



The JMA activities and network for GHG observation and recent topics

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JMA Mascot

Harerun

はれるん

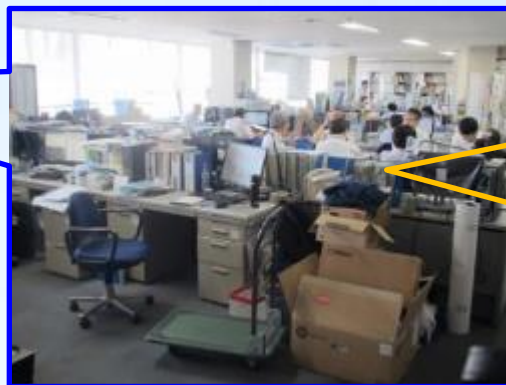
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About us



JMA Headquarter,
Tokyo



Atmospheric
Environment Division

- WDCGG
 - WCC-CH4
 - RCC-Total O3
 - QA/SAC
- } GAW
Central
Facilities

- **Greenhouse gas observation unit**
- Aerosol observation unit
-
-

My job (an example)



Operation of
GAW Station



Aircraft observation



Standard gas
calibration



Quality check of
observed data

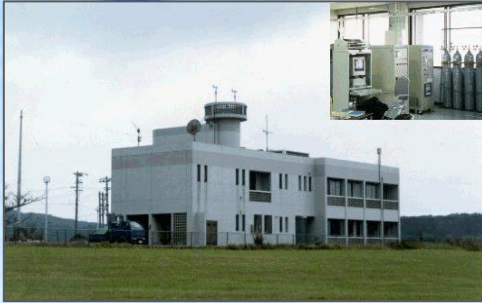


Today's Topics

- **JMA observation network and activities for atmospheric Greenhouse gases**
- **Collaboration with Japanese research groups**



