Summary of Korea Global Atmosphere Watch

2013 Report

KMA Korea Meteorological Administration

GAW

영문 요약

□ **Greenhouse gases**

The mean concentrations of greenhouse gases measured in Anmyeondo, in 2013 are 402.4 ppm, 1,957 ppb, 326.1 ppb and 8.6 ppt for CO_2, CH_4, N_2O and SF_6, respectively. They increased by 0.54% for CO_2, 0.97% for CH_4, and 0.06% for N_2O, compared to those of 2012 and, in particular, SF_6 showed notable enhancement by 4.65%. The CO_2 mean concentration annually has increased by 2.1% on the average from 1999 to 2013, higher than 400 ppm in all the months except the summer in 2013. The same result was observed in Gosan, where the CO_2 mean concentration of 2013 marked 402.8ppm. However, the CFC-11, 12 and 113 regulated by the Montreal Protocol gradually decreased to 236.1 ppt, 514.0 ppt and 73.7 ppt, respectively with the decrease by 0.3 - 3% compared to those of 2012.

□ **Reactive gases**

The mean concentrations of reactive gases measured in 2013 are 39.6 ppb, 306.6 ppb, 6.3 ppb and 2.5 ppb for O_3, CO, NO_x and SO_2, respectively, in Anmyeondo and 41.4 ppb, 206.0 ppb, 3.5 ppb and 0.5 ppb in Gosan, Jeju, indicating that higher annual mean values in Anmyeondo than in Gosan except O_3. The CO, SO_2 and NO_x showed higher concentrations in winter and lower concentration in summer of 2013 both in Anmyeondo and Gosan. O_3, the secondary pollutant, however, showed higher concentration in spring from both sites and lower concentrations in winter in Anmyeondo and in summer in Gosan. In the observation since 2008, CO marked the highest annual mean value in 2013 and its concentration has gradually increased for the recent 3 years.

□ **Atmospheric radiation**

The monthly mean values of direct and scattered solar radiation measured in Anmyeondo in 2013 was higher in March and December, compared to those from the last decade. The solar downward radiation was higher in March, October and November compared to other months and marked the lowest value in June and July. The solar upward radiation was higher in the winter, compared to those for the last decade. The earth downward and upward radiation, however, showed lower distribution. The net radiation was higher in June.

Anmyeondo showed lower solar downward radiation in June and July due to the increase in the cloud amount, and small amount of the cloud amount in March caused the direct and scattered sunlight to be increased in 2013.

The direct solar radiation measured at the Gosan site in 2013 was higher from January to March and from August to December compared to the last decade. The scattered sunlight was lower than the previous year in February and September and the solar downward radiation was higher in all the months except May.

The solar radiation of Gosan in 2013 increased due to the longer sunshine duration from February to April and from August to October and the decrease in the cloud amount.

□ **Aerosol**

The long-term trend in the aerosol mass concentration in the atmosphere over the Korean Peninsula has continuously decreased from 1999 to 2013. The annual mean mass concentration of PM_{10} in 2013 was 38.4 μg/m^3, lower than the mean (52.3 μg/m^3) of 14 years from 1999 to 2012.

In particular, the aerosol mass concentration of PM_{10} was lower in winter and spring due to relatively less Asian dust phenomena. Meanwhile, it was frequently affected by the smog events originating from Asian continent in spring. The comparison analysis of the smog and Asian dust events observed in

2013 showed 2 features. From the analysis of the volume concentrations with the size distribution measured by the aerodynamic particle sizer, the concentrations of particles with < 2 μm diameter increased in cases of smog, but the concentrations of particles with > 2 μm diameter increased in cases of the Asian dust. The measurement results by the aerosol Lidar showed that the smog demonstrated higher depolarization ratios near the ground but the Asian dust showed higher depolarization ratios up to 3～4 km altitude or the lower part of the troposphere. In addition, the background scattering ratio in cases of the Asian dust was observed higher than the smog.

□ **Ozone and UV in the stratosphere**

Total ozone columns (TOCs) of 2013 in Anmyeondo, Pohang, and Gosan are 319 DU, 318 DU, and 304 DU respectively, reflecting their latitudes. TOC in Pohang showed slightly higher compared to the mean values (314 DU) of 18 years from 1994 to 2012. The monthly variation in TOCs in 2013 shows the highest values of 355 DU, 349 DU, and 343 DU in Anmyeondo, Pohang, and Gosan respectively in April, while the lowest values in October indicating in order of Pohang (273 DU), Gosan (274 DU), Anmyeondo (279 DU).

