



2017 IWEP4

RECOMMENDATION FOR EARTHQUAKE FORECASTING SYSTEM AND ORGANIZATION

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Current circumstance of earthquake prediction field

- Earthquake Prediction is considered as impossible
- Short term earthquake forecasting is possible in nowadays
- Earthquake forecasting should be started now as practical disaster prevention information (separate from academic matter)

Earthquake Forecasting Organization

- It is recommended for organizations such as national/local government and infrastructure companies to observe EQ precursors and to responsibly create EQ forecasting information independently for necessary area

Recommended Organization for EQ forecasting

- Base data for EQ forecasting should be observed by your selves
- In case of Japan, in addition with your own data, the following methods are significant
 - 1) VLF/LF band ionosphere disturbance observation method
ULF/ELF direct emission observation method
 - 2) RTM method based on earthquake catalog from Japan Meteorological Agency (JMA)
 - 3) Crustal deformation observation method observed by GPS data from Geospatial Information Authority of Japan (GSI)

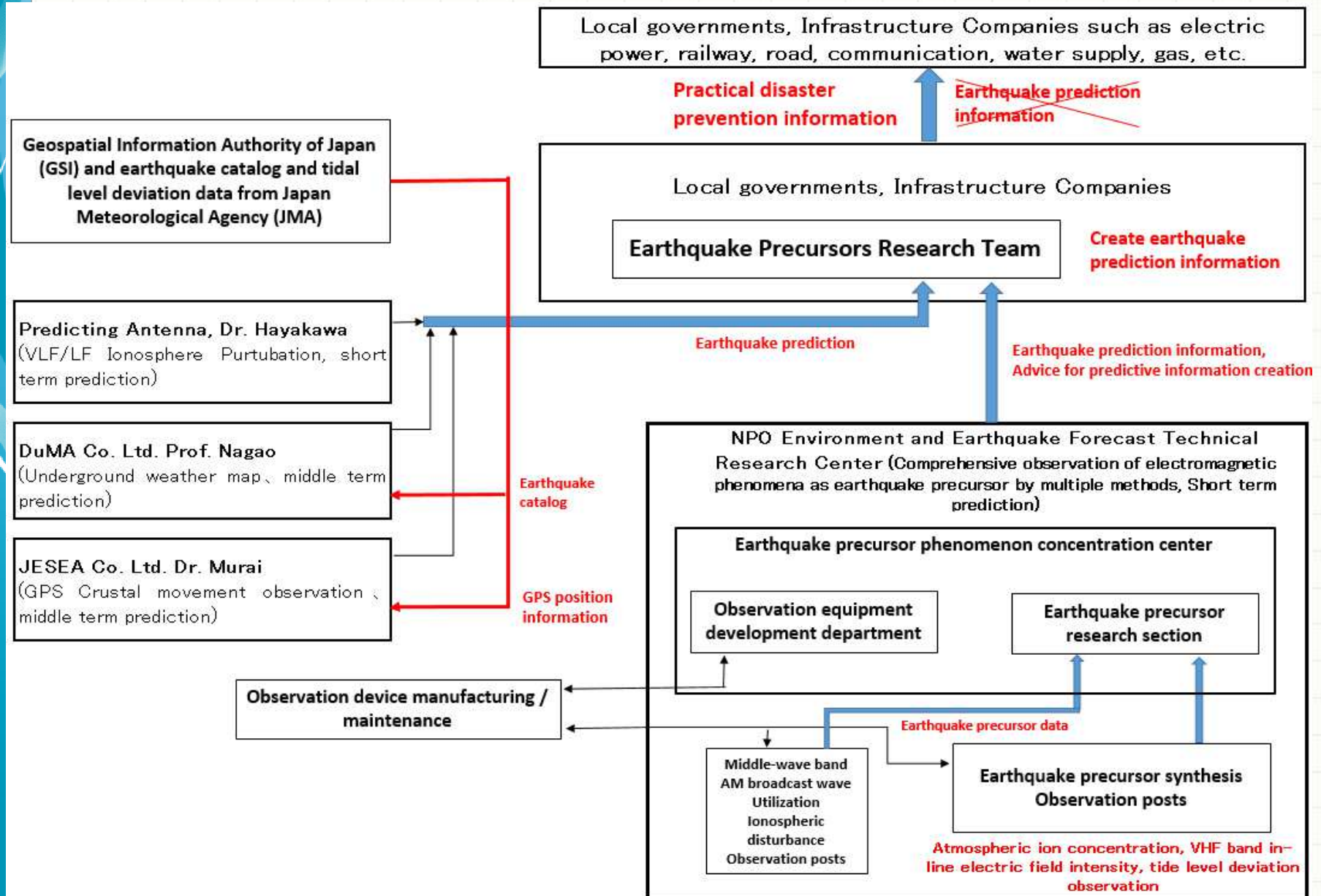
Recommended Organization for EQ forecasting

- You should be self responsible on creating EQ forecasting information
- Multiple methods listed in this paper are recommended for your own observation as effective examples.