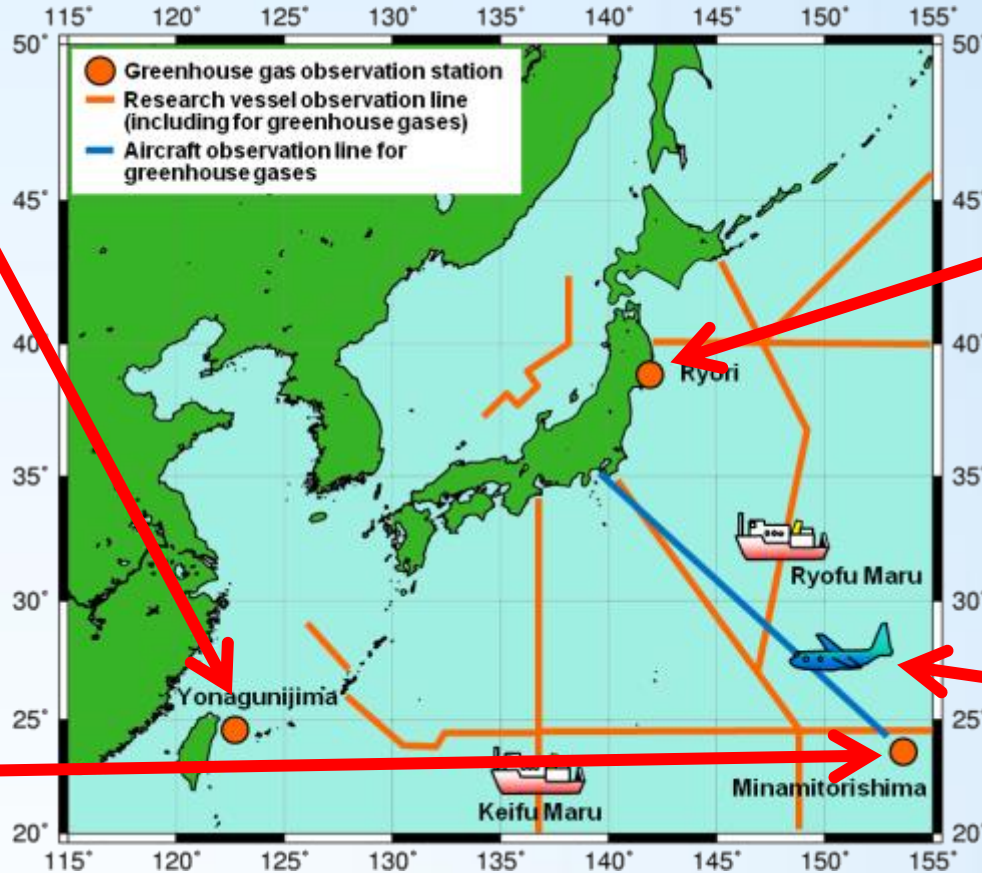
GHG observation network



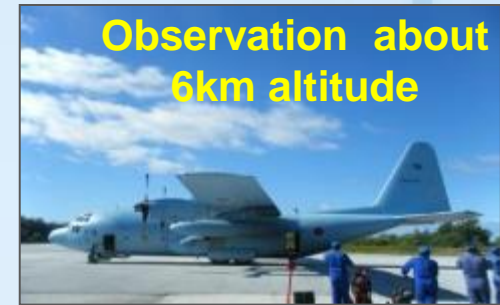
**Yonagunijima
(GAW regional station)
Since 1997**



