

Videosonde Observations in Zao2013

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- What is a videosonde ?
- Zao2013 Observation
- Results and future plans

Videosonde Observation Plans 2013-2015

In 2013: Intensive observation of melting layer in Zao, Yamagata

- Targeting the melting layer for the ground validation
- Conducted videosonde observations as a part of this field campaign

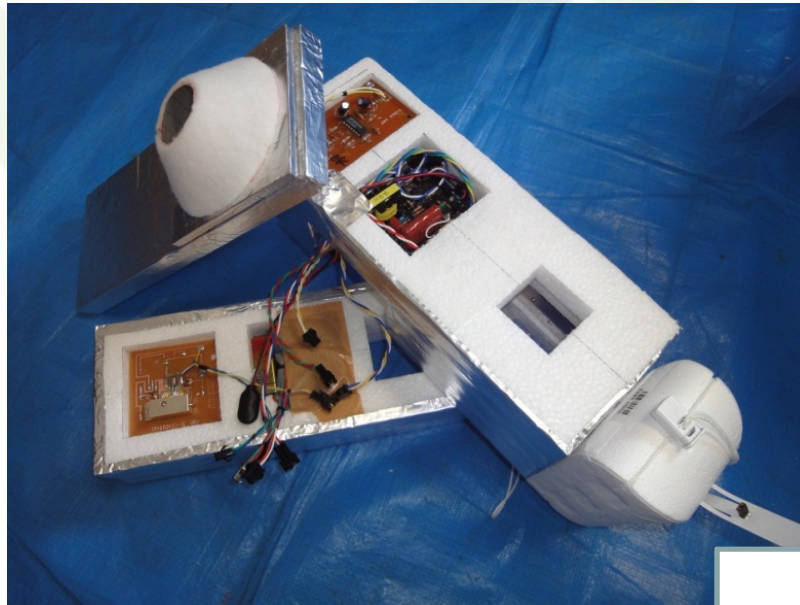
In 2014: Videosonde launchings in the other field campaign

- Southern Kyushu targeting orographic strengthen rain (Yamaguchi Univ.)
- Amazon in Brazil (with Prof. Carlos of Sao Paulo University) ???
- JAXA/TNSC videosonde observations in Jan-Feb (tentative)
- Phased array radar (NICT Okinawa)
- Kyoto-Kobe intensive observation in Jul-Aug (tentative)

In 2015: R/V Mirai cruise over the Indian Ocean

Videosonde

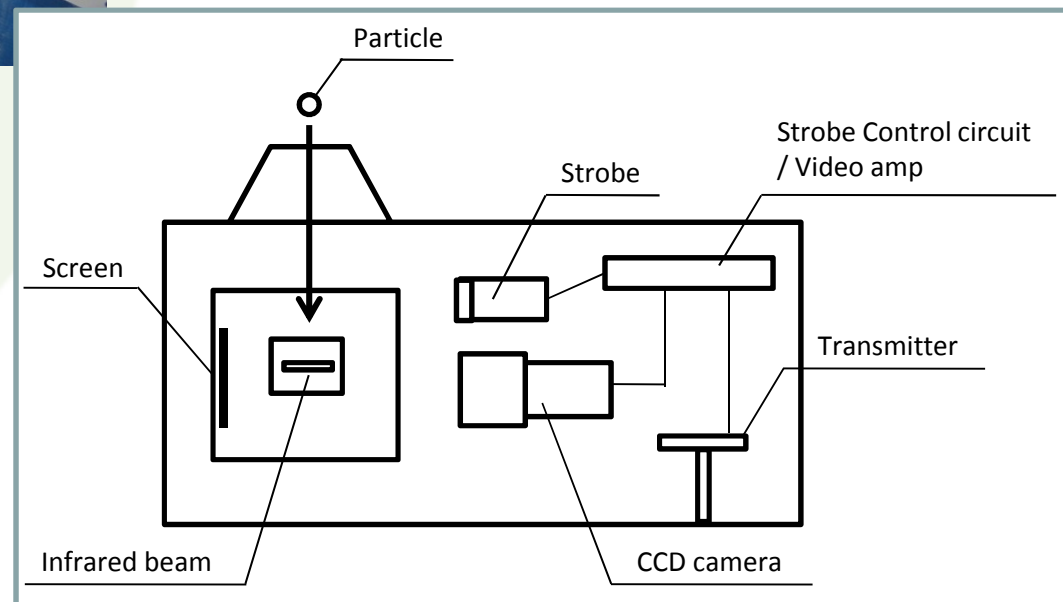
a balloon-borne radiosonde that acquires images of precipitation particles via a CCD camera, developed by Takahashi (1990)



