Site report : Tateno (Japan)

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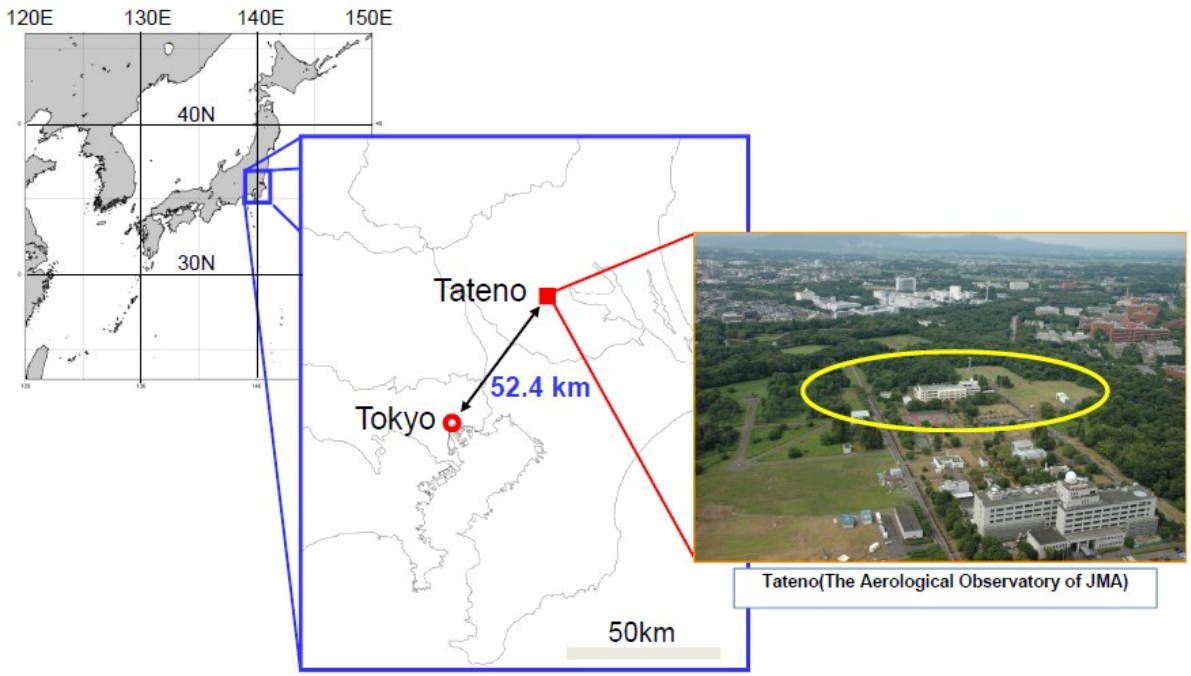
Japan Meteorological Agency (JMA)

(GRUAN ICM-4, 5 - 9 March 2012)

Contents

Tateno site

Observations with operational basis are performed



Wish to expect the site visit tomorrow

Recent progress of Tateno for GRUAN

Dec. 2009 □ Oct. 2010 : Inter-comparison between RS2-91 and RS92-SGP with double launching carried out 120 times

Mar. 2011 : The results were reported at ICM-3

Jun 2011 : Provide the inter- comparison data to GRUANs Lead Centre

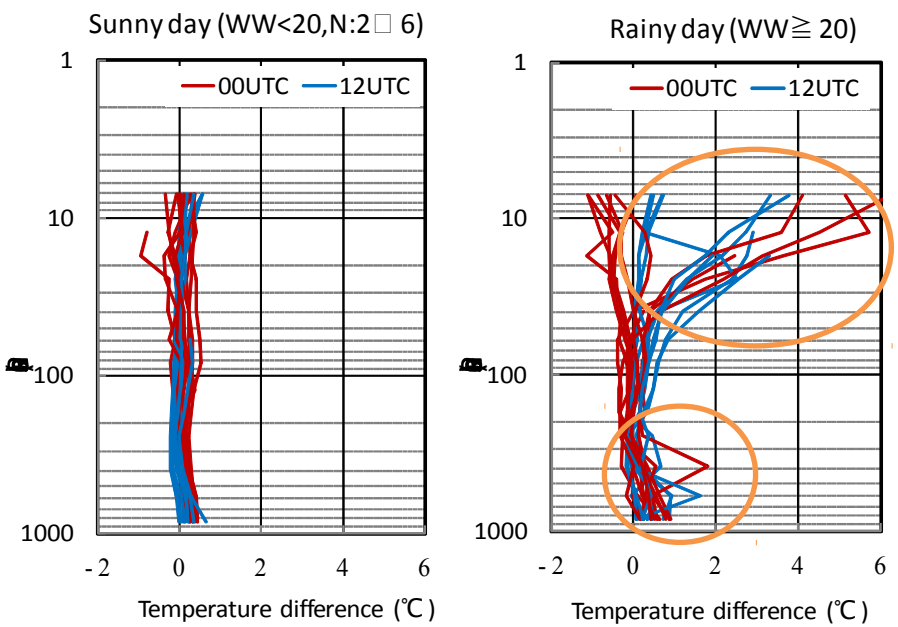
Jun 2011 : Begin quasi-real-time report of routine upper-air observation data and radiosonde launch metadata to GRUAN Lead Center by using the RsLaunchClient