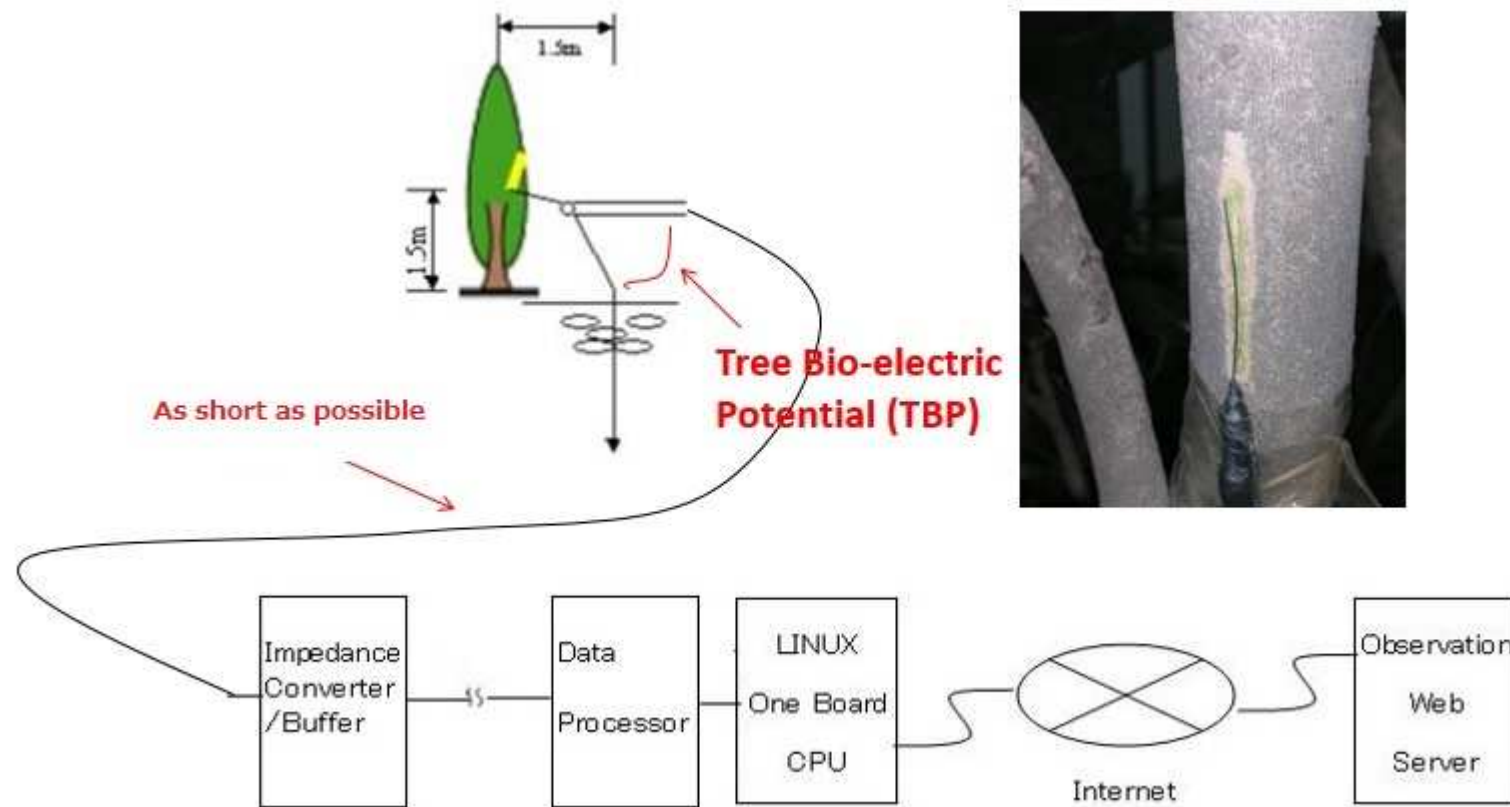
Recommended Observation method and system

- 1) Tree Bio-electric Potential observation
- 2) Combination observation of VHF band within and over horizon
- 3) Dual frequency simultaneous observation in LF/MF/VHF/UHF band
- 4) Terminator Time observation method by utilizing AM broadcasting wave (Ionosphere perturbation)
- 5) Air ion concentration observation
- 6) Tidal level deviation observation

Observation and forecasting organization



Tree Bio-electric Potential observation (TBP)