**Minamitorishima
(GAW global station)
Since 1993**

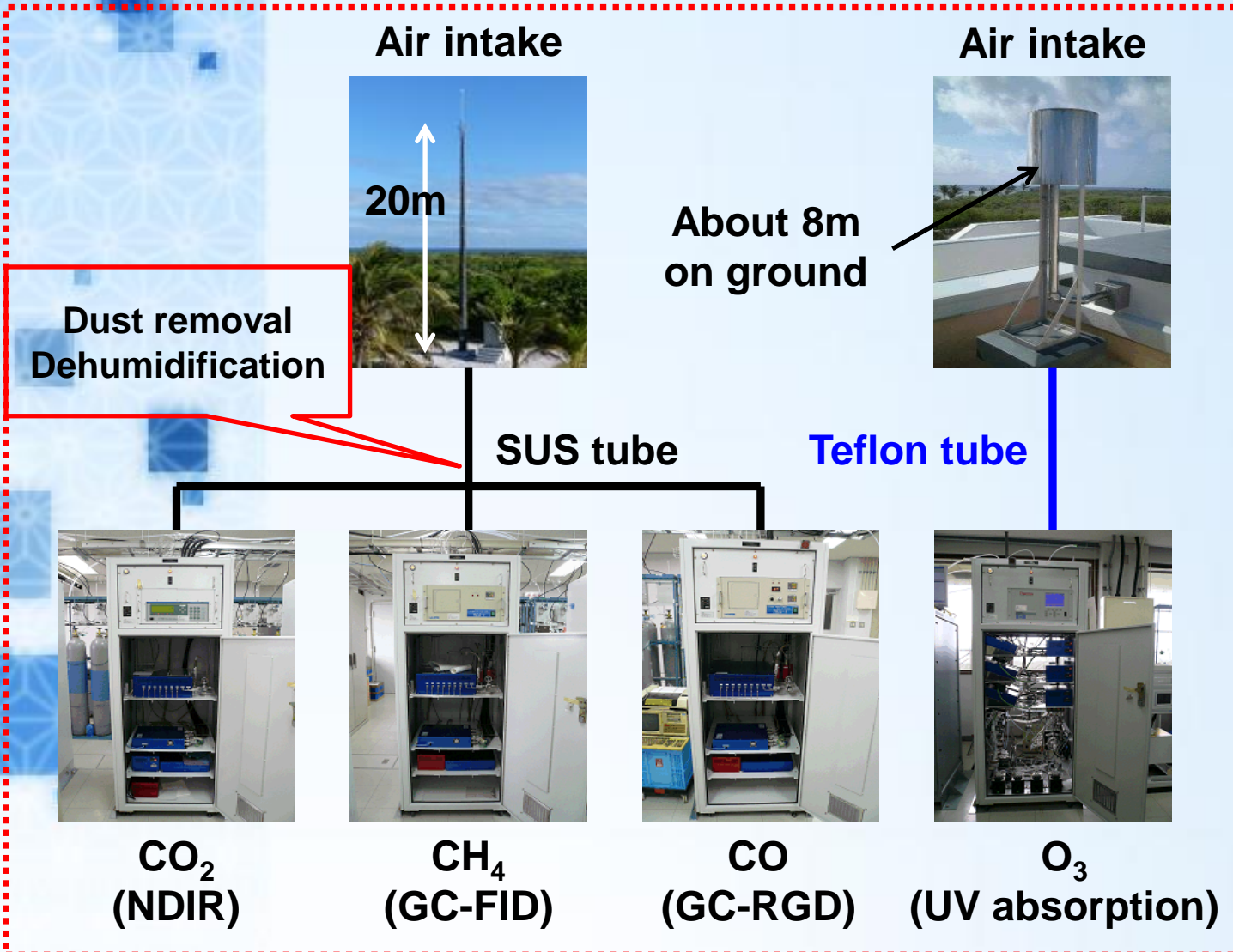


**Ryori
(GAW regional station)
Since 1987**



**Cargo aircraft (C-130H)
Collaboration with
Japan Air Self-Defense Force
Since 2011**

Observation systems





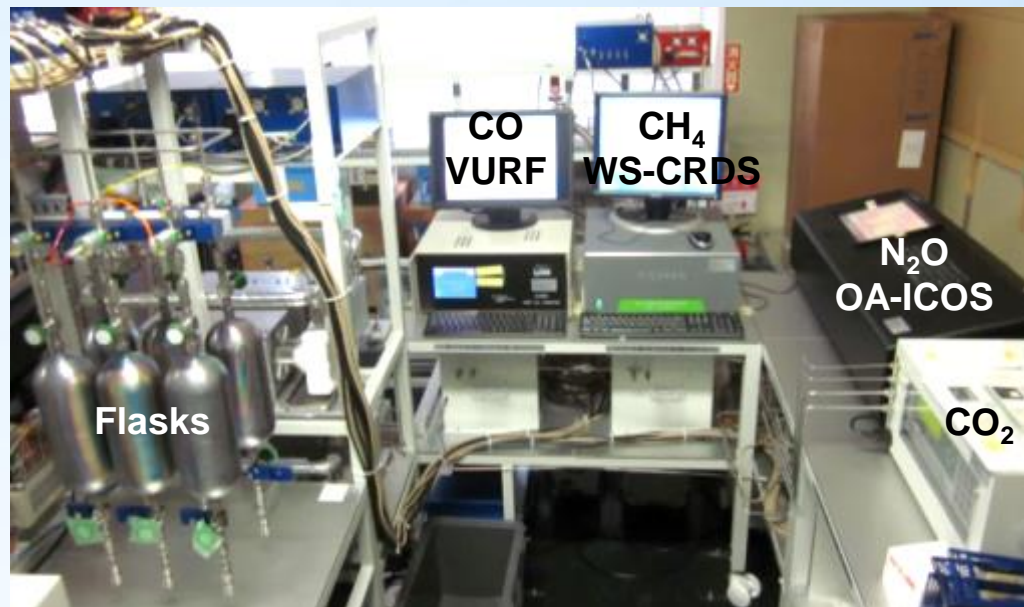
Precision and standard gas scale



Parameter	Analyzer (Method)	Precision	Standard Gas scale
CO ₂	LI-COR LI-7000 (NDIR)	≤0.02ppm	WMO X2007
CH ₄	Round Science RCG-1 (GC-FID)	≤2ppb	WMO X 2004
CO	Round Science TRA-1 (GC-RGD)	≤2ppb	WMO CO X2004
O ₃	Thermo Fisher Scientific 49i (UV absorption)	≤1ppb	NIST



