International Space Weather Initiative

BSSI: 1991-2004

IHY: 2005-2009

ISWI: 2010-2012

Office for Outer Space Affairs
United Nations Office at Vienna
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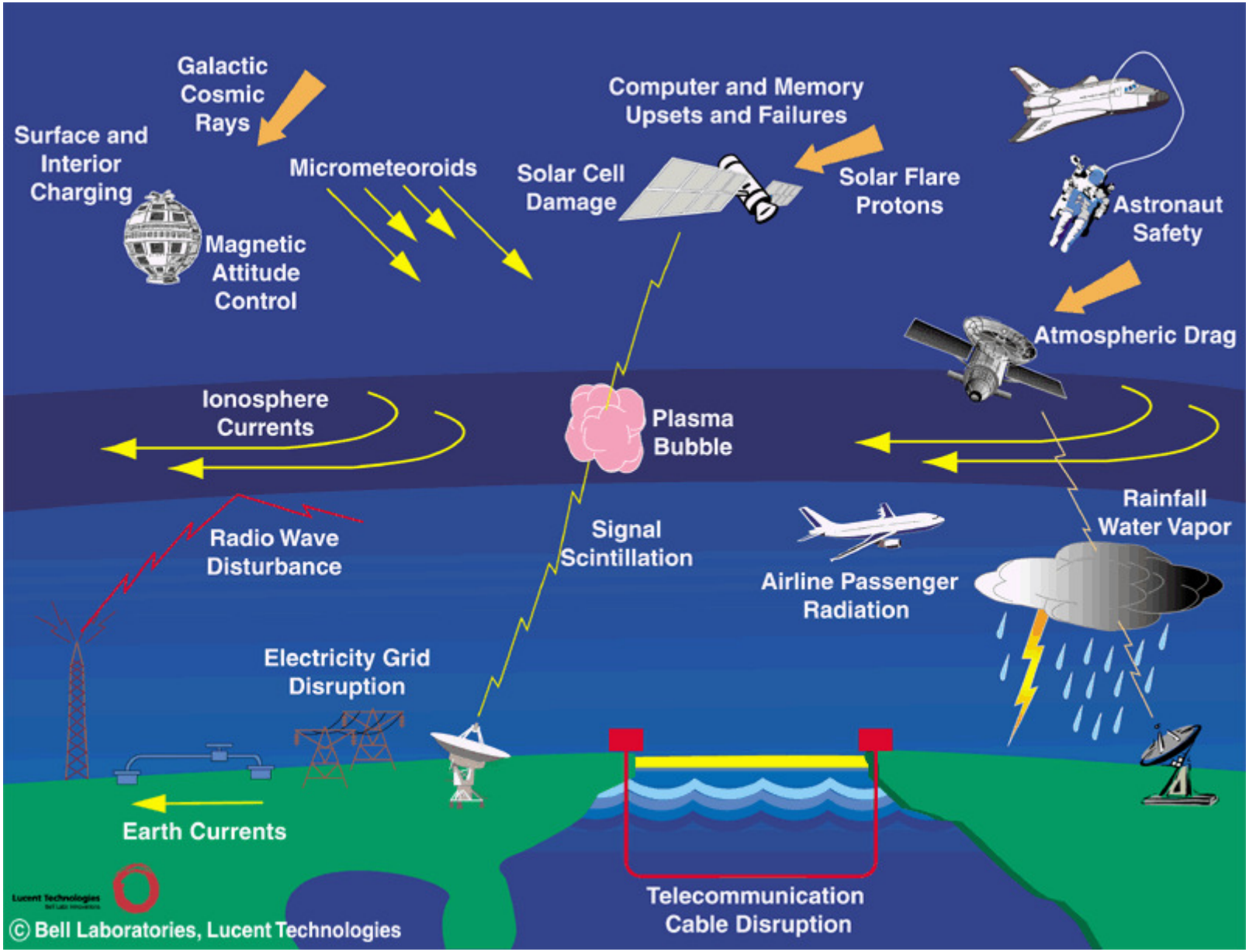
Galactic Cosmic Rays
Surface and Interior Charging
Micrometeoroids
Solar Cell Damage
Computer and Memory Upsets and Failures