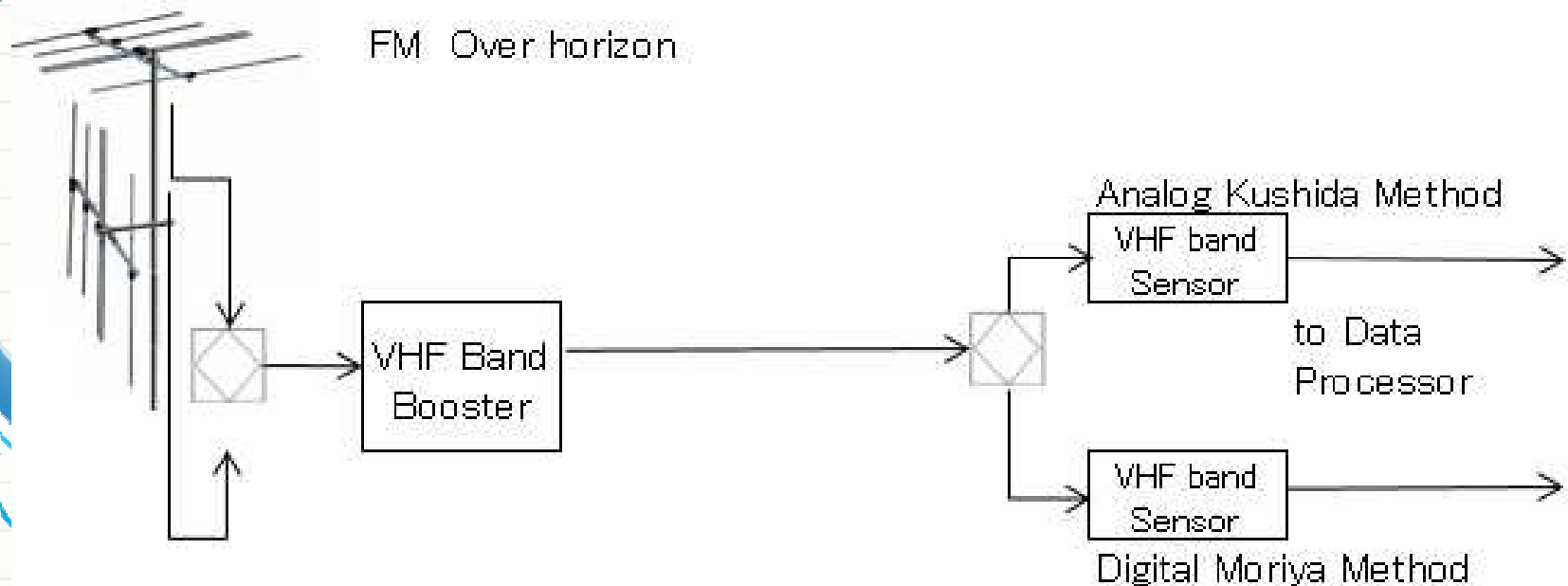


Combination observation of VHF band within and over horizon

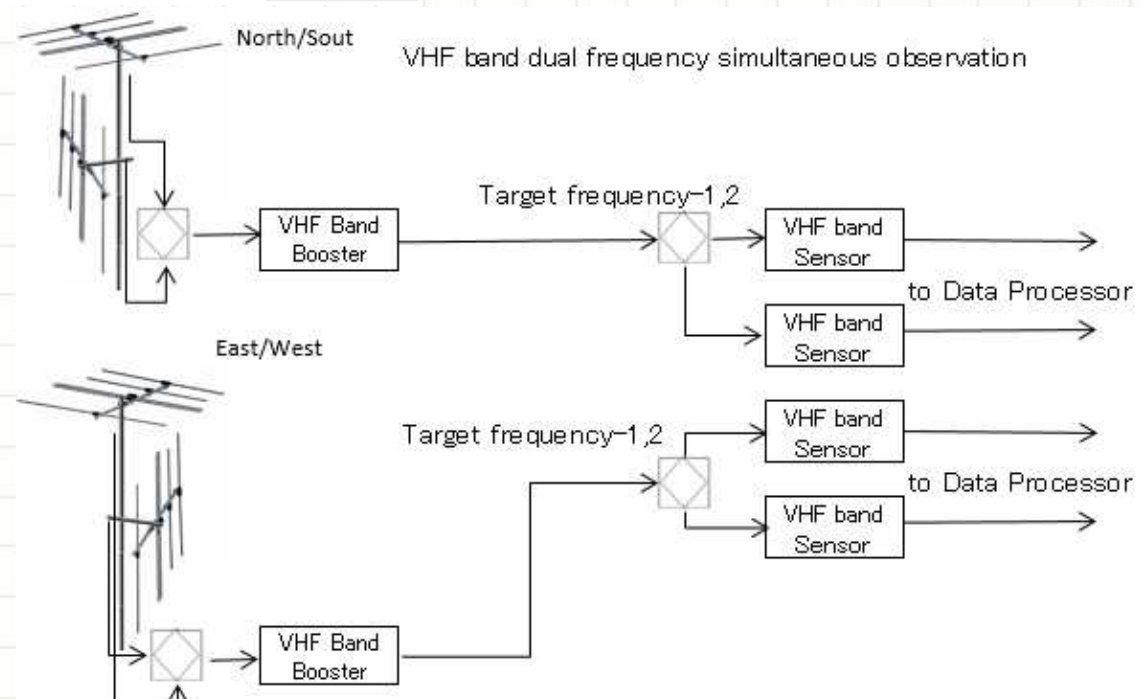
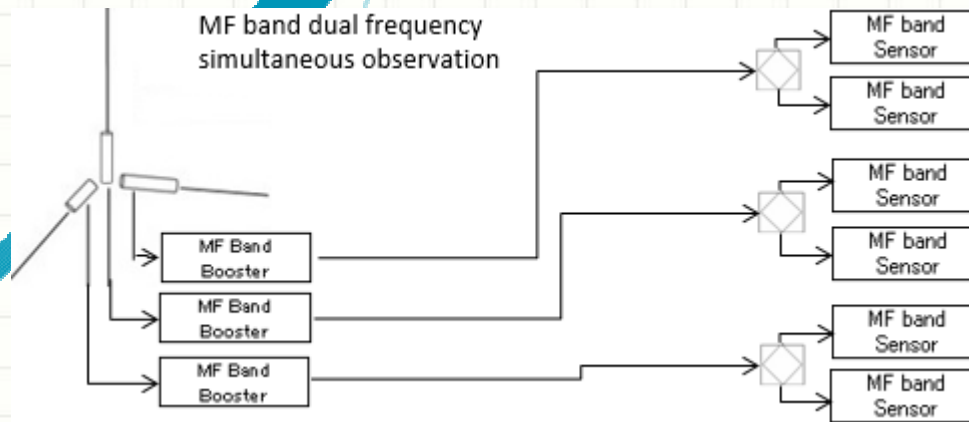
VHF band in line horizon observation



