Upper-air observations at Tateno Aerological Observatory

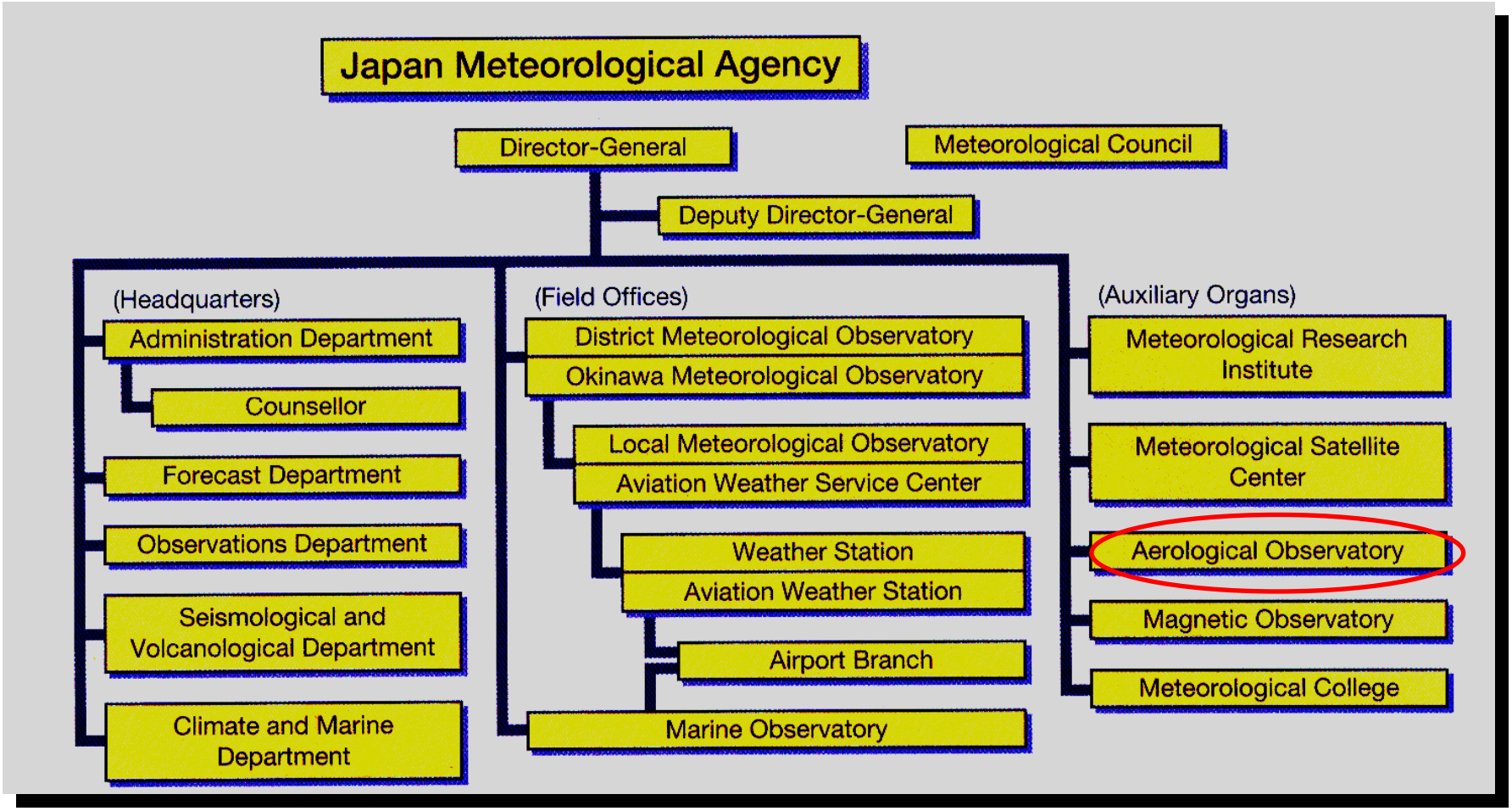
Masahito ISHIHARA
Director of Aerological Obserbatory
Japan Meteorological Agency

GRUAN ICM-4 site visit
8 March 2012

Outline

- Organization and History
- Current Status of Operation and R&D
- Future Plans of R&D

