



# Contributions of UKM towards the International Space Weather Initiative

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# Outline

- Introduction
- Research Facilities
- Research and Activities in UKM
- UKM and ISWI
- Future Work
- Conclusion

# Introduction

- Where are we?



**Institute of Space Science**

**Universiti Kebangsaan Malaysia**

**Geographic coordinate : (2.92°N, 101.77°E)**

**Geomagnetic coordinate: (5.93°S, 173.23°E)**



# Research Facilities



- **Trimble TS5700 GPS Receiver – Scott Base, Antarctica**  
(77.9°S, 166.8°E)
- **Trimble TS5700 GPS Receiver – UKM (2.92°N, 101.77°E)**
- **GPS receiver at Arctic (64.7°N, -21°E)**
- **MAGDAS Magnetometer, National Observatory Centre, Langkawi, Kedah**  
(6.33N, 99.85E)
- **All sky Camera (AAN), Arrival Height, Antarctica (77.9°S, 166.8°E)**
- **Microwave & RF R&D Facilities**
- **GISTM system over Malaysia**
- **VLF receiver**
- **SID**
- **Anechoic Chamber**
- **Cosmic Ray Detection System**
- **Ultra-violet Radiation Detection System**
- **3 Labs:**
  - **Satellite and Mobile Lab**
  - **Microwave Lab**
  - **Muon Lab**