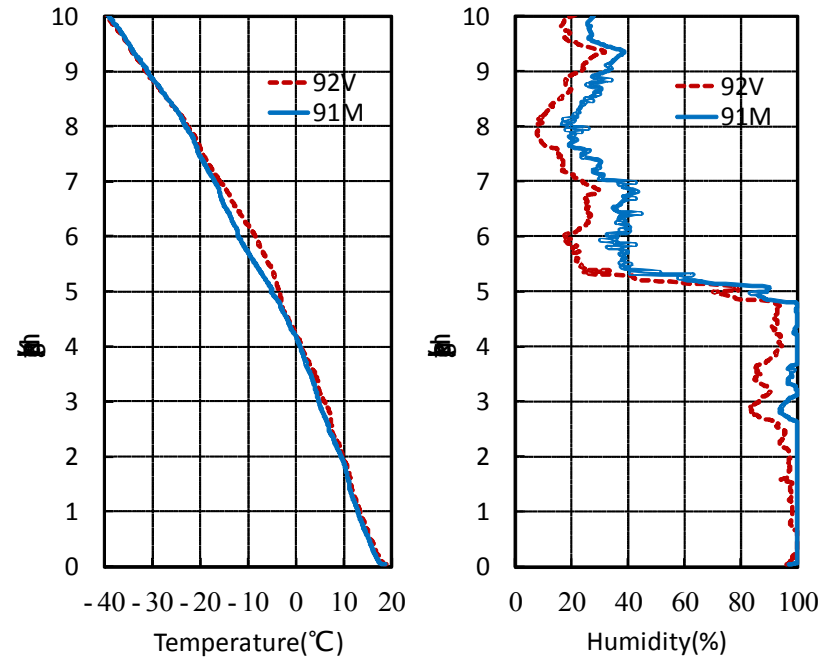
Jan. 2012 : Tateno's RsLaunchClient application was upgraded to Ver. 0.4

The follow-up for ICM-3

□□ Temperature difference under high humidity condition □

Tateno has carried out comparison observations under the different humid conditions since last year. Taneno is going to analyze the obtained data. It would be expected to be a follow-up analysis for the inter-comparison (Visala RS92-SGP (using Ver.3.63) vs. Meisei RS2-91) reported in ICM-3.



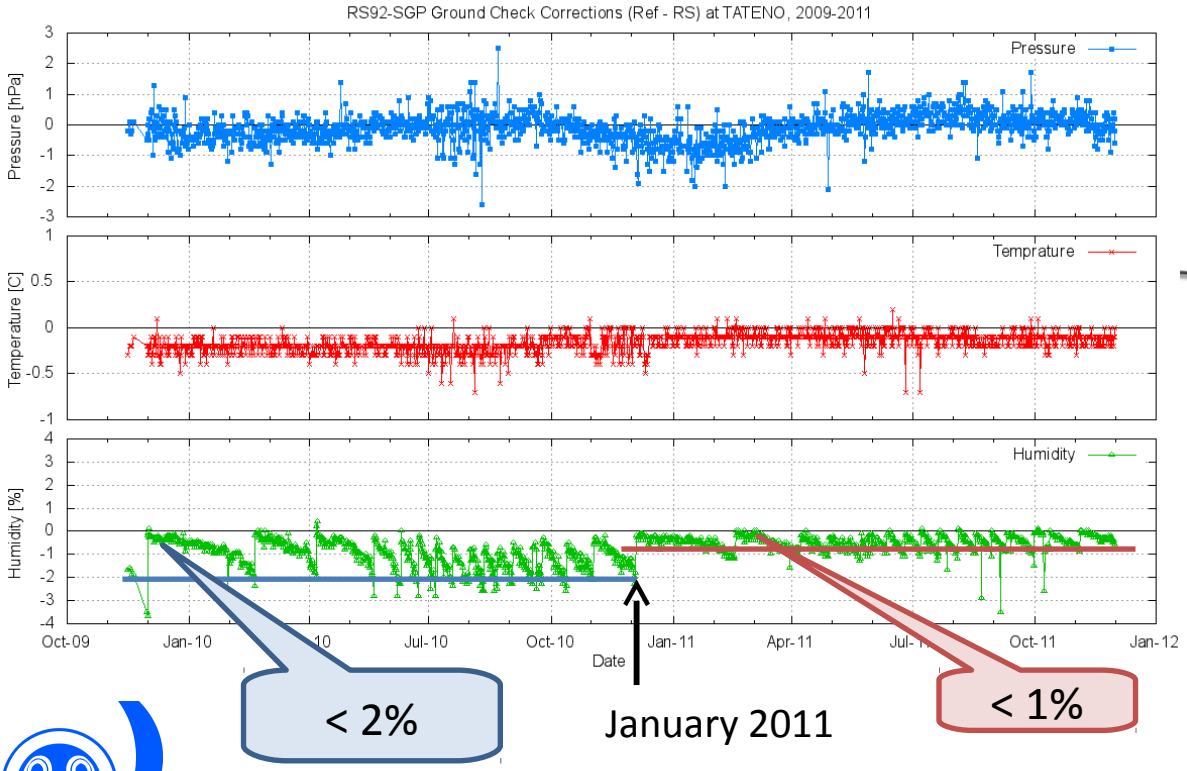


Observed data on 17 June 2011 (00UTC)

