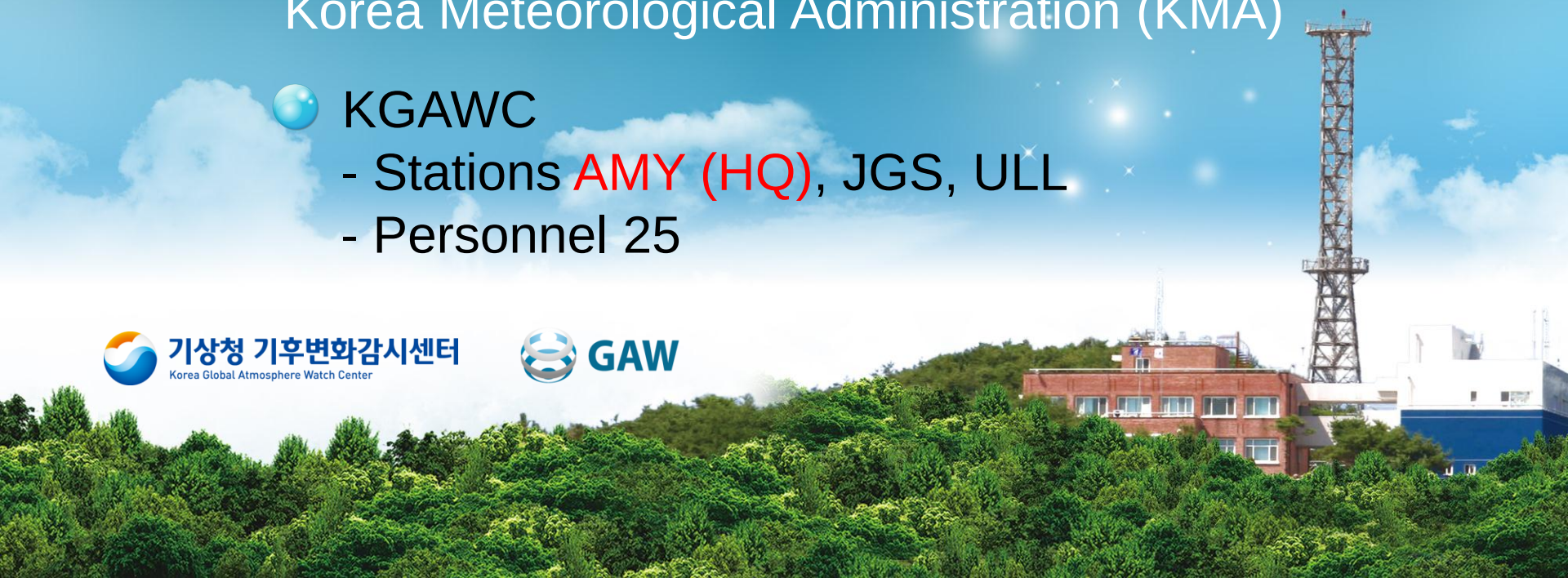
GAW Activities in Korea

Oct. 20, 2014

Chulkyu Lee

Korea Global Atmosphere Watch Center (KGAWC)
Climate Science Bureau (CSB)
Korea Meteorological Administration (KMA)

- KGAWC
  - Stations AMY (HQ), JGS, ULL
  - Personnel 25



Contents

History of KGAWC

1987. 1.	Establishment of a weather station at Mt. Soback (Purpose of air pollution measurements)
1996. 9.	Movement from Mt. Soback to Anmyeondo Beginning of background atmosphere watch at Anmyeondo
1998. 4.	Continuous measurement of greenhouse gases and radiation (CO_2 , CH_4, N_2O, CFC-11,12, designated a regional GAW station)
2003. 12.	Sampling from 40 m tower (AGL) (~86 m ASL)
2007. 1.	Beginning of continuous measurement of CFC-113 and SF_6 Aerosol sampling from the integrated inlet system
2009. 1.	Operation of the Jeju Gosan (JGS) station
2012. 10.	Establishment of the WMO World Calibration Center for SF6
2014. 5.	Operation of the station at Ulleungdo