□ **Precipitation chemistry**

The annual precipitation amounts measured in 2013 was 956.0mm for Anymeondo, 994.4mm for Uljin, 863.0mm for Gosan, and 1267.3mm for Ulleungdo. All the sites showed less precipitation compared to the average of the last decade. The average acidity (pH) of the precipitation inthe Korean Peninsula marked 4.73 in 2013. It was lower than the average (pH 4.8) for 1997 to 2012, but higher than pH the average (pH 4.68) of 2012. The annual averages of pH measured in 2013 were 4.57 for Anmyeon, 4.78 for Uljin, 4.68 for Gosan, and 4.93 for Ulleungdo, .

The ion concentrations of precipitation samples measured in Anmyeondo in 2013 were higher than the average values for 1997 - 2012. In particular, the

concentration of representing acid species, sulfate, was higher in the ion components. In Uljin, all the ion concentrations were higher compared to the average for 1998 - 2012 and, particularly, the chloride and sodium concentrations were high. The average concentrations of ions measured in Gosan were higher than those of 2012 but similar to the average for 1998 to 2012. Sulfateconcentration was, however, slightly higher than the average for 1997 - 2012. In Ulleungdo, the average concentrations of ions were similar to the average for 1997 - 2012 and, particularly, the calcium concentration was higher. The annual average ion concentrations for each observatory in 2013 showed that Ulleungdo showed significantly high ion concentrations. In addition, Ulleungdo showed the highest concentrations of major acid species like sulfate and nitrate, followed by Anmyeondo, Gosan and Ulsan.

영문 약어 목록

ADAM	Asian Dust Aerosol Model
AERONET	Aerosol Robotic Network
ANSTO	Australian Nuclear Science and Technology Organization
AOD	Aerosol Optical Depth
APS	Aerosol Particle Sizer
AWS	Automatic Weather System
BAPMoN	Background Air Pollution Monitoring Network
BC	Black Carbon
BSRN	Baseline Surface Radiation Network
CCL	Central Calibration Center
CIE	Commission Internationale de l'Eclairage
CPC	Condensation Particle Counter
CPSCF	Conditional Potential Source Contribution Function
CRDS	Cavity Ring-Down Spectroscopy
DQO	Data Quality Objective
EC	Electric Conductivity
ECD	Electro Capture Detector
EUV	Erythemal ultraviolet
ESRL	Earth System Research Laboratory
FID	Flame Ionization Detector
GAW	Global Atmosphere Watch
GAWTEC	Global Atmosphere Watch Training and Education Center
GAWSIS	Global Atmosphere Watch Station Information System
GC	Gas Chromatograph
GLC	Gas Liquid Chromatograph

GO_3OS	Global Ozone Observing System
GSC	Gas Solid Chromatograph
GSRN	Global Surface Radiation Network
GWP	Global Warming Potential
HEPA	High Efficiency Particulate Air
HYSPLIT	Hybrid Single Particle Lagrangian Integrated Trajectory Model
IPCC	Intergovernmental Panel on Climate Change
IQR	Interquartile Range
LCD	Liquid Crystal Display
MED	Minimal Erythema Dose
MPoLAR	Multi-wavelength Polarization Lidar for Atmospheric Research
NASA	National Aeronautics and Space Administration
NDIR	Non-Dispersive InfraRed
NILU	Norsk Institutt for Luftforskning(노르웨이어)
NOAA	National Oceanic and Atmospheric Administration
OMI	Ozone Monitering Instrument
OPC	Optical Particle Counter
PFR	Precision Filter Radiometer
PMOD	Physikalisch-Meteorologisches Observatorium Davos
PMT	Photomultiplier Tube
PM10	Particle matter 10 μm
PSC	Polar Stratospheric Cloud
QA	Quality Assurance
RCC	Regional Calibration Center
RRT	Round Robin Test
SAC	Science Activity Center
SAG	Scientific Advisory Group
SMPS	Scanning Mobility Particle Sizer
SOP	Standard Operating Procedure
SSA	Single Scattering Albedo
TOMS	Total Ozone Mapping Spectrometer

TSP	Total Suspended Particle
TUV	Total ultraviolet Radiation
UN	United Nations
UV-A	Ultra Violet-A
UV-B	Ultra Violet-B
UNEP	United Nations Environment Programme
UVI	Ultraviolet Index
VOCs	Volatile Organic Compounds
WCC	World Calibration Center
WCCAP	World Calibration Center for Aerosol Physics
WCP	World Climate Programme
WDC	World Data Center
WDCA	World Data Centre for Aerosols
WDCGG	World Data Centre for Greenhouse Gases
WDCPC	World Data Centre for Precipitation Chemistry
WDC-RSAT	World Data Centre for Remote Sensing of the Atmosphere
WMO	Word Meterological Organization
WORCC	World Optical Depth Research and Calibration Center
WOUDC	World Ozone and Ultraviolet Radiation Data Center
WRDC	World Radiation Data Center
WWRP	World Weather Research Programme
WWW	World Weather Watch Programme