In rainy days, large temperature difference are observed in both troposphere and stratosphere.

Tateno has changed the conditions of exchan ging drier(Molecular sieve)

Tateno conducts to humidity conditions from < 2% to <1% at the ground check.
(In the practical use of exchanging drier (Molecular sieve))



Humidity Condition □□ 2 □

Since Jan. 2011

Humidity Condition □□ 1 □

To understand the temporal and spatial representation of GPS-PWV

Cross-correlation coeficient

between GPS-PWV values at Tateno and those at other stations (i) for the lag time (k)

$$r_{ik} = \frac{\sum_{j=1}^{N-k}(X_{oj} - \overline{X}_{0k})(X_{ij+k} - \overline{X}_{ik})}{\sqrt{\sum_{j=1}^{N-k}(X_{oj} - \overline{X}_{0k})^2}\sqrt{\sum_{j=1}^{N-k}(X_{ij+k} - \overline{X}_{ik})^2}}$$

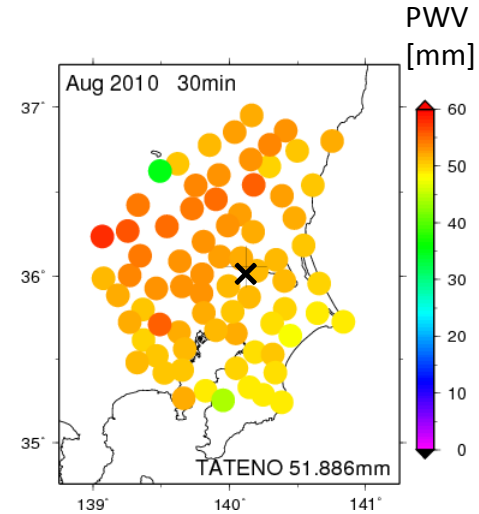
N : Number of observations for 1 month

X_{0j} : GPS-PWV at Tateno at the time of j

$\overline{X}_{0k}$: Monthly mean of X0j

X_{ij+k} : GPS-PWV at other station(i) at the time of j+k

$\overline{X}_{ik}$: Monthly mean of Xij+k



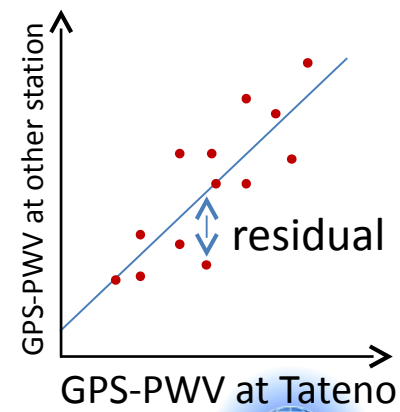
Distribution of GPS receivers within a distance of 100 km from Tateno. ×denots Tateno.