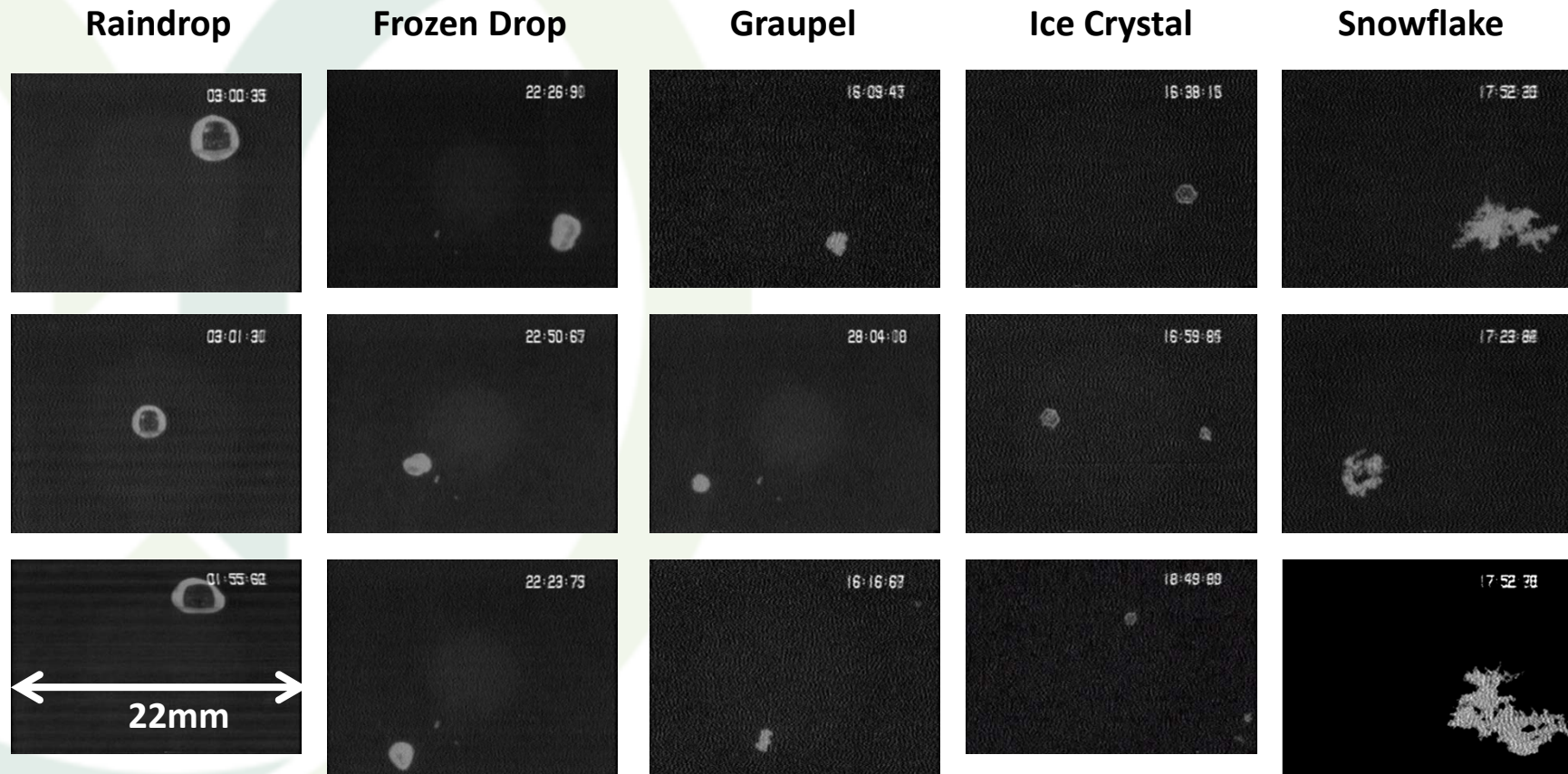
The system has a stroboscopic illumination that provides information on particle size and shape. Interruption of the infrared beam by particles triggers a flash lamp and particle images are then captured by the CCD camera.