# RESEARCH FACILITIES



GPS Station,UKM



Microwave Lab, UKM



Magnetometer, Langkawi



UV Detector, UKM



GPS station, Arctic

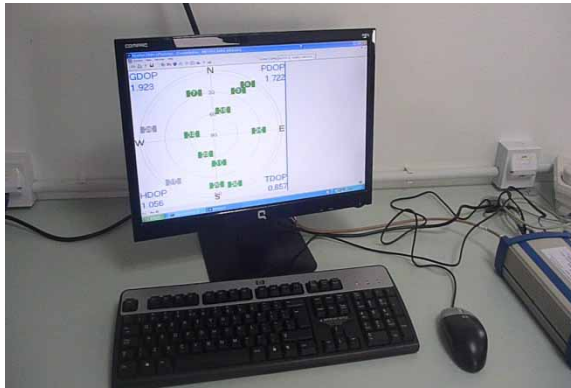


GPS Antenna, UKM



GPS station, Antarctica

# RESEARCH FACILITIES



GISTM



AWESOME VLF

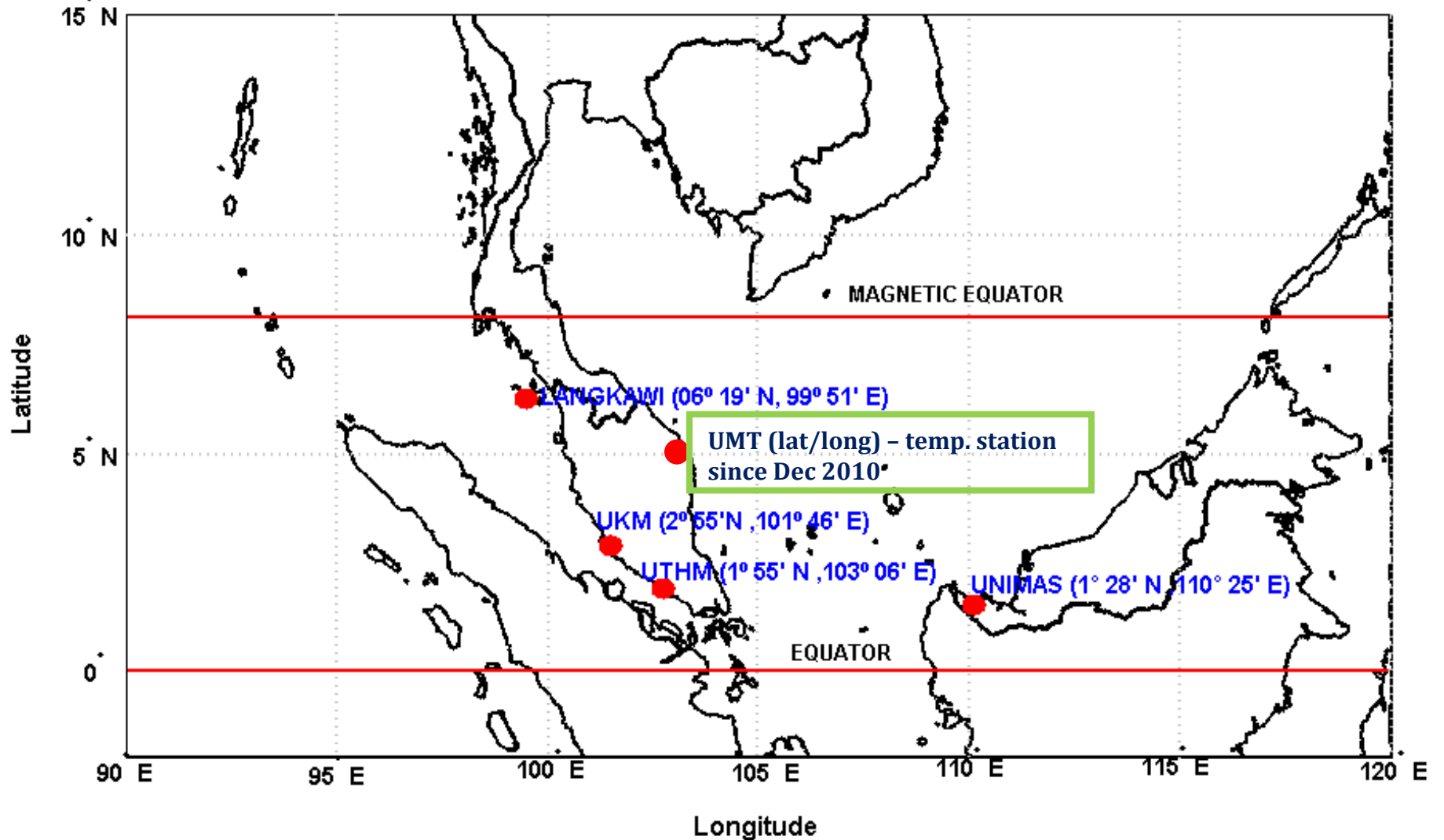


SID, UKM





# GPS IONOSPHERIC SCINTILLATION & TEC MONITOR



# RESEARCH AND ACTIVITY



1. Modelling and Determination of Ionospheric effects on GNSS Measurements
2. Analysis and Prediction of Ionospheric Variations During Total and Partial Solar Eclipse Over the Polar Region
3. Analysis of Ionospheric Variation During Geomagnetic Storm Events in the Polar Regions
4. Characterization of the Interhemispheric Conjugacy Effects of Ionospheric Variations Over the Polar and Equatorial Regions
5. Study of the Travelling Ionospheric Disturbances During Geomagnetic Storms Events
6. Forecasting ionospheric delay using statistical method



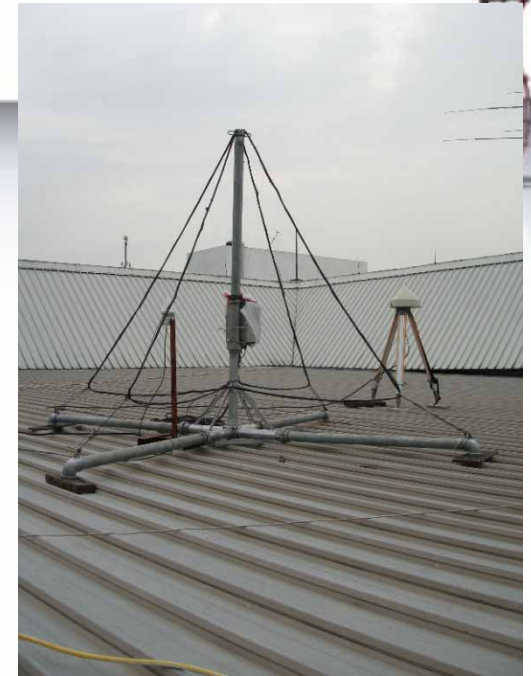
## RESEARCH AND ACTIVITY

7. Mapping the TEC using Bernese GPS Software version 5.0
8. TEC Regional Model Using Bernese and Comparison with IGS and IRI 2007
9. Ionospheric Total Electron Content Variation response to the Earthquake
10. GPS Installation at Arctic- TEC variations
11. Investigation of the Impact of Solar Eclipse on the Radiowave Propagation through Polar and Equatorial Ionosphere- cont.
12. Investigation of the Impact of Geomagnetic Storms on the Radiowave Propagation at Geomagnetically Conjugate Points in the Polar and Equatorial Regions- cont.
13. Global GPS and Ionosonde TEC and Scintillation Measurement During Storm Events



