Session 6: National and regional report on ozone research and monitoring

Region 2: Asia

Nozomu Ohkawara
Japan Meteorological Agency (JMA)
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The highest concentration of ozone is found in the Region.

→ Systematic ozone observations at many stations are necessary to know details of ozone distribution.
Roughly one third of the countries (10 countries) submitted the national report for the 10\textsuperscript{th} ORM.

- **Total ozone:** 21  
  (China: 10, Iran: 2, Japan: 5, Kyrgyzstan: 1, Thailand: 2, Turkmenistan: 1)

- **Profile ozone:** 18  
  (China: 10, Iran: 2, Japan: 4, Thailand: 2)

- **UV:** 21  
  (China: 10, Iran: 1, Japan: 5, Kyrgyzstan: 1, Mongolia: 1, Thailand: 2, Turkmenistan: 1)

- **ODS and other minor atmospheric constituents:** 14  
  (China: 5, Iran: 1, Japan: 6, Kyrgyzstan: 1, Thailand: 1)
Status of total ozone data archived in WOUDC

2011-2013

2014-2016

- Dobson (11)
- Brewer (11)
- Filter (12)
- Saoz (1)

- Dobson (7)
- Brewer (9)
- Filter (23)
- Saoz (0)
• Data availability at the world data center is improved in terms of level 0 Dobson data.

• Japan Meteorological Agency (JMA) held a regional Dobson intercomparison campaign for Asia (DIC-T2016) in March, 2016 to provide Asian countries with technical support to ensure the quality of ozone observation in the region.

• JMA also provides technical support on ozone observation to Asian and South-West Pacific countries via email upon their request as a part of the WMO Quality Assurance/Science Activity Centre (QA/SAC) activities.
Intercomparison of Dobson spectrophotometer for Asia, 2016 (DIC-T2016)

JMA held the WMO/GAW Regional Dobson Intercomparison for Asia at Tsukuba, Japan in March 2016 (DIC-T2016) as the activity of RDCC-A.

Conceptual diagram of traceability of Dobson spectrophotometers within the framework of WMO
Summary of DIC-T2016

• DIC-T2016 was taken place to ensure ozone data quality by Dobson spectrophotometer in Asia with great support from NOAA and UNEP/WMO.

• The campaign was funded by “General Trust Fund for Financing Activities on Research and Systematic Observations Relevant to the Vienna Convention”.

Summary of DIC-T2016

<table>
<thead>
<tr>
<th>Period</th>
<th>7 - 25 March, 2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>Venue</td>
<td>Aerological Observatory / JMA, Japan</td>
</tr>
<tr>
<td>Technical director</td>
<td>Mr. Glen McConville (NOAA)</td>
</tr>
</tbody>
</table>
| Participant countries and institutes | China (D075) : Chinese Academy of Sciences  
Pakistan (D100) : Pakistan Meteorological Department  
Thailand (D090) : Thai Meteorological Department |
Outline of DIC-T2016

- Each instrument was cleaned and adjusted before the intercomparison.
- Every instruments were calibrated with the regional standard Dobson.
- The science director and JMA staffs gave training on observation and data analysis so that participants could conduct secure observation after they return home.

Training on ozone observation

Intercomparison (i.e. calibration)
Systematic observations to evaluate the changing state of the ozone layer, including detection of ozone layer recovery, should be continued in cooperation with international monitoring networks, such as NDACC and the WMO/GAW programme.

Several countries have plans to start ozone/UV observation.

Several countries need financial and technical supports to start ozone/UV observation and to continue observation.

Training on observation, data submission and data analysis is necessary for systematic ozone monitoring.

Systematic calibration activities on a regular basis within international programme are necessary to ensure observation data quality.
Research Activities in Japan and Other Asian Countries

Ground-based observation

- AGAGE monitoring stations: **China, Korea, and Japan**

- Ozone measurements at Tsukuba, **Japan** has been stopped

  - Ozone lidar (October 1990 – March 2011)
  - Millimetre-wave radiometers (September 1995 – March 2011)

  Millimetre-wave radiometer at Rikubetsu, **Japan** has been operating since March 1999

- **China**: total ozone and UV monitoring
- **Iran**: total ozone and UV monitoring
- **Kyrgyzstan**: total ozone and UV monitoring
- **Mongolia**: UV measurement
- **Turkmenistan**: total ozone monitoring

Courtesy of Hideharu Akiyoshi,
National Institute for Environmental Studies (NIES)
Halocarbon concentrations increased at Ochiishi station after the earthquake.

Estimates of halocarbon emission

Saito et al. (2015, GRL)
SMILES observation of mesospheric ozone during the solar eclipse

Colored: data in the eclipse region
Gray: data outside the eclipse

SMILES observation points and times along four paths (A, B, C, and D)

Imai et al. (2015, GRL)
Three Japanese CCM (NIES, MRI, JAMSTEC and Nagoya University) participate in Chemistry Climate Model Initiative (CCMI).

- NIES primarily performed the recommended simulations for stratospheric process study.
- JAMSTEC and Nagoya University primarily performed those for tropospheric process study.
- MRI performed those for stratospheric and tropospheric process study.
1. **A SATREPS project**, *The Project for Development of the Atmospheric Environmental Risk Management System in South America*, by Nagoya Univ. (Japan), NIES (Japan), CEILAP (Argentina), UMAG (Chili), 2012 – 2017
   - Aerosol lidar, ozone differential absorption lidar, millimeter-wave radiometer, ozonesonde, and UV radiometer measurements in Argentina and Chili
   - Chemical Transport Model simulation of ozone depleted airmass towards South America continent

   - 100 year CCM simulations to investigate year-to-year variation in Arctic ozone in the future global warming
Future plans, needs, and recommendations

- Observation of ODS from natural source
- Observation of ozone in the tropics and subtropics
- Observation of water vapor and HOx
- Regular update of CCM based on the newest GCM
  
  CCSR/NIES-CCM → MIROC3.2-CCM → MIROC5-CCM → MIROC6-CCM
  (IPCC—AR4) (IPCC—AR5) (IPCC—AR6)

- CCMs updated in the future need to be coupled to the ocean.
- CCMs need to include the effects of solar proton event and cosmic rays.
- Chemistry-climate interaction study using CCMs needs to be developed, associated with stratospheric and tropospheric ozone change, UV change, stratospheric and tropospheric aerosol change, and solar activity change. These observation data are necessary.
Thank you for your attention!!