ISWI Instrument Updates

Presented at the ISWI Steering Committee Meeting

Vienna, Austria, February 7, 2020

Compound Astronomical Low-cost Low-frequency Instrument for Spectroscopy and Transportable Observatory Network (e-Callisto)

Christian Monstein

Institute for Particle Physics and Astrophysics

ETH Zürich and IRSOL Locarno

Switzerland

Global Ionosphere Flare Detection System (GIFDS)
&
Solar Flares detected by Ionospheric Effects (SOFIE)

Jens Berdermann

Scintillation Network Decision Aid (SCINDA)

Keith Groves

Atmospheric Weather Education System for Observation and Modeling of Effects (AWESOME)

- Just announced a public data repository for all the VLF/AWESOME data
  - World Archive for Low-frequency Data and Observations (WALDO; http://waldo.world/)
  - Press releases
    - https://www.eurekalert.org/pub_releases/2019-12/uocd-rpa120919.php
    - https://www.ece.gatech.edu/news/629922/researchers-preserve-and-release-trove-public-low-frequency-radio-data
  - Includes IHY/ISWI/AWESOME data starting in 2006, through the rest of Stanford University recordings
  - Currently holds ~200 TB
  - With daily uploads, may reach ~1000 TB in a year.

(Info supplied by Morris Cohen)

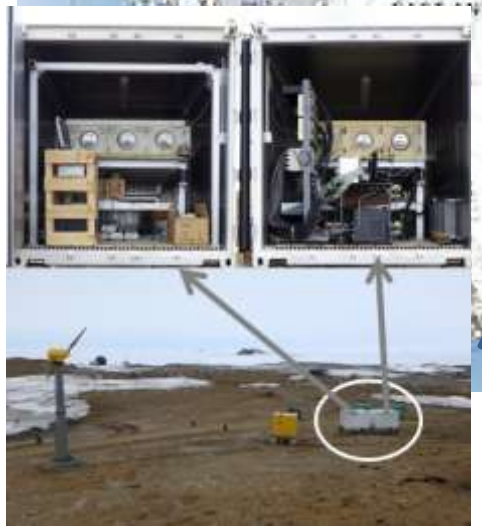
Global Muon Detector Network (GMDN)

