Comparison of Meisei's Gpssonde

- Session 5, 24 April 2018 -

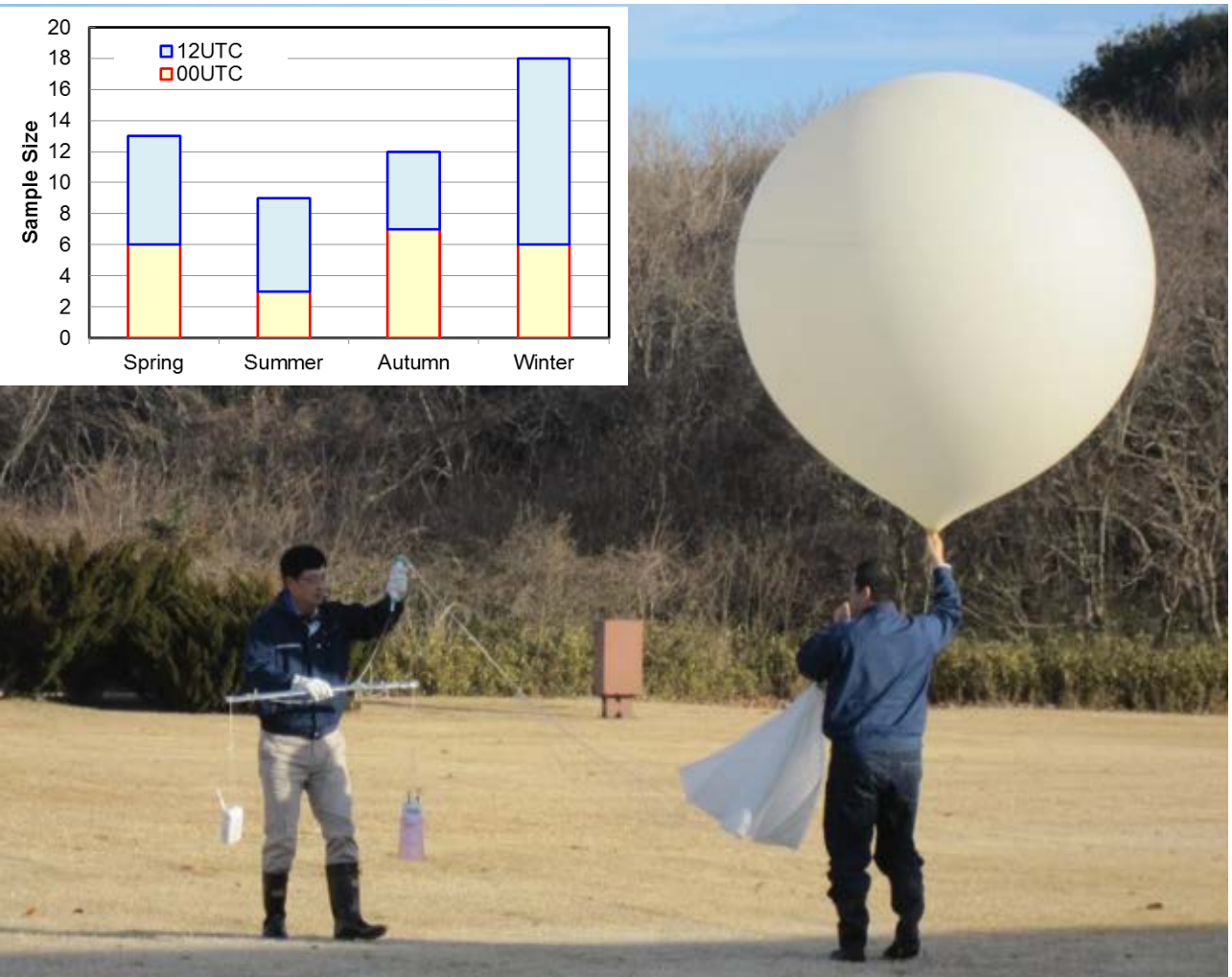
Masami Iwabuchi (JMA)

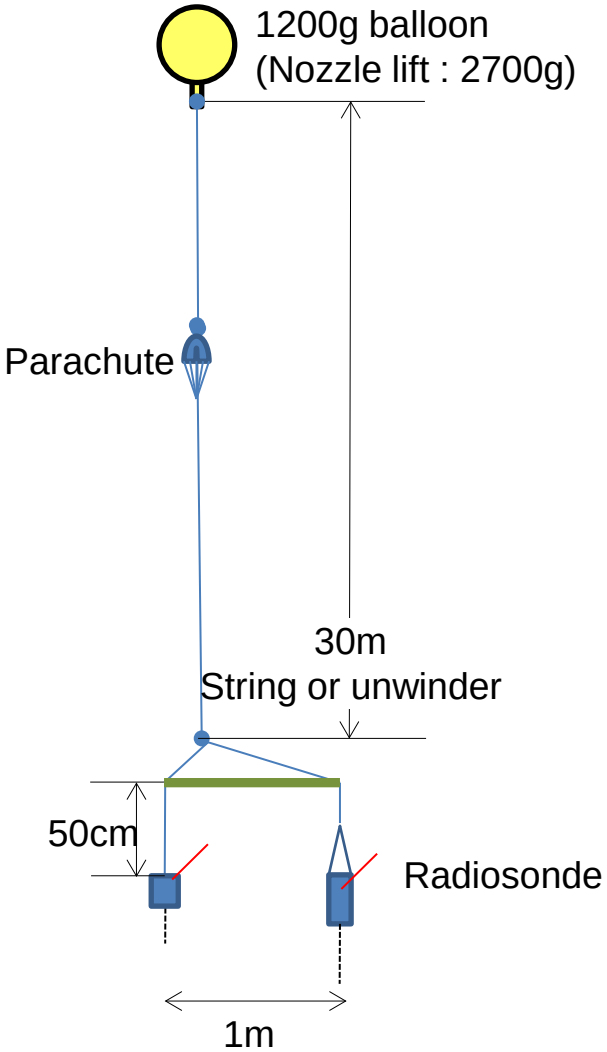
Comparison of Meisei Gpssondes

- Comparison of RS92-SGP and RS-11G
- Comparison of RS92-SGP and iMS-100
- Summary of comparison results of 11G(GDP), iMS(GDP) and RS92(GDP)
- Comparison of CFH, RS-11G and iMS-100
- Comparison of MTR, RS92-SGP, RS-11G and iMS-100
- Comparison of GNSS RO and RS-11G

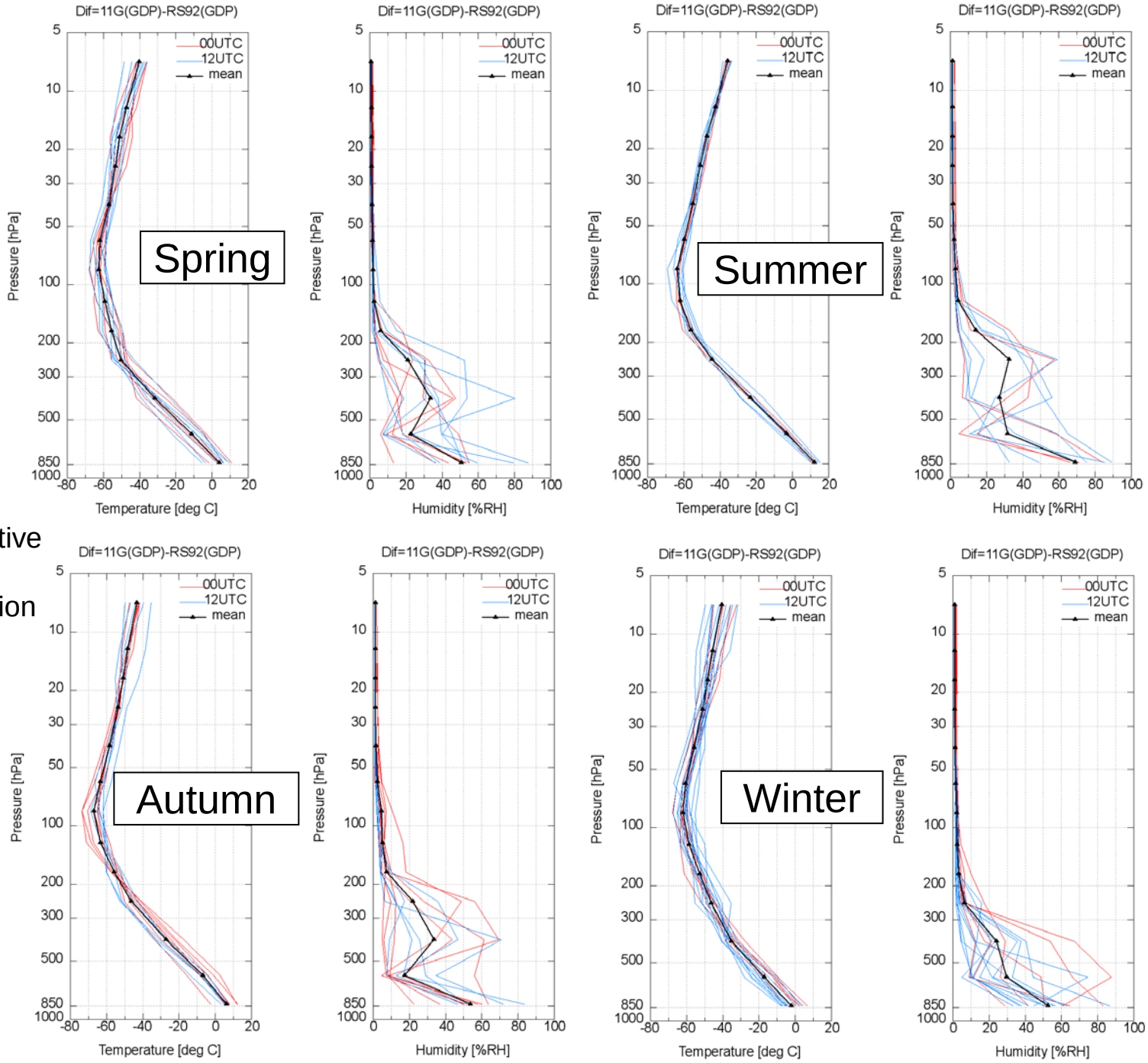
Comparison of RS92-SGP and RS-11G

- Analysis period: April 2015 - June 2017
- Number of samples: 52 observations
  (daytime: 22, nighttime: 30)