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Observatories of KGAWC

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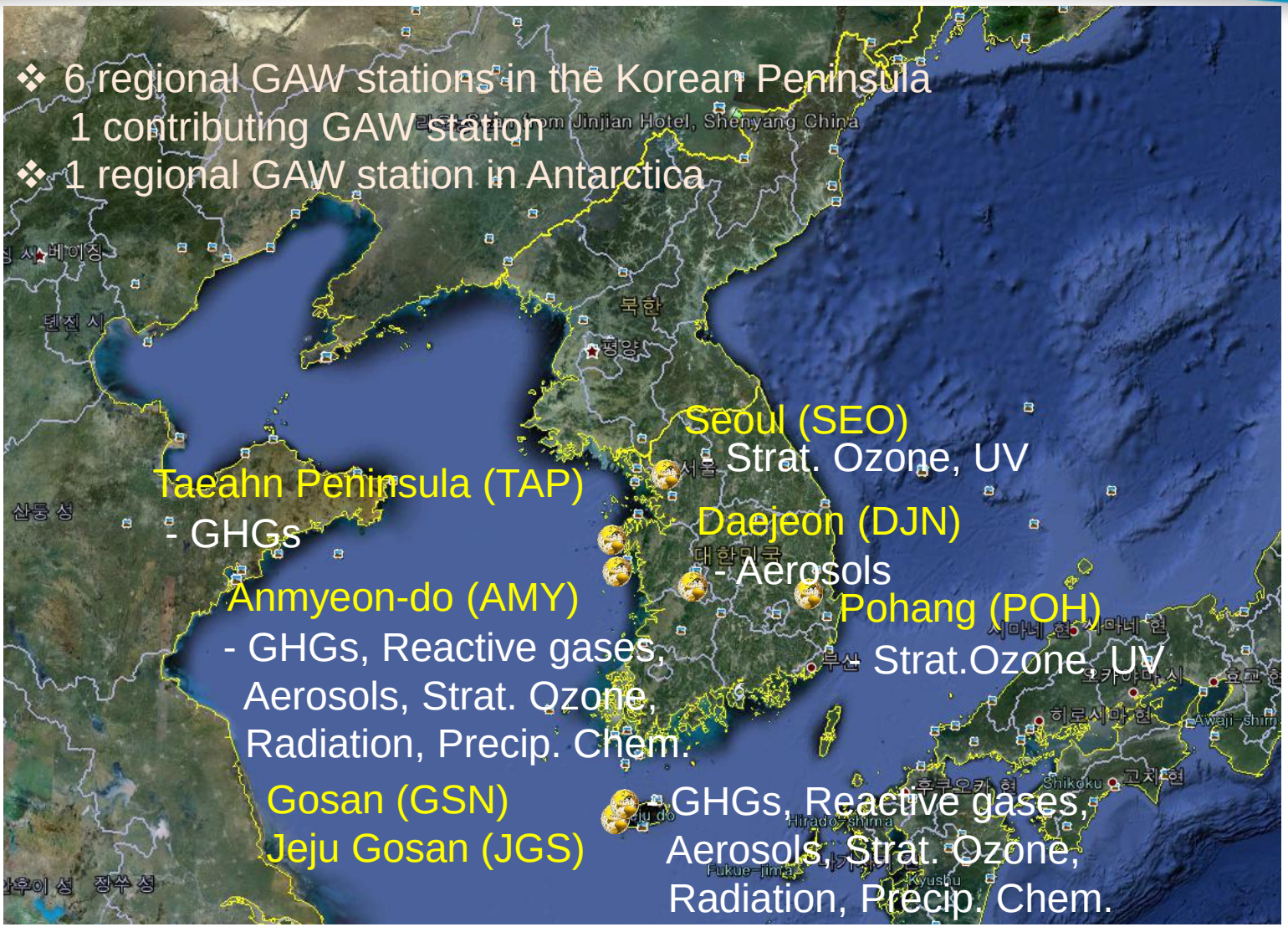
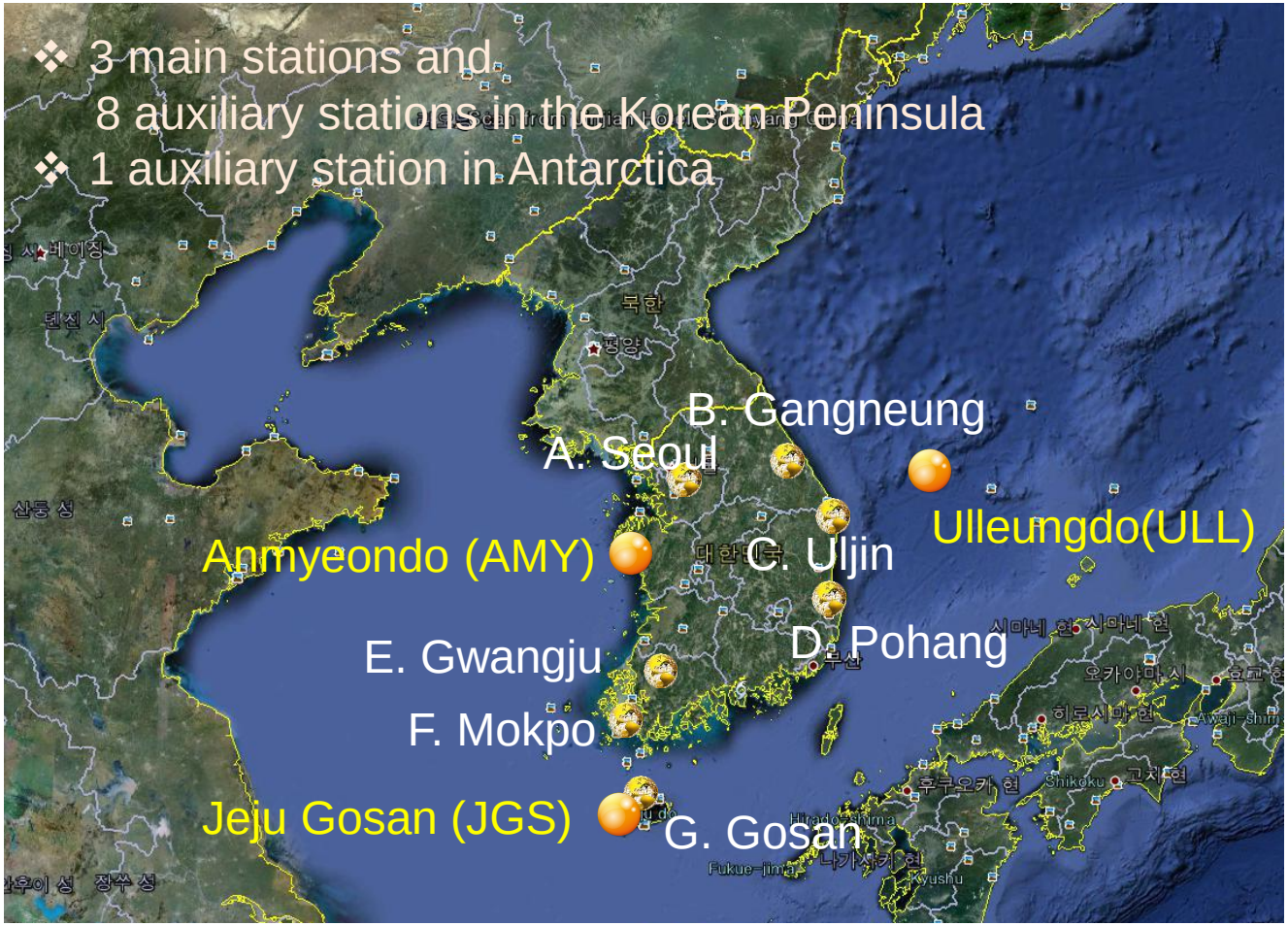
GAW Stations in Korea



King Sejong (KSG), Antartica : GHGs, Strat. Ozone

Main and Auxiliary Stations of KGAWC



Main stations

- AMY, JGS, ULL
- GHGs, Reactive gases, Aerosols, Strat. Ozone, Radiation, Precip. Chem.