Launching into the precipitating clouds with 600g balloon filled with He gas



Precipitation Particle

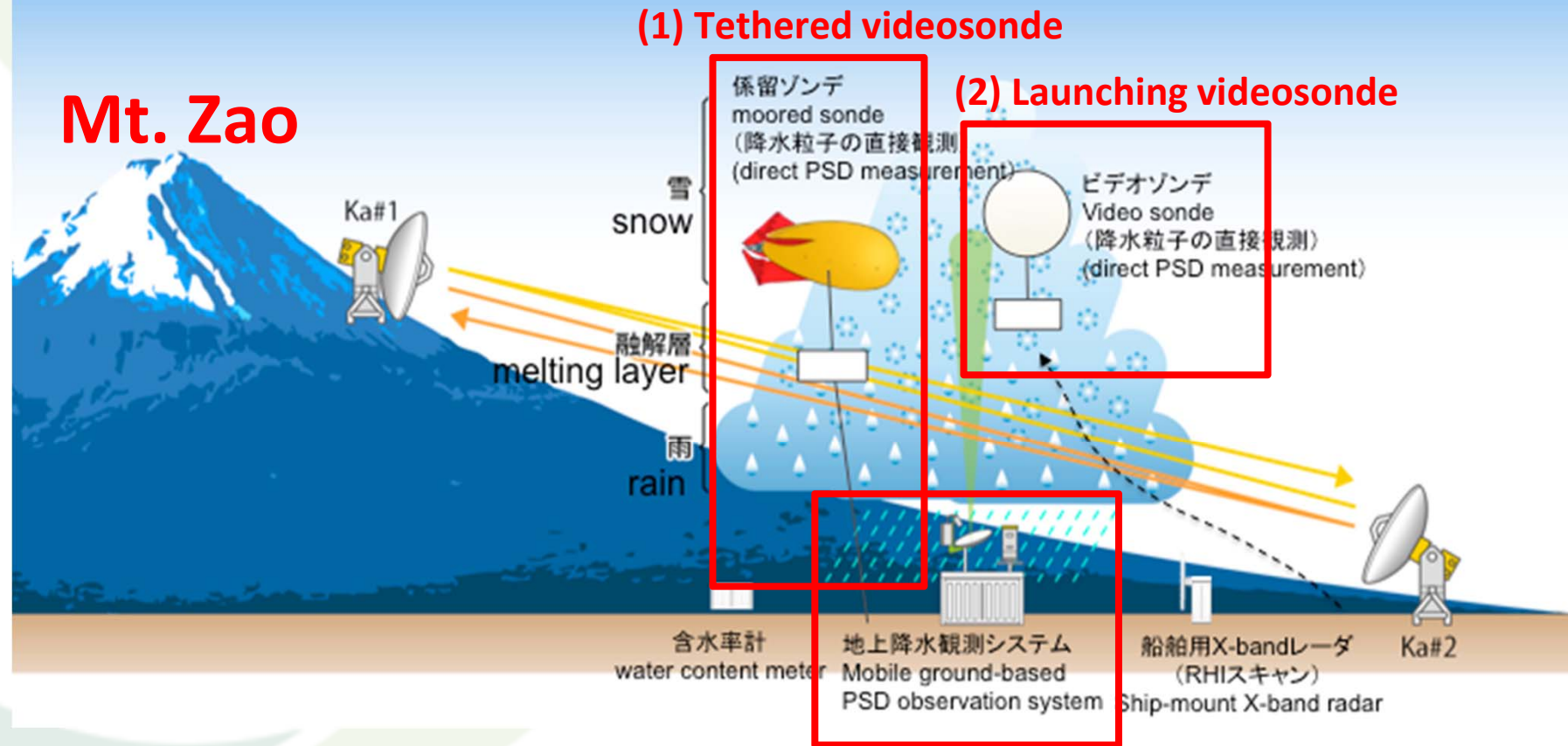


Recorded precipitation particles were classified as raindrops, frozen drops, graupel, ice crystals, or snowflakes on the basis of transparency and shape.

Videosonde observations in Zao

2013.10~2013.12@Mt.Zao

Mt. Zao



(3) Ground-based video probe

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Launching/Mooring Site



Tethered Balloon



Preparing a Balloon



Preparing a Balloon for launch



Videosonde



Just before launching
on Dec. 7 (snow)

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Receiving antenna/mobile PSD
Observation system