Standard deviation of residuals*

$$SR_{ik} = SD_{ik}\sqrt{1 - r_{ik}^2}$$

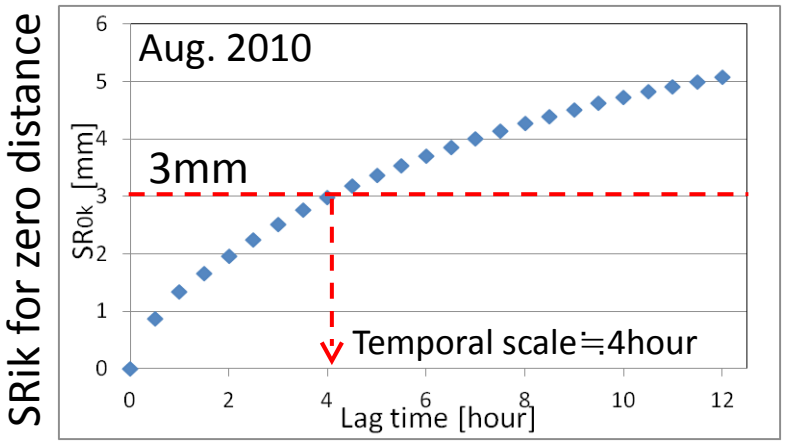
SD_{ik} : Standard deviation of XIJ+K

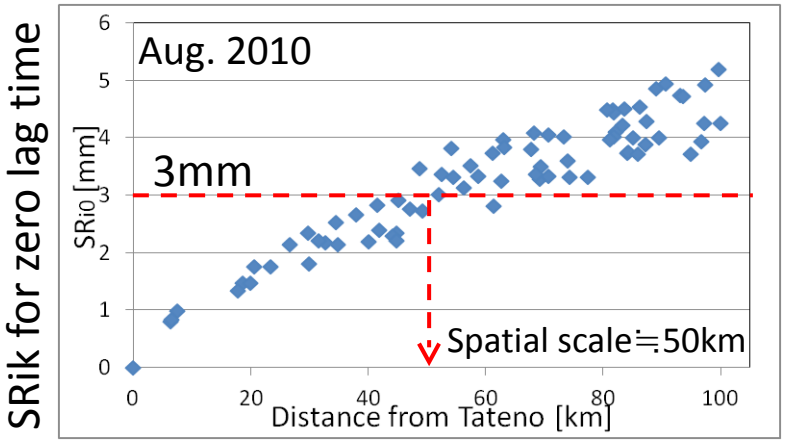
Represents a error due to temporal-spatial variability of GPS-PWV.

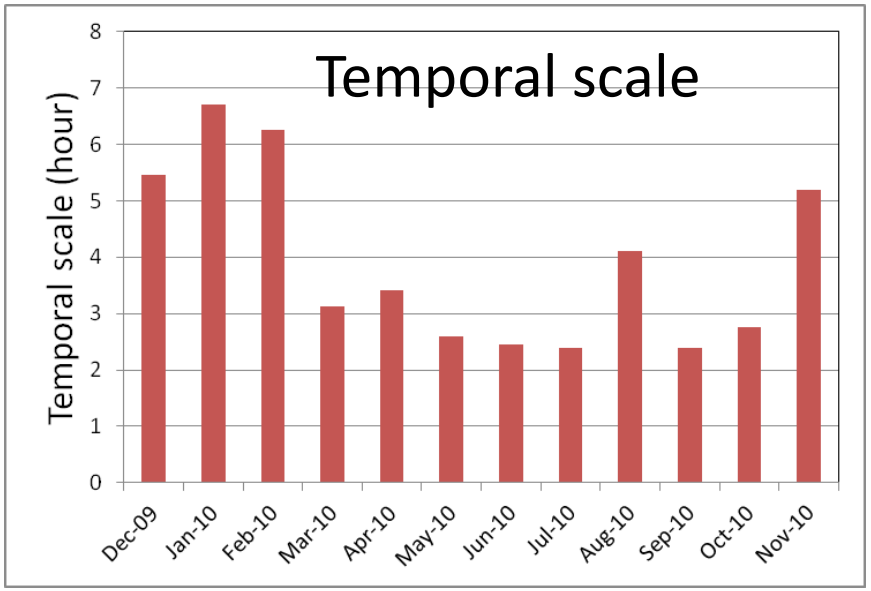


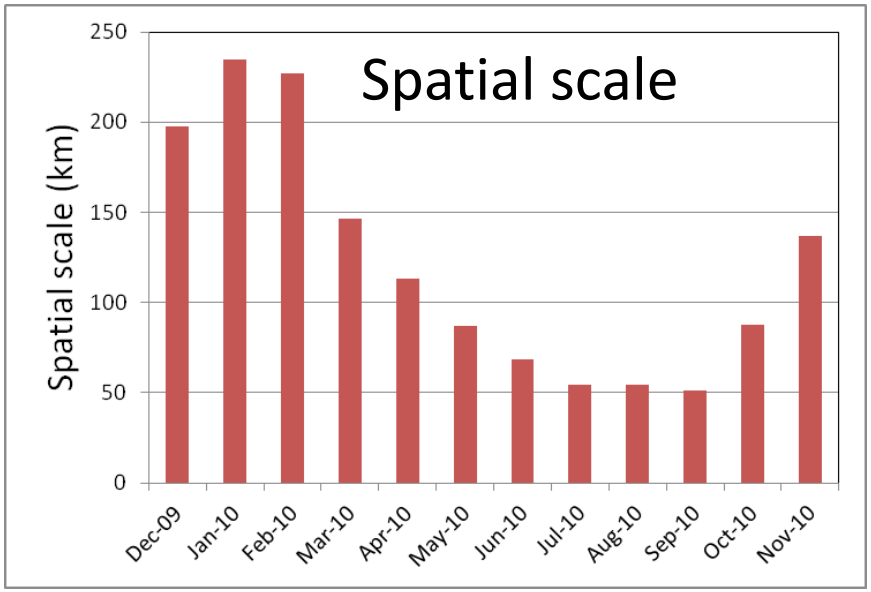
* Standard deviation of residuals (SRik) defined as differences between observational values and predicted values based on linear regression using GPS-PWV values at Tateno (the explanatory variable) and those at other stations (the dependent variable) for lag time.