Solar Flare Protons
Astronaut Safety
Magnetic Attitude Control
Atmospheric Drag
Ionosphere Currents
Plasma Bubble
Radio Wave Disturbance
Signal Scintillation
Airline Passenger Radiation
Rainfall Water Vapor
Electricity Grid Disruption
Earth Currents
Telecommunication Cable Disruption
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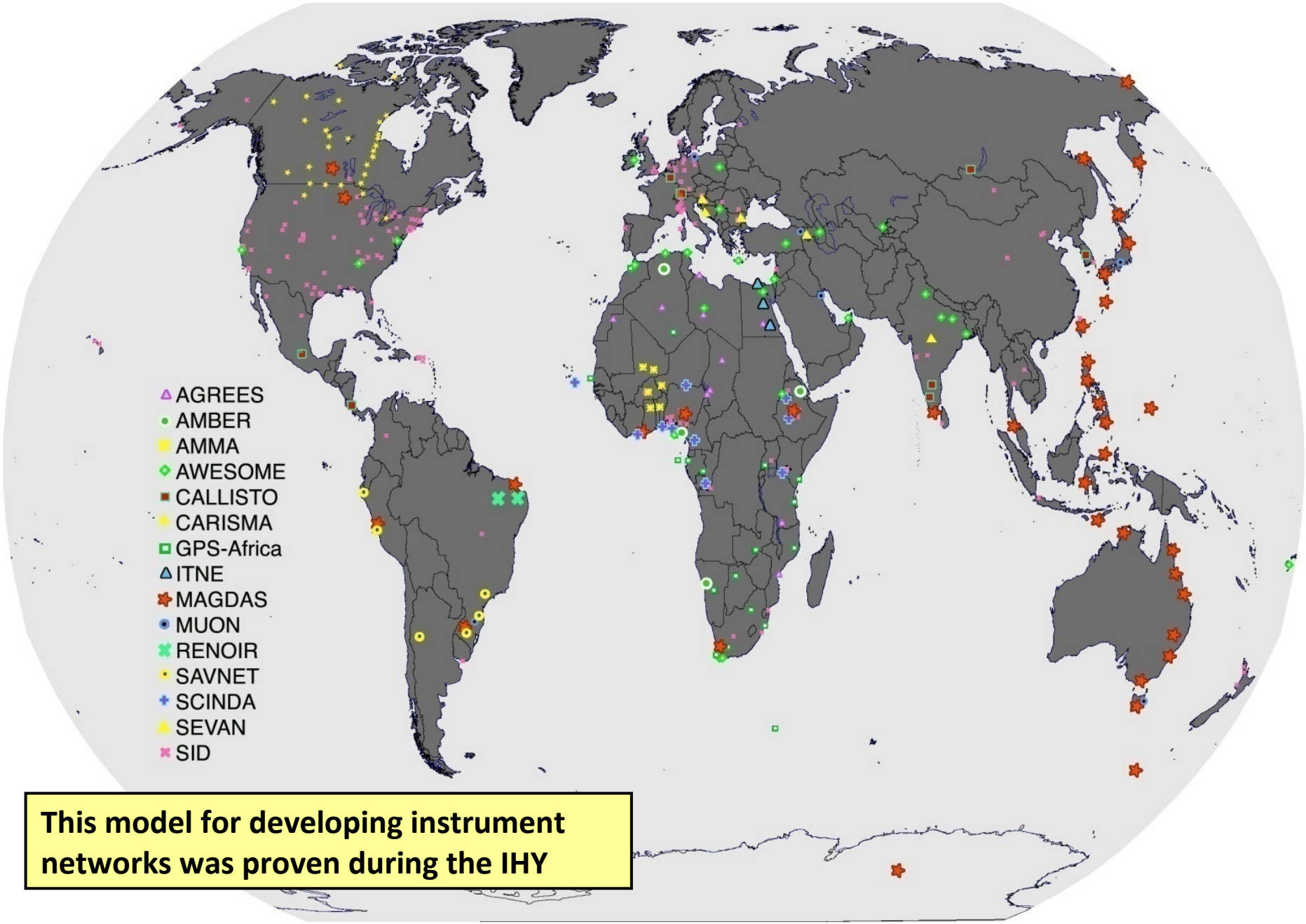
Objectives