# Very Low Frequency (VLF)

- Collaboration with Stanford University since 2007 through IHY programme
- The receiver consists of three major parts: a 1.7 m<sup>2</sup> triangle shaped orthogonal crossed loop antenna aligned in the N/S and E/W directions, a preamplifier placed close to the antennas to minimize the resistive loss then passes the signals in the range of 0.8 to 47 kHz to the line receiver that is connected to a PC.
- The received continuous data is sampled with 100 kHz signal and converted to digital format using a 16-bit ADC card installed into the PC. Data acquisition software produced by Stanford University saves the data in MAT-file format [4]



Location of VLF antenna



Location of VLF receiver at UKM,  
Malaysia

# Very Low Frequency (VLF)

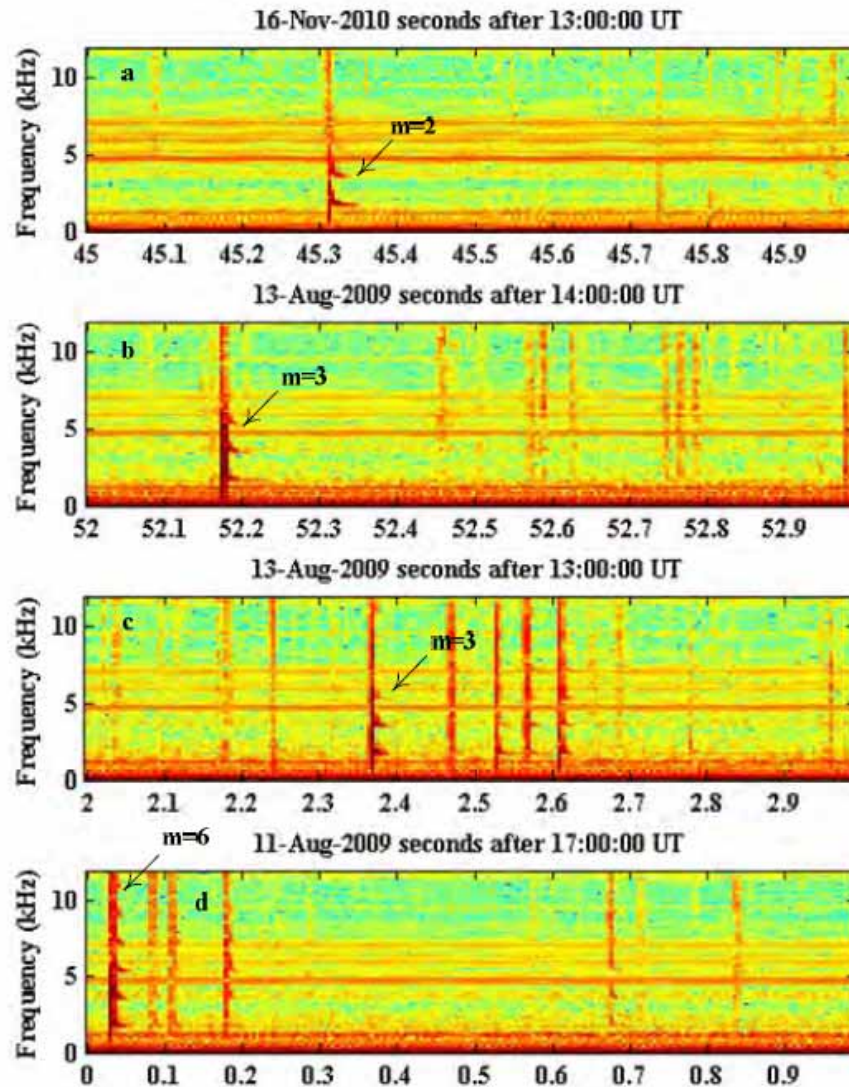


Figure 2. Four examples of multimode tweek atmospherics observed in August 2009 and November 2010. (LT= UT+ 8)