RS-11G
temperature and relative humidity profile in comparative observation

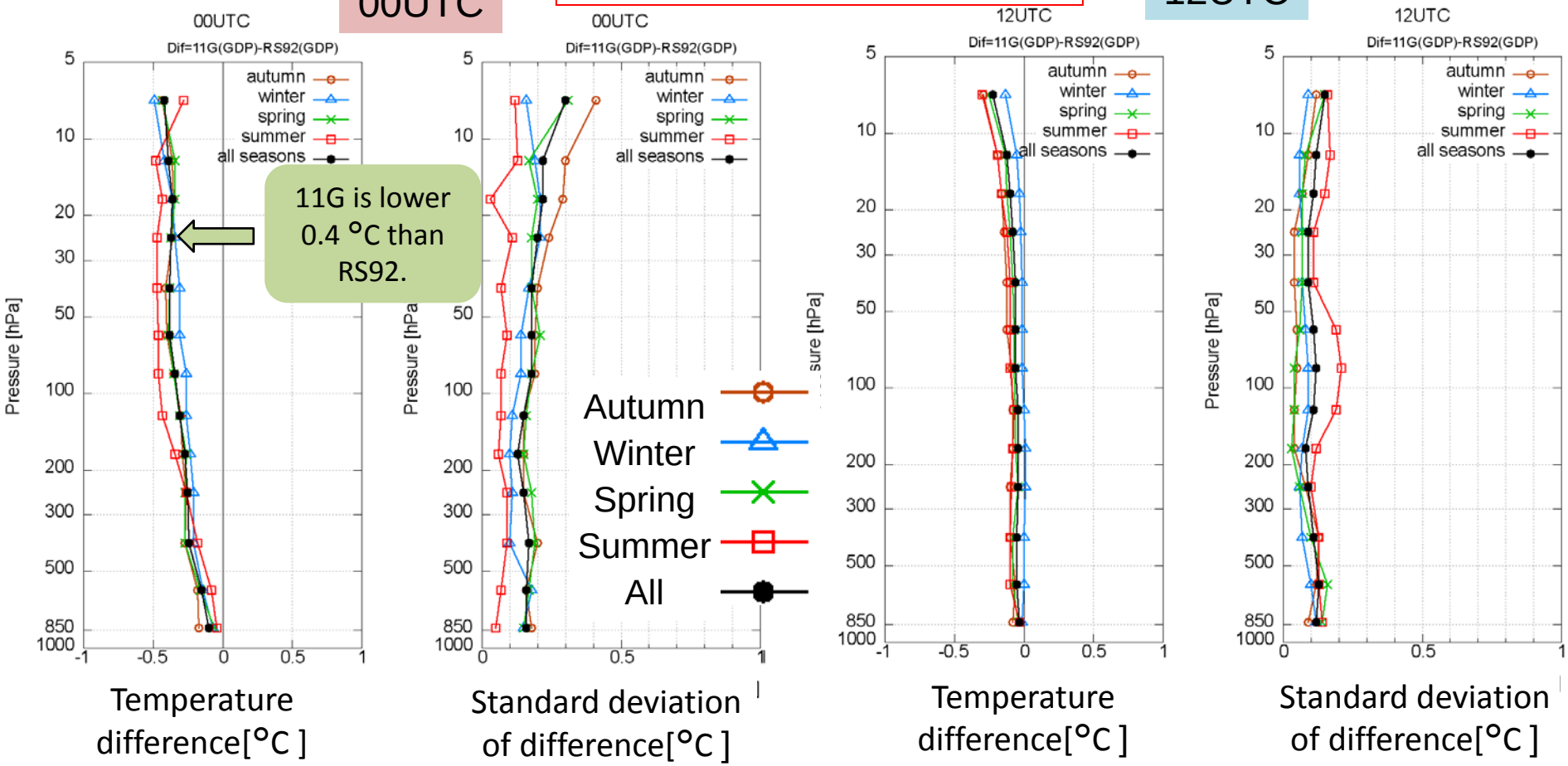


11G(GDP)-RS92(GDP) Temperature difference

Difference = 11G - RS92

00UTC

12UTC



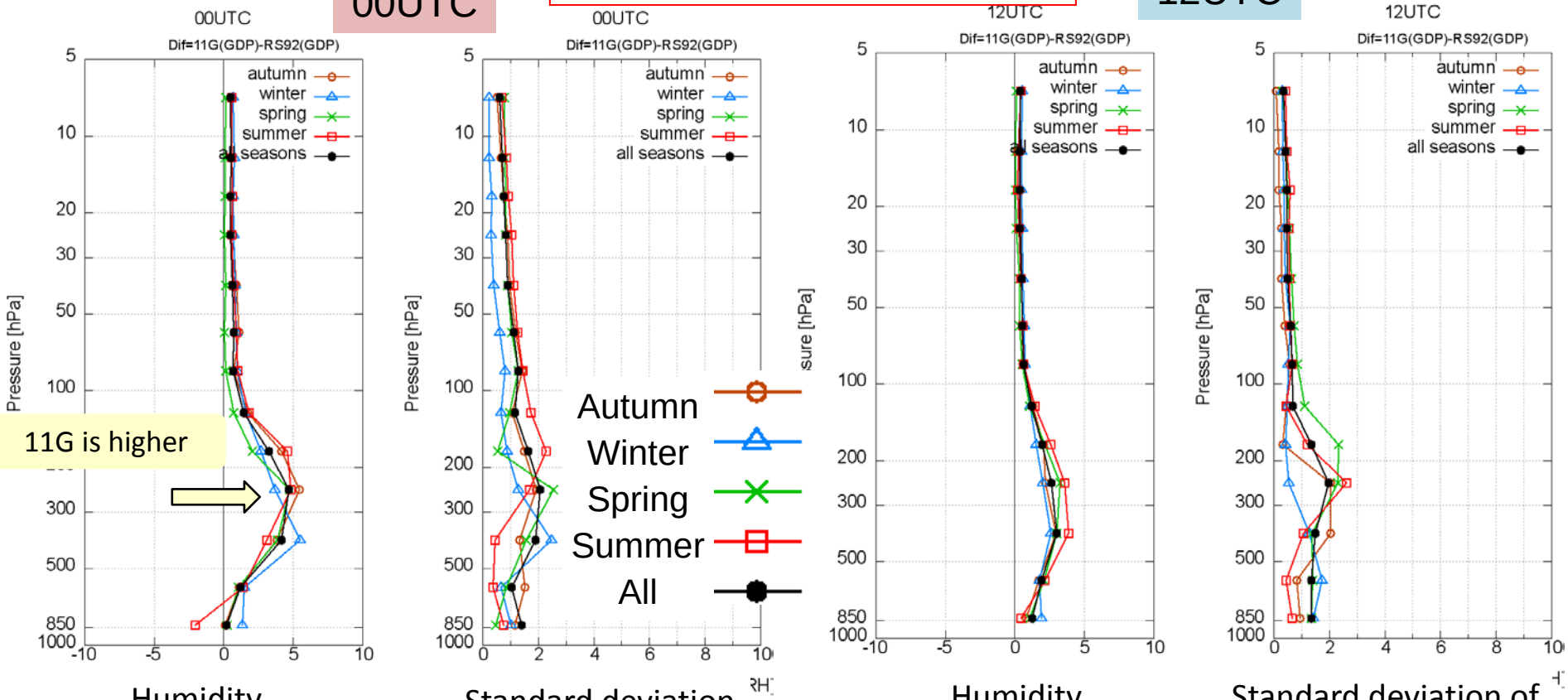
- In the daytime (00 UTC) observation, 11G is lower 0.4 °C than RS92 in the stratosphere.
- In the night (12 UTC) observation, the difference is small compared to the daytime.

11G(GDP)-RS92(GDP) Humidity difference

Difference = 11G - RS92

00UTC

12UTC



Humidity difference[%RH]

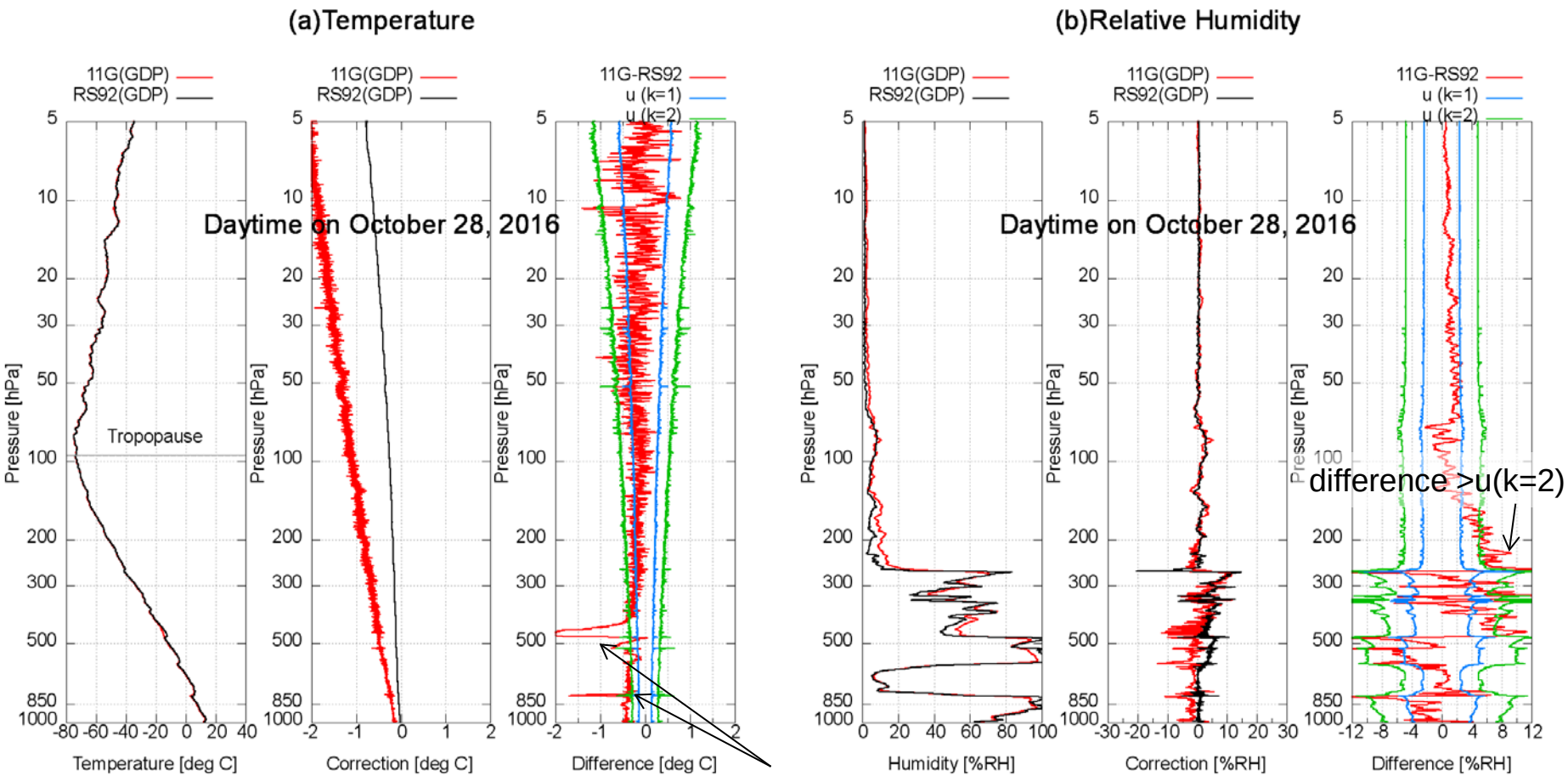
Standard deviation of difference[%RH]