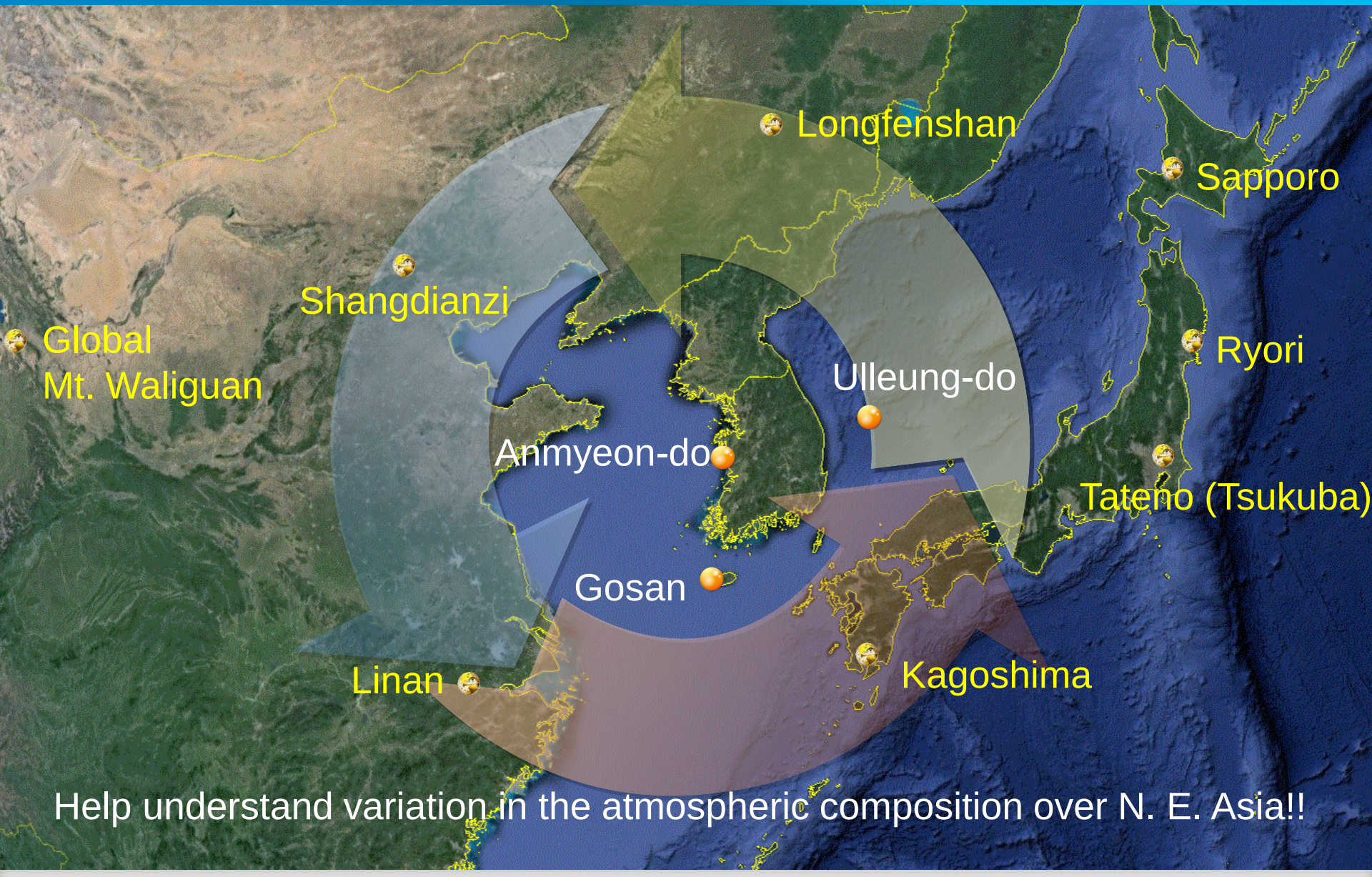
Auxiliary stations (KMA)

- B : Strat. Ozone, UV
- C : Precip. Chem.
- D : Ozone sonde, UV
- F : UV

Auxiliary stations (Univ.)

- A : CO2 flux, Strat. Ozone, UV
- E : Aerosol LIDAR, AOD
- G : Radon
- H : CO2, Strat. Ozone

Observatories in N.E. Asia



Help understand variation in the atmospheric composition over N. E. Asia!!

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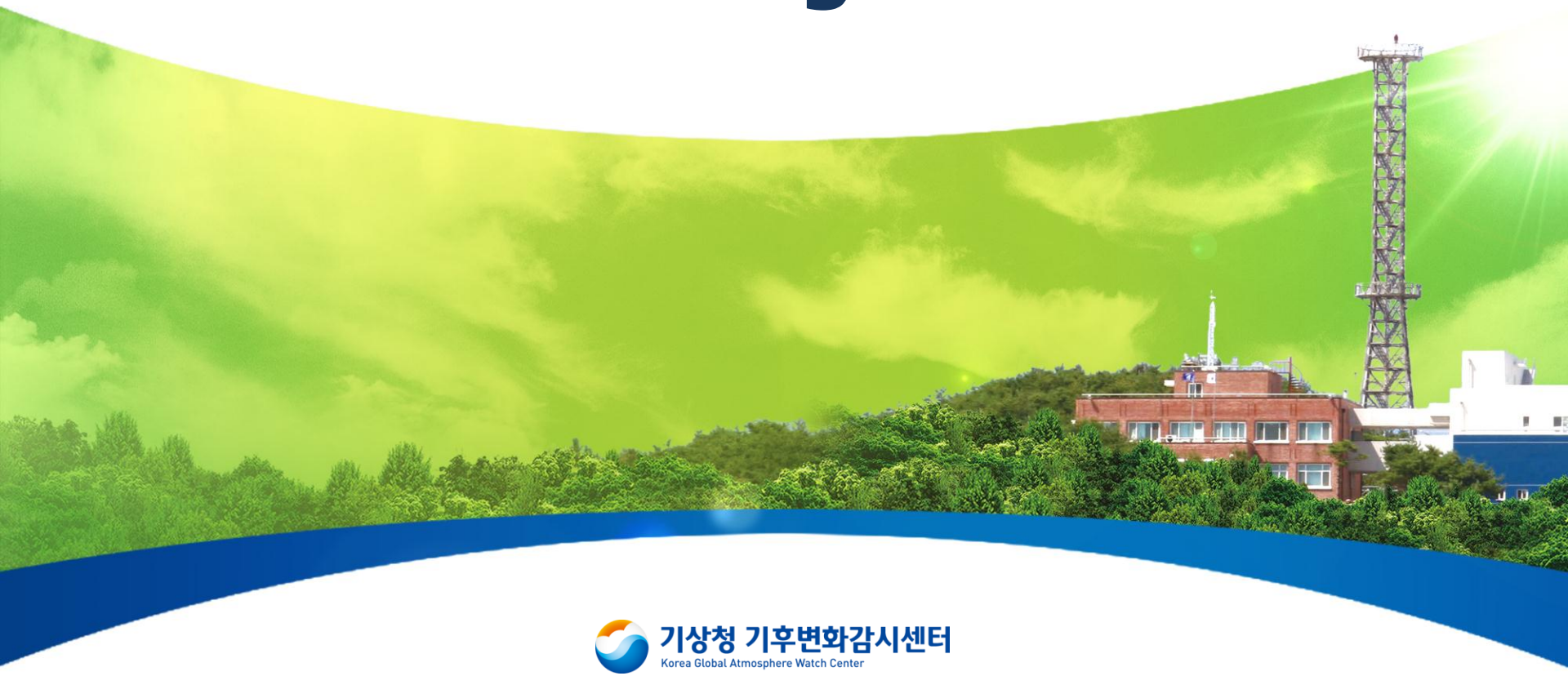
Measurement Programs in KGAWC