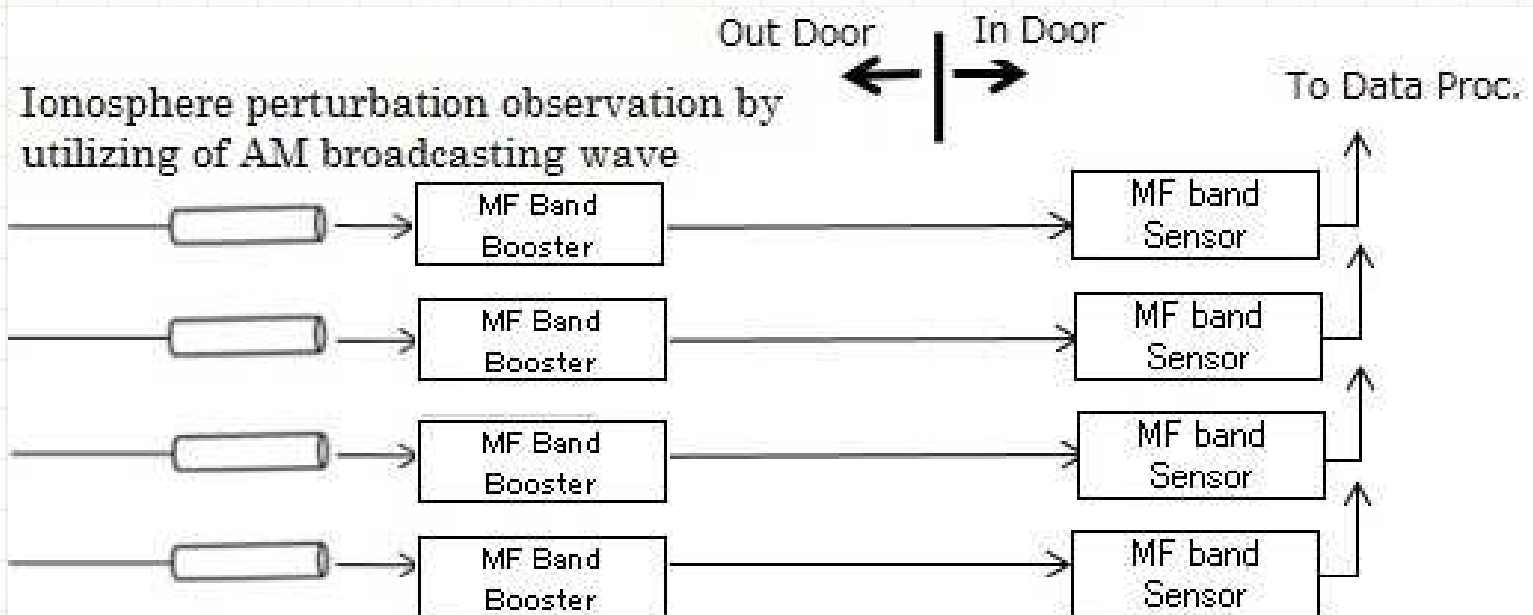
FM Over horizon



LF/MF/VHF/UHF band dual frequency simultaneous observation



Terminator Time (Ionosphere perturbation) observation by utilizing of AM broadcasting signal



Air ion concentration observation

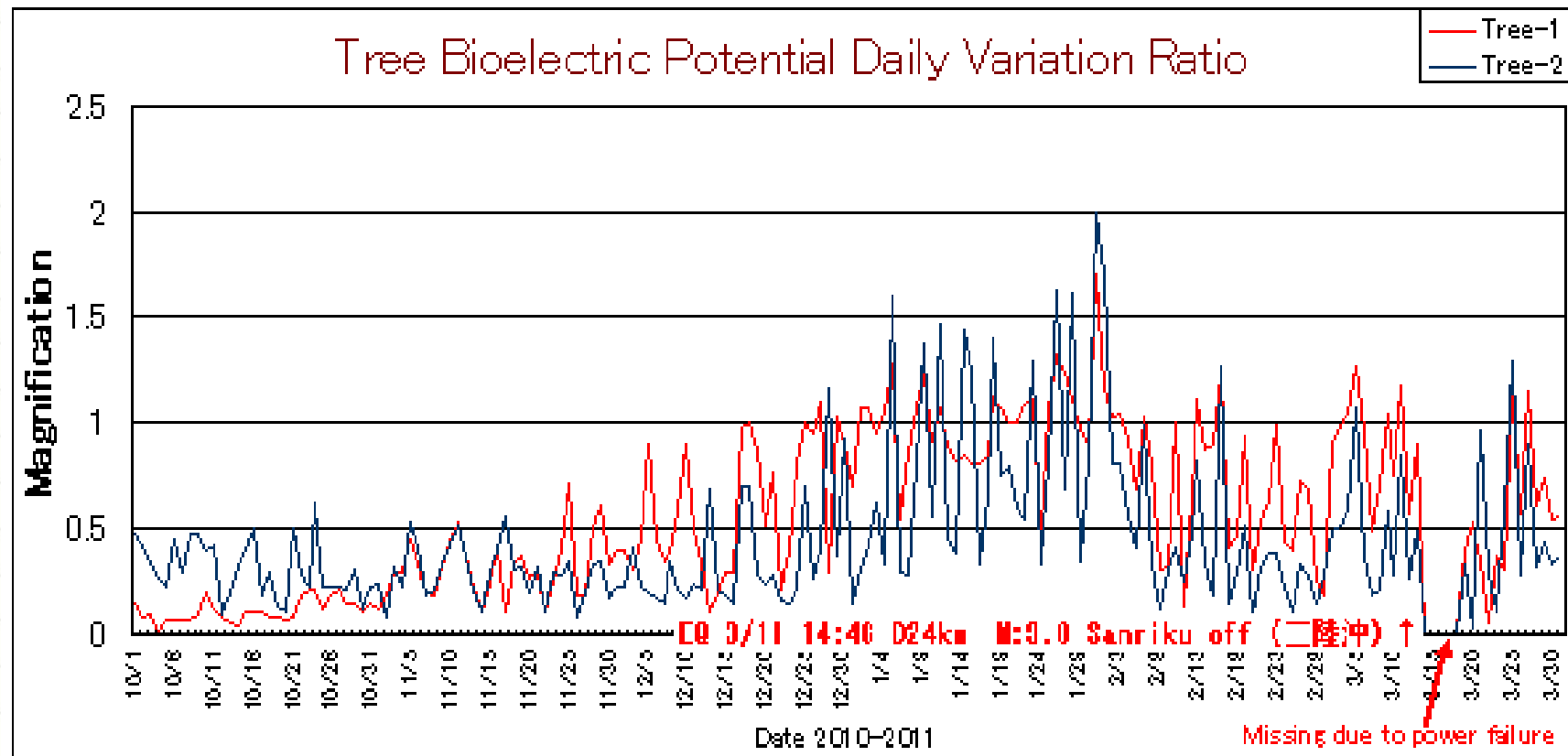


Data Processor

1. Capable to input 10 Channel analog data (Max 100Ch)
2. Digitize in 1kHz sampling rate
3. Outputs maximum, minimum and average value in every 1 minute in CSV format to CPU (LINUX one board Micro CPU Raspberry-Pi)
4. Maximum value is useful to measure impulsive signal
5. CPU outputs to Observation Web Server to produce daily, weekly, monthly and 3 monthly graphs.