Humidity difference[%RH]

Standard deviation of difference[%RH]

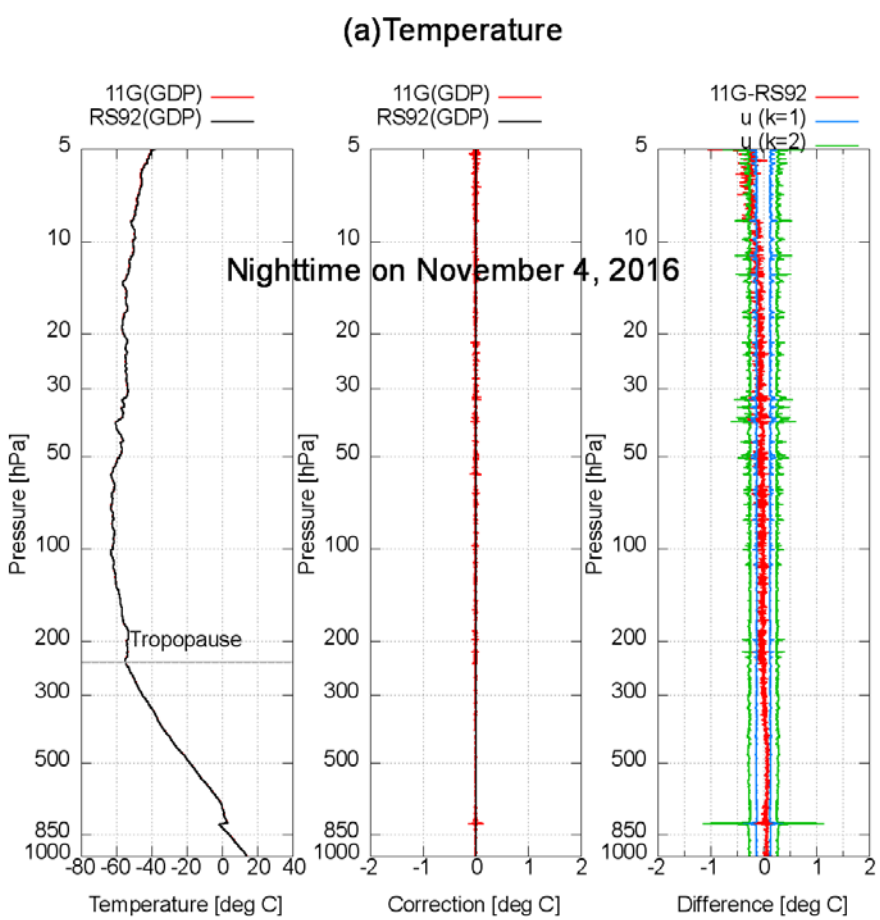
- Humidity of 11G (GDP) is higher 5%RH than RS92 (GDP) in 500～150hPa.

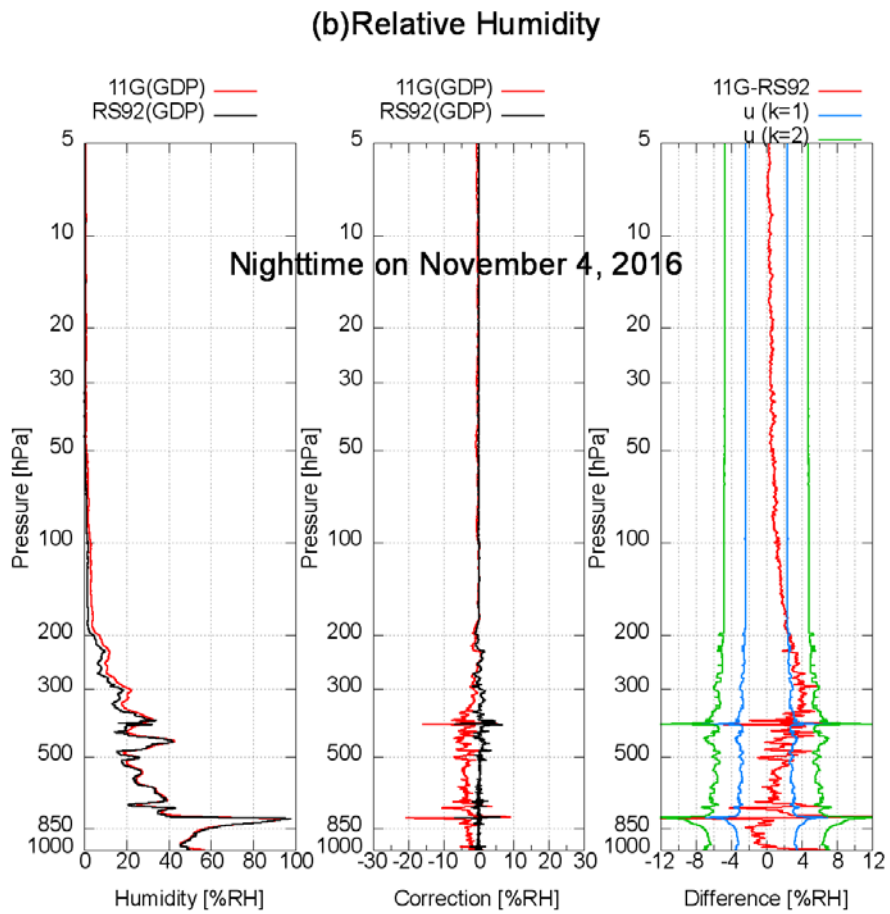
Evaluation of GDP using uncertainty (Daytime case)



- Temperature : 11G is lower than RS92 from the ground up to 400 hPa.
- Humidity : 11G is higher than RS92 in 500 hPa and 250 hPa.
- A significant difference occurs when changing from high humidity to drying zone.
- Stratospheric temperature difference < u (k = 2).
- Stratospheric humidity difference < u (k = 1).

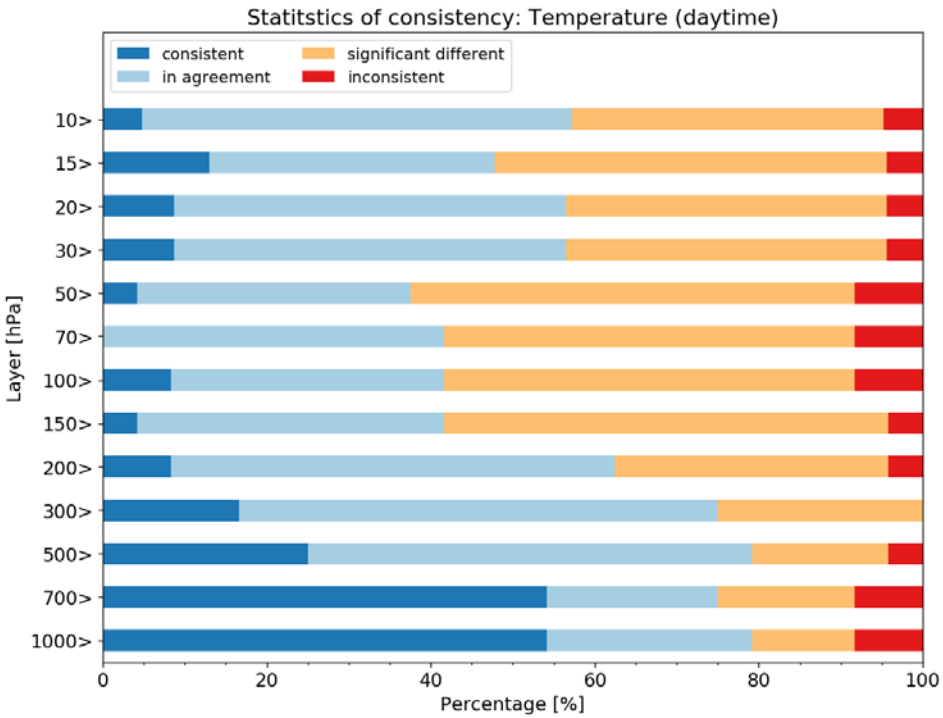
Evaluation of GDP using uncertainty (Nighttime case)

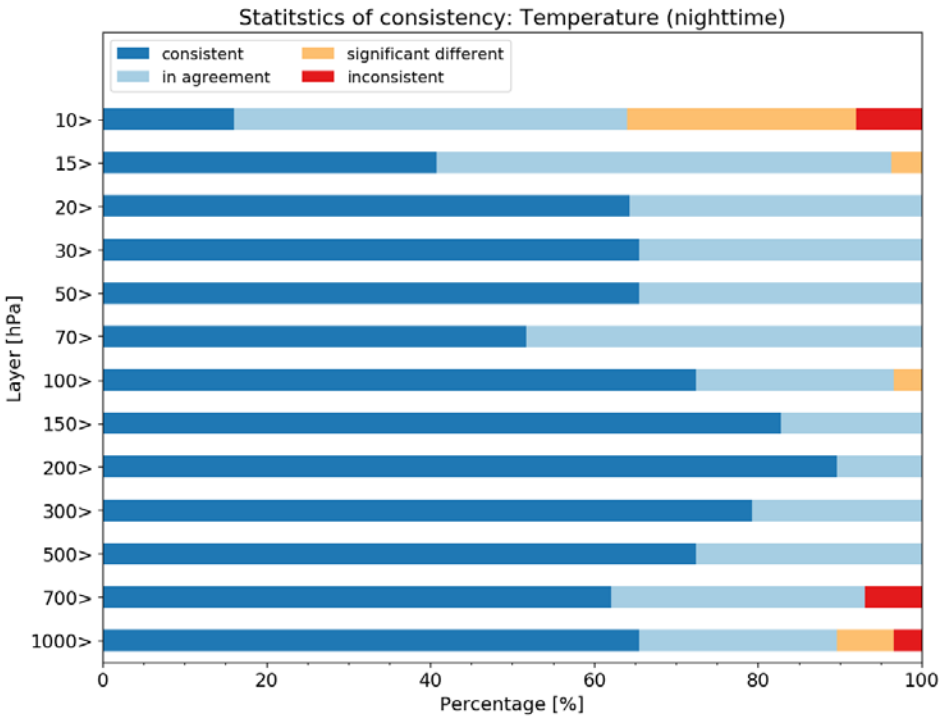




- Temperature uncertainty does not depend heavily.
- The temperature difference < u (k = 1) (up to 30 hPa).
- Humidity difference < u (k = 2)