High-precision measuring system



Analyzer (Method)	Parameter	Precision	Standard Gas scale
Picarro G2301 (WS-CRDS)	CH ₄ CO ₂	≤0.26ppb ≤0.014ppm	WMO X 2004 WMO X2007
Los Gatos Research DLT100 (OA-ICOS)	N ₂ O CO	≤0.07ppb ≤0.08ppb	NOAA 2006A WMO CO X2004
LI-COR LI-7000 (NDIR)	CO ₂	≤0.064ppm	WMO X2007
Aero-Laser AL5002 (VURF)	CO	≤0.28ppb	WMO CO X2004

Natural disasters during Long-term observation

CO₂ Concentration

2015/09/28
Typhoon No.21 (Dujan) attack
 Yonagunijima was damaged

2011/03/11
Great East Japan Earthquake
 Ryori was damaged

2006/09/03
Typhoon No.12 (Ioke) attack
 Minamitorishima was damaged



O₂ [ppm]
 380

1981 1982 1991

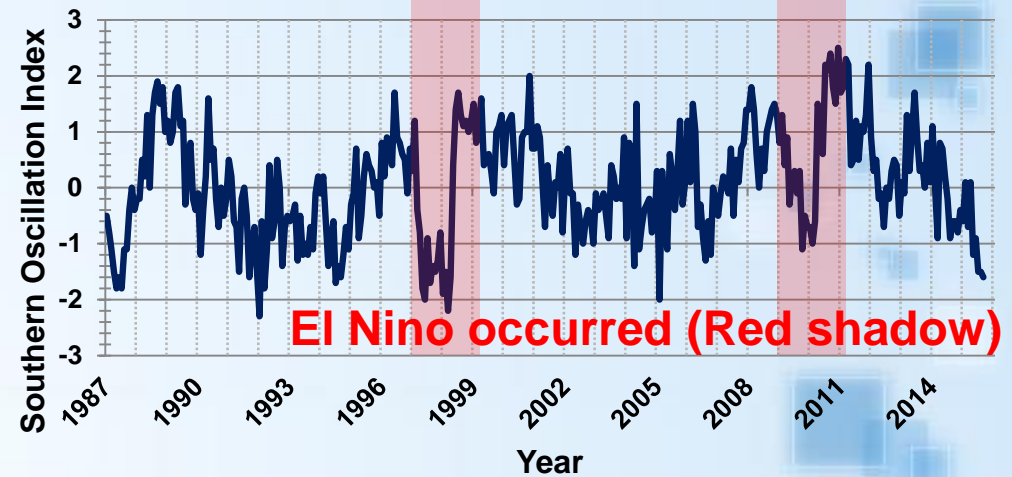
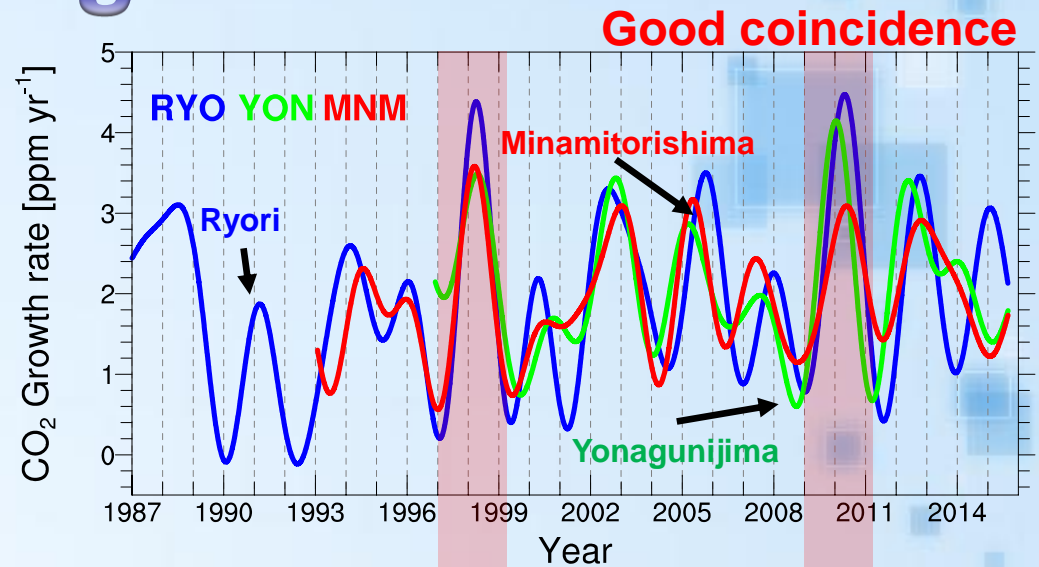
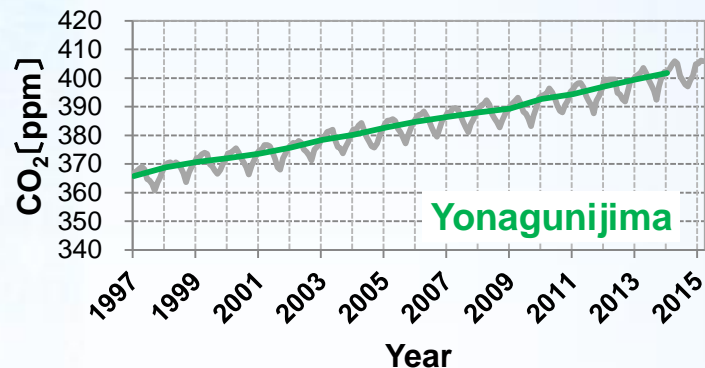
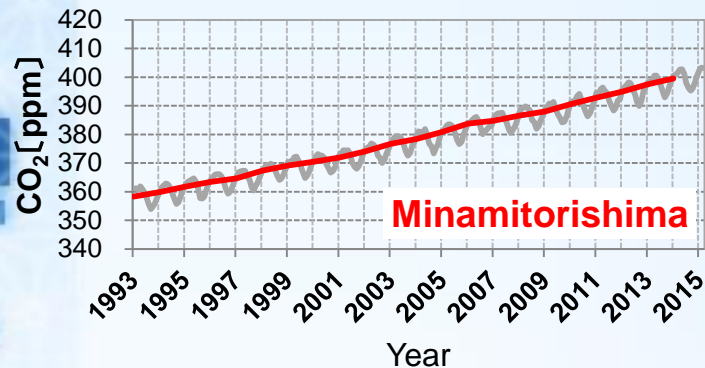
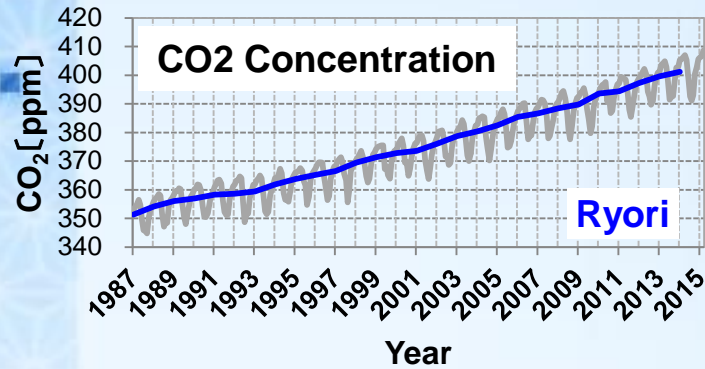
1997 1999 2001 2003 2005 2007