Example of TBP Anomalous Data

TBP at Yachimata prior to 2011/3/11 Tohoku EQ M9.0

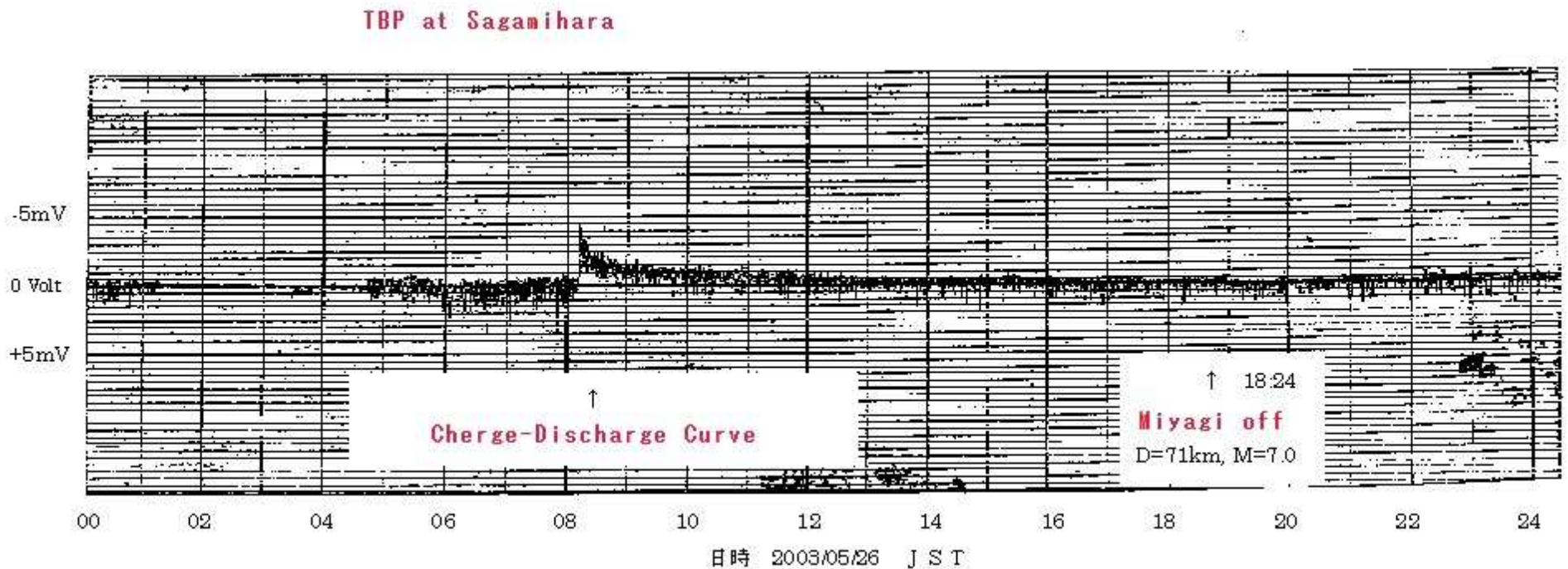


1.5 Months before EQ

3 Months before EQ

Example of TBP Anomalous Data

Charge-Discharge Curve observed 10 hours prior to
2003/5/26 Miyagi off M7.0



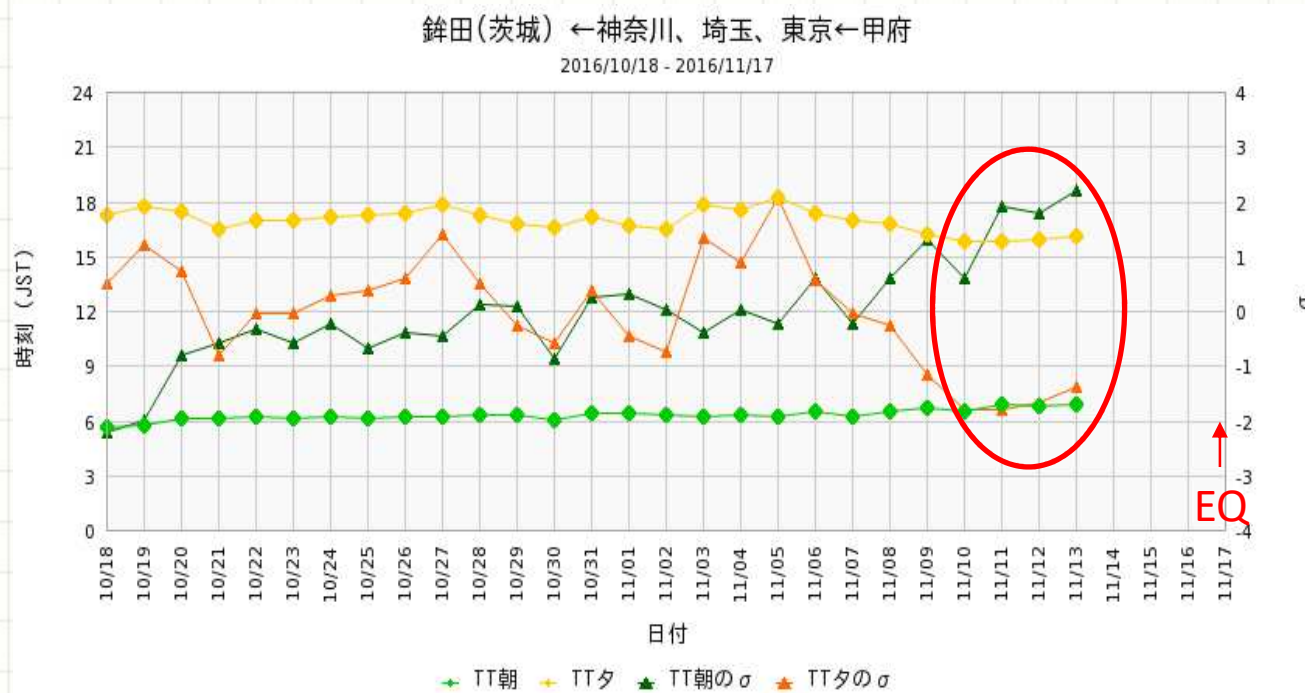
TBP法: Toriyama Bioelectric Potential Method