Temporal and spatial scale of GPS-PWV



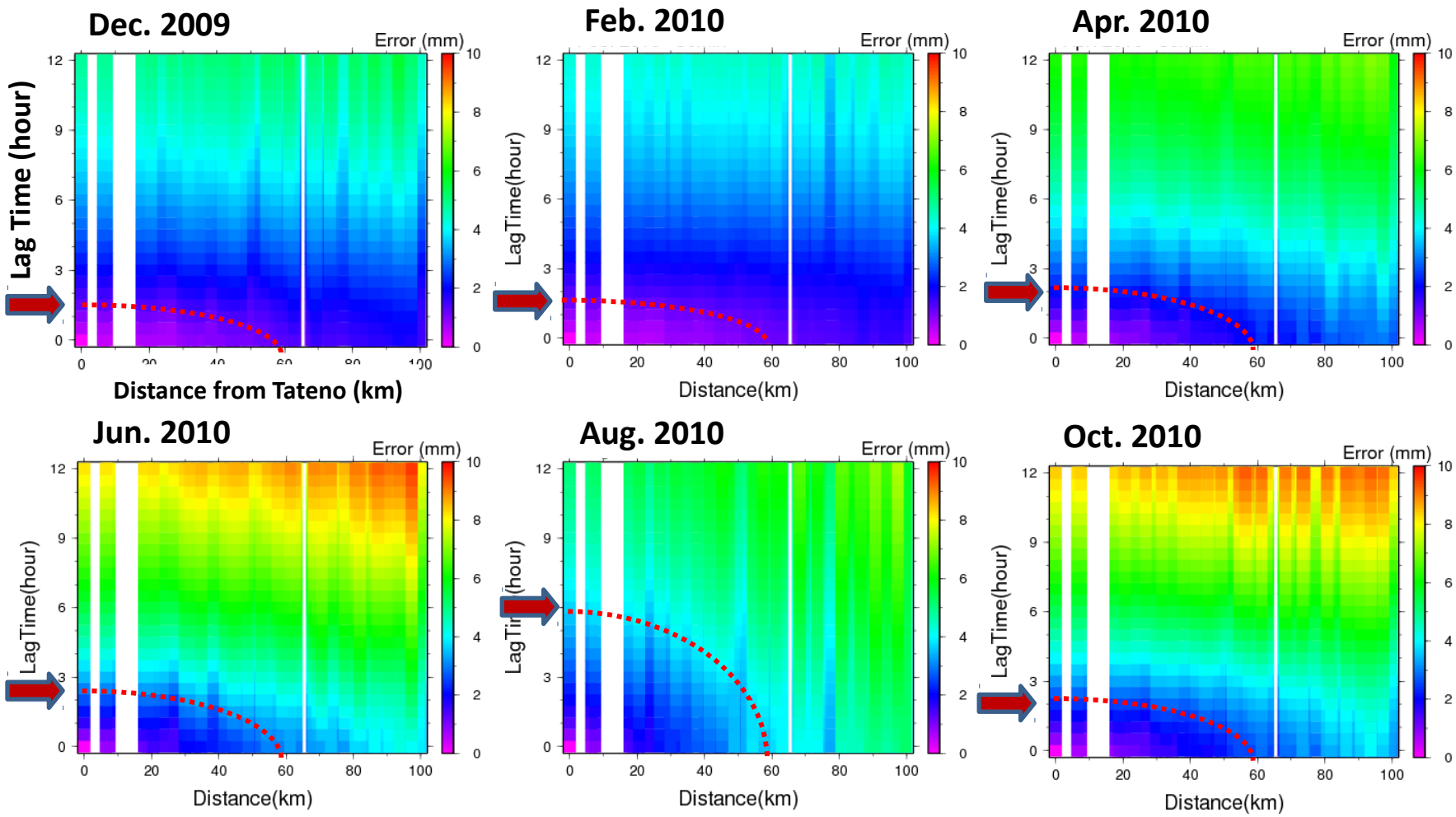






- Similar annual cycle was derived with temporal scale and spatial scale. (Became larger(smaller) in the winter(summer) season.)
- Exceptionally, temporal scale in August was relatively large.

Variation of SRik

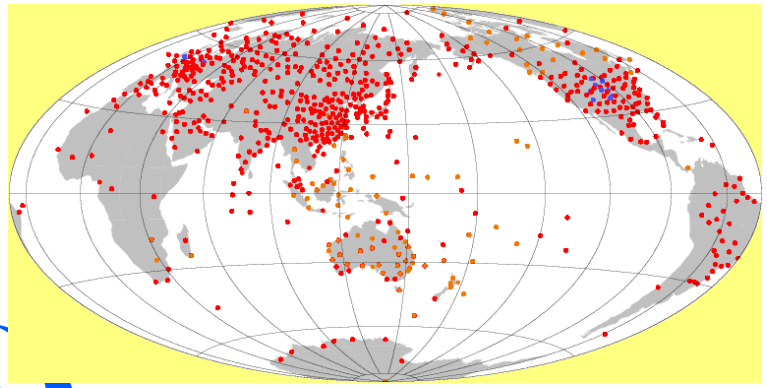


- SRik shows a increasing function of distance and lag time.
- For example, lag time(indicated by ➡) which was equivalent to the distance of 60km was drifted with season.
- The ratio of distance to lag time should indicate the mean phase velocity of