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Measurement Programs on GAW

Greenhouse Gases

CO_2, CH_4, N_2O,
$CFC_{11, 12, 113}$, SF_6

Reactive Gases

SO_2, CO, NOx, O_3

Aerosols

Physical, chemical,
optical properties

Ozone & UV

UV-A, UV-B
Stratospheric Ozone

Precipitation Chemistry

Acidity, Conductivity
F^-, Cl^-, NO_3^-, SO_4^{2-},
Na^+, NH_4^+, K^+, Mg^{2+}, Ca^{2+}

Atmospheric Radiation

Direct/ diffuse sunlight
Solar/Terrestrial radiation
Net radiation

Anmyeondo (AMY) Station

Tower (40m) inlets for gases

Lat.: 36.538 86° (36°32’19.9”)
Lon.: 126.329 95° (126°19’47.8”)
ASL: 85.119 m

Ground-based RS: Brewer, Sunphotometer, PFR

Lat.: 36.538 65° (36°32’19.1”)
Lon.: 126.330 05° (126°19’48.2”)
ASL: 56.496 m

Atmospheric Radiation

Lat.: 36.538 46° (36°32’18.5”)
Lon.: 126.329 95° (126°19’47.8”)
ASL: 47.026 m

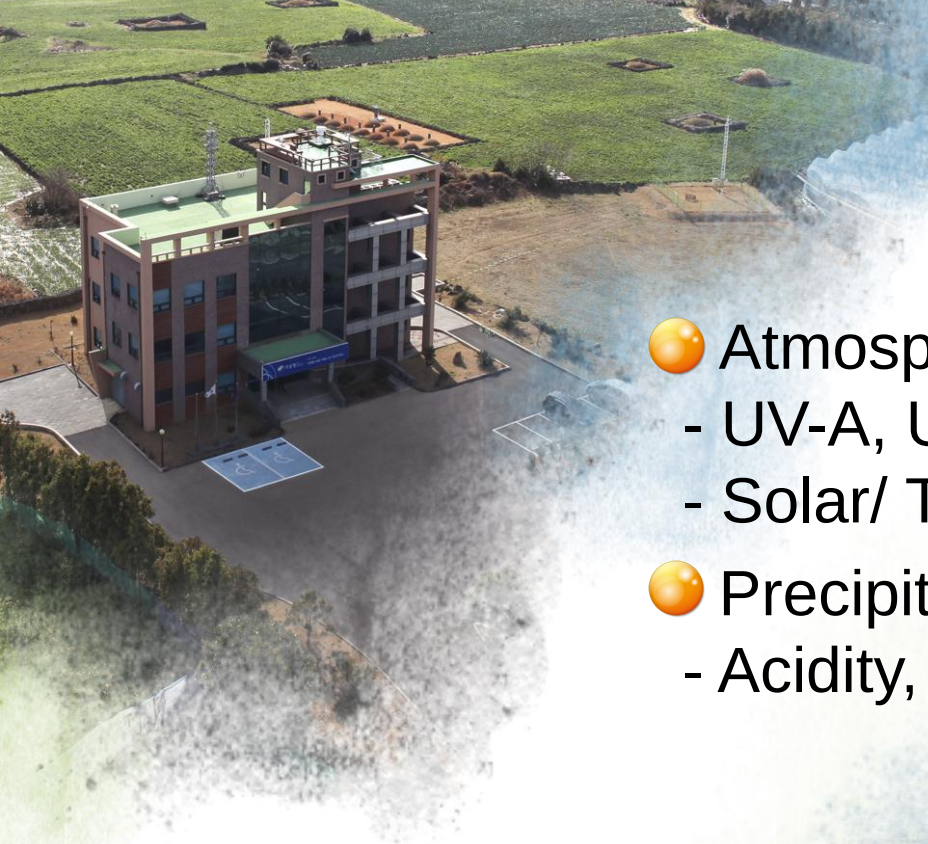
AWS, Inlets for aerosols Aerosol LIDAR

Lat.: 36.538 79° (36°32’19.7”)
Lon.: 126.330 22° (126°19’48.8”)
ASL: 57.697 m

FTS (KMA/NIMR)

Lat.: 36.538 22° (36°32’17.6”)
Lon.: 126.331 02° (126°19’51.7”)
ASL: 23.810 m

Jeju Gosan (JGS) Station

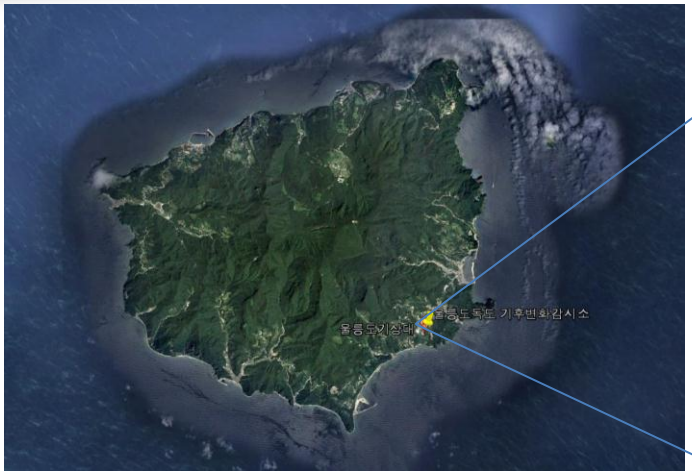


Lat./Lon. : 33° 18'N / 126 ° 12'E

- Atmospheric radiation
  - UV-A, UV-B, PFR
  - Solar/ Terrestrial radiation
- Precipitation chemistry
  - Acidity, Conductivity, Ions

- Greenhouse gases
  - CO_2, CH_4, N_2O
- Reactive gases
  - CO, SO_2, NOx, O_3
- Aerosols
  - PM_{10}, APS (0.5-20 ㎛), CPC (0.01-3 ㎛)
  - AOD