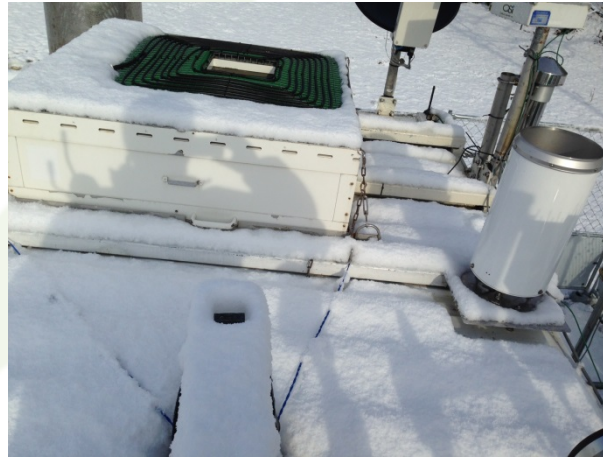
Receiving antenna
@Ka radar #2 site



Receiving system



Videosondes before setting up



Ground-based video sonde in snow
on the mobile PSD observation system

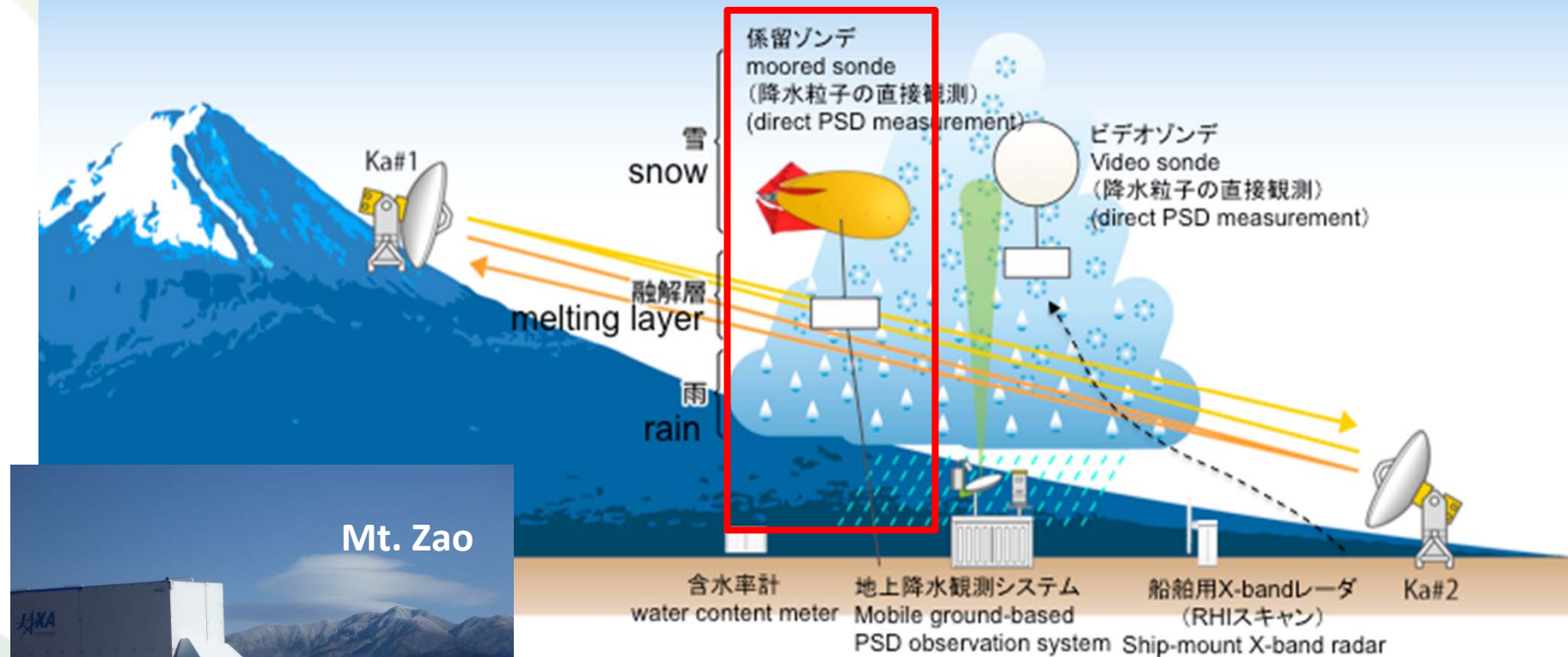


Data recorder and power supply
for ground-based video sonde

Videosonde observations in Zao

2013.10~2013.12@Mt.Zao

(1) Tethered videosonde



Goal...