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Example of Anomalous Data of MF band Ionospheric disturbance observation

Prior to 2016/11/17 Chiba NW M4.1

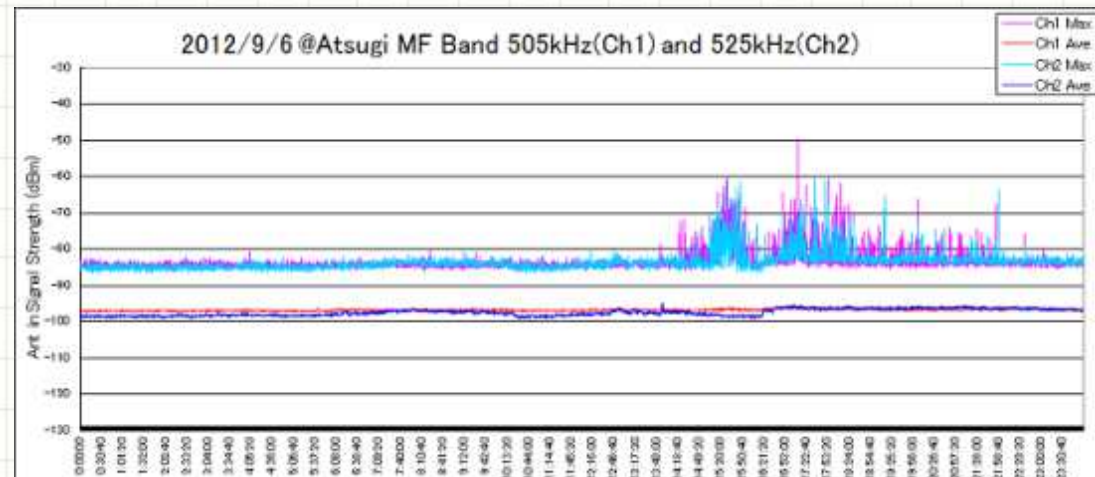
Terminator Time Standard deviation $\sigma > 2$ for 4days



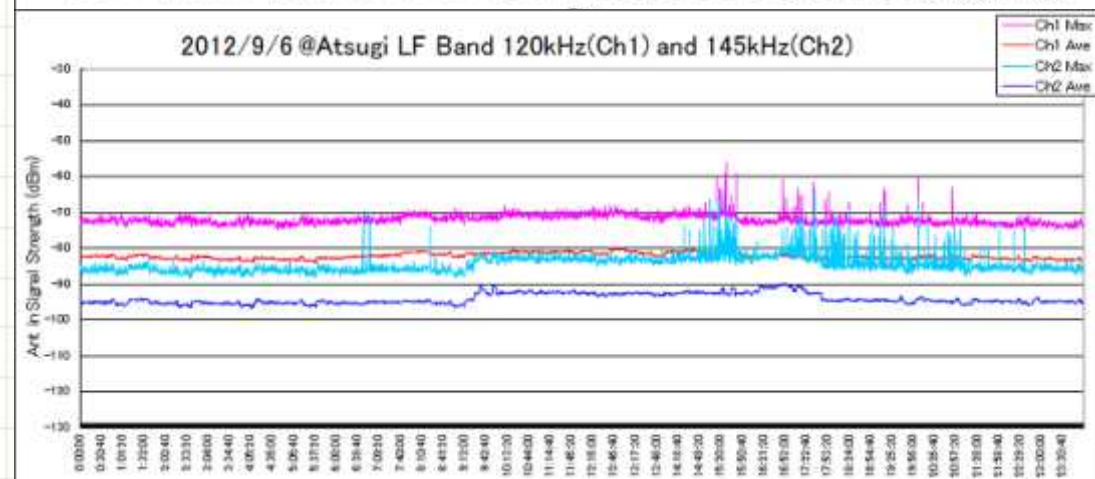
Example of Anomalous Data of dual frequency simultaneous observation

