

## RECOMMENDATION FOR EARTHQUAKE FORECASTING SYSTEM AND ORGANIZATION

2017/5/27

Yoshiharu SAITO

**Director General** 

NPO Environment and Earthquake Forecast

**Technical Research Center** 

### 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 (lonosphere perturbation)
- 5) Air ion concentration observation
- 6) Tidal level deviation observation

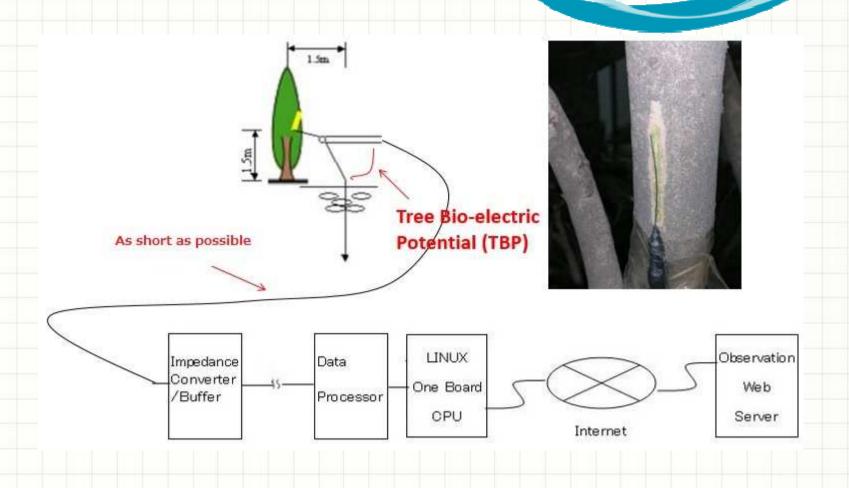
#### Observation and forecasting organization Local governments, Infrastructure Companies such as electric power, railway, road, communication, water supply, gas, etc. Practical disaster Earthquake prediction information prevention information Geospatial Information Authority of Japan (GSI) and earthquake catalog and tidal Local governments, Infrastructure Companies level deviation data from Japan Meteorological Agency (JMA) Create earthquake **Earthquake Precursors Research Team** prediction information Predicting Antenna, Dr. Hayakawa Earthquake prediction Earthquake prediction information, (VLF/LF Ionosphere Purtubation, short Advice for predictive information creation term prediction) NPO Environment and Earthquake Forecast Technical DuMA Co. Ltd. Prof. Nagao Research Center (Comprehensive observation of electromagnetic (Underground weather map, middle term Farthquake phenomena as earthquake precursor by multiple methods, Short term prediction) catalog prediction) Earthquake precursor phenomenon concentration center JESEA Co. Ltd. Dr. Murai (GPS Crustal movement observation : **GPS** position Observation equipment Earthquake precursor middle term prediction) information development department research section Observation device manufacturing / maintenance Earthquake precursor data Middle-wave band Earthquake precursor synthesis AM broadcast wave Observation posts Utilization Ionospheric disturbance

Observation posts

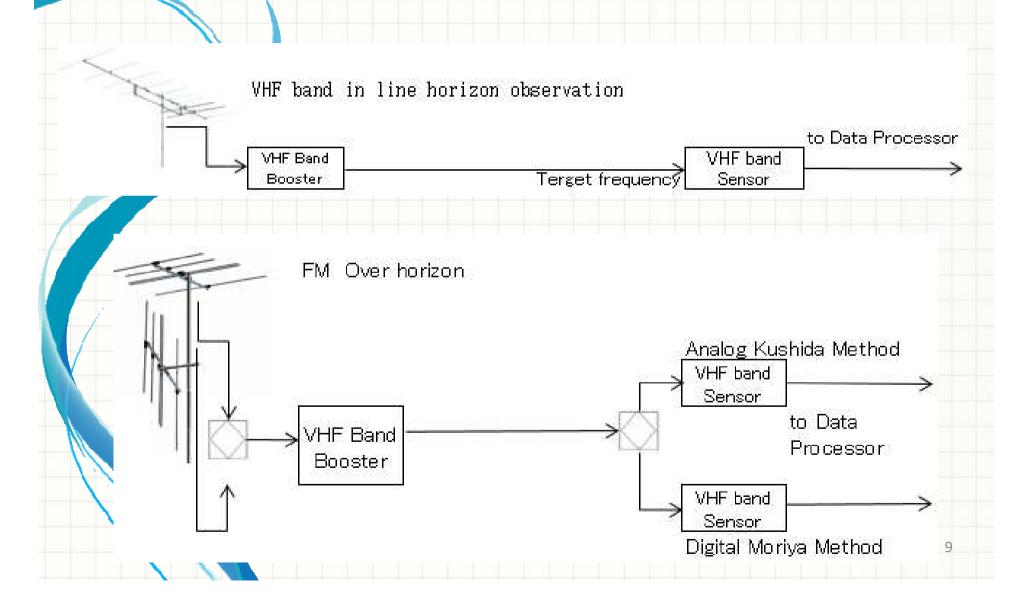
Atmospheric ion concentration, VHF band in-