Consistency check by uncertainty (Temperature)

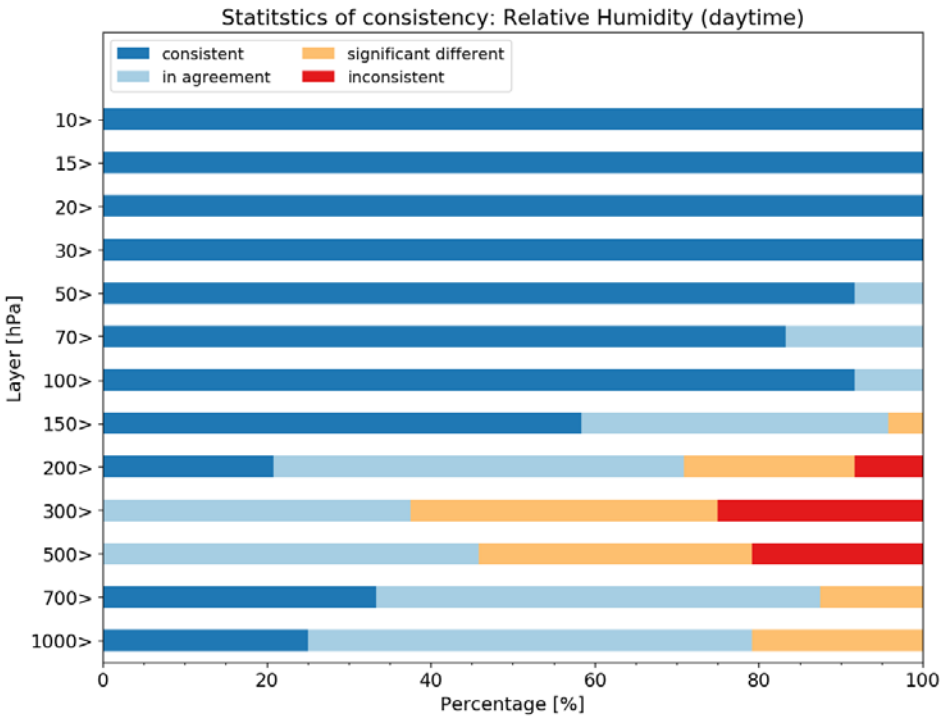


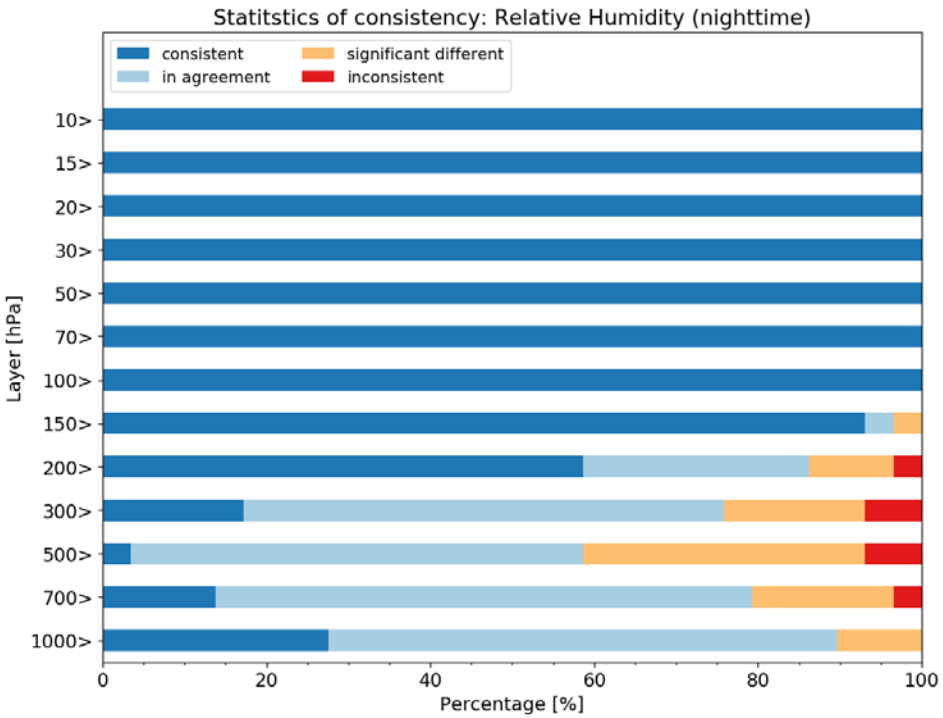


Daytime: observations in agreement are less than 80 % for all layers; less than 50 % near tropopause.

Nighttime: observations are almost in agreement except lower troposphere and above 10 hPa.

Consistency check by uncertainty (Humidity)

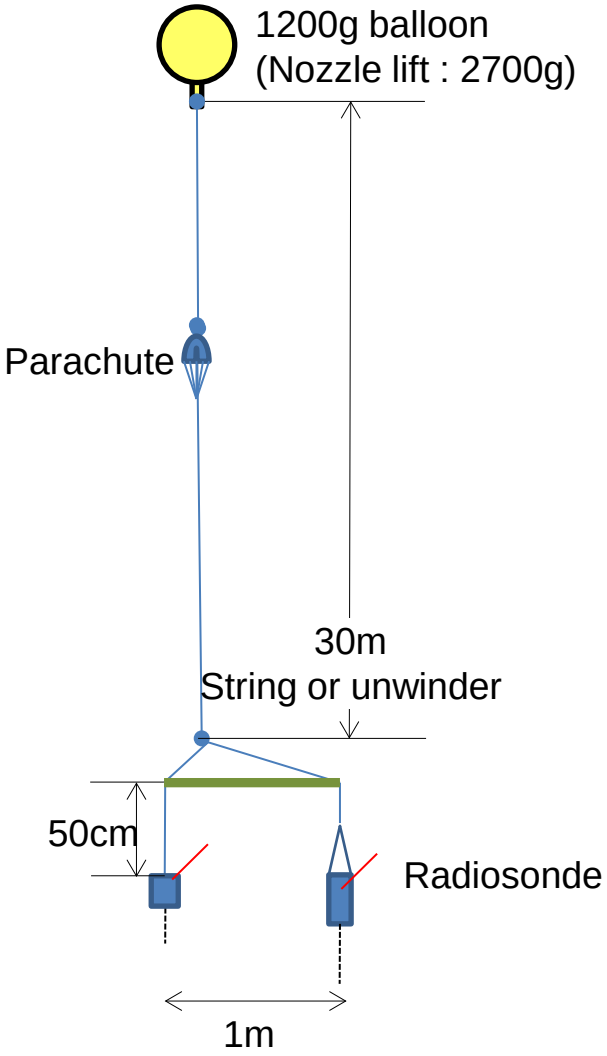




Observations are almost in agreement above 150 hPa.

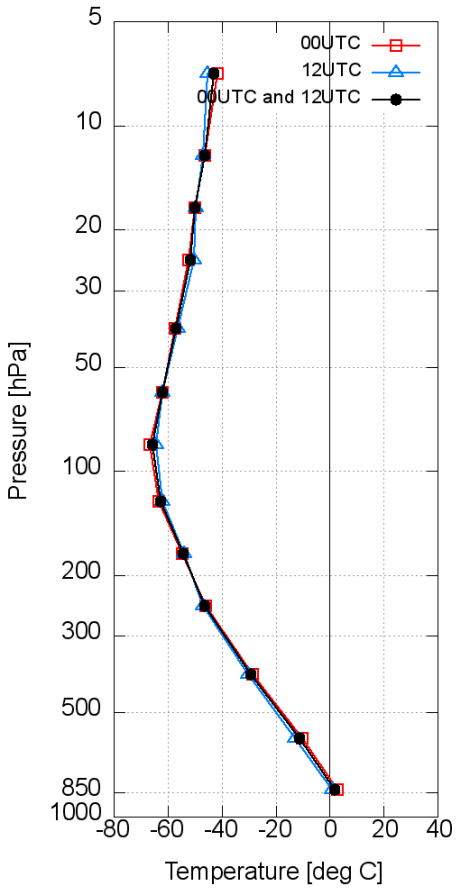
Comparison of iMS-100 and RS92-SGP

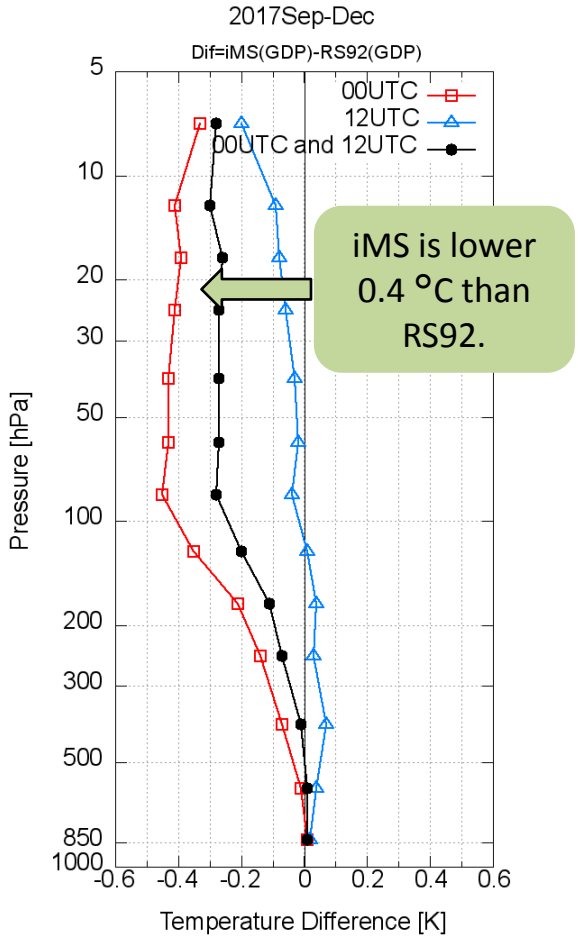
Analysis period: SEP. 2017 – DEC. 2017
Number of samples: 10 observations
(daytime: 6, nighttime: 4)