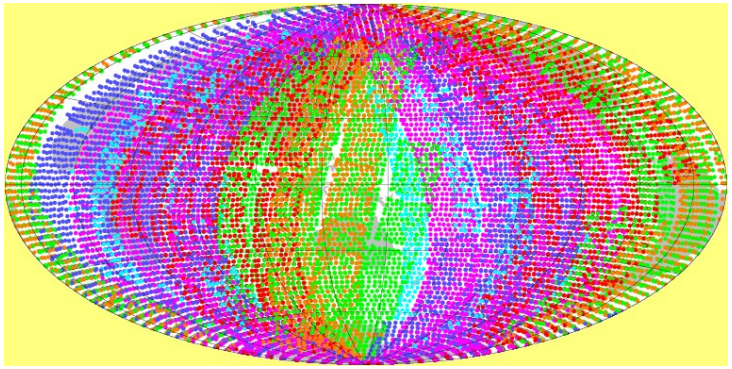
The importance of upper-air observations and GRUAN

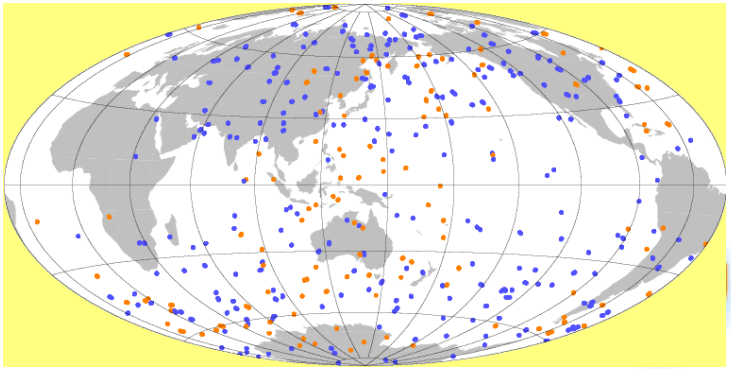
□ Available Observations for NWP in the stratosphere (JMA) □

- radiosonde (**t**,**q**,w)
  - direct observations for the atmospheric properties
  - can work as "anchor" for satellite obs.
- pilot balloon (w)
- wind profiler (w)
  - some profilers reaches to the stratosphere (in US and Europe)



- satellite
  - Sounders (radiance:~$\Sigma f(p,\mathbf{t},\mathbf{q})dz$)
  - GPS-ROs (refractivity:~$f(p,\mathbf{t},\mathbf{q})$)
  - Indirect observations and it needs external information to extract the atmospheric properties

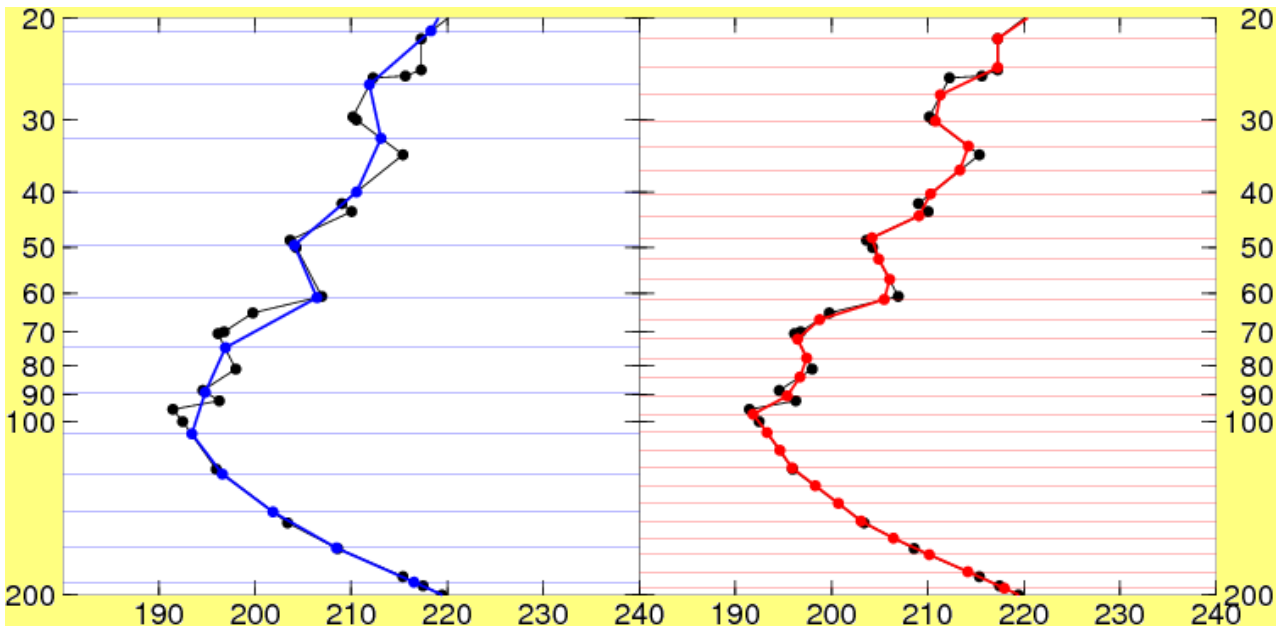




Increase of NWP model levels (JMA)

JMA/NPD has a plan to increase the Global/Regional NWP model levels and raise the models' top in the next high-performance computing system which will become operational in 2012.