Ulleungdo Station



- Greenhouse gases : CO_2, CH_4, N_2O, SF_6
- Reactive gases : CO, SO_2, NOx, O_3
- Aerosols : $PM_{1, 2.5,10}$, AOD, APS (0.5-20 ㎛)
- Radiation
  - UV-A, UV-B, PFR
  - Solar/ Terrestrial radiation
- Precipitation chemistry
  - Acidity, Conductivity, Ions

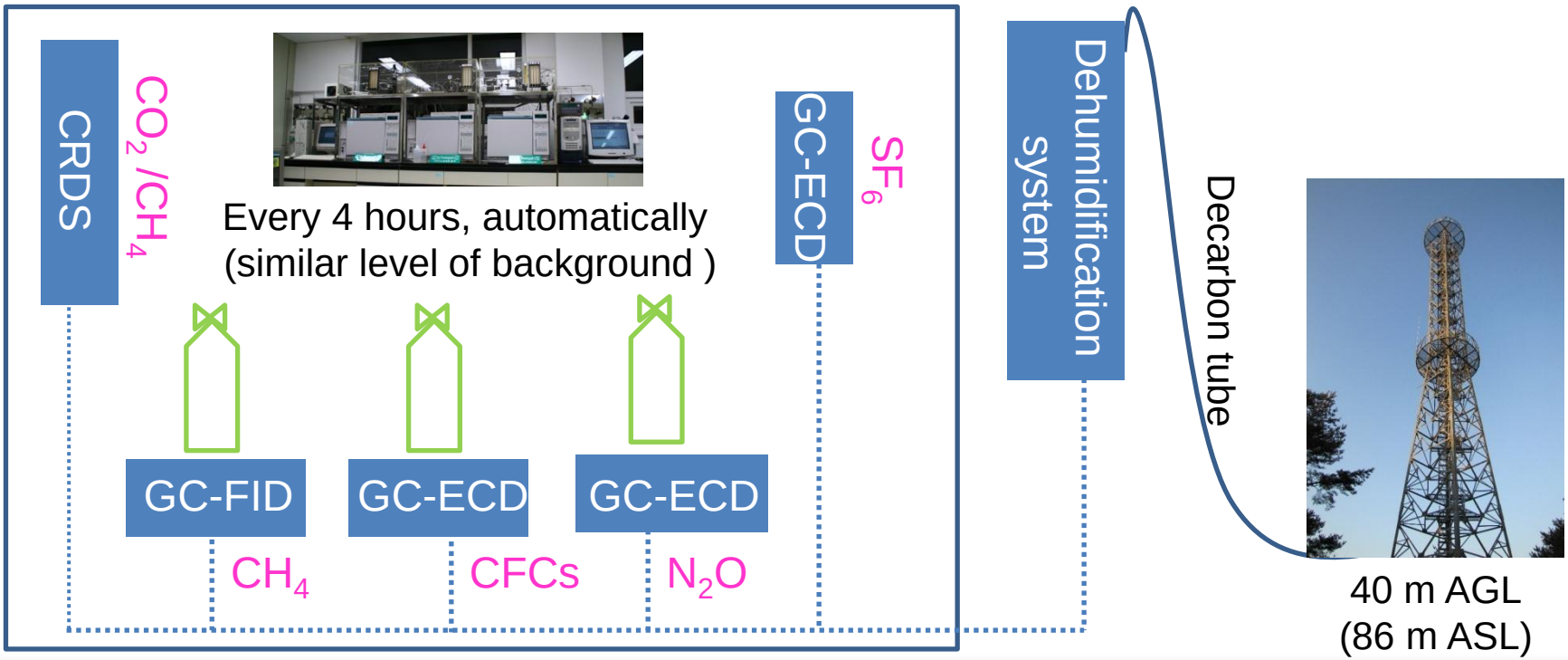
Greenhouse Gases (GHGs)

CO_2, CH_4

❖ CRDS (Cavity Ring Down Spectroscopy)
- Piccaro G2301 (with H_2O), Resol. 5 sec

N_2O, SF_6, CFCs

❖ GC-ECD (Gas Chromatography – Electron Capture Detector)
- Resol. 1 hr



Reactive Gases

NOx

❖ Gas-phase Chemiluminescence
- Resol. 5 min (42i-TL, Thermo Sci.)

SO_2

❖ Ultraviolet Flourescence
- Resol. 5 min (43i-TLE, Thermo Sci.)

O_3

❖ Ultraviolet Photometer
- Resol. 5 min (49i, Thermo Sci.)

CO

❖ Nondispersive Infrared Photometer (NDIR)
- Resol. 5 min (48i-TLE, Thermo Sci.)

→ changing to

CRDS (G2401, $CO/CO_2/CH_4/H_2O$)

Aerosols

Size Distribution
Resol. 3 min

- Scanning Mobility Particle Sizer : 0.01-0.5 nm 54 Ch.
- Aerodynamic Particle Sizer: 0.5-20 ㎛, 52 Ch.
- Grimm Dust-monitor : 0.25-32 ㎛, 31 Ch.

Scattering/ Absorption
Resol. 5 min

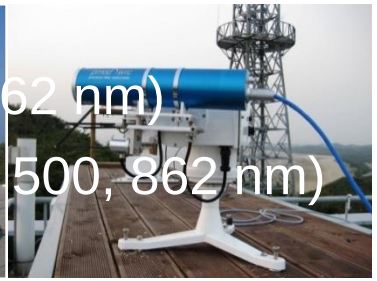
- Nephelometer: 3 wavelengths (RGB)
- Aethelometer

Mass Conc.
Resol. 5 min

- ß-ray PM_{10}, $PM_{1,\ 2.5,\ 10}$ (Grimm Dust-monitor)
- High Volumn Sampler (TSP, PM10, PM2.5, 1 day/ 1 week)

AOD
Resol. 1 min

- Sunphotometer: 5 Ch. (368, 500, 675, 778, 862 nm)
- Precision Filter Radiometer: 4 Ch. (368, 412, 500, 862 nm)