Charts provided by

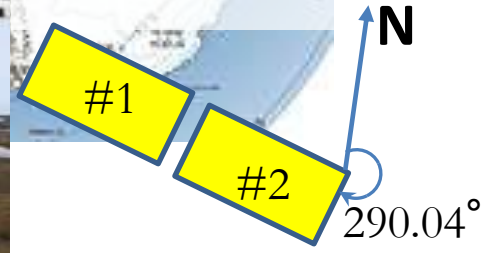
Chihiro Kato
Shinshu University, Japan

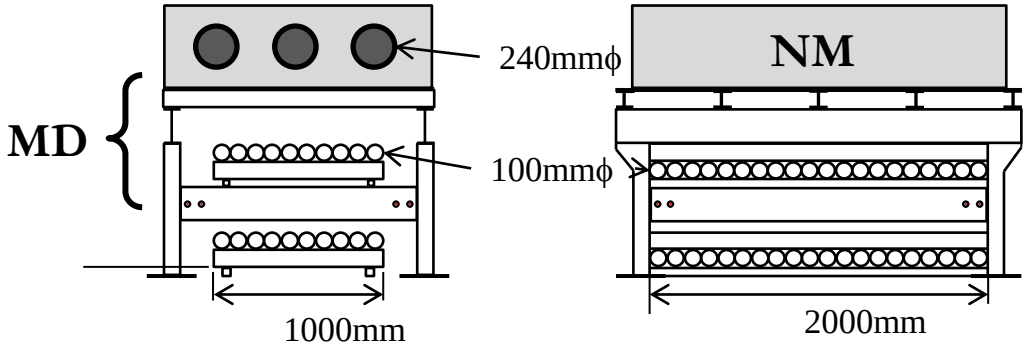
Syowa CR observatory forming GMDN+

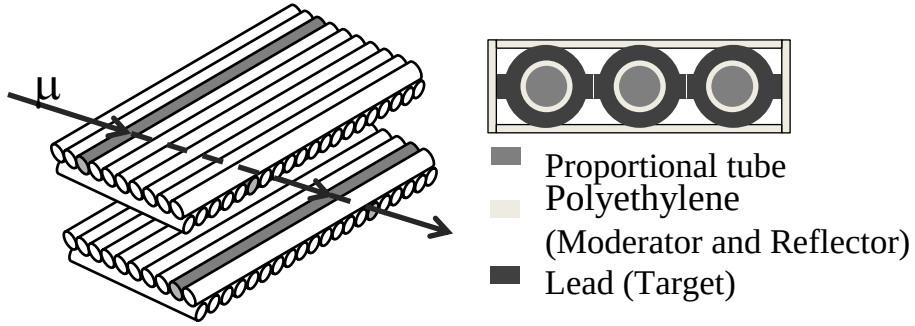
- The detectors were carried and assembled in two refrigerated containers by the 59th Japanese Antarctic Research Expedition (JARE59).
- Neutron Monitors (NMs) were set into both of the container, a Muon Detector (MD) system was set into one of the container.
- The observatory started its operation on February 1st, 2018.
- The MD is expected to be added to the Global Muon Detector Network (GMDN) to form GMDN+(GMDN 'plus').
- GMDN+, an all sky monitor of CR, allows us to determine CR flow around the Earth.



Alt. 24.7 m
Lat. -69° 00'29.2934"
Lon. 39° 35'23.8185"