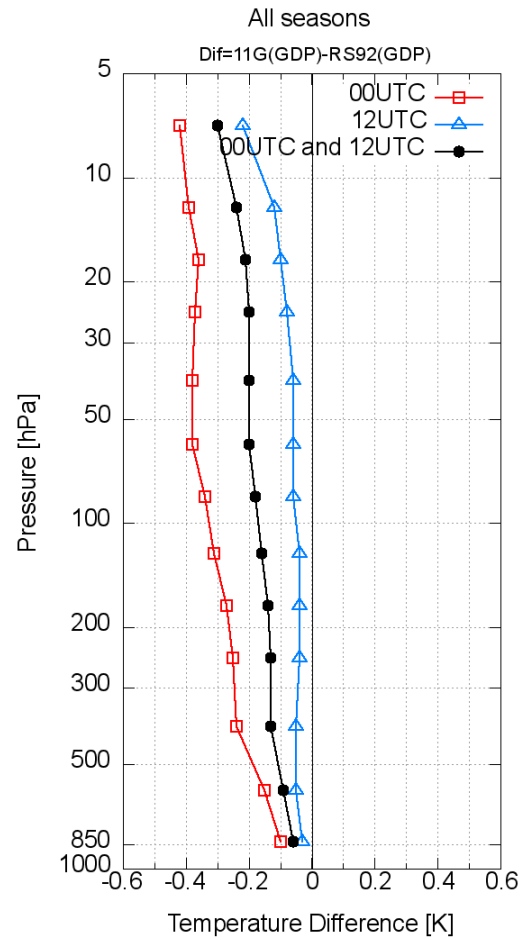
iMS(GDP)-RS92(GDP) Temperature difference

Difference = iMS - RS92





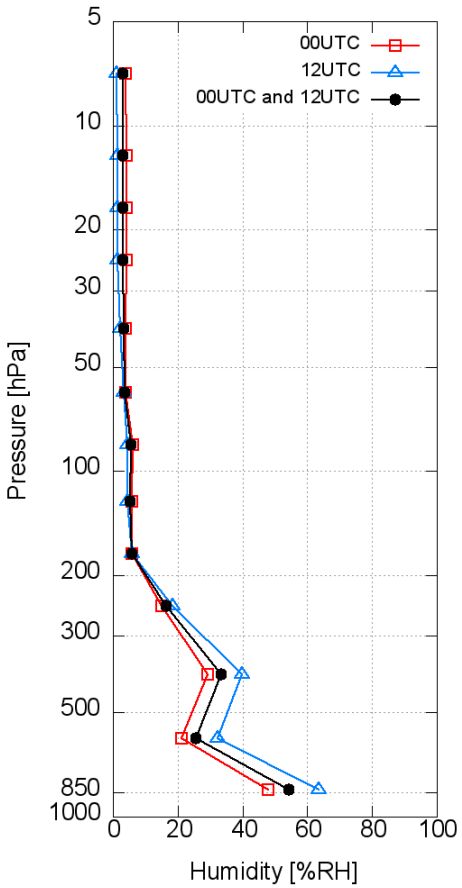
iMS is lower 0.4 °C than RS92.

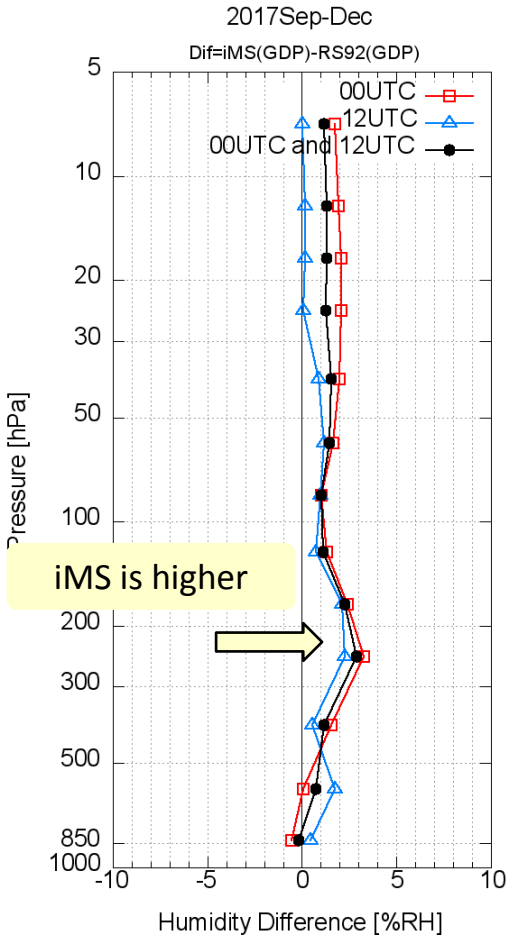


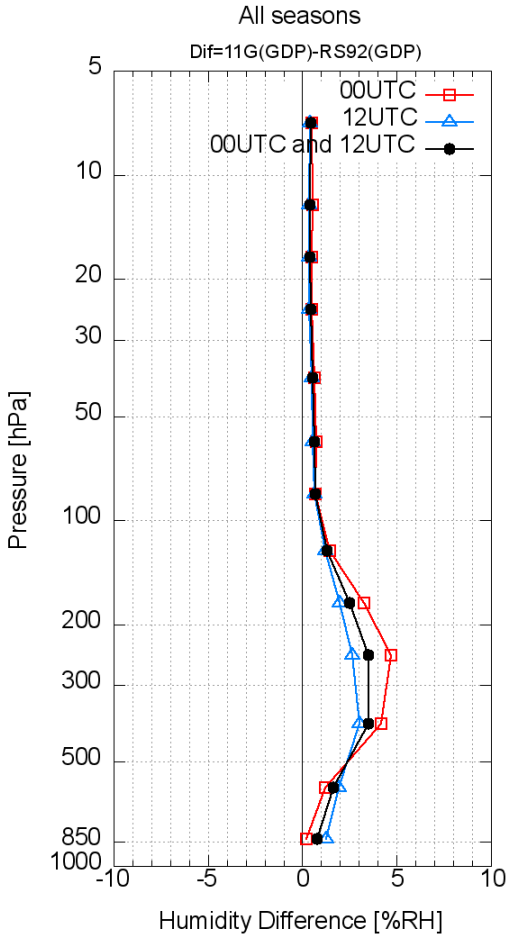
- In the daytime (00 UTC) observation, iMS is lower 0.4 °C than RS92 in stratosphere, less difference in the troposphere.
- In the nighttime (12 UTC) observation, difference is within ±0.1 °C except 10 hPa。

iMS(GDP)-RS92(GDP) Humidity difference

Difference = iMS - RS92







- Humidity of iMS is higher 3%RH than RS92 in 300～200hPa.
- In the daytime, iMS is 1%RH larger in the stratosphere.
- Characteristics are different between iMS and 11G. This may be due to differences in sensor temperature estimation method.

Summary of comparison results of 11G(GDP), iMS(GDP) and RS92(GDP)

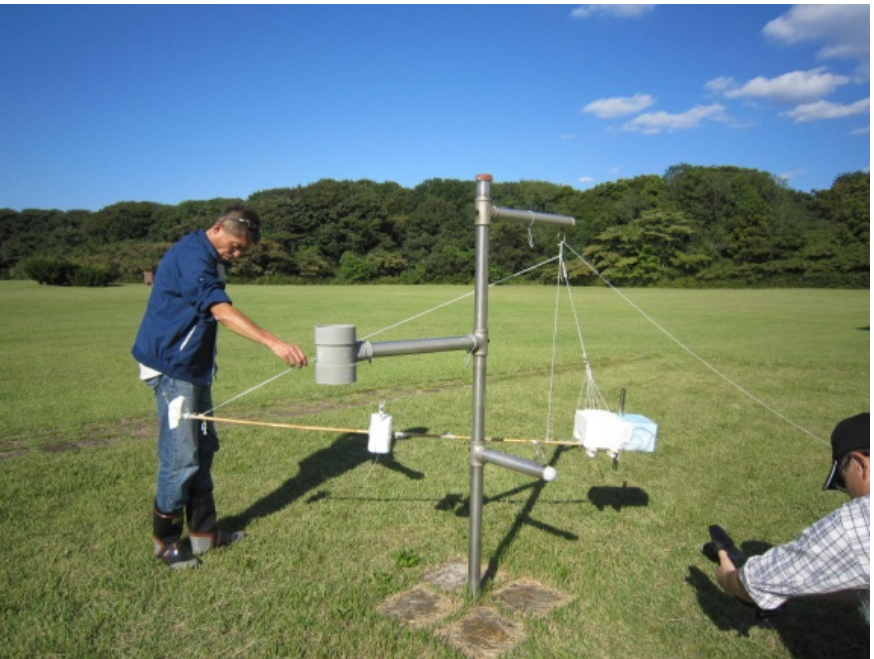
Element	Temperature		Humidity	
Observation time	Daytime (00UTC)	Nighttime (12UTC)	Daytime (00UTC)	Nighttime (12UTC)
Stratosphere	11G, iMS < RS92 :-0.4°C	±0.1°C	RS92 < 11G < iMS :+1～2%RH	< 1%RH
Troposphere	11G < iMS < RS92 :-0.2°C	±0.1°C	RS92 < 11G, iMS :+5%RH (Especially 300~200hPa)	RS92 < 11G, iMS :+3%RH