Year

— Ryori — Minamitorishima — Yonagunijima

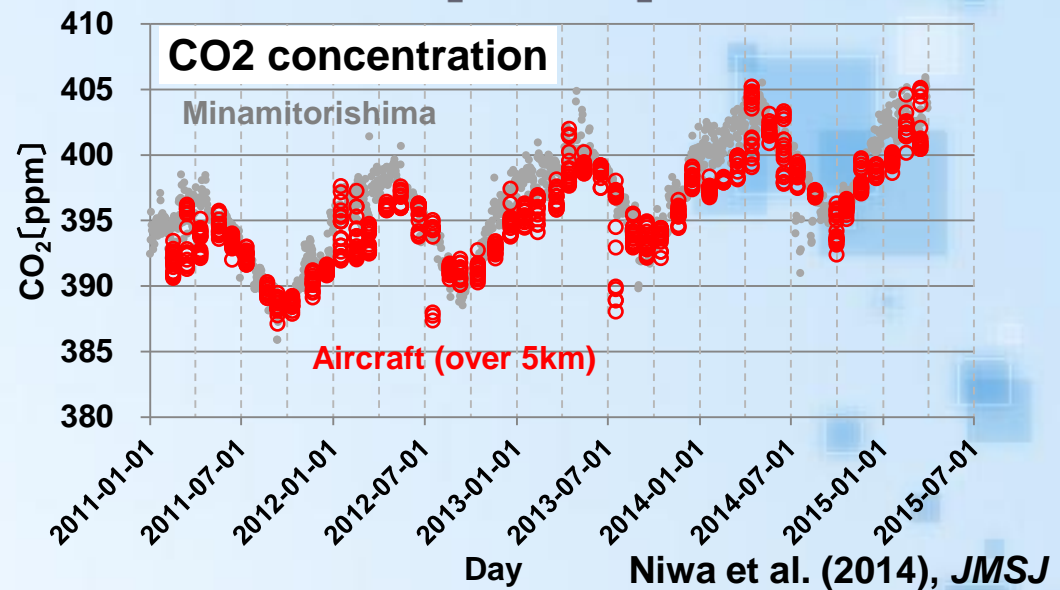
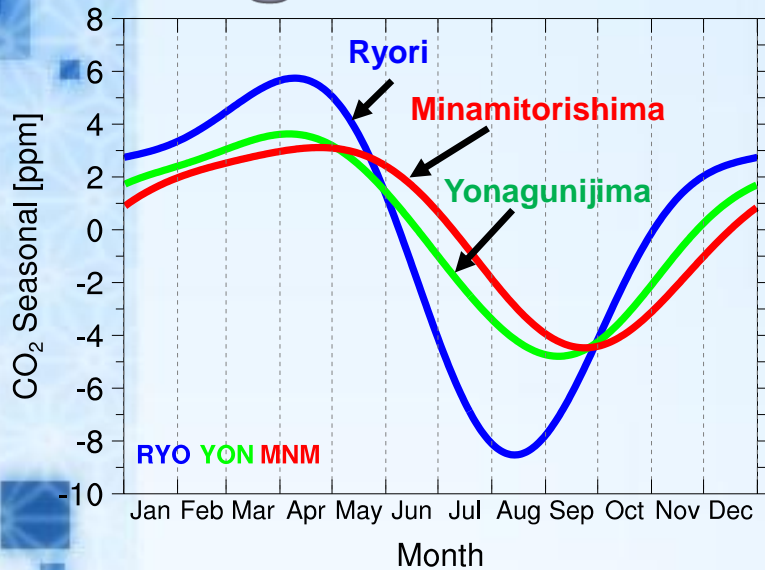


Observed CO₂ Concentration and annual growth rate



<http://www.data.jma.go.jp/gmd/cpd/db/elnino/index/soi.html>

Averaged CO₂ cycle and comparing with ground and mid-troposphere



- The difference of seasonal variation rate reflects the difference of biosphere.
- The phase shift indicates that the air convection carries high CO₂ concentration to mid-troposphere from ground.