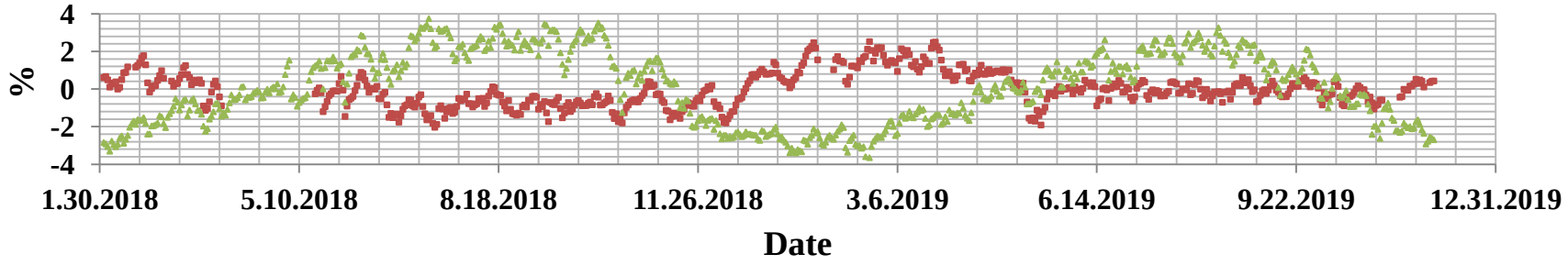


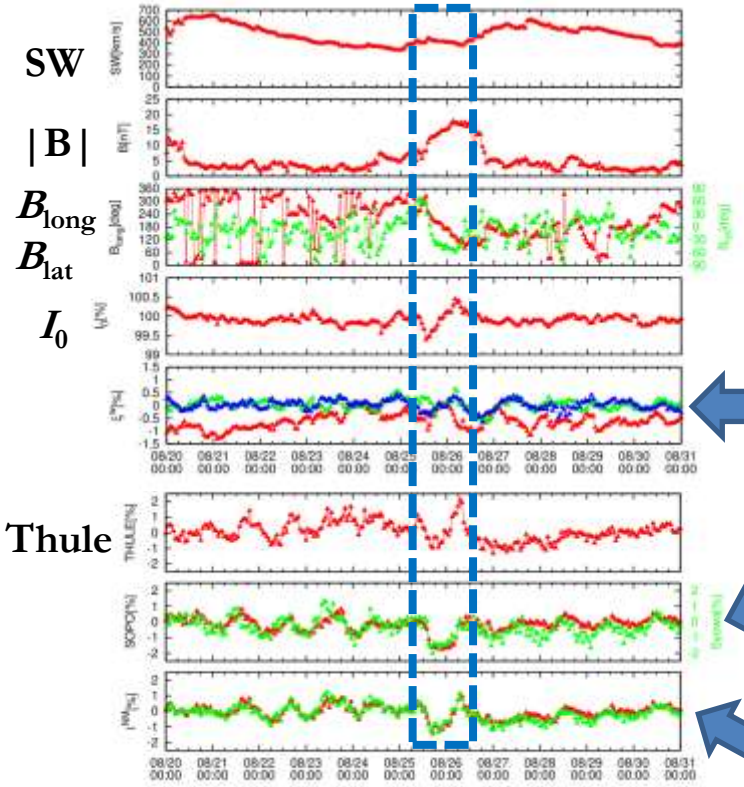




Daily average of MD and NM count

NM & MD Duty cycle= 99 %





Red:ξ_x
Grn:ξ_y
$Blu: \xi_z$

NM(South Pole)
NM(Syowa)