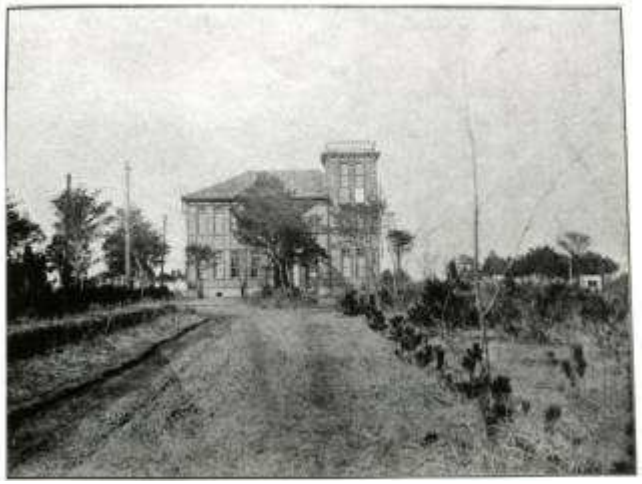
Japan Meteorological Agency



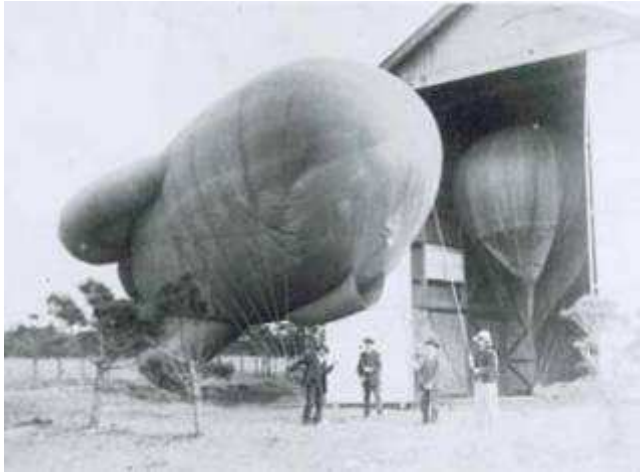
JMA Aerological Observatory “Tateno”

- Wasaburo Ooishi, the 1st director of the observatory, stayed at the Lindenberg Aerological Observatory, Germany in 1911-1913.
- He also traveled to the U.S. in 1919 to prepare upper-air equipments.
- The Observatory was established at Tateno in 1920.
- Tateno is a root of the Tsukuba Science city, that was initiated in 1970s.
- Meteorological Reseerch Institute was transfered from Tokyo to Tsukuba in 1980.

Early days of Tateno



Observatory



Tethered balloon

Pilot balloon and theodolite on a base

Theodolite

Article Discussion Read

Jet stream

From Wikipedia, the free encyclopedia

Discovery

After the 1883 eruption of the Krakatoa volcano, weather watchers tracked and mapped the effects on the sky over several years. They labelled the phenomenon the "equatorial smoke stream".[3][4] In the 1920s, a Japanese meteorologist, Wasaburo Oishi,[5] detected the jet stream from a site near Mount Fuji. He tracked pilot balloons, also known as pibals (balloons used to determine upper level winds),[6] as they rose into the atmosphere. Oishi's work largely went unnoticed outside Japan. American pilot Wiley Post, the first man to fly around the world solo in 1933, is often given some credit for discovery of jet streams. Post invented a pressurized suit that let him fly above 6,200 metres (20,300 ft). In the year before his death, Post made several attempts at a high-altitude transcontinental flight, and noticed that at times his ground speed greatly exceeded his air speed.[7] German meteorologist Heinrich Seilkopf is credited with coining a special term, *Strahlströmung* (literally "jet streaming"), for the phenomenon in 1939.[8] (Modern German usage is *"Strahlstrom"*.) Many sources credit real understanding of the nature of jet streams to regular and repeated flight-path traversals during World War II. Flyers consistently noticed westerly tailwinds in excess of 100 mph (160 km/h) in flights, for example, from the US to the UK.[9]

Pilot balloon report on 2 December 1924

13年12月2日10時7分飛揚

観測地 Z

分	高サ	方位	度高	水平距離
0	0	—	—	0
1	849	194°7	2°7.8	1059
2	707	206°9	12°6	1068
3	1050	179°1	5°0	1119
4	1373	170°3	4°3	1410
5	1684	169°3	5°0	1688
6	2015	193°0	5°6	2179
7	2364	172°7	4°3	2408
8	2622	176°2	4°7	2706