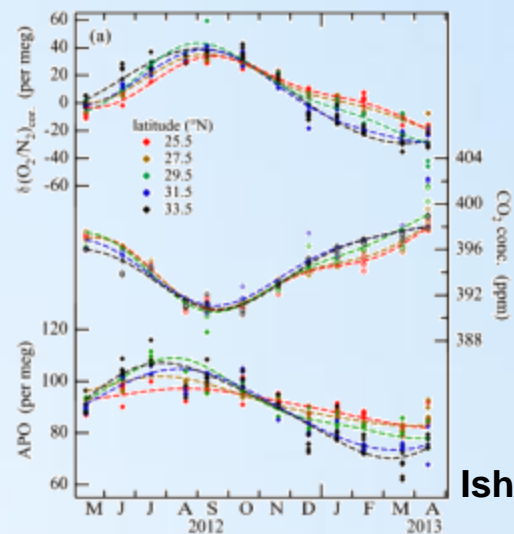
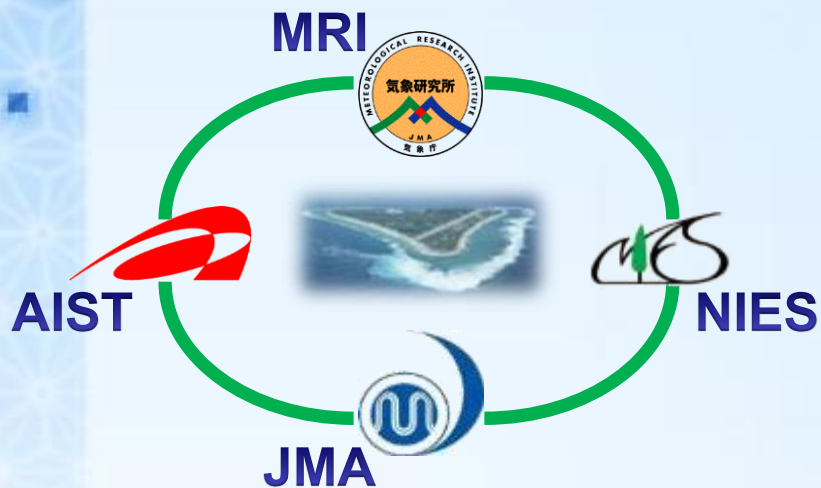
The new findings are obtained but it is required **furthermore observations** to **elucidate the carbon cycle**.



Collaboration with Japanese research group



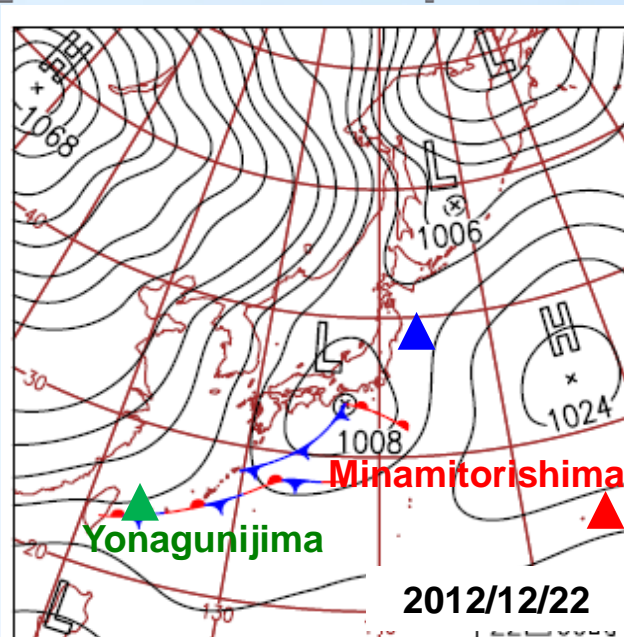
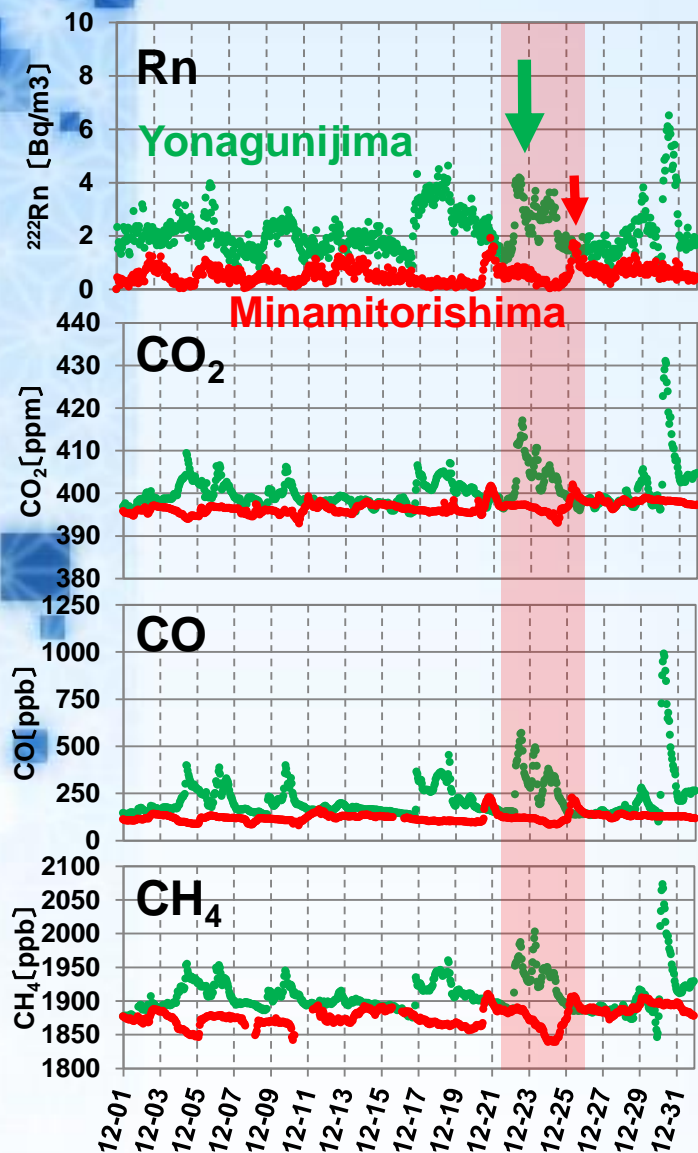
Collaboration at Minamitorishima



