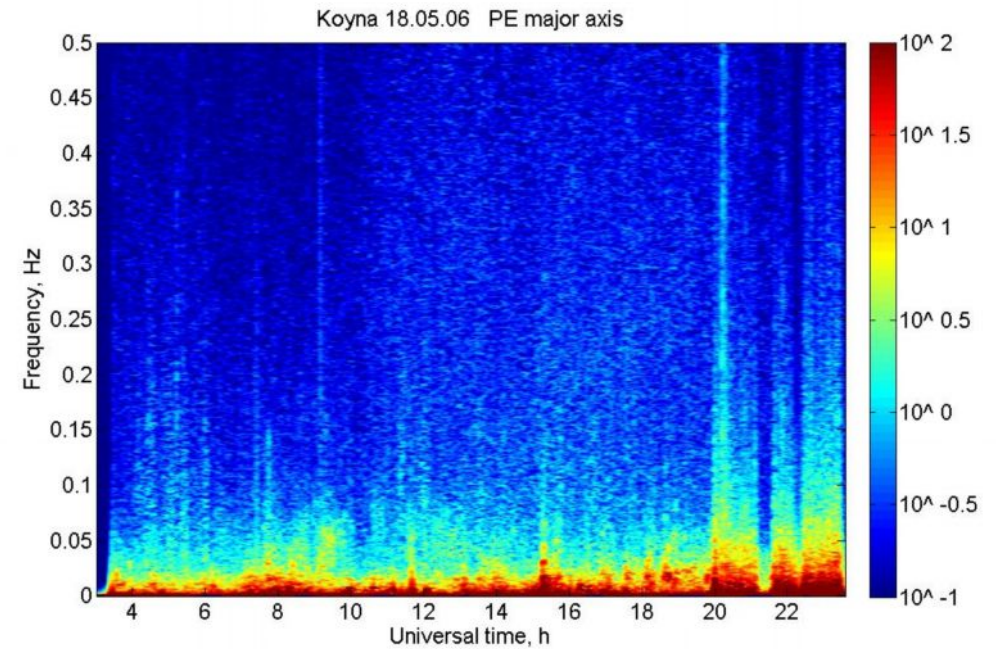
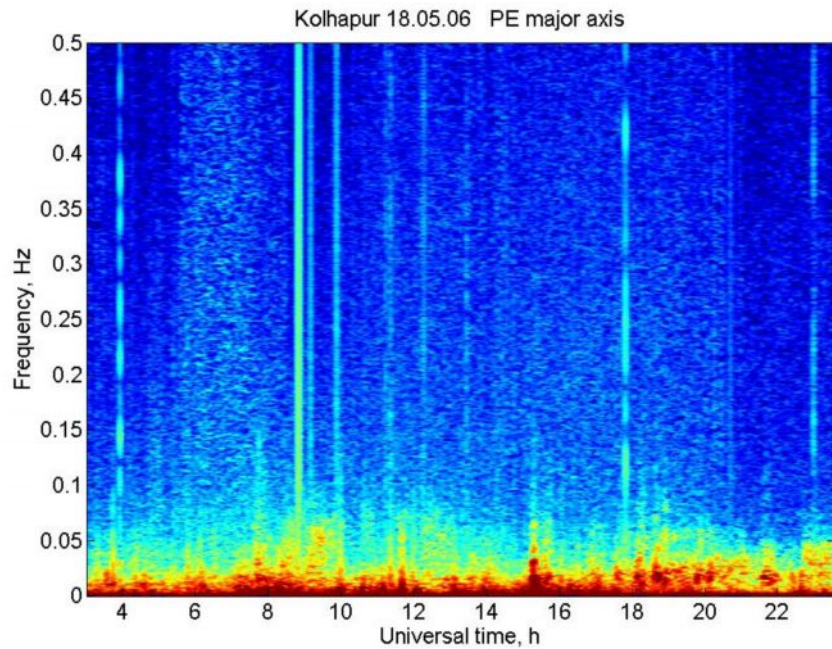