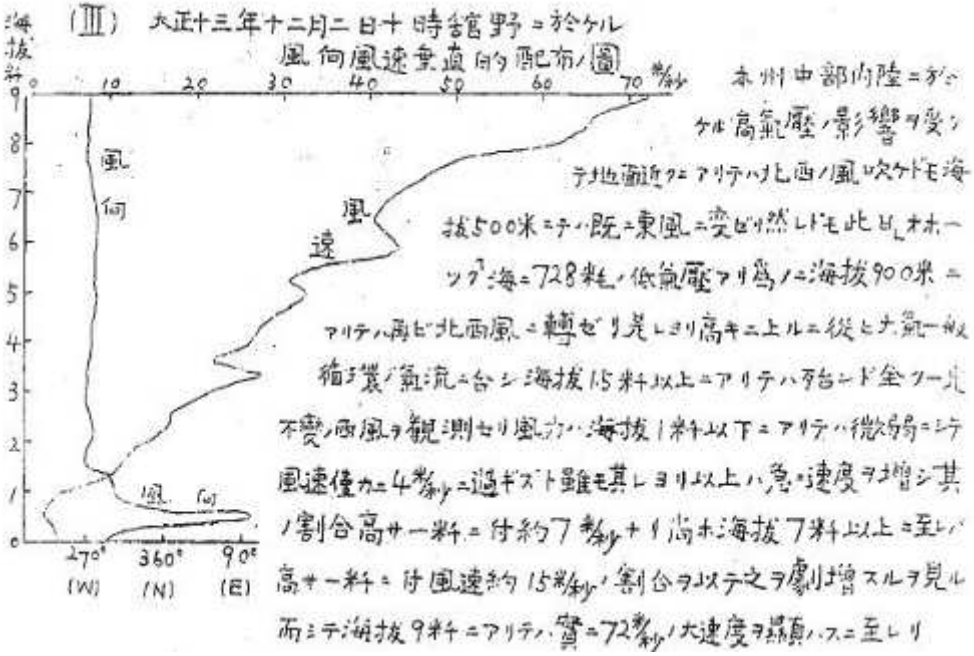
海拔	風向	風速
214	217	3.8
461	200	2.4
904	304	3.4
1337	302	9.8
1754	272	11.1
1875	271	13.0
2215	282	16.4
2543	277	16.8
2860	272	20.4

観測者 斎藤敏夫

経緯儀 Bosch

気球 重サ / 浮力 / 昇騰速度

球体 種類



(Ⅲ) 大正十三年十二月二日十時舘野ニ於ケル風向風速垂直的配布ノ圖

海拔粁 0 1 2 3 4 5 6 7 8 9

10 20 30 40 50 60 70 米/秒

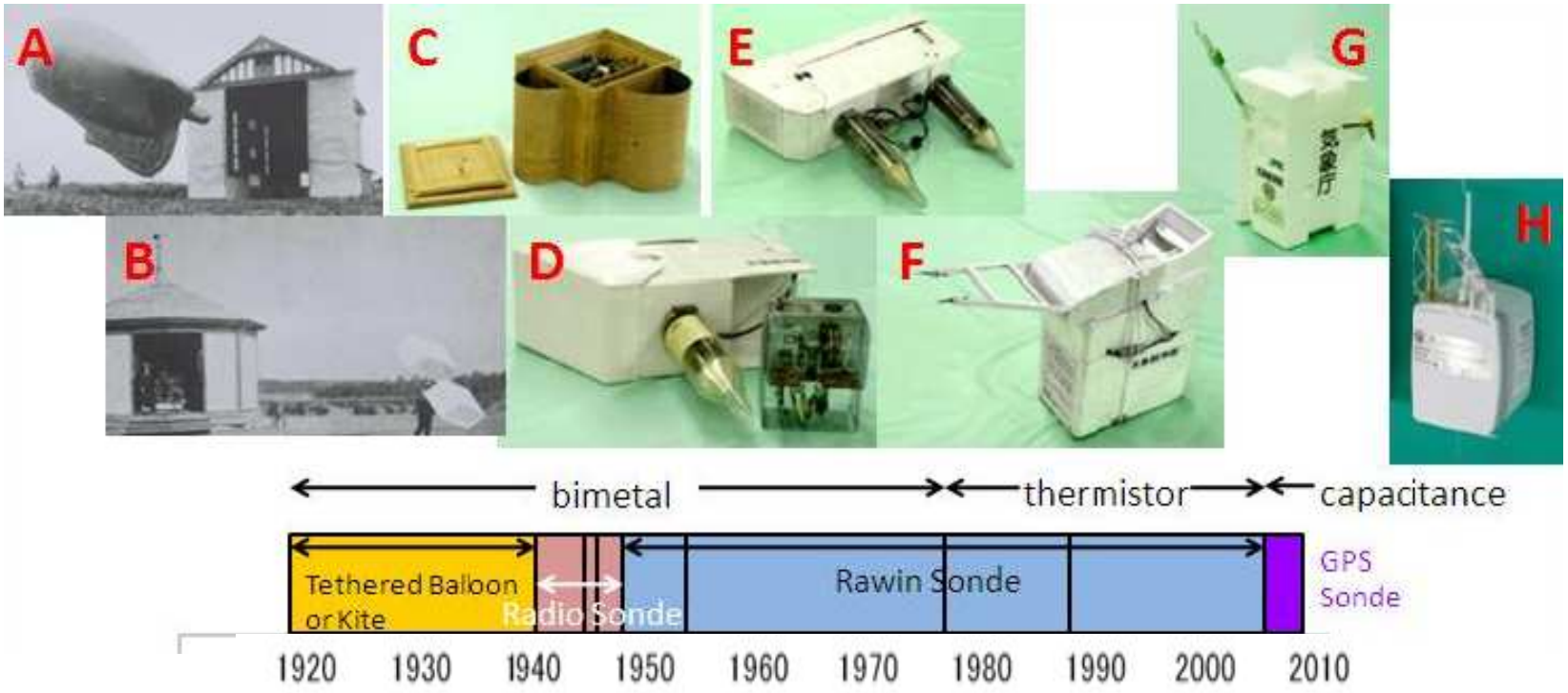
風向 風速

270° (W) 360° (N) 90° (E)