# Super Ionospheric Disturbance (SID)



- Collaboration with International Space Weather Initiative since 2010
- Received two Super SID
- Collaborate with school student (age : 16 years old)



Student with the SID antenna



SID complete system



SID at PermataPintar

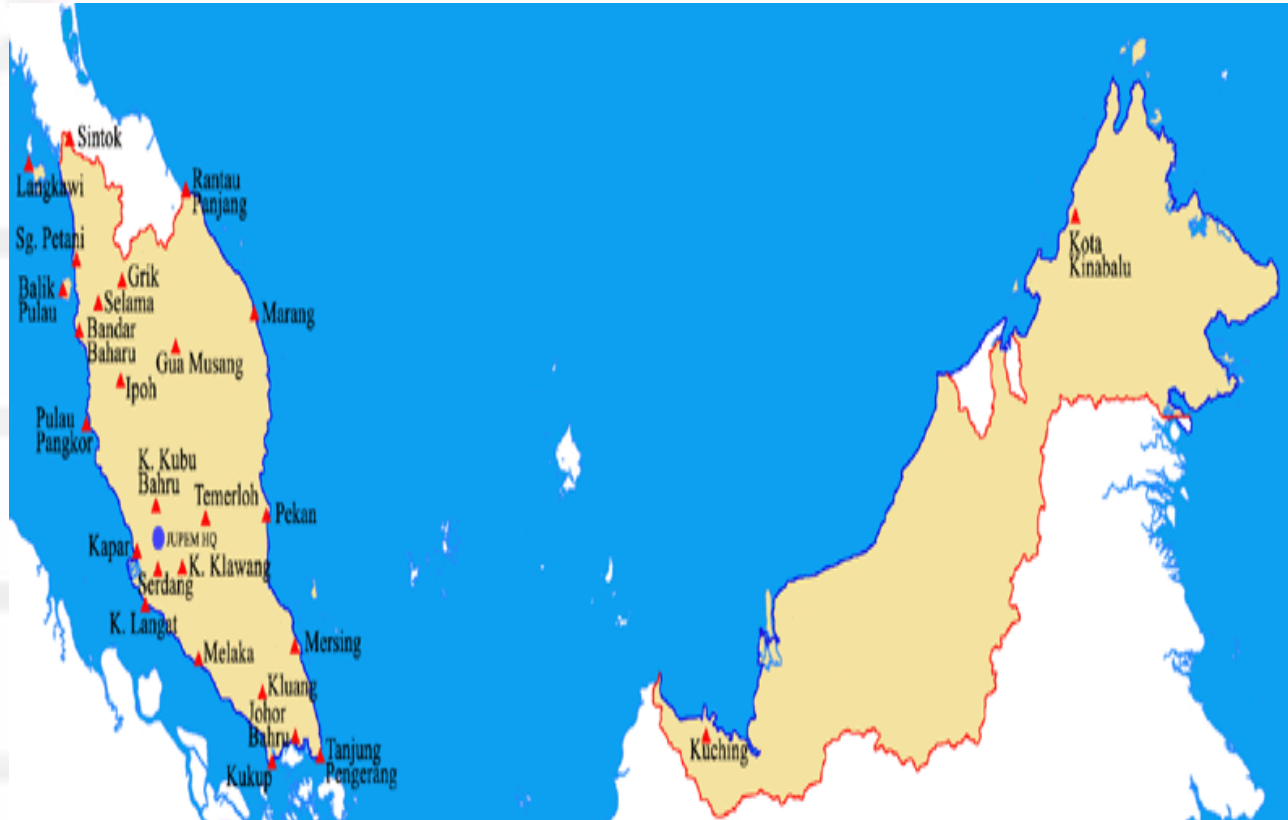
## **LOCAL & INTERNATIONAL SUPPORT**

- 1. Ministry of Higher Education (MOHE)**
- 2. Ministry of Science, Technology and Innovation (MOSTI)**
- 3. Universiti Kebangsaan Malaysia (UKM)**
- 4. Academy of Sciences Malaysia (ASM),  
Antarctica, IHY, IPY, ICESTAR**
  - 1. Antarctica New Zealand - logistic**
  - 2. University of Canterbury, NZ - Ionosonde Data**
  - 3. National Institute of Water and Atmospheric Research (NIWA) - Meteorological Data**
- 5. Space Environment Research Center, Kyushu University, Japan - MAGDAS data & AAN**
- 6. Universiti Tun Hussein Onn (UTHM)**
- 7. Universiti Malaysia Serawak (UNIMAS)**
- 8. National Institute of Polar Research, Japan (NIPR)- Arctic**
- 9. Science Institute of University Iceland (SIUI)**
- 10. University of Stanford: AWESOME (VLF) - COA**





## OTHER RELATED RESEARCH INSTITUTES



**GPS receivers organized by DSSM (57 RTK)**

- 1. Universiti Tun Hussein Onn (UTHM)**
- 2. Universiti Teknologi Malaysia (UTM)**
- 3. Department of Survey and Mapping Malaysia (DSSM)**

# UKM, IHY and ISWI

- Collaboration between the Institute of Space Science (ANGKASA) UKM and Stanford University, U.S. under the International Heliophysical Year (IHY) 2007-2008, research in remote sensing using VLF receiver was initiated in 2009 at the university using AWESOME monitor.
- Following the success of the IHY program, the International Space Weather Initiative (ISWI) was formed that focuses mainly on space weather.
- Through this, a low cost version of the AWESOME monitor designed for high school named Sudden Ionospheric Disturbance (SID), was obtained.



# INSTRUMENT

- IHY
  - i. MAGNETIC DATA ACQUISITION SYSTEM (MAGDAS) – COLLABORATION WITH SPACE ENVIRONMENT RESEARCH CENTER, KYUSHU UNIVERSITY, JAPAN