$$I^{NM} = \frac{Thule + SthPl}{2}$$

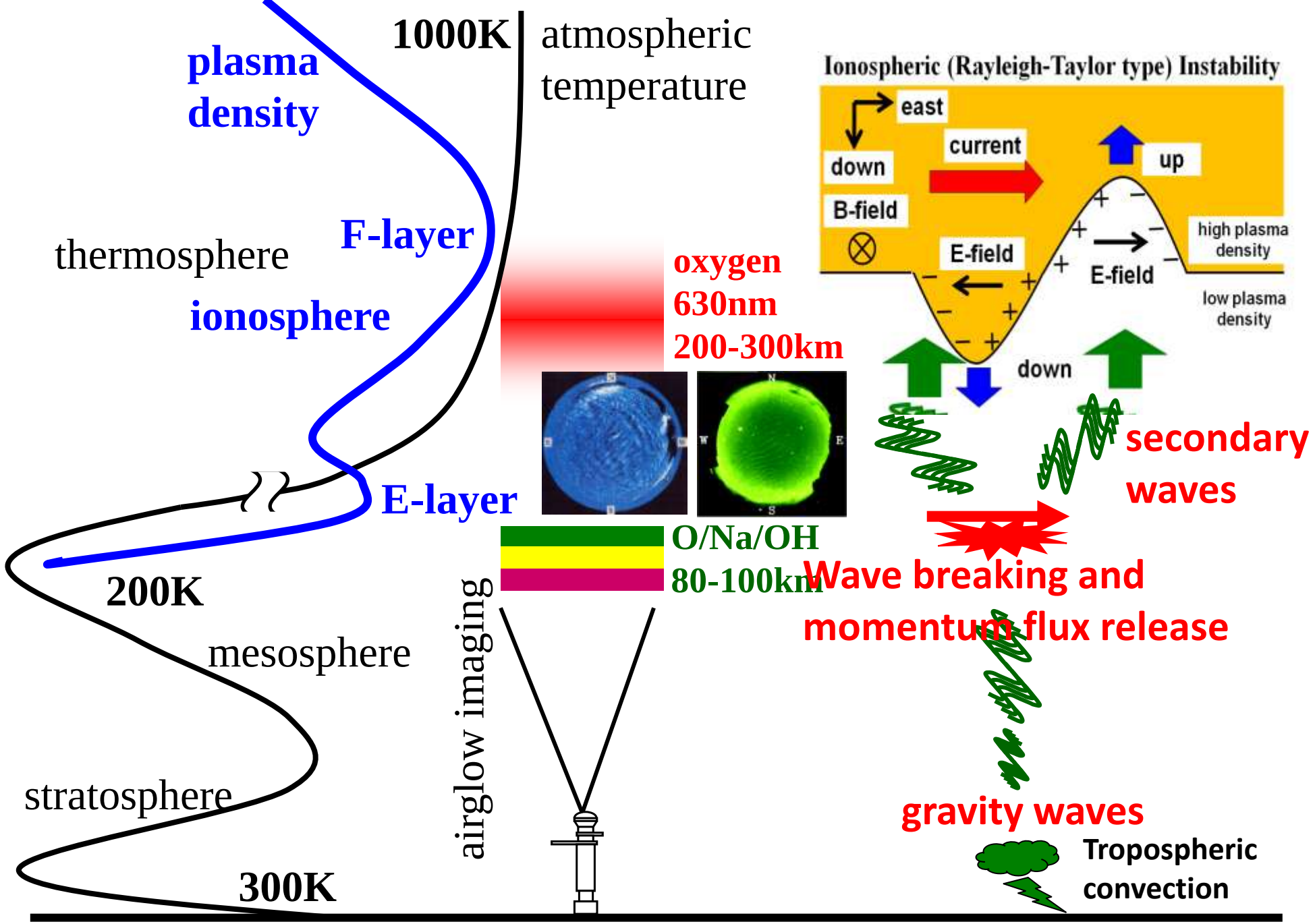
$$I^{NM} = \frac{Thule + Sywa}{2}$$

- Observations have been stably maintained.
- An example of space weather