**Kp=1.3**

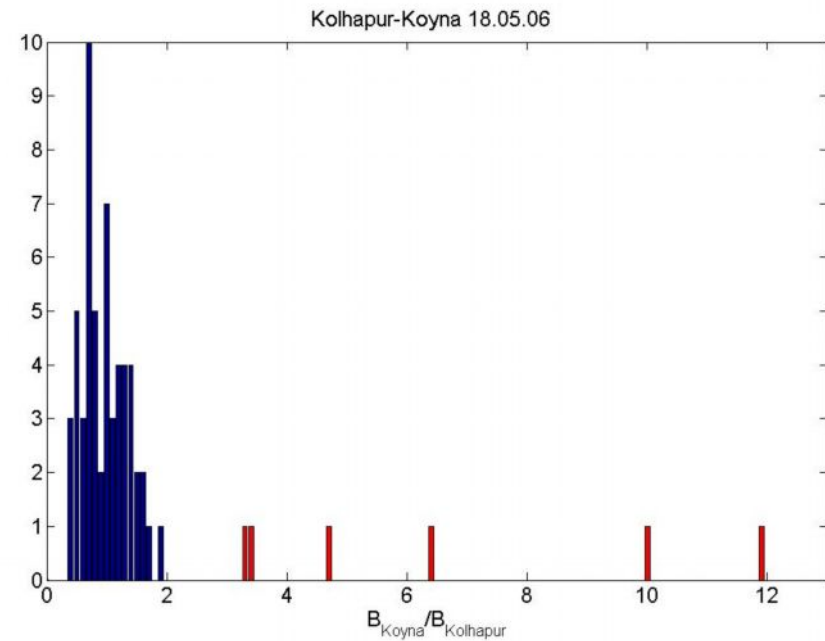
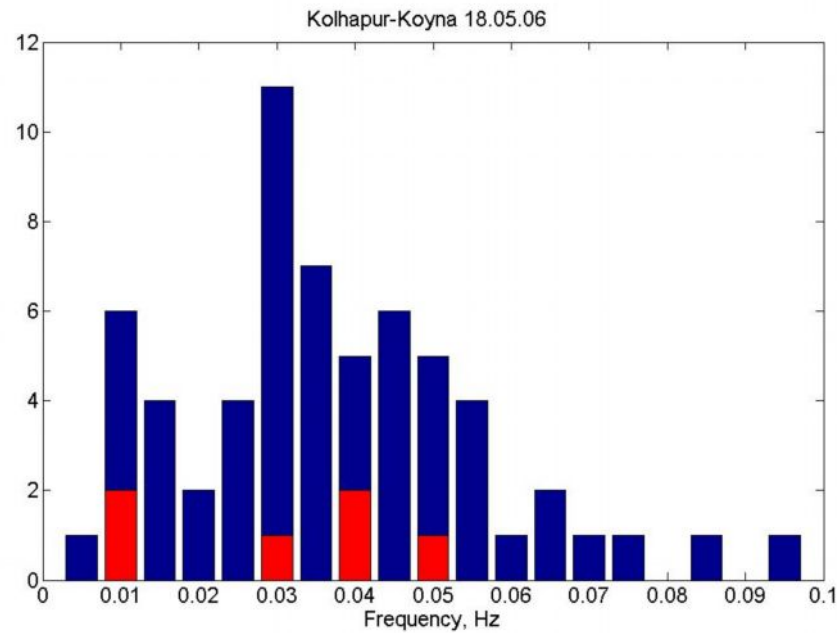