To detect the melting layer, and investigate precipitation particle distributions in cloud between two Ka radars (#1 and #2).
Rain or snow, melting... Quantitative evaluation, if possible

(1) Tethered videosonde

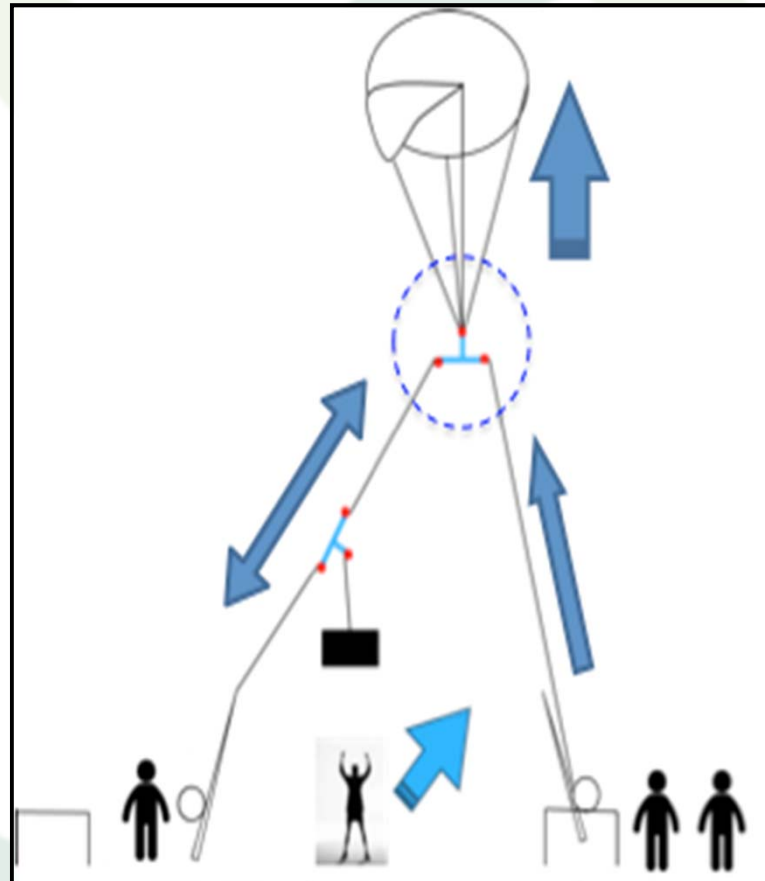


Image of tethered balloon operation

Advantage of tethered videosonde

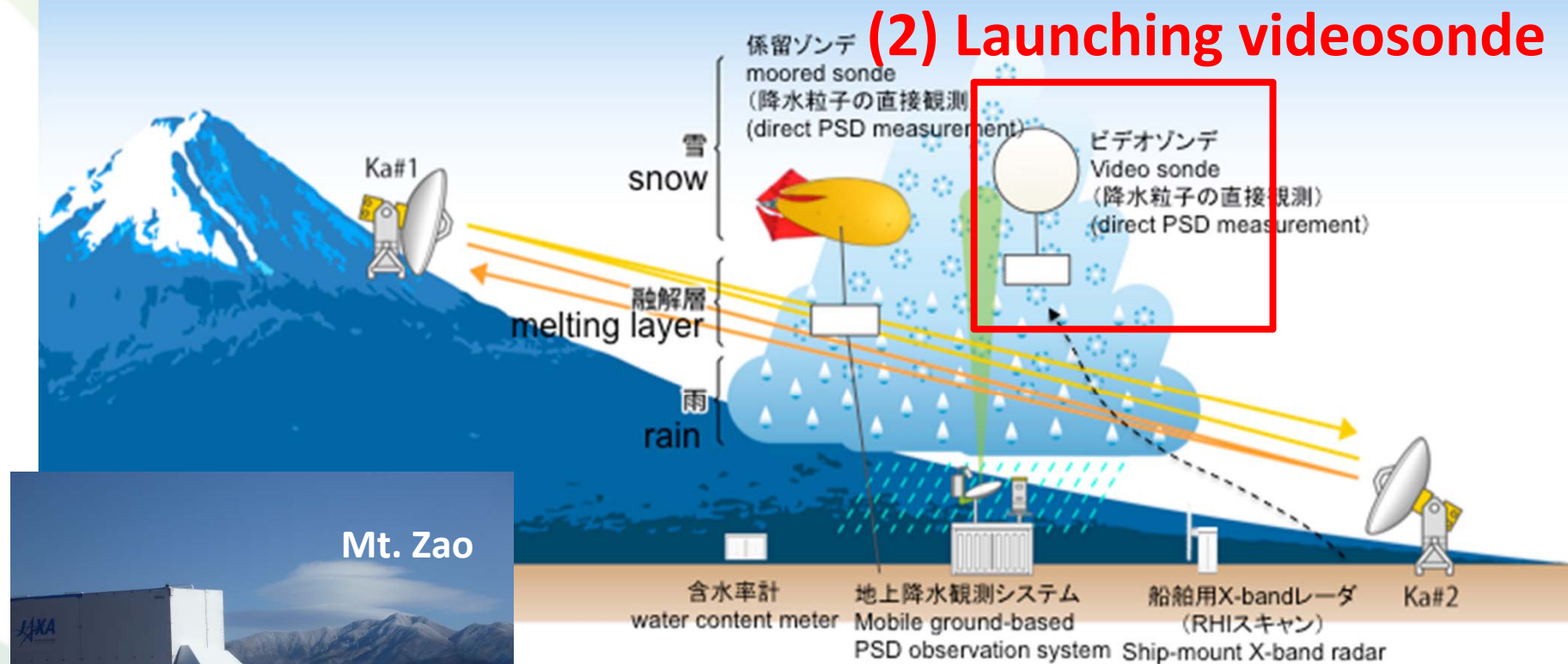
- Direct measurement of precipitation particles in cloud (rain or snow?)
- Long time (6-8 hours) observation
- Enough samplings for quantitative evaluation
- Possible to use an improved videosonde repeatedly
- Possible to change an observing height (up to 500m) and control for detecting the melting layer
- No observation in the strong wind