Prior to 2012/09/14 Chiba North-East M5.1

1 week before at
Atsugi MF Band

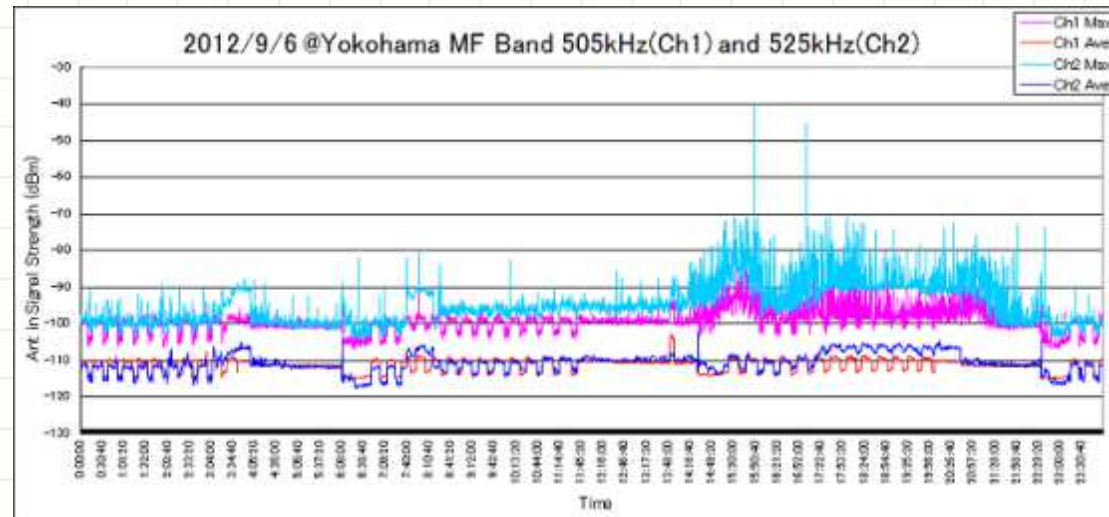


1 week before at
Atsugi LF Band

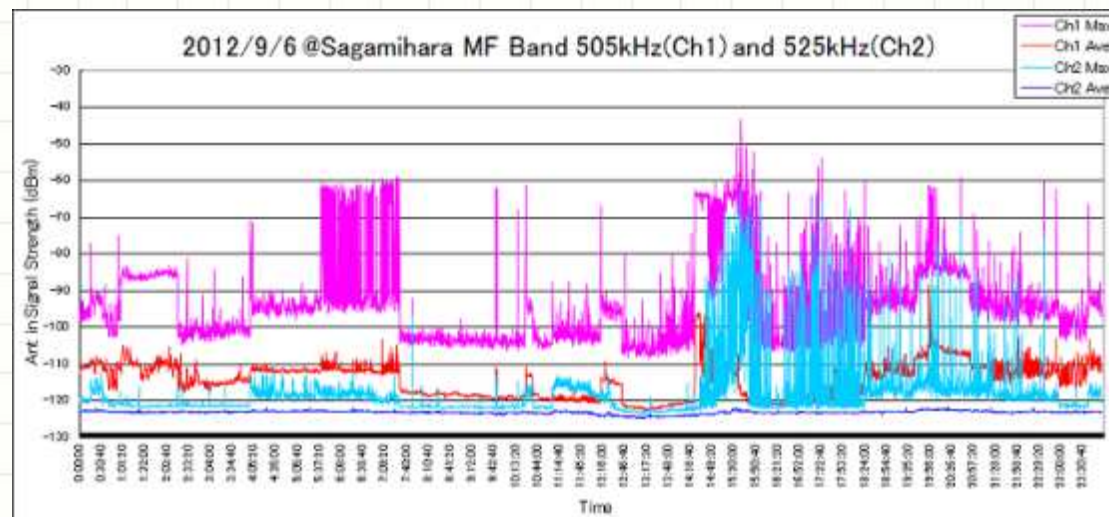


Example of Anomalous Data of dual frequency simultaneous observation

1 week before at
Yokohama
MF Band

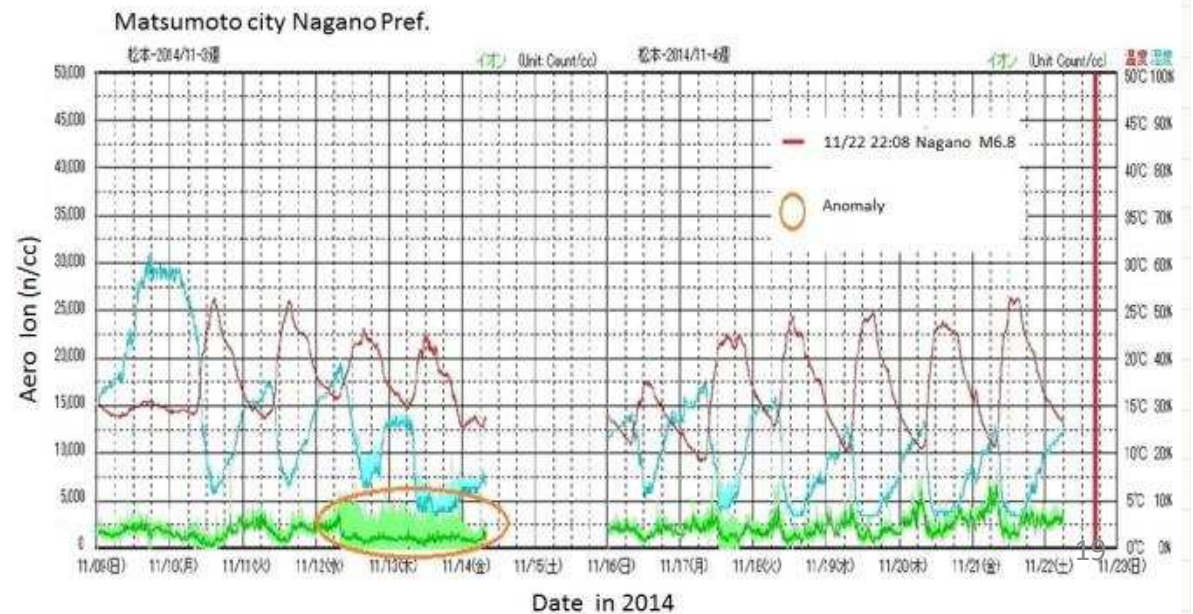
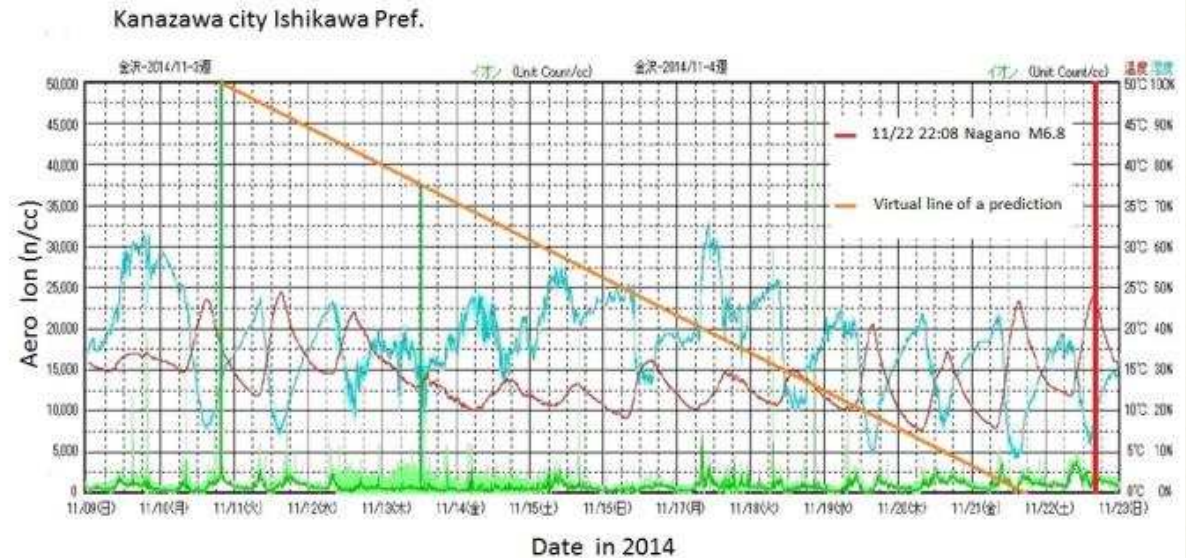