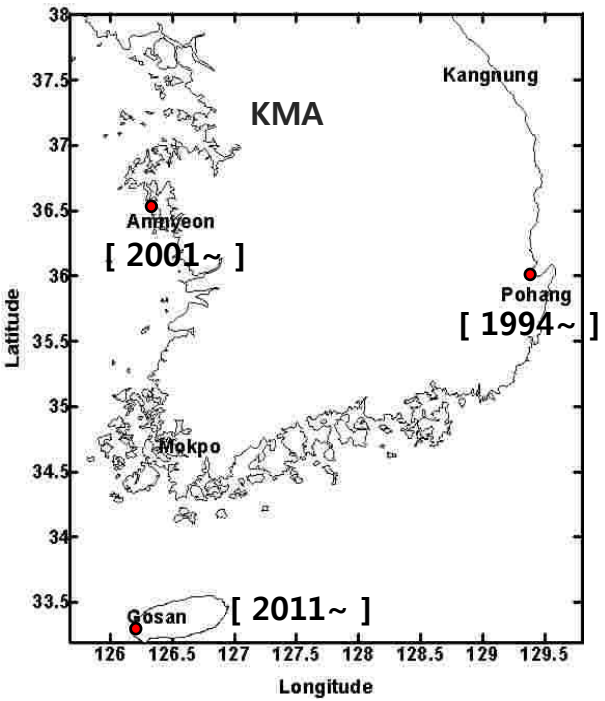


Vertical Distribution
Resol. 20 min

- Aerosol LIDAR (1064, 532 nm)
  - Backscattering coeff., Depolarization ratio, Color ratio

Stratospheric Ozone

Brewer #213 Anmyeon, KMA



Brewer #161
WMO/GO3OS Stn No. 332.
Pohang, KMA

Brewer #196 Jeju Gosan, KMA

Ozonesonde Model 5A ECC
Pohang, KMA

Atmospheric Radiation & UV

UV-A
UV-B

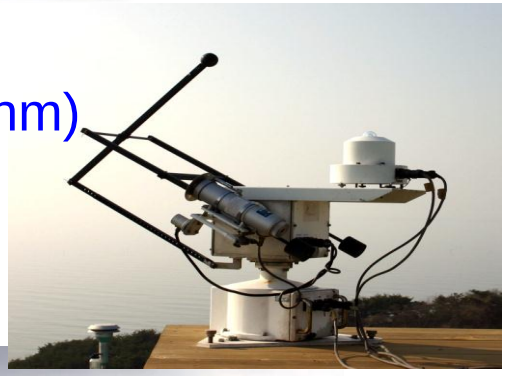
Resol. 10 min

- UV-Biometer (320-400 nm)
- UV-Biometer (280-320 nm)

Direct / Diffuse Solar

Resol. 1 min

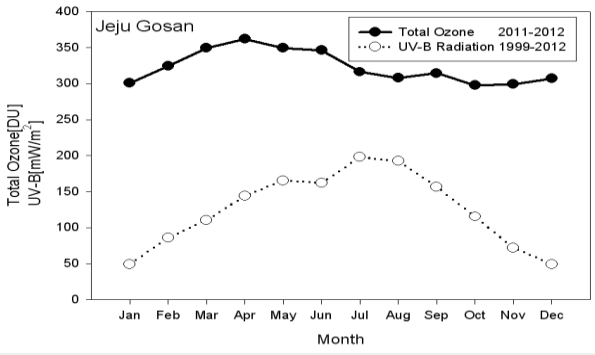
- Pyheliometer (200-2800 nm)
- Shadow band Pyranometer (305-2800 nm)

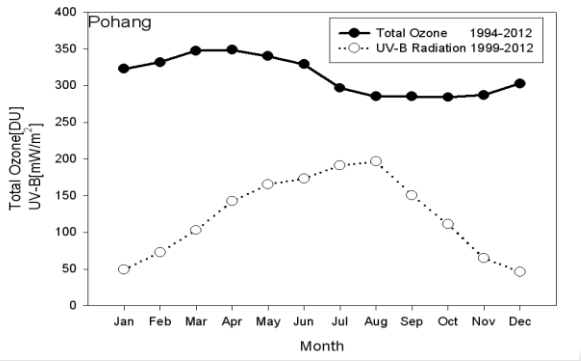


Radiation balance

Resol. 1 min

- Pyranomter, Pyrgeometer (3-50 ㎛)
- Net Pyradiometer (0.3-50 ㎛)

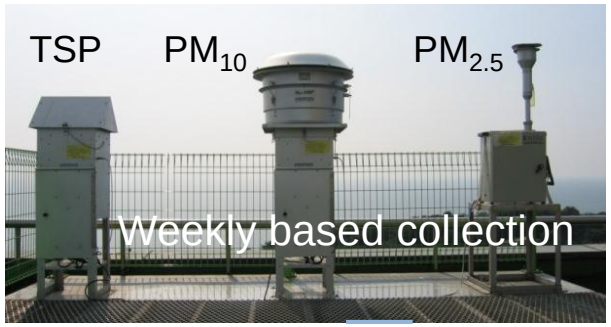




Integrated surface radiation system for upward/downward radiation measurements

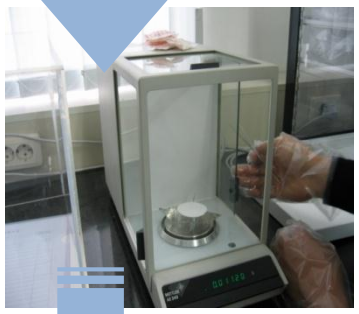
Precipitation Chemistry

Automatic Dry & Wet Sampler
- wet (at precipitation), dry (monthly)



Acidity Conductivity

- ❖ pH meter
- ❖ Conductivity meter



Ions

- ❖ Ion Chromatography
- ❖ F^-, Cl^-, NO_3^-, SO_4^{2-}, Na^+, NH_4^+, K^+, Mg^{2+}, Ca^{2+}