本州中部内陸ニ於ケル高氣壓ノ影響ヲ受ケテ地面近クニアリテハ北西ノ風吹ケドモ海拔500米ニテハ既ニ東風ニ変ジ然レドモ此ヨリホーツプ海ニ728粁ノ低氣壓アリ為ノニ海拔900米ニアリテハ再ビ北西風ニ轉ゼリ見レヨリ高キニ上ルニ從ヒ大氣一般ニ循環ノ氣流ニ合シ海拔15粁以上ニアリテハ殆ンド全ク一定不變ノ西風ヲ觀測セリ風力ハ海拔1粁以下ニアリテハ微弱ニシテ風速僅カニ4米/秒ニ過ギスト雖モ其レヨリ以上ハ急ニ速度ヲ増シ其ノ割合高サ一粁ニ付約7米/秒ナリ尚ホ海拔7粁以上ニ至レバ高サ一粁ニ付風速約15米/秒ノ割合ヲ以テ之ヲ劇増スルヲ見ル而シテ海拔9粁ニアリテハ實ニ72米/秒ノ大速度ヲ觀測スルニ至レリ

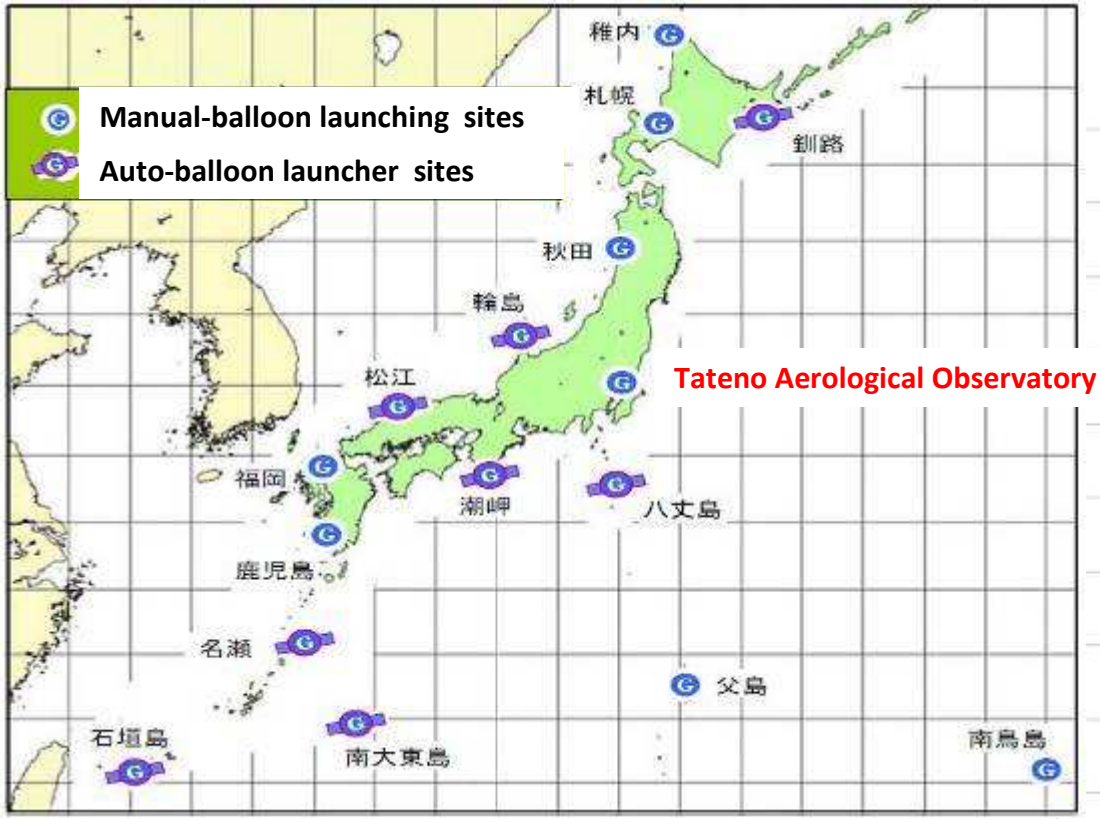
Wasaburo Ooishi and the memorial stone

Changes of equipments for upper-air observation at Tateno



JMA Upper-air Observation Network