- **Develop the scientific insight necessary to understand the space science, and to reconstruct and forecast near-Earth space weather**
  - **Instrumentation and data analysis**
    - **Expand and continue deployment of new and existing instrument arrays**
    - **Expand data analysis effort for instrument arrays and existing data bases**
  - **Coordinate data products to provide input for physical modeling (joint with other more extensive modeling efforts)**
    - **Input instrument array data into physical models of heliospheric processes**
    - **Develop data products that reconstruct past conditions in order to facilitate assessment of problems attributed to space weather effects**
  - **Coordinate data products to allow predictive relationships to be developed (joint with space weather prediction organizations)**
    - **Develop data products to allow predictive relationships that enable the forecasting of space weather to be established**
    - **Develop data products that can easily be assimilated into real-time or near real-time predictive models**
- **Education**
  - **University and Graduate Schools**
    - **Encourage and support space science courses and curricula in universities that provide instrument support**
  - **Public Outreach**
    - **Develop public outreach materials unique to the ISWI, and coordinate the distribution**

Principles of the Instrument Programme

- The lead scientist or principle investigator funded by his/her country provides instrumentation (or fabrication plans) and data distribution
- The host country provides the workforce, facilities, and operational support typically at a local university.
- Host scientists become part of science team
- All data and data analysis activity is shared
- All scientists participate in publications and scientific meetings where possible



This model for developing instrument networks was proven during the IHY

What is Unique about ISWI?

- **UN Endorsement**
  - Opens new opportunities for collaboration in countries with little/no space physics by involving governments and universities or national labs
  - Encourages governmental response
  - Allows broad dissemination of information in 6 languages to 192 countries of the UN
- **Government Participation**
  - Helps with import/export and technology issues
  - Help with visas, security, logistics, operational support

Scientific Benefits

- New and interesting phenomena along the DIP equator and in other regions can be studied for the first time
- Arrays provide 3D information that can be used in tomographic reconstructions
- By observing in new geographical regions, a more global picture of Earth's response to various inputs can be obtained.
- These networks will eventually provide real-time data valuable for forecasting and nowcasting.

Current Instrument Arrays (May 2009)

ID	INSTRUMENT	Lead Scientist	Country	Objective
1	Scintillation Network Decision Aid (SCINDA)	K. Groves keith.groves@hanscom.af.mil (Hanscom AFRL)	USA	Study equatorial ionospheric disturbances to aid in the specification and prediction of communications degradation due to ionospheric scintillation in the Earth's equatorial region
2	Coherent Ionospheric Doppler Radar (CIDR)	T. Garner garner@arlut.utexas.edu (U Texas)	USA	To tomographically reconstruct the ionosphere and to provide input to data assimilation models
3	Atmospheric Weather Education System for Observation and Modeling of Effects (AWESOME) and Sudden Ionospheric Disturbance monitor (SID)	U. Inan inan@stanford.edu D. Scherrer deborah@solar2.stanford.edu (U Stanford)	USA	Lightning, sprites, elves, relation to terrestrial gamma ray flashes, whistler induced electron precipitation, conjugate studies
4	Remote Equatorial Nighttime Observatory for Ionospheric Regions (RENOIR)	J. Makela jmakela@illinois.edu (U Illinois)	USA	Study the equatorial/low-latitude ionosphere/thermosphere system, its response to storms, and the irregularities that can be present on a daily basis
5	African GPS Receivers for Equatorial Electrodynamics Studies (AGREES)	E. Yizengaw ekassie@igpp.ucla.edu M. Moldwin (UCLA)	USA	Understand unique structures in equatorial ionosphere, low/mid latitude plasma production, effect of ionospheric and plasmaspheric irregularities on communications
6	African Meridian B-field Education and Research (AMBER)	M. Moldwin mmoldwin@igpp.ucla.edu E. Yizengaw (UCLA)	USA	Understand low latitude electrodynamics, ULF pulsations, effect of Pc5 ULF on MeV electron population in inner radiation belts