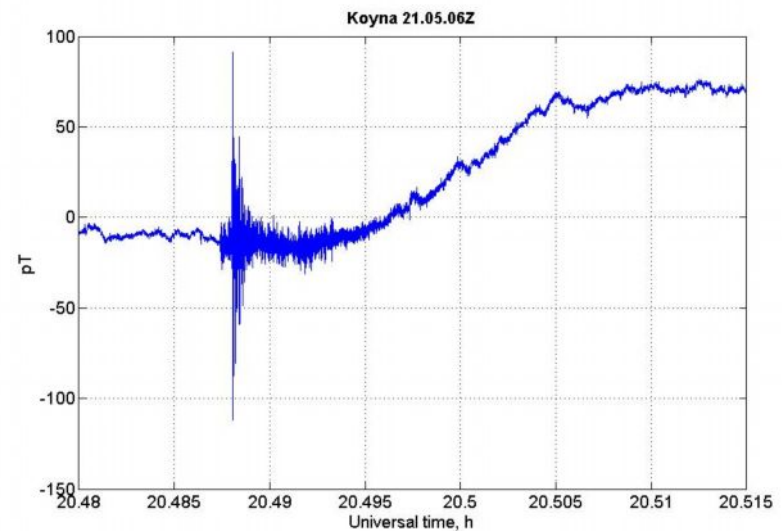
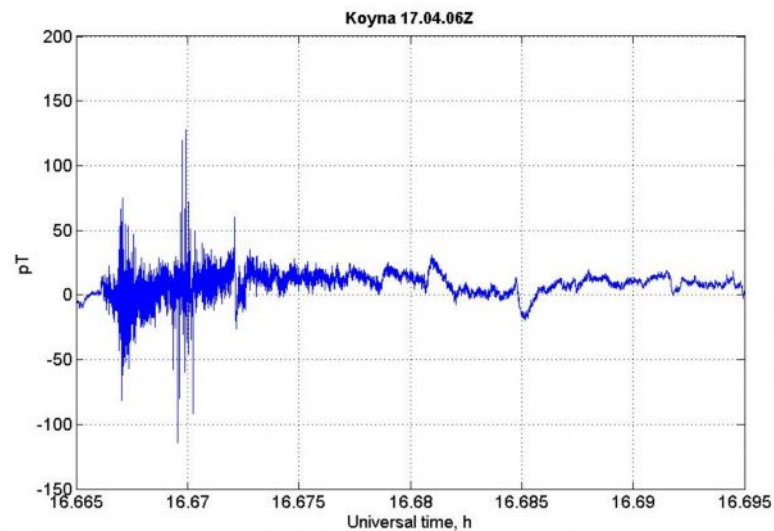
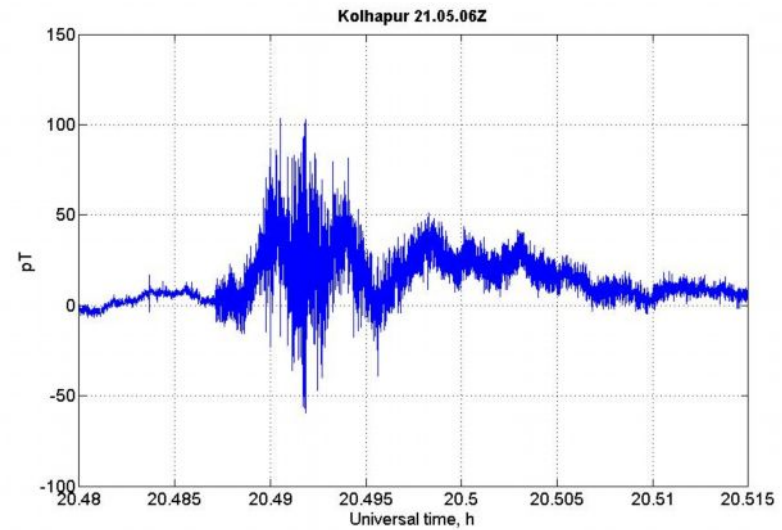
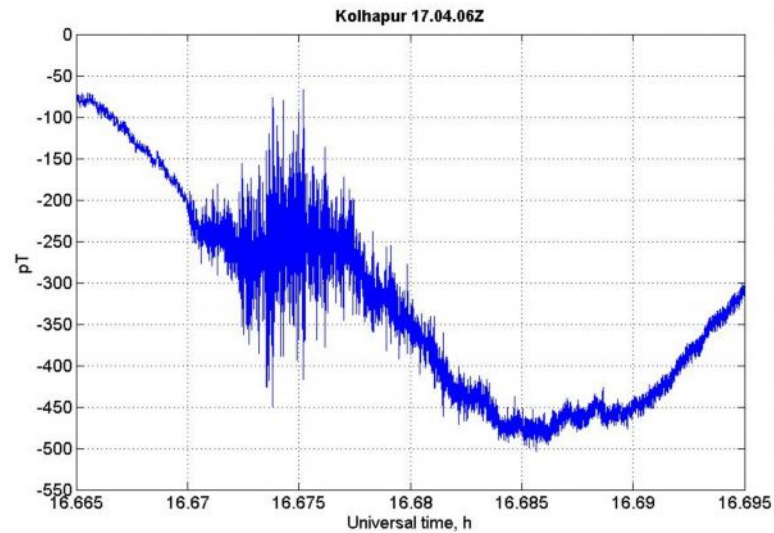
# Dynamical Fourier spectra of PE major axis for 18 May 2006



# Distribution of frequencies and PE major axes ratio for precursor candidates on 18 May 2006



# Waveforms of magnetic coseisms (Z-components)



# Conclusions

- Direction finding method of signal arrival from magnetic dipole-like source was developed. In many cases it gives a possibility for sources separation of lithospheric and ionospheric origin.
- This method was approved on magnetic field data in ULF range, which were obtained from two spaced measuring sites located in seismo-active region Koyna (Maharashtra, India).
- Using this method the ULF magnetic pre-EQ activity before two clustered EQs on 17 April 2006 (M=4.7, h=10 km, 17.07 N, 73.69 E, UT 16.39.58.87) and 21 May 2006 (M=3.7, h=10 km, 16.9 N, 73.61 E, UT 20.29.00.29 ) was found. Magnetic precursor candidates are in frequency band 0.01-0.07 Hz and correspond to magnetic moment orientation mainly in N-W – S-E direction.
- The intensity of ULF magnetic precursors for 2nd EQ (M=3.7) exceeds this one for 1st EQ (M=4.7). This fact can be explained by inequality of fault occurrences before EQs relatively to magnetic meridian.