line electric field intensity, tide level deviation observation

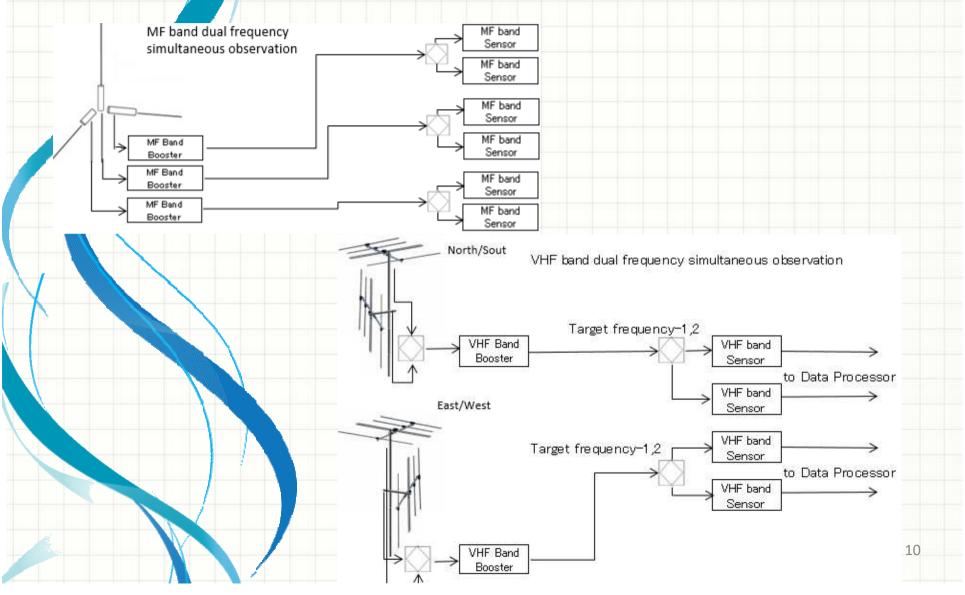
### Tree Bio-electric Potential observation (TBP)



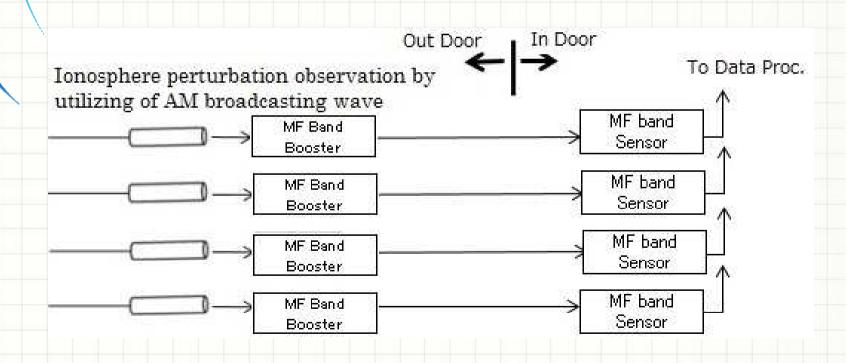
### Combination observation of VHF band within and over horizon