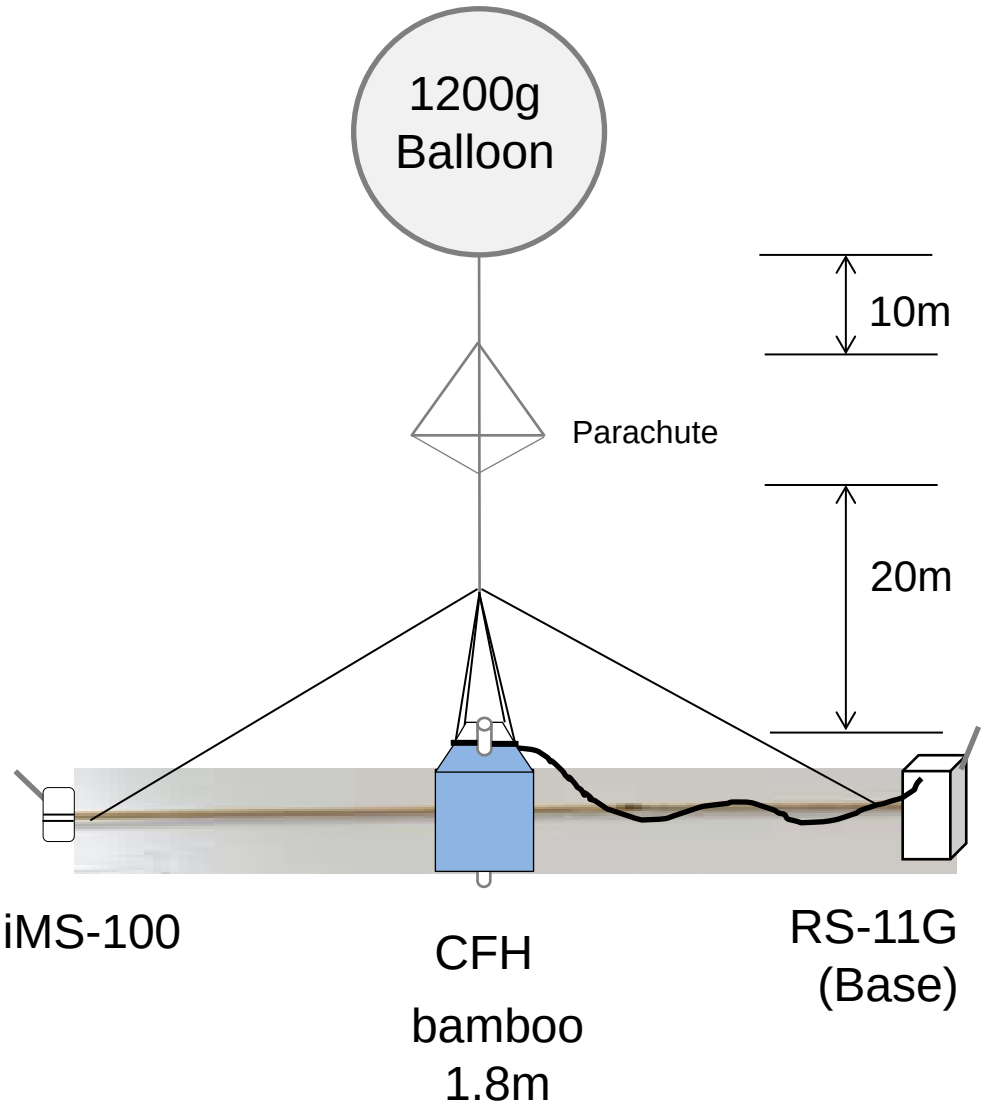
- It may be necessary to review the solar radiation correction method of RS11G and iMS.
- Relative humidity of 11G and iMS tends to be higher than RS92.
- The effect of humidity recalibration by HSC is unclear.
- Since iMS has few cases, it is necessary to increase the number of cases and analyze again.

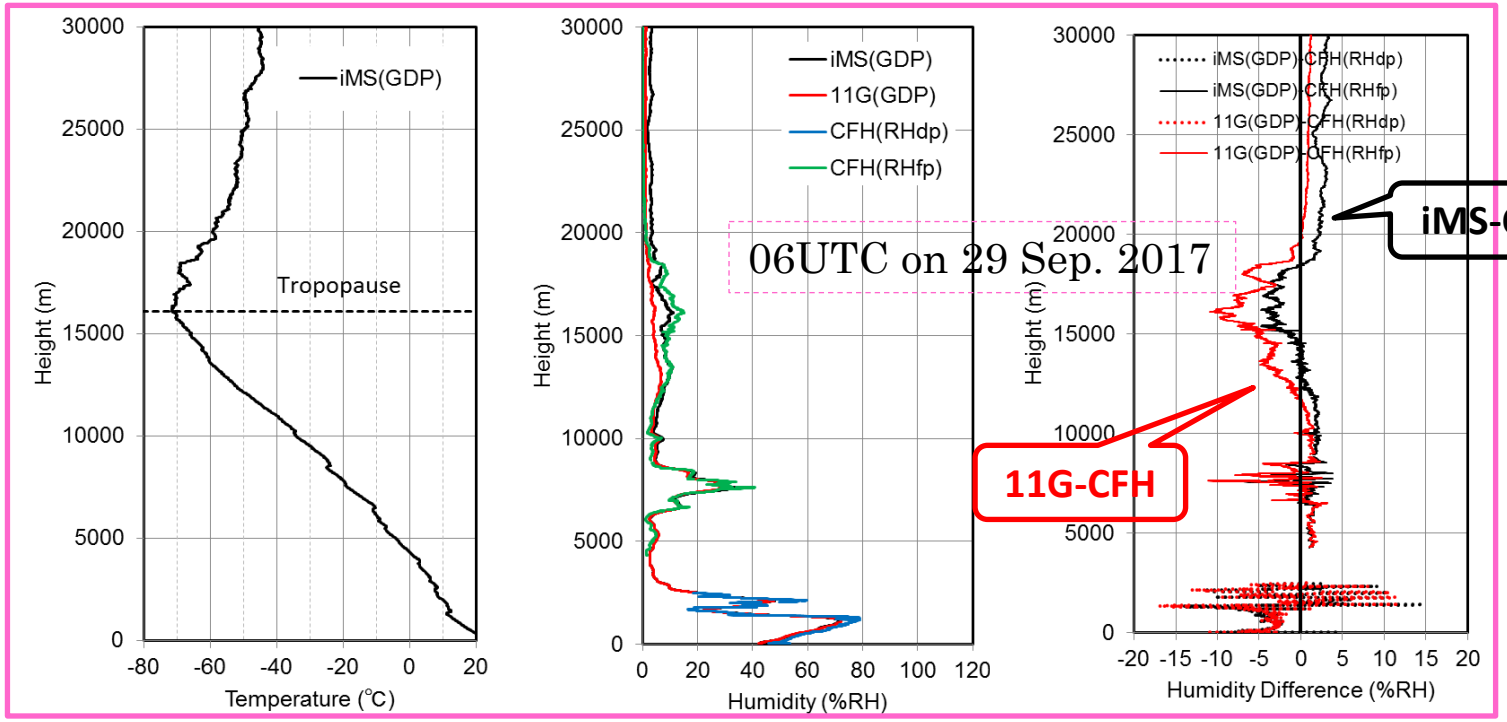
- We are preparing to post these result to the literature.

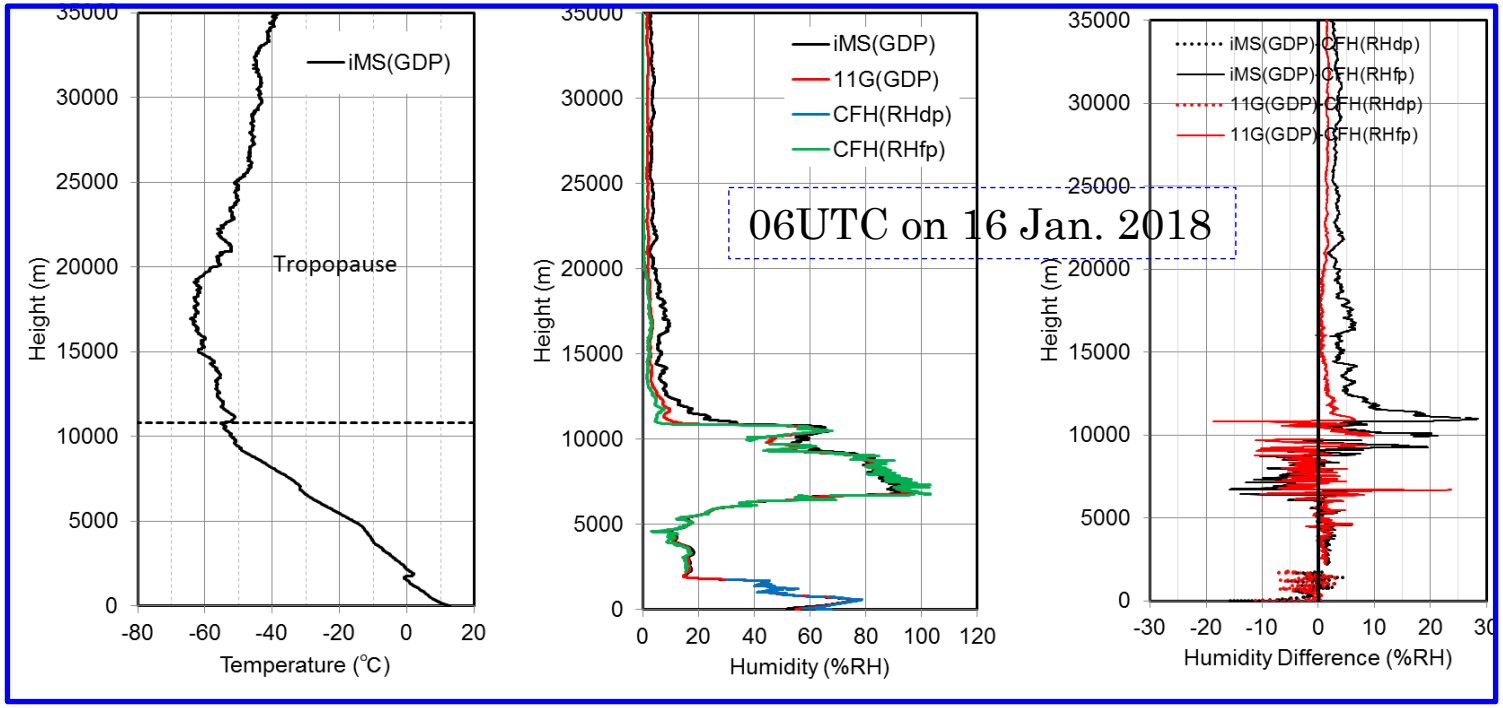
Comparison of CFH, RS-11G and iMS-100

- Observations are made twice a year.
  (1) 29 SEP. 2017 06UTC
  (2) 16 JAN. 2018 06UTC