Heavy metals

- ❖ Trust tests

Korea Global Atmosphere Watch Center

WCC & Other Activities

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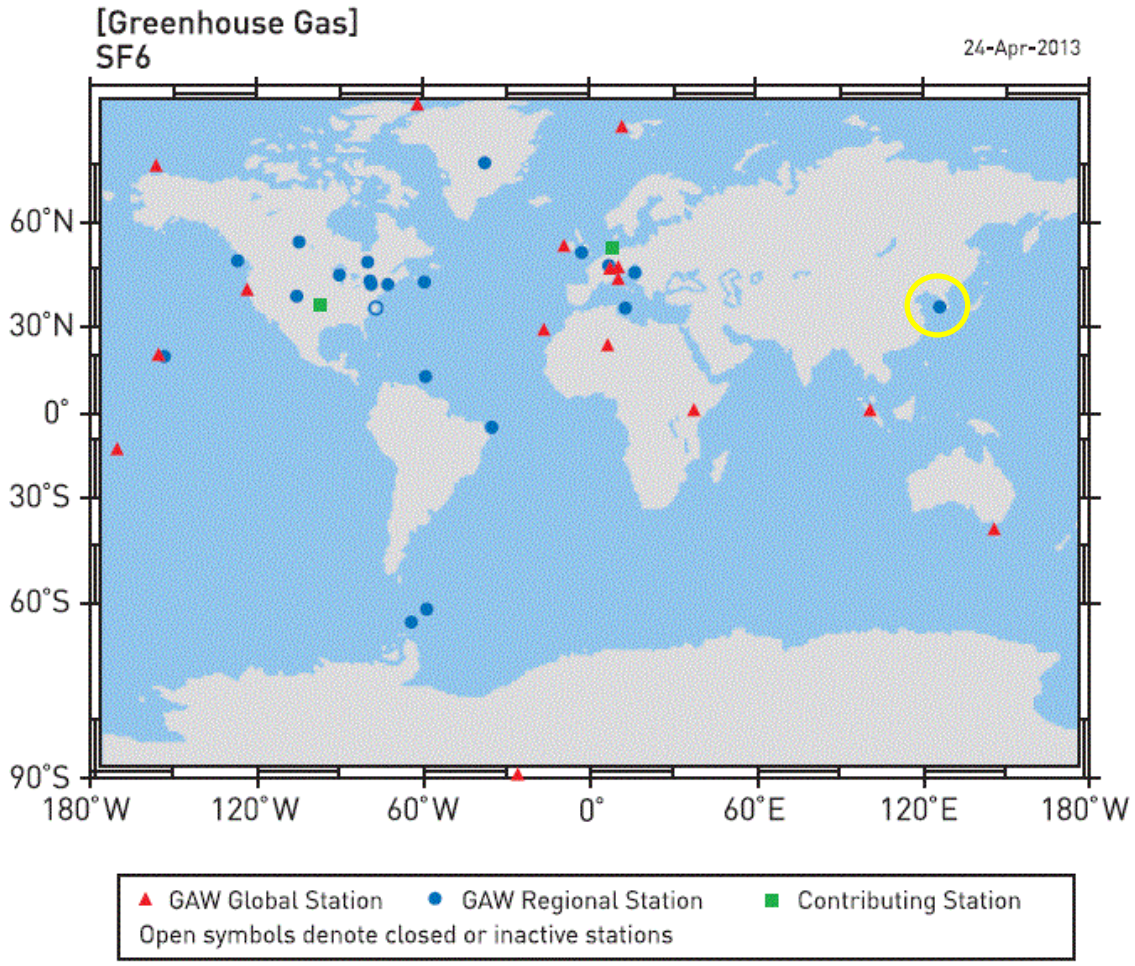
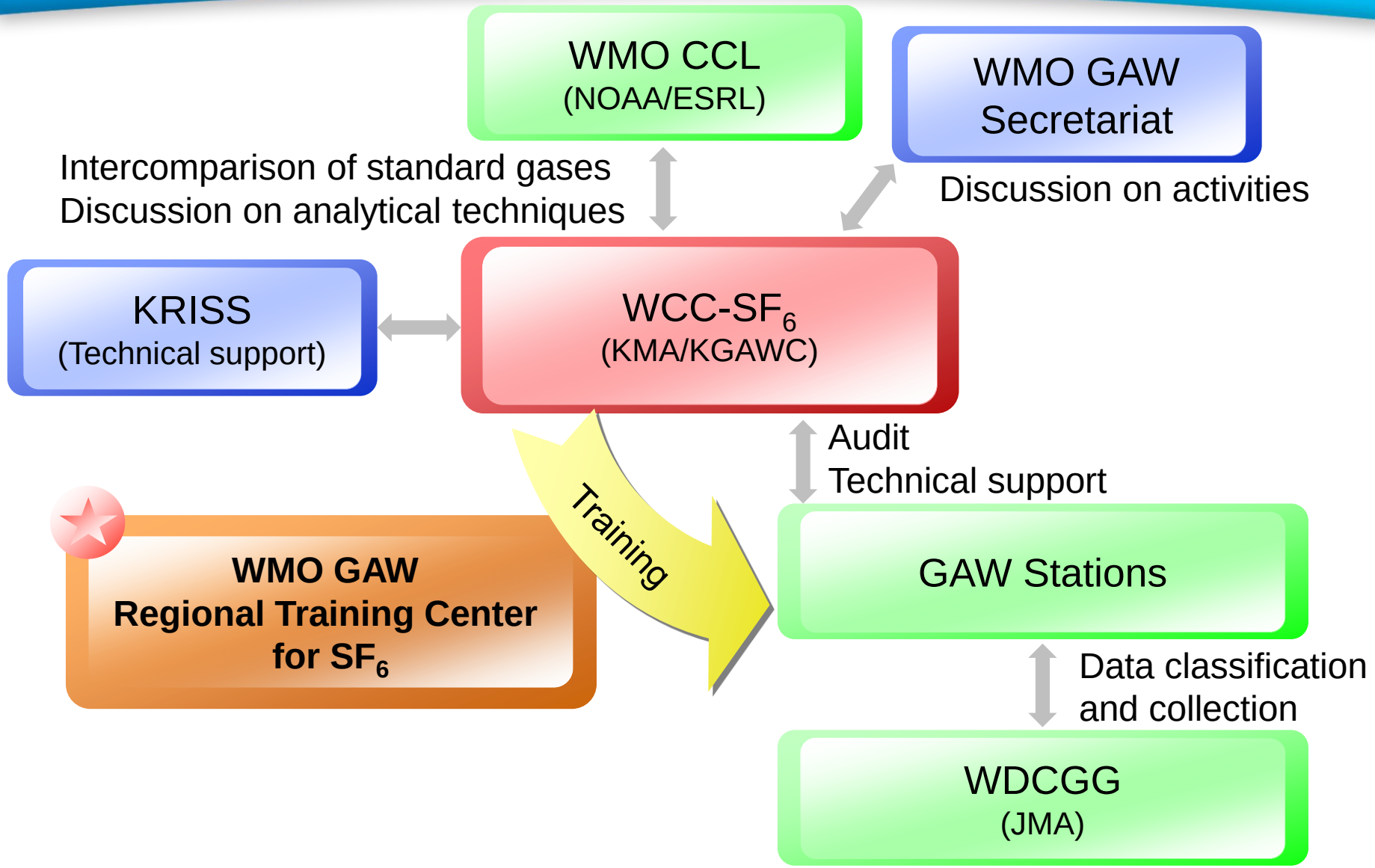
World Calibration Center for SF_6 (WCC-SF_6)



Global stations: 16
Regional stations: 21
Contributing stations: 2

KMA/KGAWC has measured SF_6 since 2007, was designated as the WCC-SF_6 in 2012, and got started with its operation in 2013