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



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



#### Air ion concentration observation

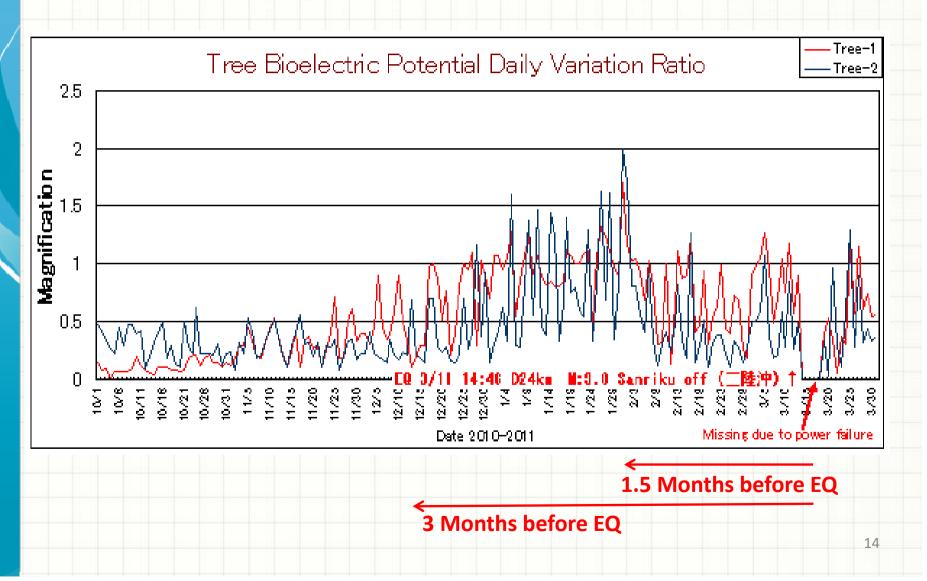


#### **Data Processor**

- 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**

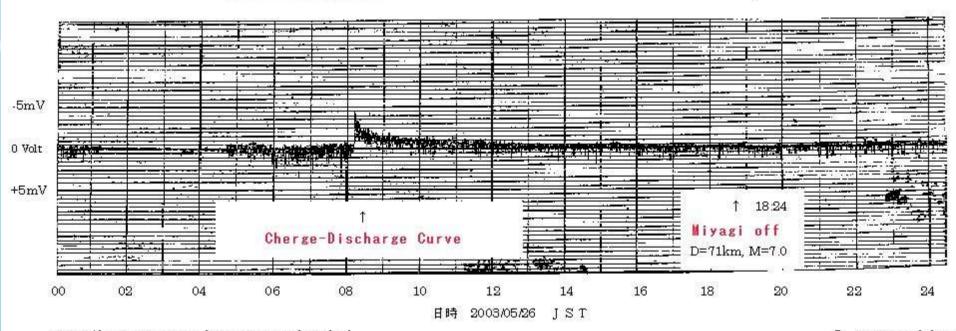
TBP at Yachimata prior to 2011/3/11 Tohoku EQ M9.0