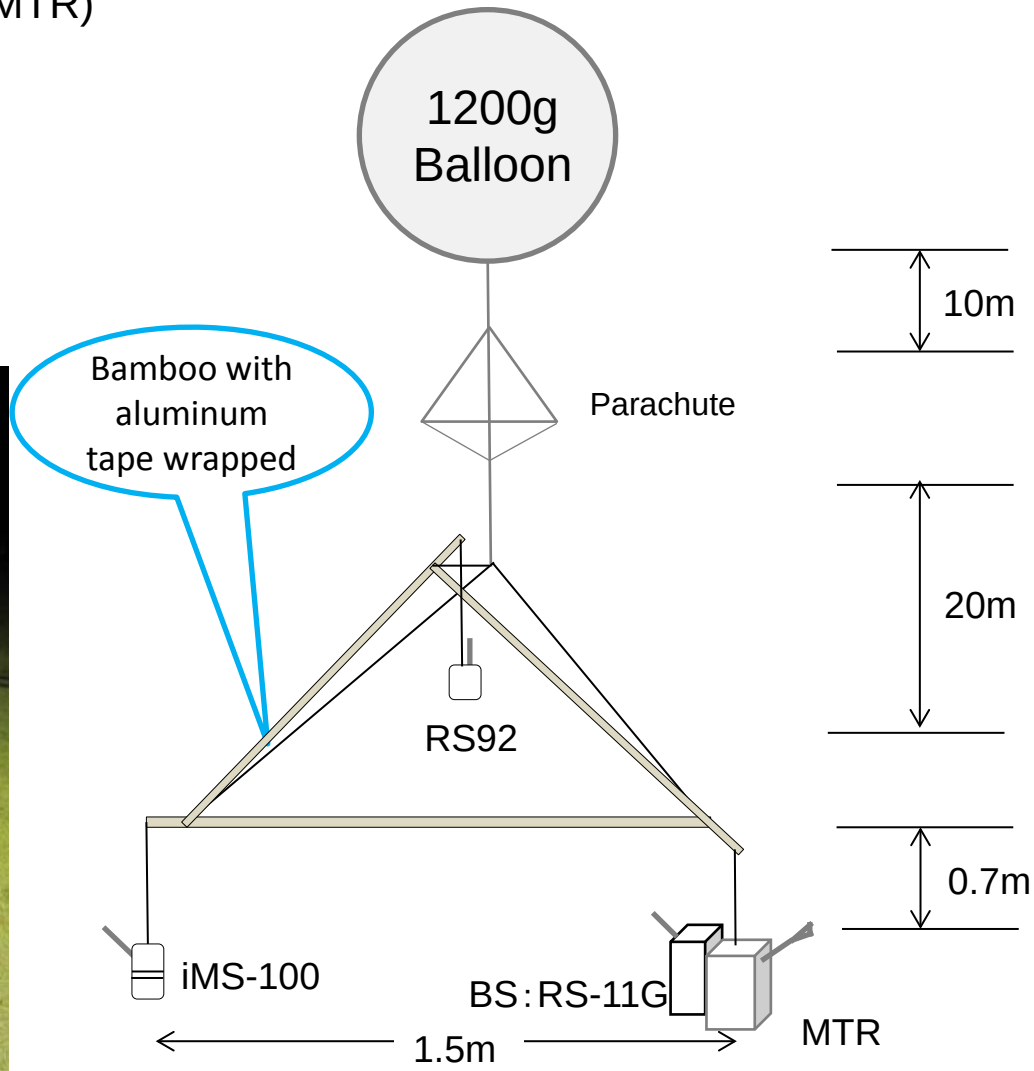
[Stratosphere]
iMS>11G>CFH
(Same tendency as the comparison with RS92.)

[29 Sep. 2017]
11G and iMS have a dry bias near the tropopause.

[16 Jan. 2018]
There is no dry bias of 11G and iMS near the tropopause.

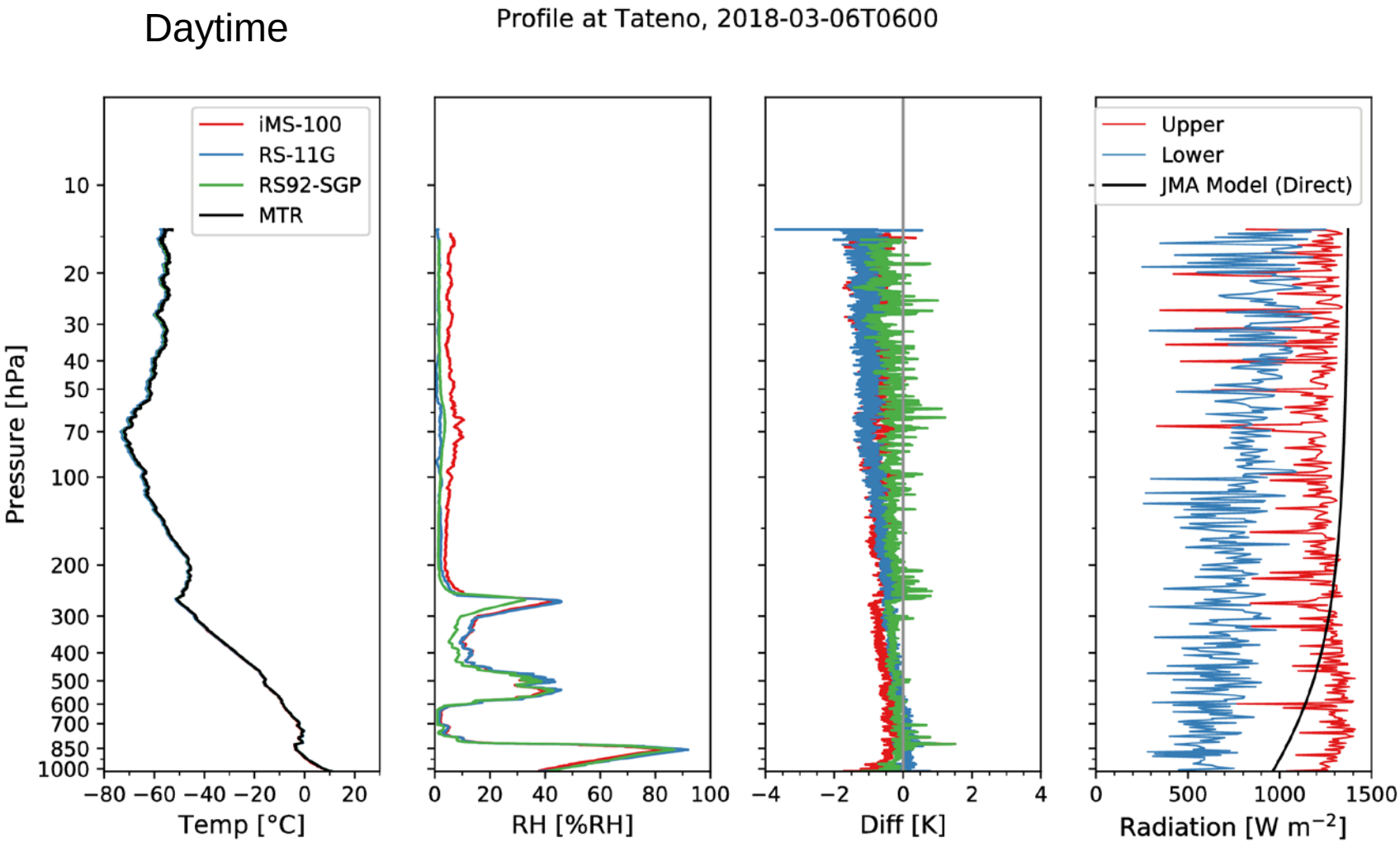
Comparison of MTR, RS-11G, iMS-100 and RS92

- Used Meisei Temperature Reference (MTR)
- Observations wear made twice a year.
  (1) 6 Mar. 2018 06UTC
  (2) 6 Mar. 2018 12UTC



Comparison between RS-11G/iMS-100/RS92/MTR

Daytime

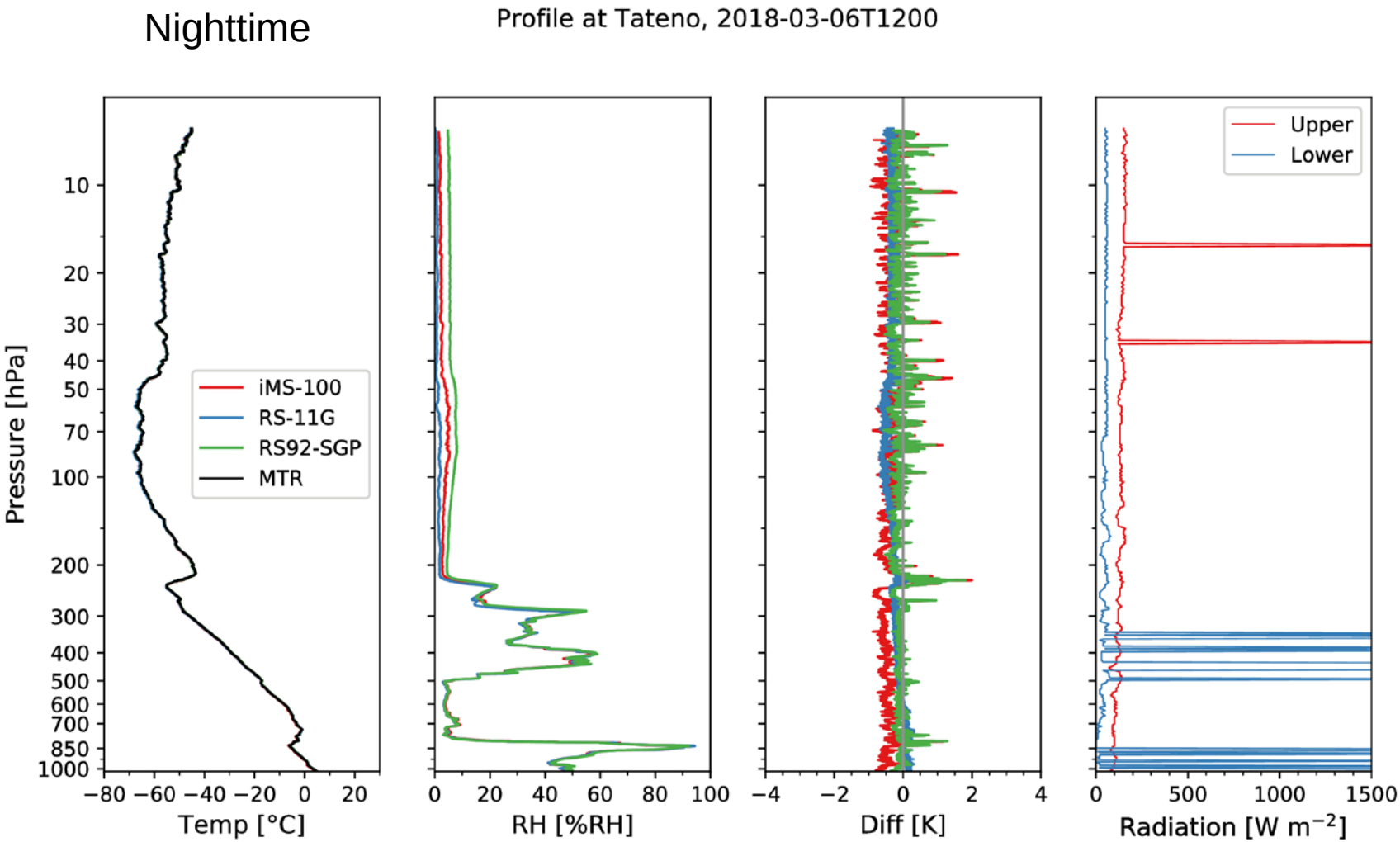


All sondes underestimate against MTR.