event observed with GMDN(+SyowaMD) and with Syowa NM, Thule NM, and South Pole NM in August 2018.

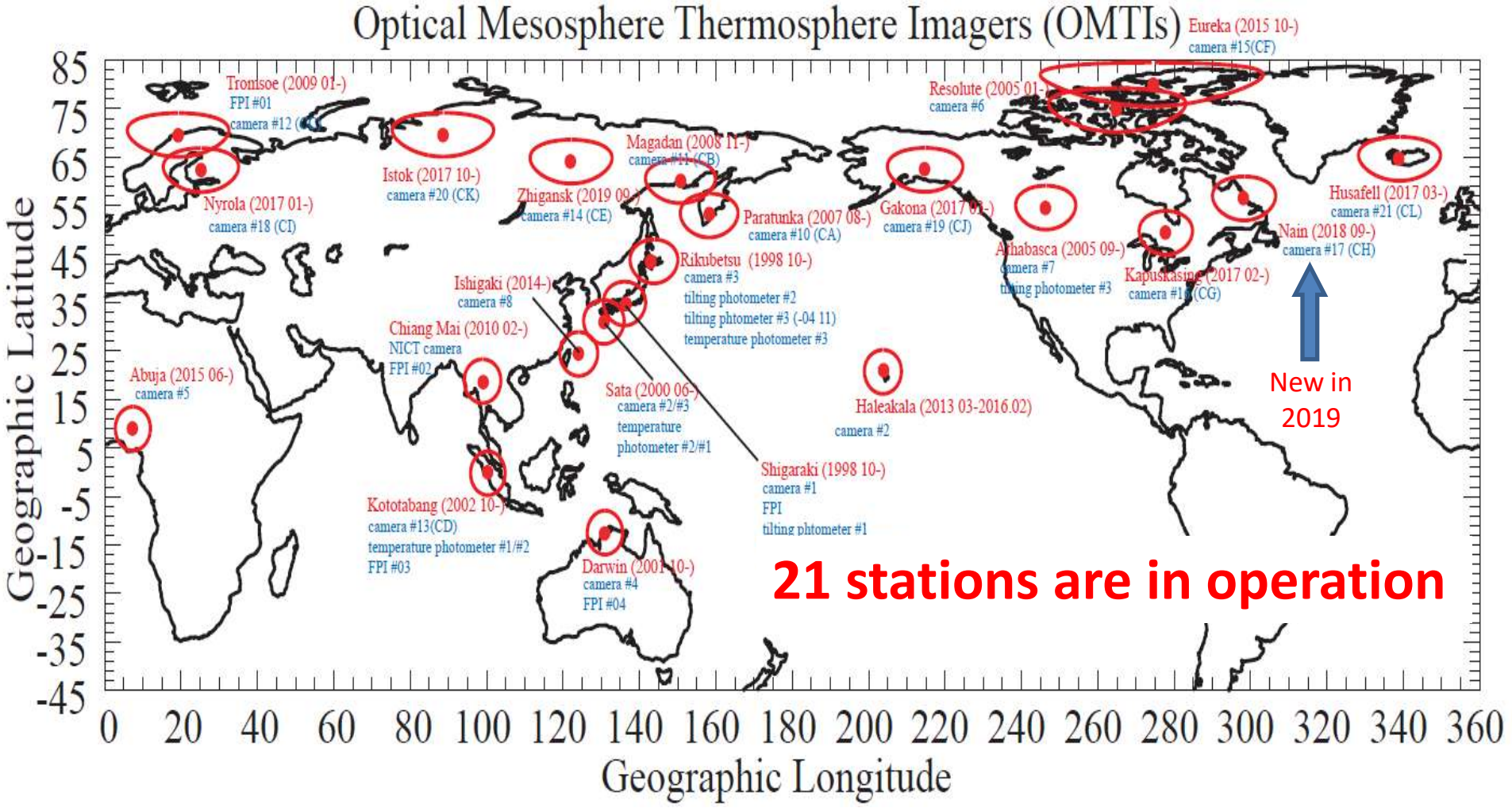
Optical Thermosphere Thermosphere Imagers (OMTIs)