Current Instrument Arrays (May 2009)

ID	INSTRUMENT	Lead Scientist	Country	Objective
7	Compound Astronomical Low-cost Low-frequency Instrument for Spectroscopy and Transportable Observatory (CALLISTO)	A.Benz benz@astro.phys.ethz.ch C. Monstein monstein@astro.phys.ethz.ch (ETH-Zentrum)	Switzerland	Study the magnetic activity of a wide range of astrophysical objects with emphasis on the Sun and cool stars
8	South Atlantic Very Low frequency Network (SAVNET)	J.-P. Raulin raulin@craam.mackenzie.br (U Presbiteriana)	Brazil	Study of the SAMA region at low ionospheric altitudes and its structure and dynamics during geomagnetic perturbations
9	Magnetic Data Acquisition System (MAGDAS)	K. Yumoto yumoto@serc.kyushu-u.ac.jp (Kyushu U)	Japan	Study of dynamics of geospace plasma changes during magnetic storms and auroral substorms, the electromagnetic response of iono-magnetosphere to various solar wind changes, and the penetration and propagation mechanisms of DP2-ULF range disturbances
10	African Dual Frequency GPS Network	C. Amory-Mazaudier christine.amory@lpp.polytechnique.fr (CETP/CNRS)	France	To increase the number of real-time dual-frequency GPS stations worldwide for the study of ionospheric variability, response of the ionospheric total electron content (TEC) during geomagnetic storms over the African sector

Current Instrument Arrays (May 2009)

11	Space Environmental Viewing and Analysis Network (SEVAN)	A.Chillingarian chili@aragats.am (Aragats)	Armenia	A network of particle detectors that aims to improve fundamental research of the particle acceleration in the vicinity of the Sun and the space environment, as well as to provide forewarnings of dangerous consequences of space storms
12	Global Muon Detector Network (GMDN)	K. Munakata kmuna00@gipac.shinshu-u.ac.jp (Shinsu U)	Japan	To identify the precursory decrease of cosmic ray intensity that takes place more than one day prior to the Earth-arrival of shock driven by an interplanetary coronal mass ejection
13	Continuous H-alpha Imaging Network (CHAIN)	S. UeNo ueno@kwasan.kyoto-u.ac.jp K. Shibata (Kyoto U)	Japan	Solar activity, flares, filaments, filament eruptions
14	Optical Mesosphere Thermosphere Imager (OMTI)	K. Shikawa (Nagoya U)	Japan	Dynamics of the upper atmosphere through nocturnal airglow emissions

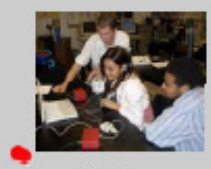
Appendix:
Instrument Array Examples

Deployed during the International Heliophysical Year 2007 campaign

(2005-2009)

Space Weather Monitor Sites

IHY Distribution 2007-2009



USA

Mexico

Germany

Nigeria

Ethiopia

China

AWESOME research monitors (26)