Are these difference from overestimation of radiation effects?

Comparison between RS-11G/iMS-100/RS92/MTR

Nighttime



Meisei sondes seem to underestimate temperature against MTR even at night…?

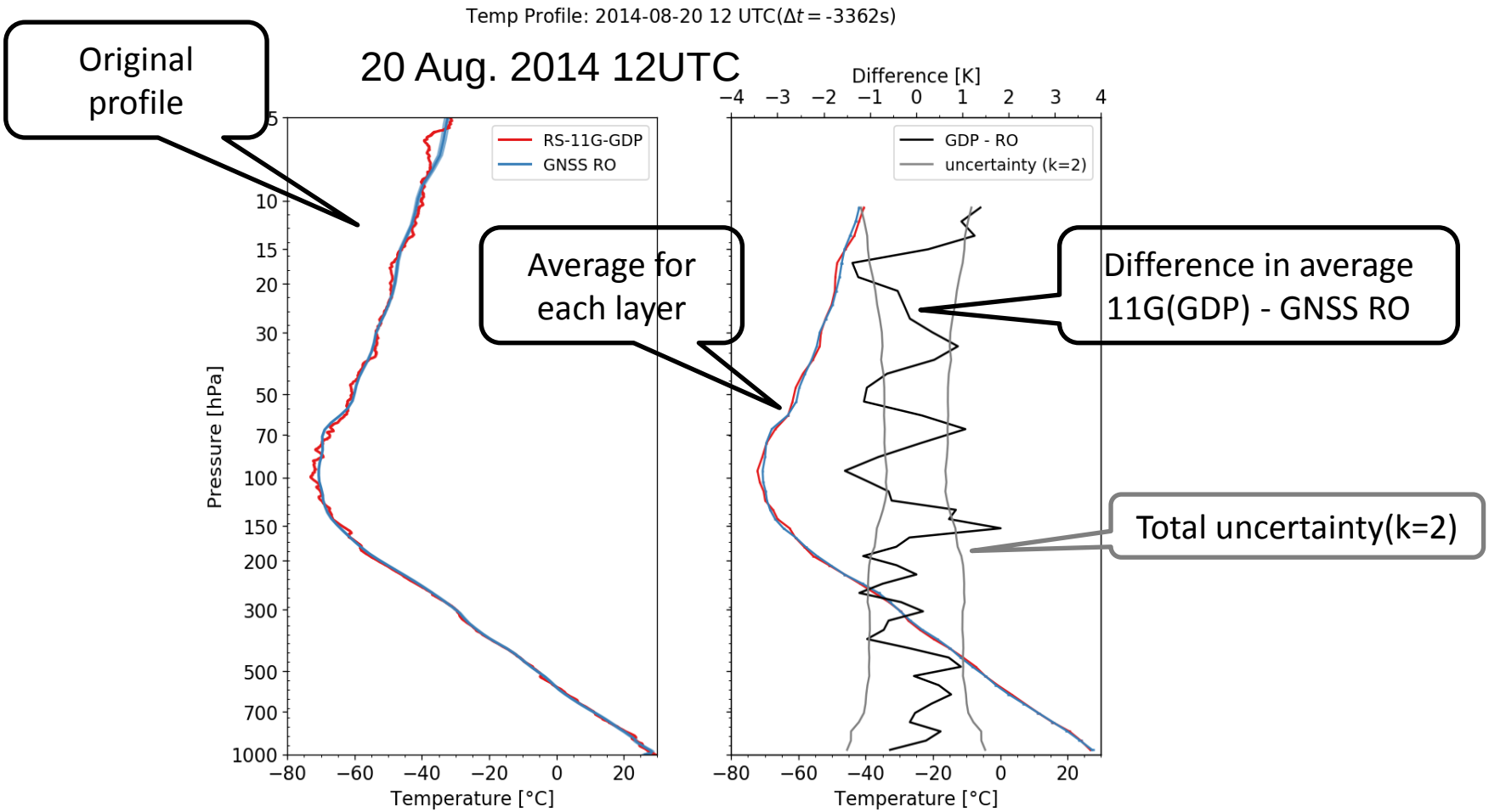
Comparison between RS-11G and GNSS RO

GNSS RO :
EUMETSAT Radio Occultation Meteorology Satellite Application Facilities

The following data was extracted.
· Observation time of GNSS RO within 90 minutes of observation time of 11G
· The observation point is within 100 km from the point of 100 hPa surface of 11G
- Number of samples : 26 (daytime13, nighttime : 13)

Comparison method
Divide 1000 hPa to 100 hPa into 30 layers with log (P) at equal intervals, 20 layers in 100 hPa to 10 hPa similarly and divide it into 50 layers in total, and calculate the average value and uncertainty of each layer.

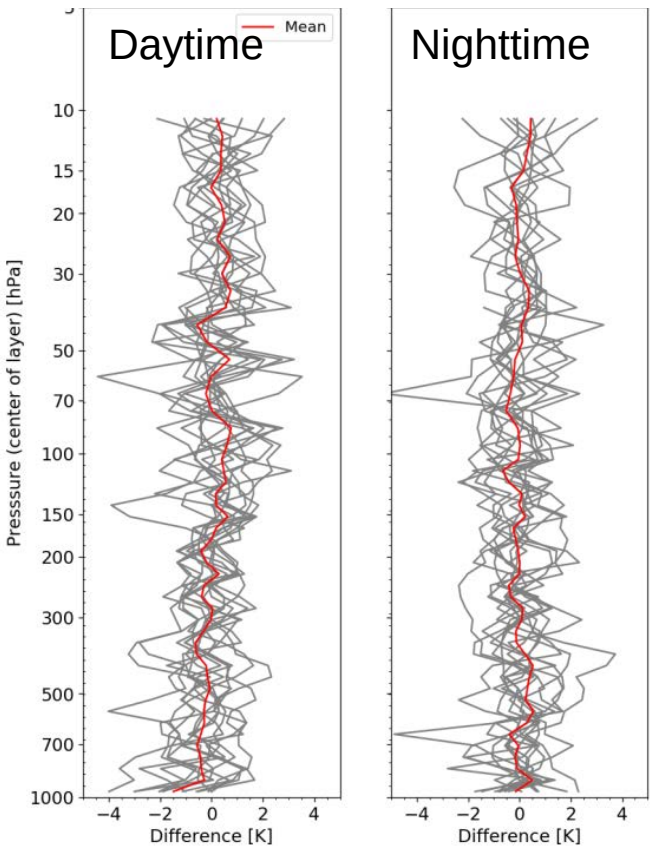
Example of temperature profile



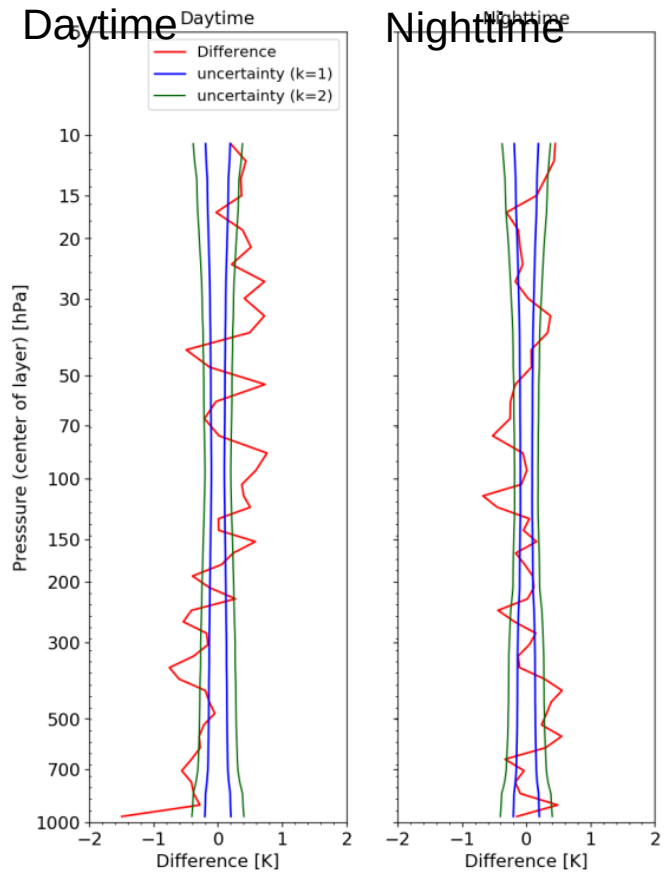
In this case the overall profile is largely consistent,
A temperature difference is -1.5 to 2.0°C, and a significant difference is observed in the upper troposphere layer to the lower stratosphere.

Temperature difference and average value

Temperature difference in each observation
(11G(GDP) - GNSS RO



The average temperature difference and Uncertainty(k=1、k=2)



- Both day and night have different temperature differences for each observation.
- At night, the temperature difference is roughly consistent at around 0.5 °C
- In the daytime, it exceeds k = 2 at 120 ~ 20 hPa and 11G (GDP) is large.

END

Thank you