Charts provided by

Kazuo Shiokawa
Nagoya University, Japan


1000K
atmospheric temperature
plasma density
F-layer
thermosphere
ionosphere
E-layer
200K
mesosphere
stratosphere
300K
airglow imaging
oxygen
630nm
200-300km
O/Na/OH
80-100km
Ionospheric (Rayleigh-Taylor type) Instability
east
current
up
down
B-field
E-field
high plasma density
E-field
low plasma density
down
secondary waves
Wave breaking and momentum flux release
gravity waves
Tropospheric convection

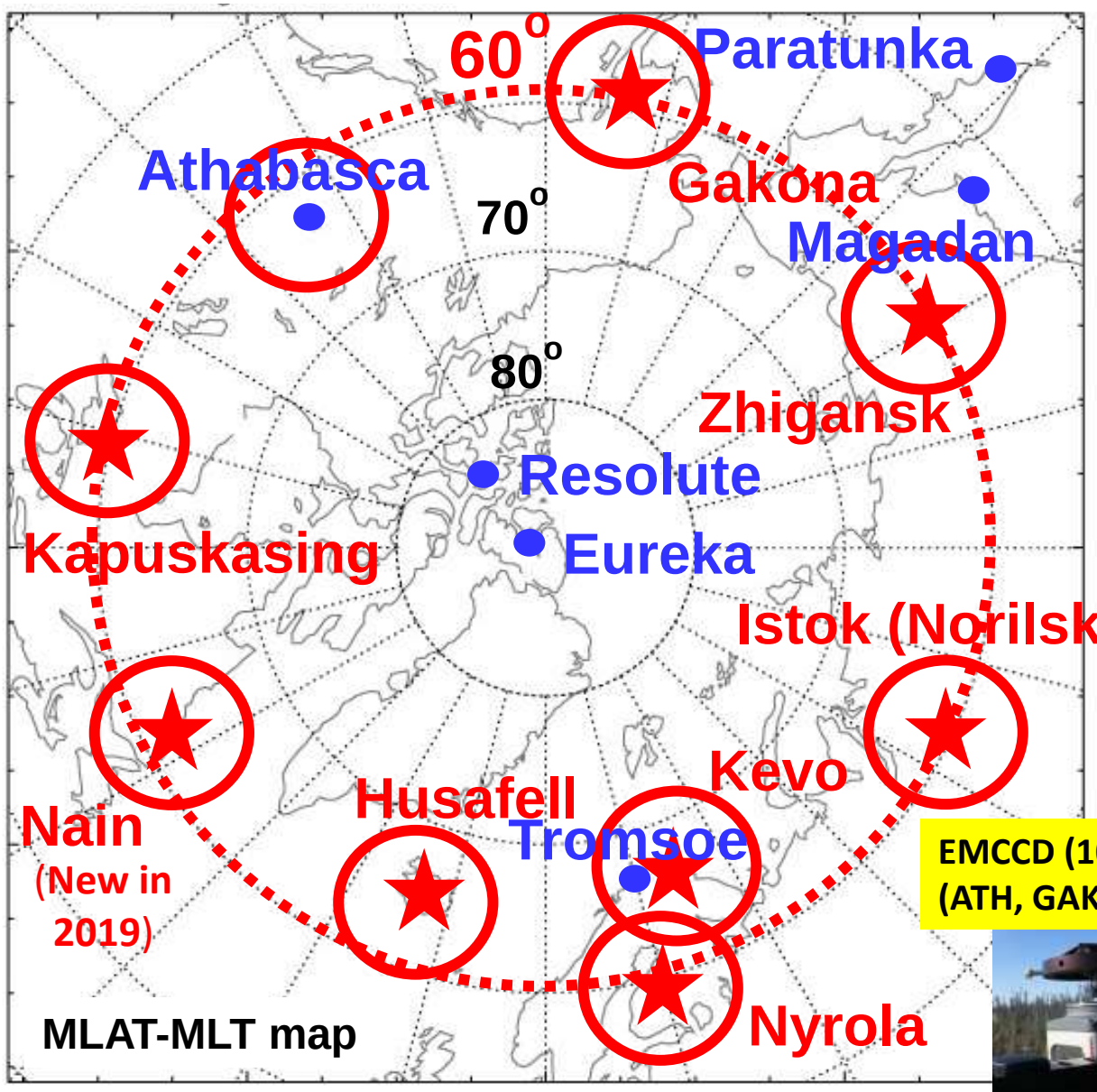
http://stdb2.isee.nagoya-u.ac.jp/omti/



The Optical Mesosphere Thermosphere Imagers (OMTIs) consist of 21 all-sky cooled-CCD imagers, 5 Fabry-Perot interferometers, 3 airglow temperature photometers, and 3 meridian-scanning photometers. They measure two-dimensional airglow images in the mesopause region and in the thermosphere, wind and temperatures in the lower thermosphere, and airglow rotational temperatures in the mesopause region.

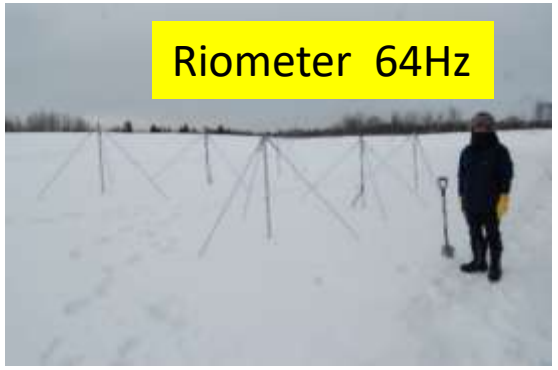
New stations are deployed by the PWING Project since May 2016

● Existing sites ★ New sites

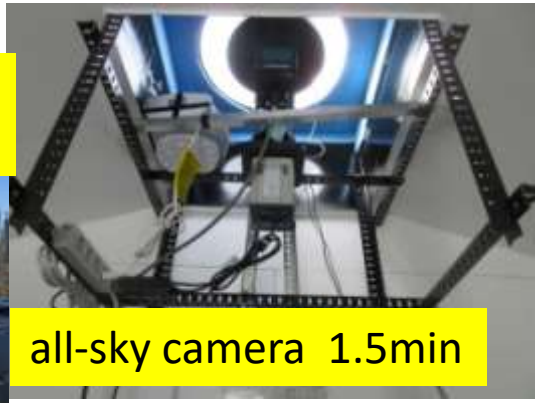


Shiokawa et al. (EPS, 2017)