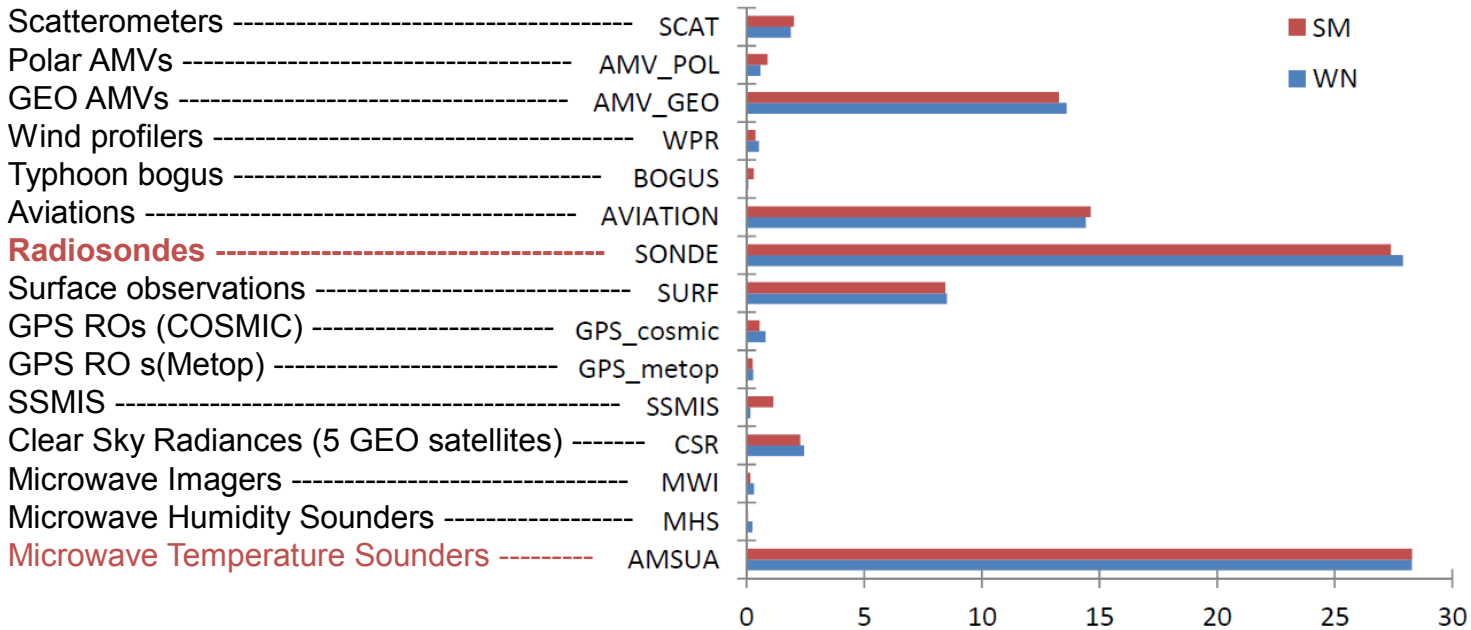
- It is expected that the small features around the Tropopause can be illustrated more clearly in the next model space.



Black lines show the observed temperature around the tropopause (at Kuala Lumpur, 24 Oct. 2011 00UTC) and Blue/Red lines show the interpolated values onto the model layers