1 week before at
Sagamihara
MF Band



Example of Anomalous Data of Air Ion Observation

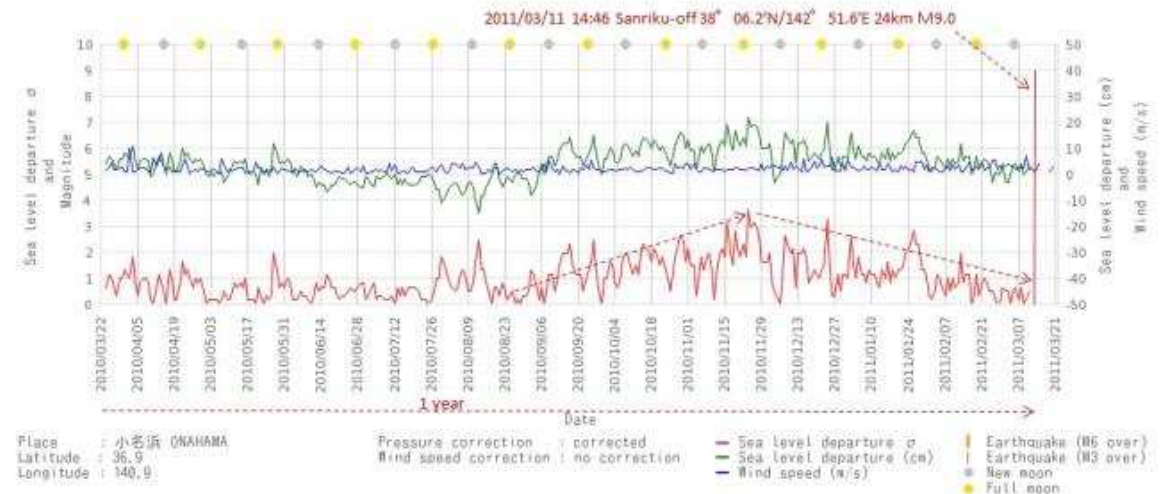
Prior to 2014/11/22
Nagano M6.8



Example of Anomalous Data of Tidal Level Deviation at Onahama

Prior to 2011/03/11
Tohoku EQ M9

Long term:
6months before EQ



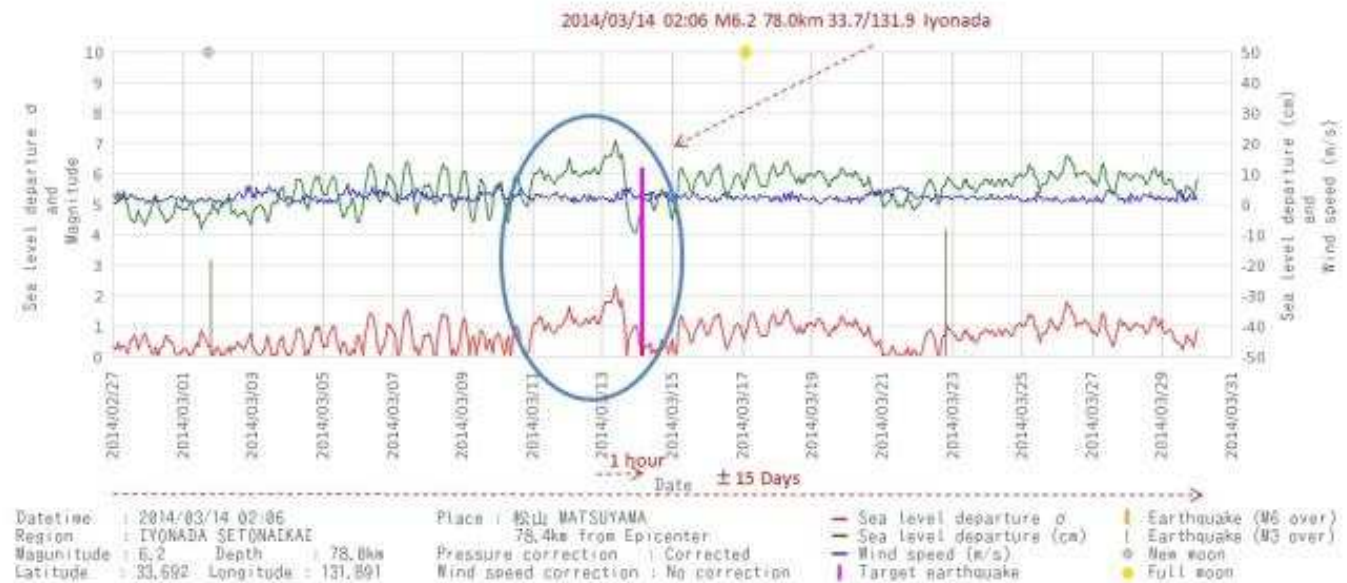
1 day before the
day of EQ



Example of Anomalous Data of Tidal Level Deviation at Matsuyama

Prior to 2014/03/14 Iyonada M6.2

± 15 days





**Thank you
for your attention!**

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