Operation of WCC-SF_6



Asia-Pacific GAW Workshop

The 1st Asian GAW workshop in 2009

The 4th Asian GAW workshop in 2012

5th: 11 countries, 64 people

The 2nd Asian GAW workshop in 2010

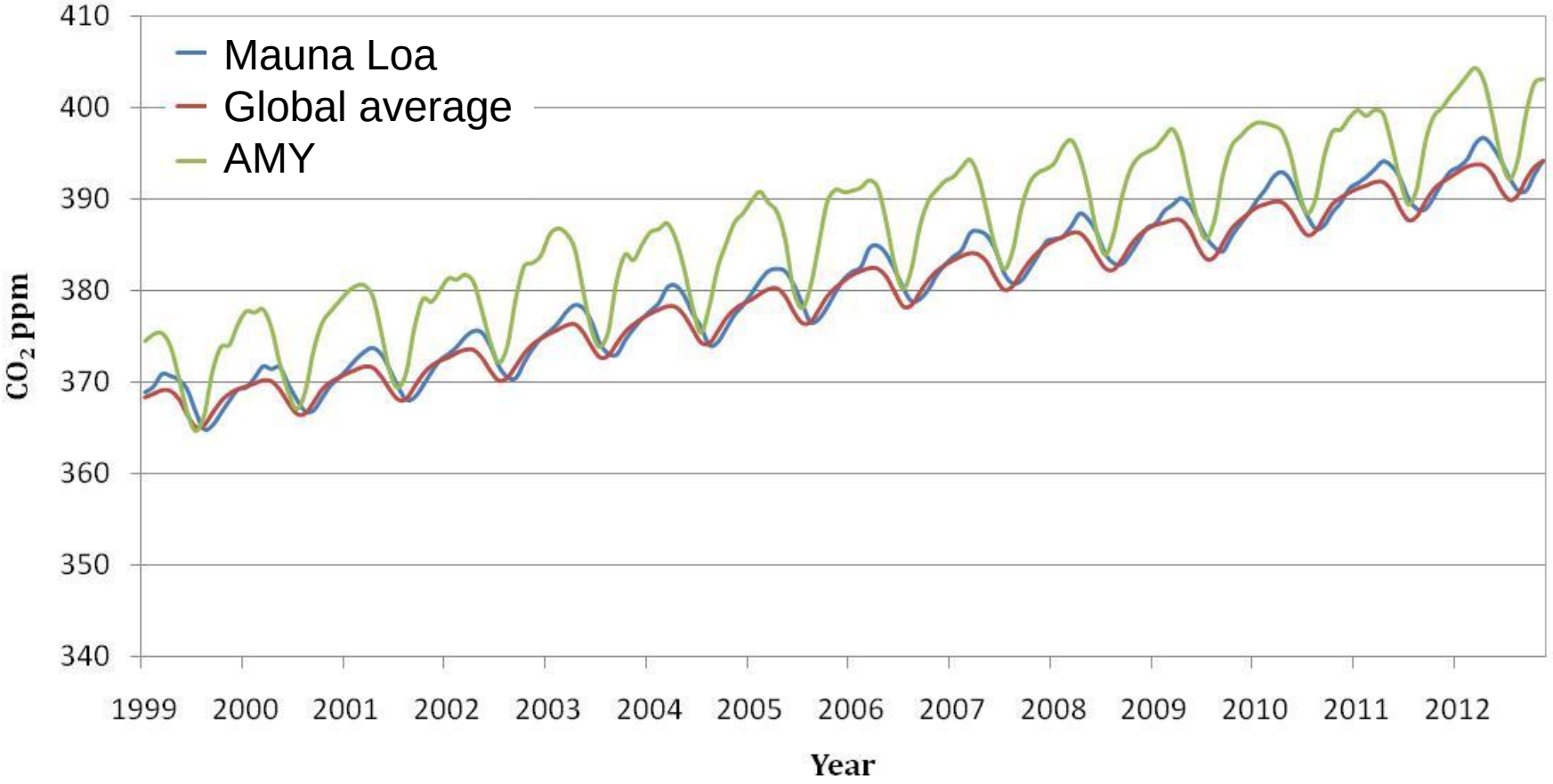
The 5th Asian-Pacific GAW workshop in Jeju, Korea, 2013

The 3rd Asian GAW workshop in 2011

News Letter & ?????

6th: 14 countries, ~70 people

Summary (1 of 2)



We are making this kinds of graphs for other components in the various fields of GAW, and improving/developing techniques for the GAW activities.

Summary (2 of 2)

- 7 GAW regional stations in Korea
- Operate the 3 main and 7 auxiliary stations related to GAW
- Focus on 6 fields in GAW; GHGs, reactive gases, aerosols, strat. ozone & UV, atmospheric radiation, and precipitation chemistry.
- Operate WCC-SF6
- Hold the Asia-Pacific GAW Workshop

Future Plan

Monitoring

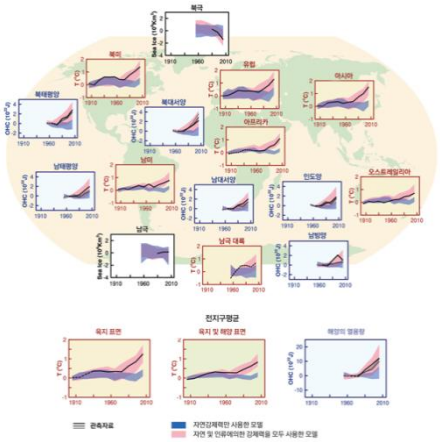
- ❖ Isotopes : $\delta^{13}C$ for CO2 and CH4
  $\delta^{15}N$, $\delta^{15}N^{\alpha}$, $\delta^{15}N^{\beta}$ for N2O
- ❖ Reactive gases : VOCs
- ❖ Aerosols : Chemical components, CPC, CCNC

QA/QC

- ❖ GHGs, Reactive gases in 2014 → Aerosols in 2015
  → Precip. Chem. in 2016

Remote Sensing

- ❖ Multi-wavelength LIDAR : Aerosols
- ❖ FTIR : GHGs



- ❖ Atmosphere: Temp., Precip.
- ❖ Ocean: Sea level, Surf. temp., Acidity
- ❖ Surface : Soil moisture, surface reflectivity
- ❖ Cryosphere: Glaciers, Snow cover
- ❖ Carbon and Other Biogeochemical Cycles
- ❖ Ecosystem Change


감사합니다
Thank you!
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