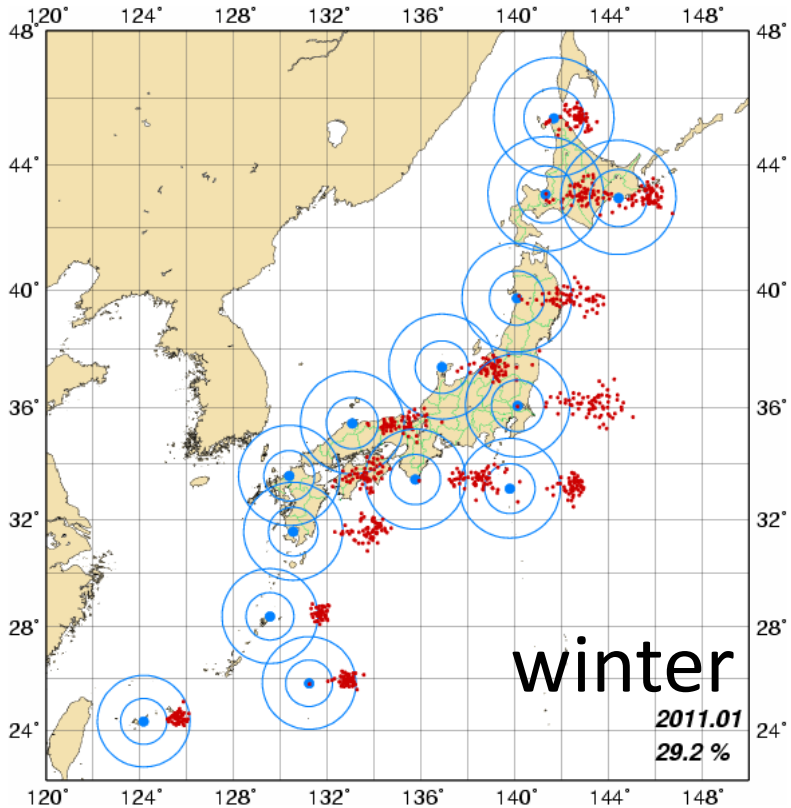
Impact of the Radiosonde data on NWP (JMA)

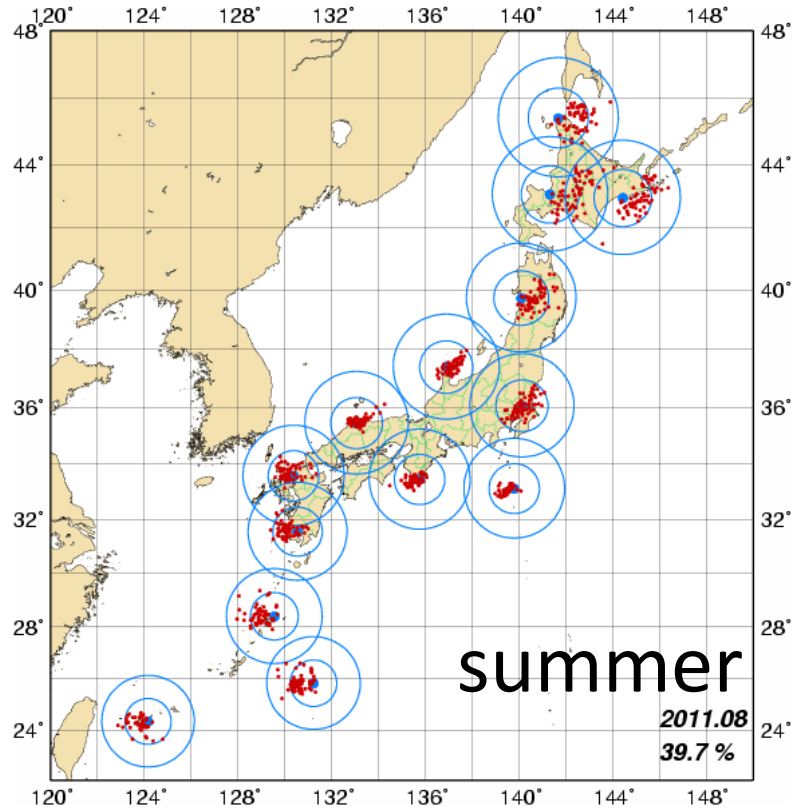
In the JMA, still radiosonde plays a very important role in the objective analyses for NWP.



Contributions (%) to the 15-hour forecast error reduction in January 2010 (WN) and August 2010 (SM). Positive values mean that the observations works to reduce the forecast error in terms of the dry energy norm.

Issue of fallen radiosonde onto urban area in Japan





Countermeasures;

- JMA requires manufacturers to pad with dumper around radiosondes,
- usually attaches a parachute,
- and has asked manufacturers to reduce the weight of sondes, use biodegradable materials and shorten sonde strings

Issue of cost-effectiveness

To expand the number of radiosonde stations, re-activate silent stations in data-sparse areas, every effort should be made to avoid closing stations and to reduce the cost barrier of radiosonde operation to support sustainable operations.

How to reduce the cost barrier of GPS radiosondes

- ✓ Manufacturers should be encouraged to be more transparent and accountable in setting sonde prices.
- ✓ A standardized output data format that can be used across the board for ground systems of different manufacturers also needs to be developed.

Summary

1. Tateno site began quasi-real-time report of routine observation data and metadata to the GRUAN Lead Centre by using the RsLaunchClient since Jun 2011. In addition, inter-comparison data performed at Tateno had been provided to the GRUAN Lead Centre.
2. The relationship between temporal and spatial variability of GPS-PWV was statistically examined.
3. Radiosonde observation is one of the most important elements of the 4D-Var data assimilation system of the NWP.
4. Countermeasures for fallen radiosonde and reduction of the cost barrier of radiosonde are expected.

Thank you

I wish you to enjoy the Tateno site visit tomorrow.