SID student monitors (300) *Larger dots indicate multiple sites*

USA

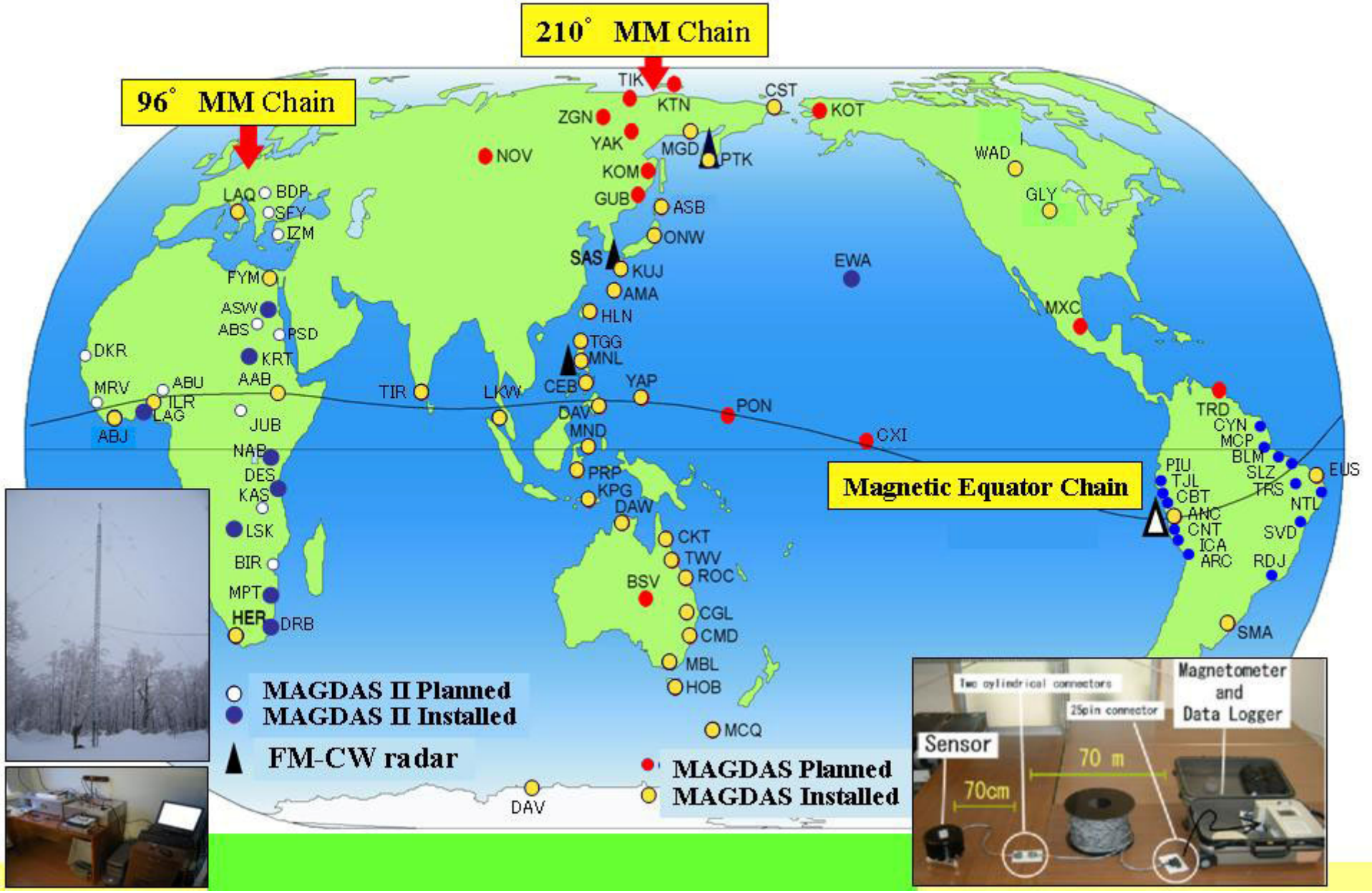
Romania

Lebanon

Thailand

MAGDAS I & II Projects at SERC, Kyushu U.

(MAGnetic Data Acquisition System/Circum-panPacific Magnetometer Network)



GPS Network and AMBER Mags