  - ii. VLF – STANFORD UNIVERSITY, USA
  
- ISWI
  - i. SUDDEN IONOSPHERIC DISTURBANCE (SID)

# CURRENT STATUS : MAGDAS



- Station located at Langkawi National Observatory (LNO), Malaysia
- Collaboration with National Space Agency of Malaysia
- Project members : Dr Geri, Dr Alina
- Output : 1 MsC student, 1 PhD (on going at Kyushu Uni)



# CURRENT STATUS : AWESOME VLF



- The station located in UKM
- The computer has been upgrade to high performance
- Output :
  - i. 3 PhD students (on going)
  - ii. 1 MsC student
  - iii. Join Publications

# CURRENT STATUS : SID

- Installation date
  - 9<sup>th</sup> December 2011 at Kolej Zaa'ba, UKM
  - 19<sup>th</sup> March 2012 at Permata Pintar, UKM
  - 4<sup>th</sup> April 2012 at Seri Puteri Cyberjaya and SMAP Kajang.
- Group members
  - Prof Ir Dr Mardina Abdullah
  - Prof Madya Dr Badariah Bais
  - Dr Alina Marie Hasbie



# CURRENT STATUS : SID

- Space Weather Competition among the school students over Malaysia –using SID
- Collaboration with National Space Agency of Malaysia
- The installation manual in Malay language in order to gain school students interest in space weather.





# CALLISTO



One station has been installed at Permata Pintar School, Universiti Kebangsaan Malaysia (UKM), Bangi, Malaysia.



Leader of Callisto Project: Prof. Dr. Mohammad Tariqul Islam  
Project Members:  
Dr. Alina Marie Hasbi  
Radial Anwar  
Azam Zavvari

Antenna Specifications:  
Operating Frequency: 50 MHz – 1.3 GHz  
Dimensions: Length 2 meters  
Width 3 meters  
Beamsize: 60-70 degrees at E-plane  
110-130 degrees at H-plane  
Observation coverage: 7 Hours





## FUTURE WORK



### Research Theme:

Solar-terrestrial relationship →  
teleconnections

- Aurora
- Geomagnetic storms
- Space weather
- Lower and Upper Atmosphere coupling
- More work on Equatorial Region i.e. Disturbances- scintillation and TIDs
- SID and VLF
- Earthquake

# For further information..



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