#### **Example of TBP Anomalous Data**

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

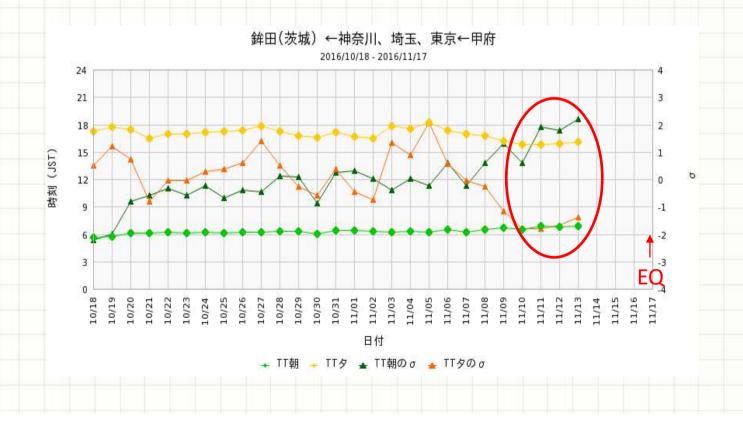




### Example of Anomalous Data of MF band lonospheric disturbance observation

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

**Terminator Time Standard deviation σ>2 for 4days** 



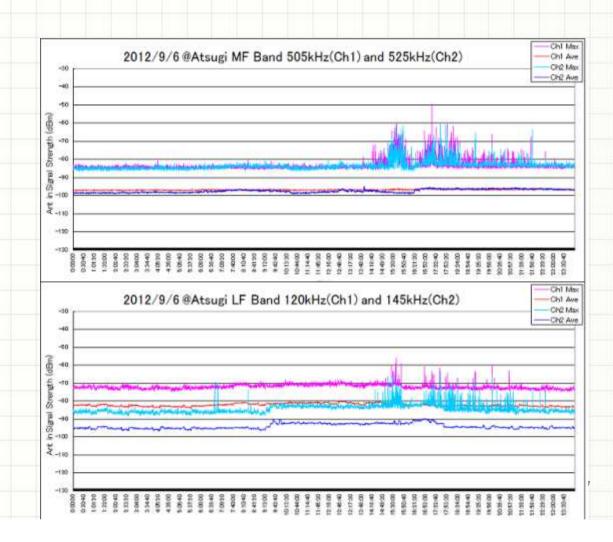
16

### Example of Anomalous Data of dual frequency simultaneous observation

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

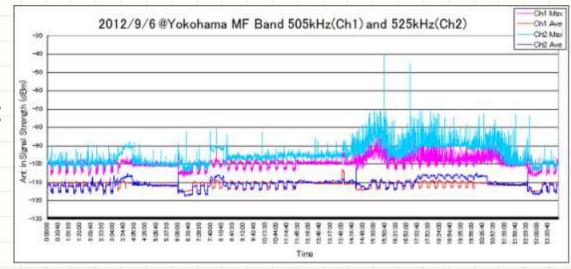
1 week before at Atsugi MF Band

1 week before at Atsugi LF Band

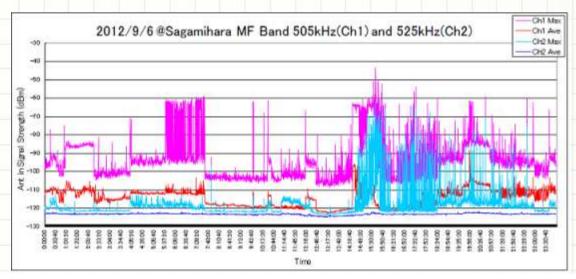


### Example of Anomalous Data of dual frequency simultaneous observation

1 week before at Yokohama MF Band

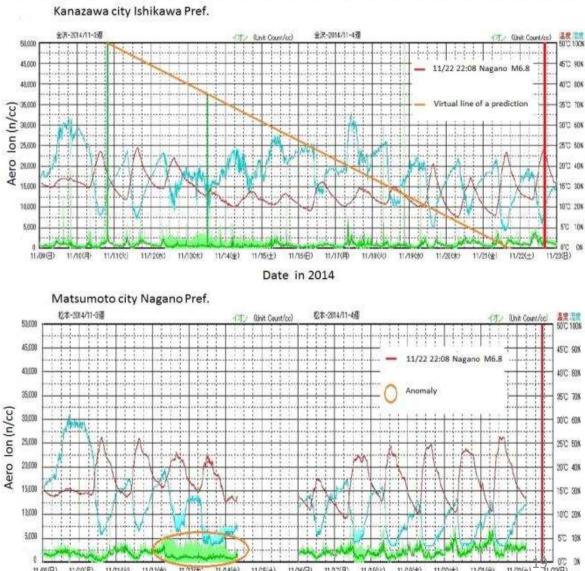


1 week before at Sagamihara MF Band



### Example of Anomalous Data of Air Ion Observation

Prior to 2014/11/22 Nagano M6.8



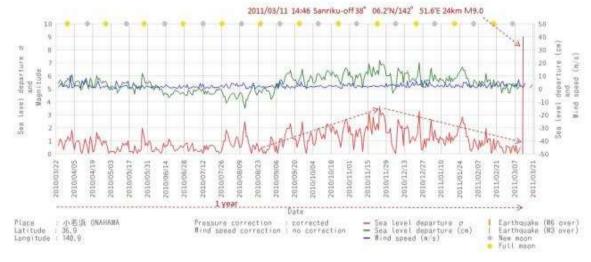
Date in 2014

### Example of Anomalous Data of Tidal Level Deviation at Onahama

Prior to 2011/03/11 Tohoku EQ M9

Long term:
6months before EQ

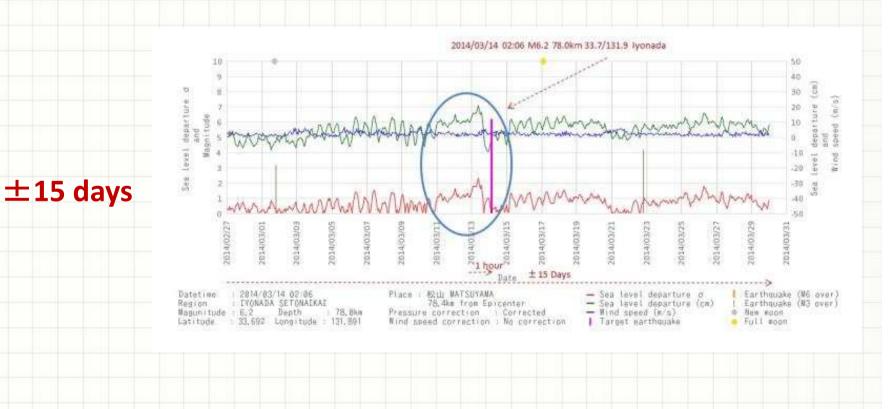
1 day before the day of EQ





### Example of Anomalous Data of Tidal Level Deviation at Matsuyama

Prior to 2014/03/14 Iyonada M6.2



21

# Thank you for your attention!

E-Mail: saito@jepcoc.jp

Web Site: http://www.jepcoc.jp/