Radiosonde Network



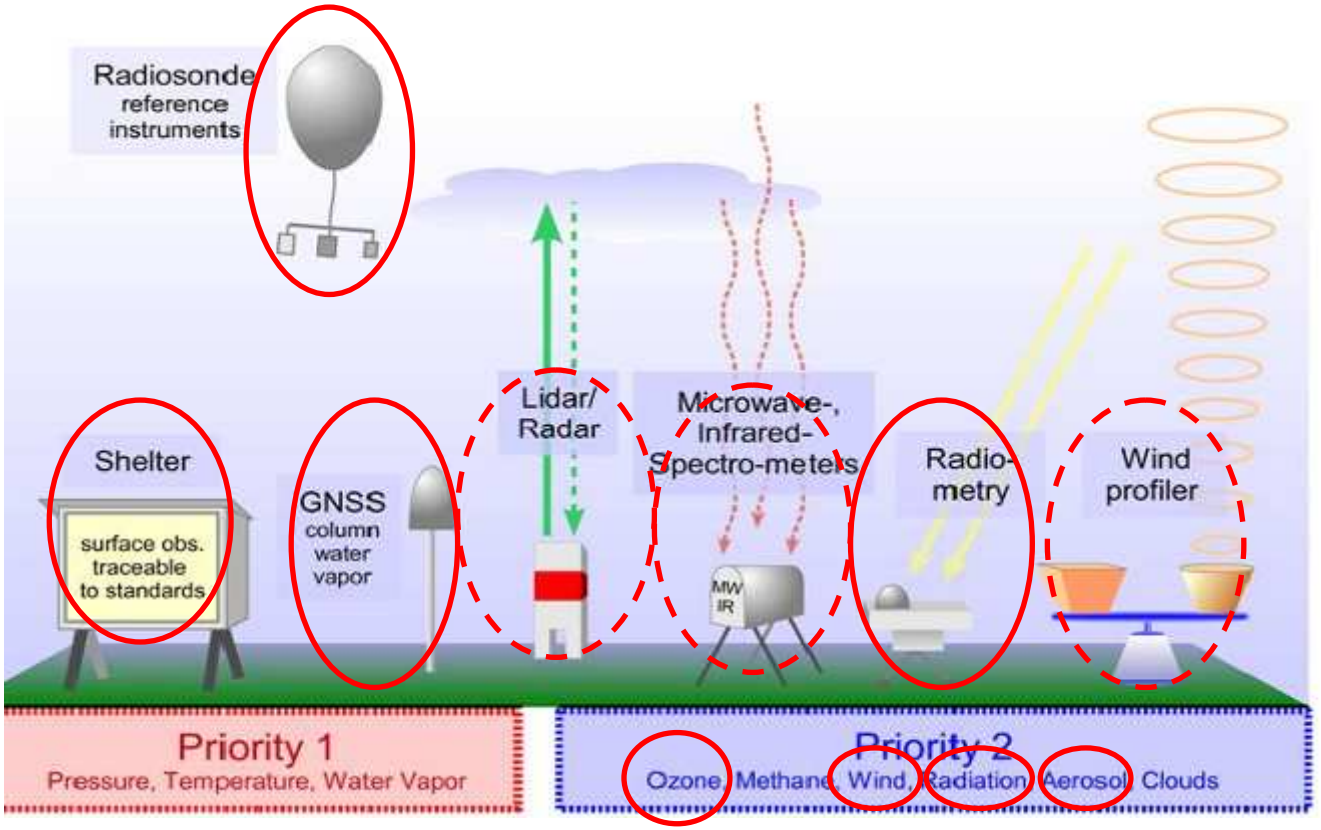
Tateno Aerological Observatory

1.3GHz Wind Profiler Network WINDAS

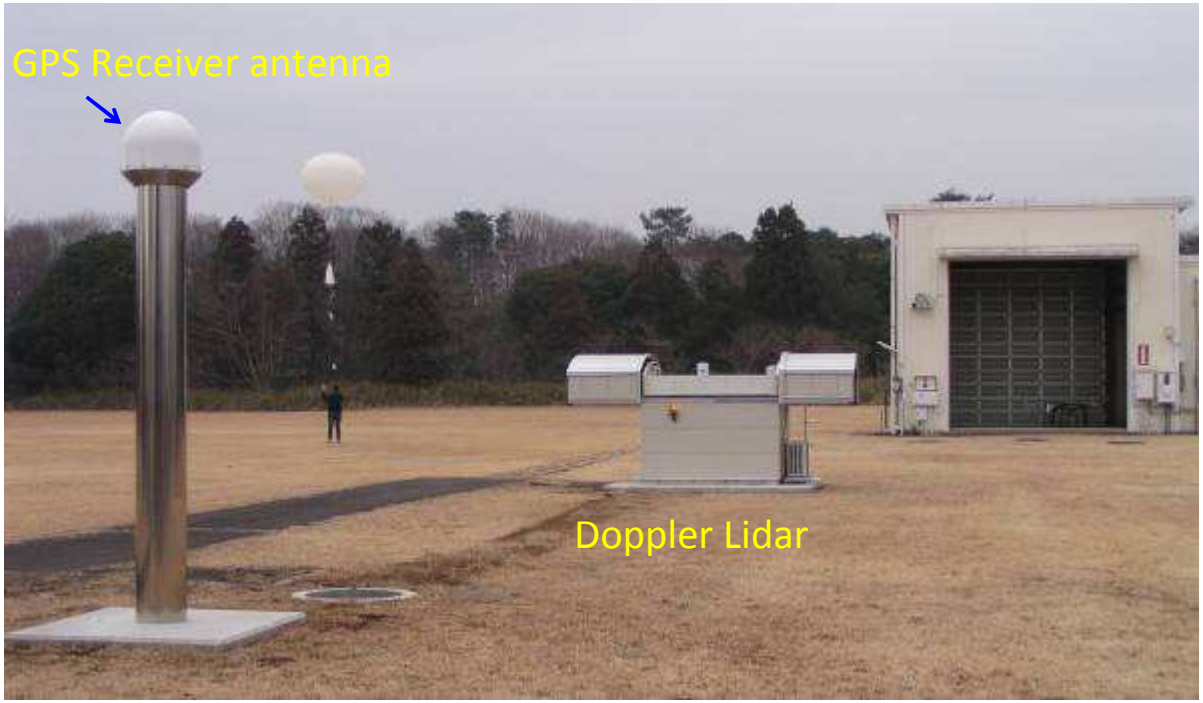
Tateno as a GRUAN station

Feb. 2008 The GRUAN Lead Centre was assigned to the Richard-Assmann-Observatory at Lindenberg.
Mar. 2009 GRUAN ICM-1 (Oklahoma)
Sep. 2009 Tateno raised a hand as a GRUAN station and was registered.
Dec. 2009-Oct. 2010 Intercomparison between Meisei RS2-91 and Vaisala RS92-SGP
Dec. 2009 Observations using Vaisala RS92-SGP started at Tateno.
Nov. 2009 GPS-PWV observation started at Tateno.
Mar. 2010 GRUAN ICM-2 (Payerne)
Mar. 2011 GRUAN ICM-3 (Queenstown)
June 2011 The 2009-2010 intercomparison data were sent to Lindenberg.
June 2011 Reporting quasi-real-time observation data and meta data from Tateno to Lindenberg started.
Summer 2011 Campaign observations of the Doppler lidar at Tateno
Mar. 2012 GRUAN ICM-4 (Tokyo) and the site visit to Tateno