Induction magnetometer 64Hz



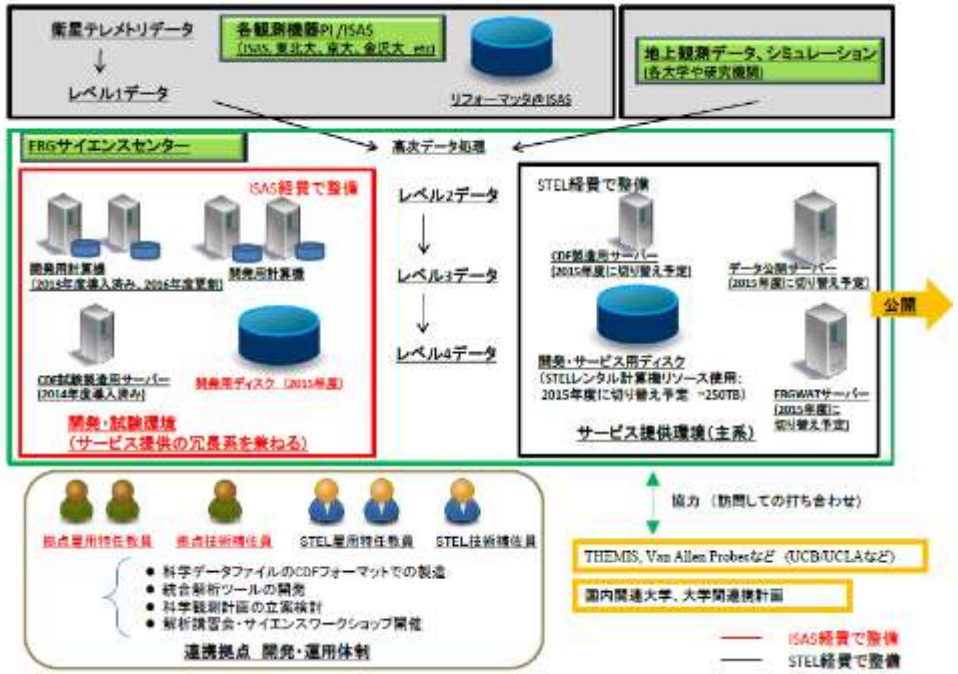
EMCCD (100Hz)
(ATH, GAK, KEV)



Database Construction

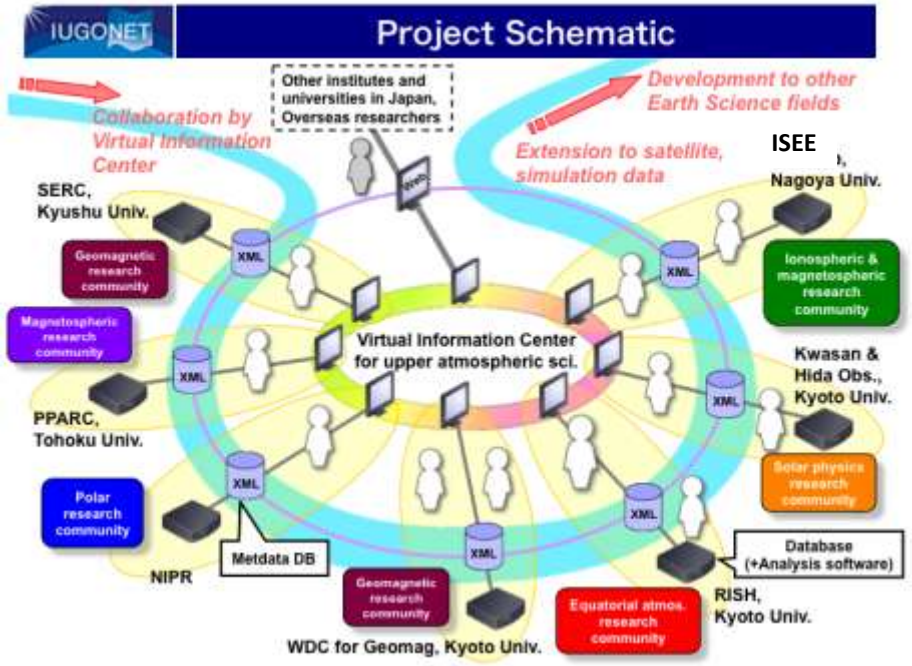
All data from ground network and ERG satellite are stored into the ERG science center in CDF and available through SPEDAS. Metadata and some plots are available at IUGONET.

ERG Science Center



https://ergsc.isee.nagoya-u.ac.jp/

IUGONET



http://www.iugonet.org/

Space Environment Viewing and Analysis Network (SEVAN)

1. SEVAN network expansion, now includes
   - 1 node in Slovakia, 1 node in Czech Republic., and 2 nodes in DESY, (Hamburg and Berlin).
   - All data is collected at Yerevan Physics Institute and is openly accessible from <http://adei.crd.yerphi.am/adei>

2. SEVAN network is used not only for solar physics and space weather, but also for studying high-energy physics in the atmosphere.
   - SEVAN detectors helps to discover electron accelerators in thunderclouds and estimate strength of electric fields in atmosphere (see recent publication: https://eos.org/science-updates/understanding-high-energy-physics-in-earths-atmosphere)

(Bullets supplied by Ashot Chilingarian)