Ishidoya et al. (2014), SOLA

Measurement Laboratory	Parameter	Sampling Type
Meteorological Research Institute (MRI(JMA's facility))	H ₂ , ²²² Rn	Continuous
National Institute for Environmental Studies (NIES)	δO ₂ /N ₂ , ¹⁴ CO ₂ , Halocarbons	Flask
National Institute of Advanced Industrial Science and Technology (AIST)	CO ₂ isotope ratio (δ ¹³ C, δ ¹⁸ O), δO ₂ /N ₂ , δAr/N ₂ , δ ¹⁵ N of N ₂ , δ ¹⁸ O of O ₂ , δ ⁴⁰ Ar	Flask

Relation between ^{222}Rn and CO_2 , CO , CH_4



- High resolution measurements of Rn well captured a synoptic-scale increase due to the intrusion of continental air masses.
- Synoptic-scale variation of radon was brought by a passage of cold front associated with a moving cyclone.

Wada et al. (2013), *TellusB*



Conclusions

- We have been operating three ground-based stations and obtained long-term data properly.
- We use advanced laser based analyzers and achieve better measurement precision .
- We started collaboration work since 2011 and the data has been accumulated.

Reference

- i. Tsuboi et al. (2013), Evaluation of a new JMA aircraft flask sampling system and laboratory trace gas analysis system, *Atmos. Meas. Tech.*, 6, 1257-1270, doi:10.5194/amt-6-1257-2013.
- ii. Niwa et al. (2014), Seasonal Variations of CO₂, CH₄, N₂O and CO in the Mid-Troposphere over the Western North Pacific Observed Using a C-130H Cargo Aircraft, *J.Meteorol. Soc. Japan*, 92(1), 55-70, doi:10.2151/jmsj.2014-101.
- iii. Ishidoya et al. (2014), New Atmospheric O₂/N₂ Ratio Measurements over the Western North Pacific Using a Cargo Aircraft C-130H, *SOLA*, vol.10, 23-28, doi:10.2151/sola.2014-006.
- iv. Wada et al. (2013), Quantification of emission estimates of CO₂, CH₄, and CO for East Asia Derived from atmospheric radon-222 measurements over the western North Pacific, *Tellus B* 2013, 65, 18037, doi:10.3102/tellusb.v65i0.18037.