Required observation as a GRUAN station



GPS column water vapor measurement and Doppler lidar wind observation



Data Server

GPS Precipitable Water Vapor Measurement

Doppler Lidar Wnd Measurement

Monitoring and global environment and Climate at Tateno

Ozone Observation

Dobson ozone spectrophotometer

Spectral Ultraviolet Radiation Observation

Brewer spectrophotometer

Radiometry Observation

Broadband UV Radiometer

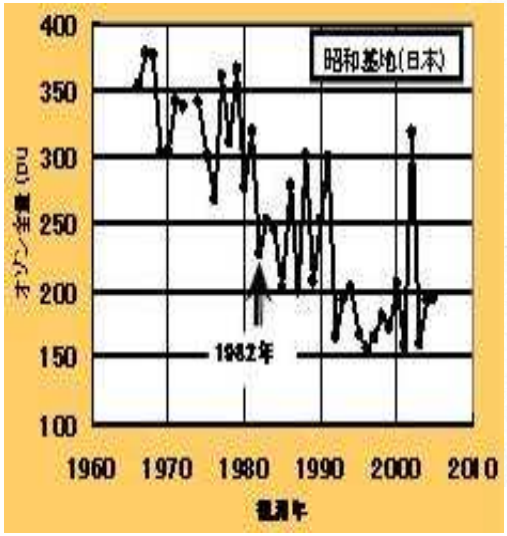
Pyranometer

Pyrgeometer

Pyrheliometer

Sunphotometer

Contribution to the discovery of the Ozone hole over the Antarctic



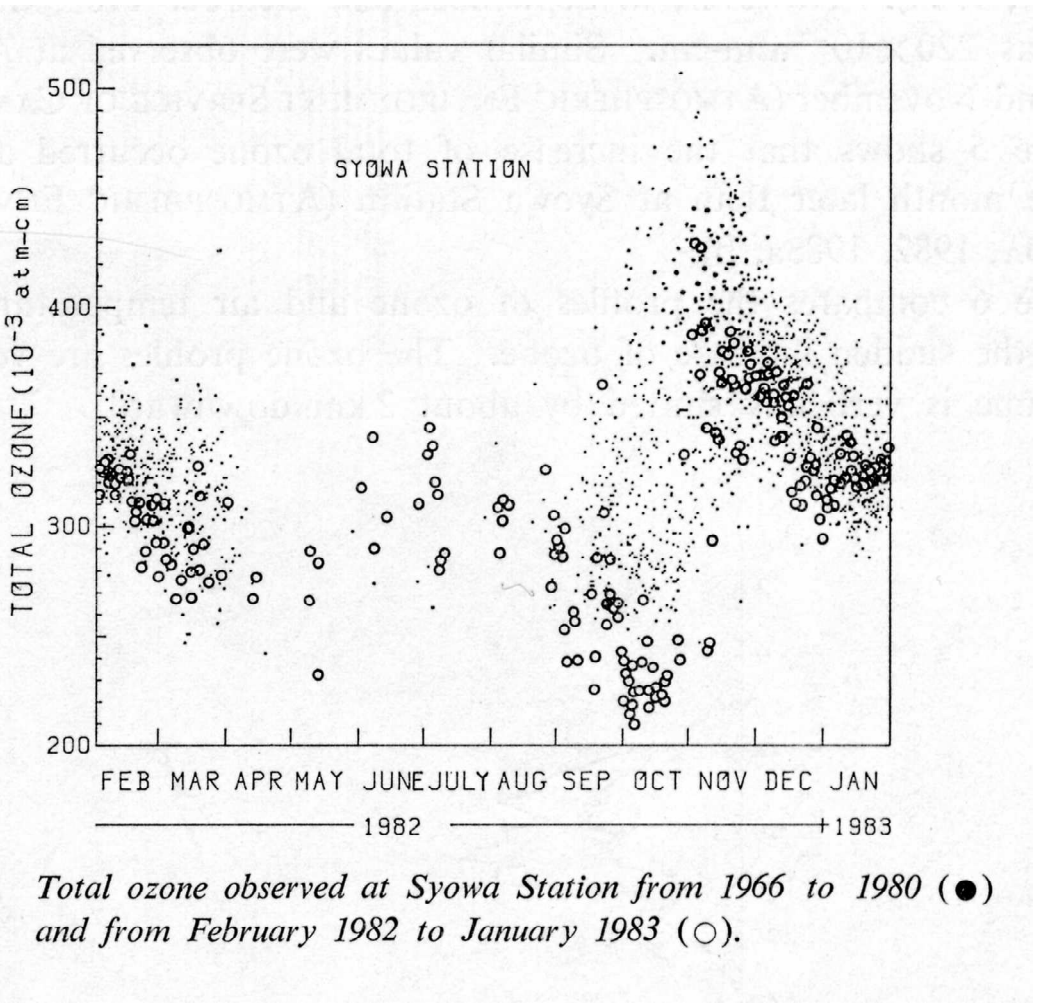


Fig. 4. Total ozone observed at Syowa Station from 1966 to 1980 (●) and from February 1982 to January 1983 (○).

Chubachi, S. Mem. Natl. Inst. Pol. Res. Spec. Iss. 34, 13-19(1984)

Test of absolute calibration of Brewer spectrophotometer on an elevated site

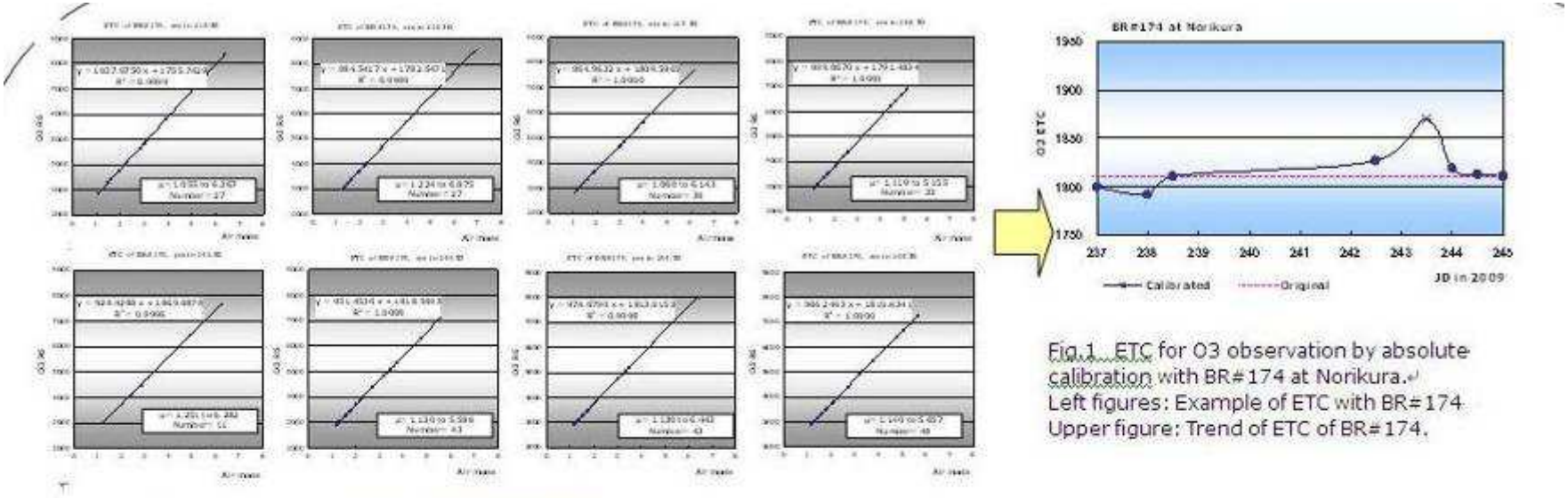


Fig.1 ETC for O3 observation by absolute calibration with BR#174 at Norikura.
Left figures: Example of ETC with BR#174
Upper figure: Trend of ETC of BR#174.

Photo.1 Observation site (upper) and Brewer spectrophotometers (right), BR#113 (left) and BR#174 (right), at Norikura observatory, ICRR, Univ. of Tokyo.

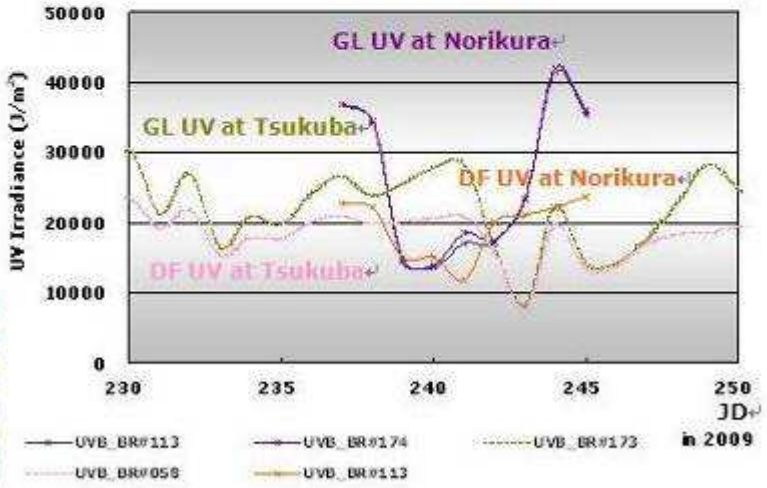


Fig.2 GL (Global UV) and DF (diffuse UV) with BR#174 and BR#113 at Norikura and with BR#173 at Tsukuba.

Calibration of pyrgeometer in black body cavity

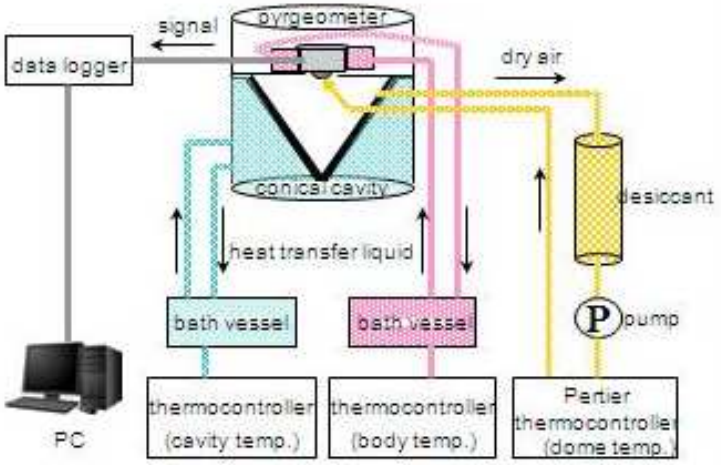
Performance of JMA's Black body (BB) cavity

Comparisons of mean difference from reference longwave radiation by class of pyrgeometer body temperature.

Temp. class (deg.C)	difference without BB calibration (W/m^2)	difference with BB calibration (W/m^2)
0 - 10	-0.58	0.13
10 - 20	0.02	-0.06
20 - 30	0.40	-0.30

Comparisons of pyrgeometer calibration coefficients by WMO/World Radiation Center(WRC) with those by JMA.

Coefficient	WRC (Dec. 2006)	JMA (Jun. 2004)	JMA (Jan. 2007)
C	3.91	3.9647	3.9328
k_1	0.01	0.0146	0.0143
k_2	1.0024	1.0025	1.0028
k_3	3.2	2.8752	2.9012



Future plans of the operation and R&D at Tateno

- Upper-air observation as a GRUAN site in accordance with the GRUAN implementation plan
- Development of higher quality radiosondes in cooperation with sonde-manufactures
- Development of operational observation technology in the lower troposphere: water vapor from Laman lidar, maicrowave radiometer....
- Precise spectrum measurement of solar radiation through ultra-violet to long-wave radiations

Thank you