However, unfortunately...
could not carry out because of some troubles.
We will try again in Zao2014 (coming soon).

Videosonde observations in Zao

2013.10～2013.12@Mt.Zao



Unfortunately (again) ...

Three videosondes were launched in December 2013 because of limitations of the number of videosonde and launching time. Analysis now in progress.

Image of Videosonde Soundings, targeting the melting layer

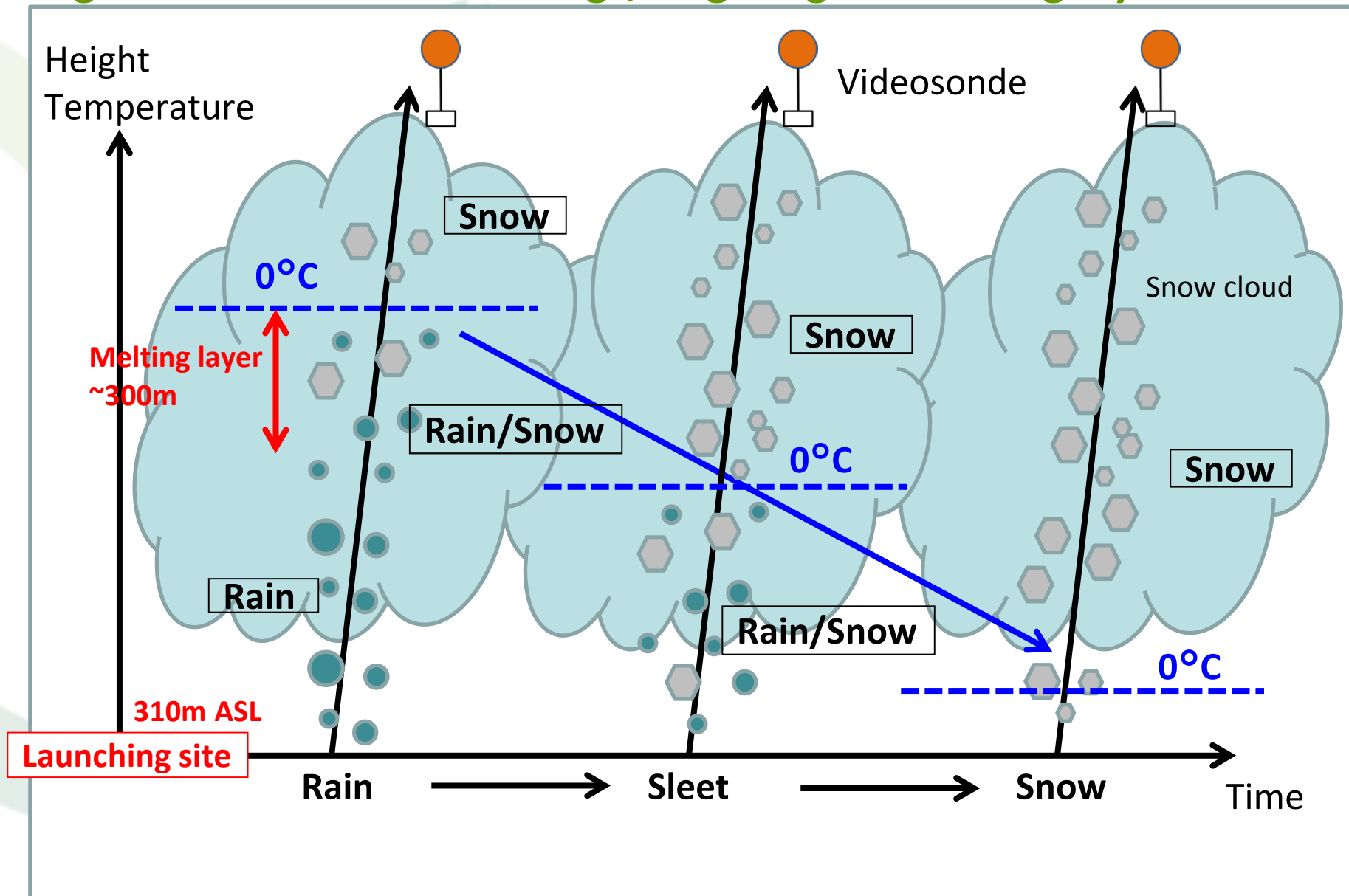
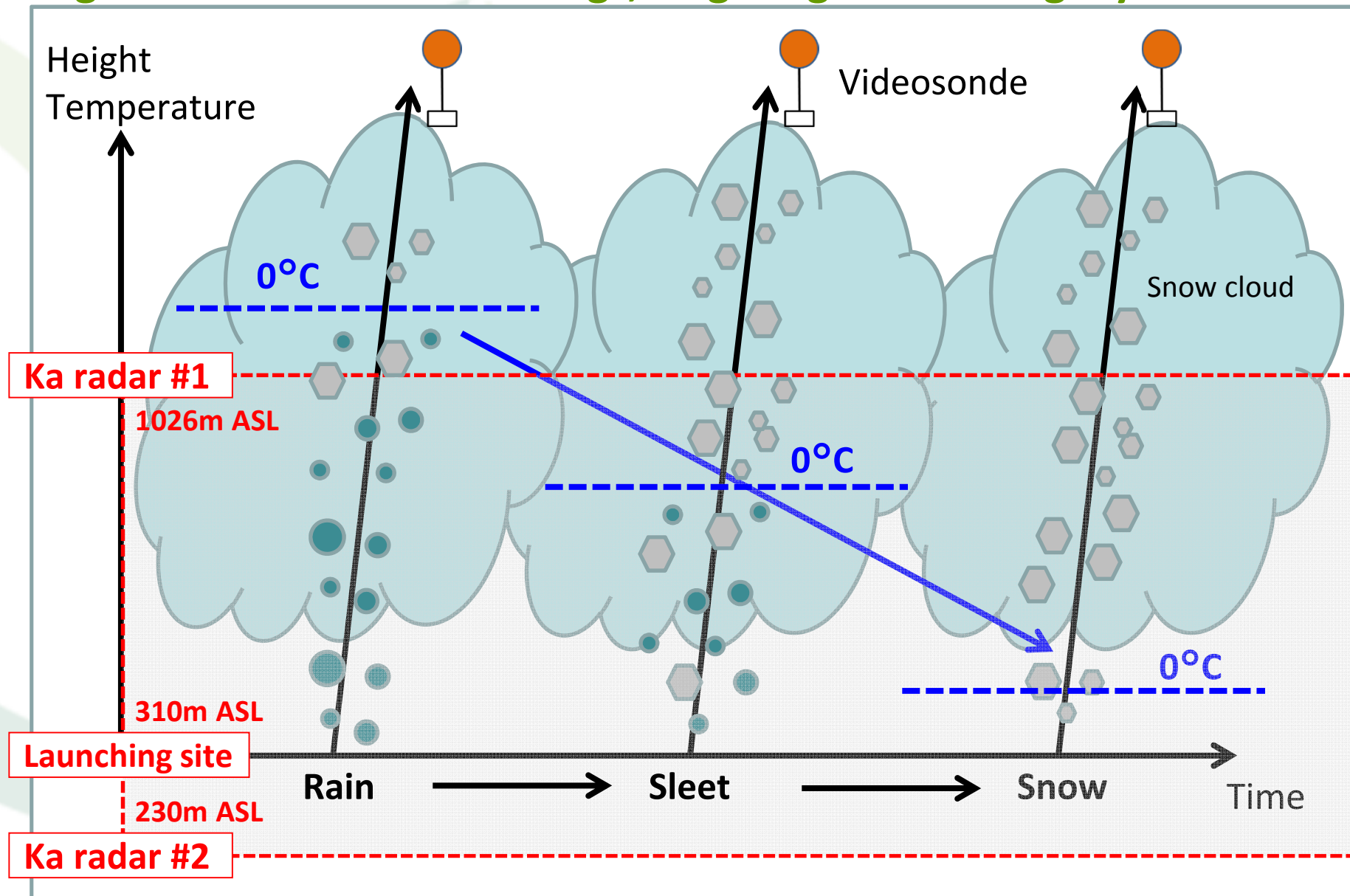
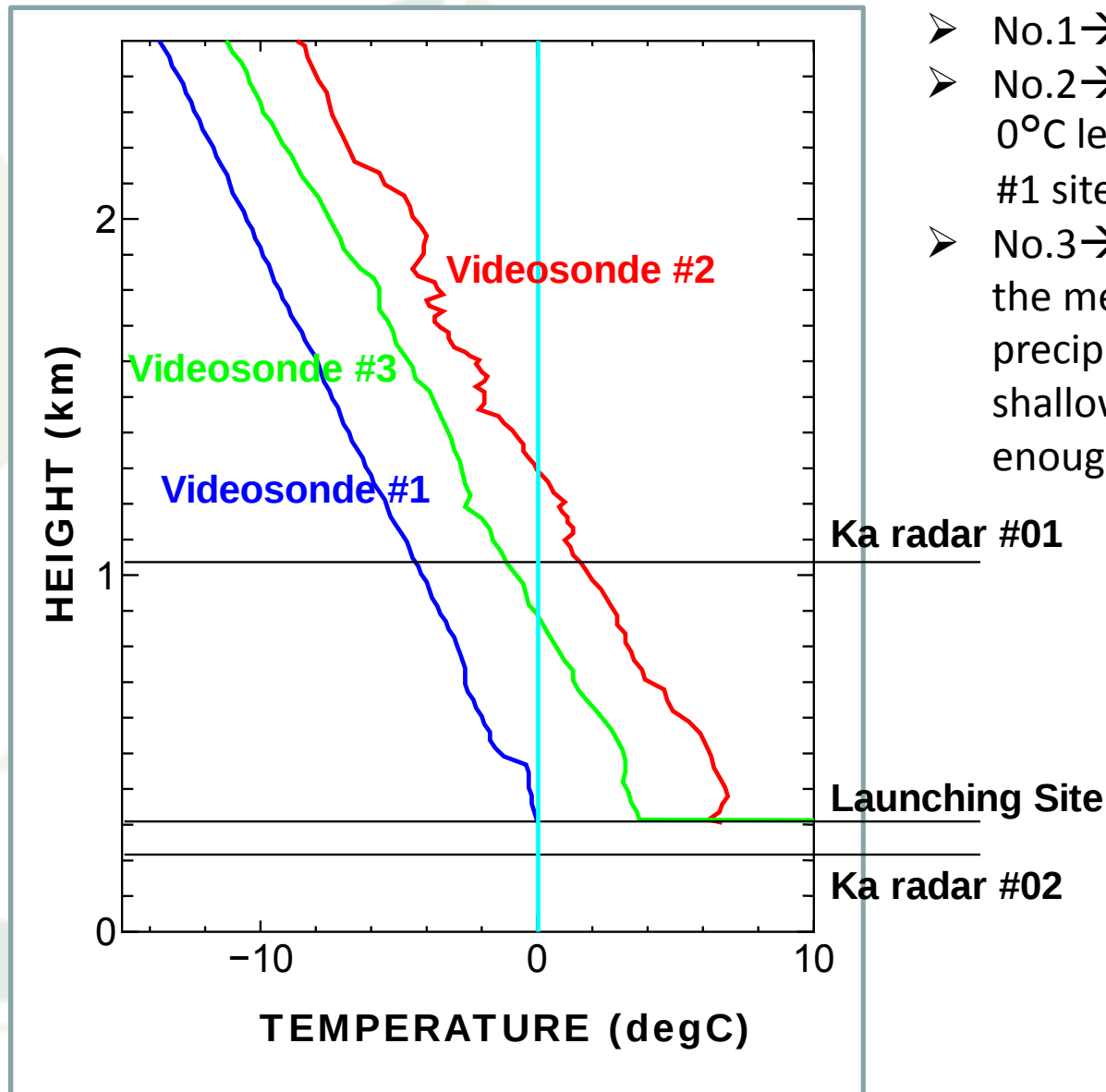


Image of Videosonde Soundings, targeting the melting layer

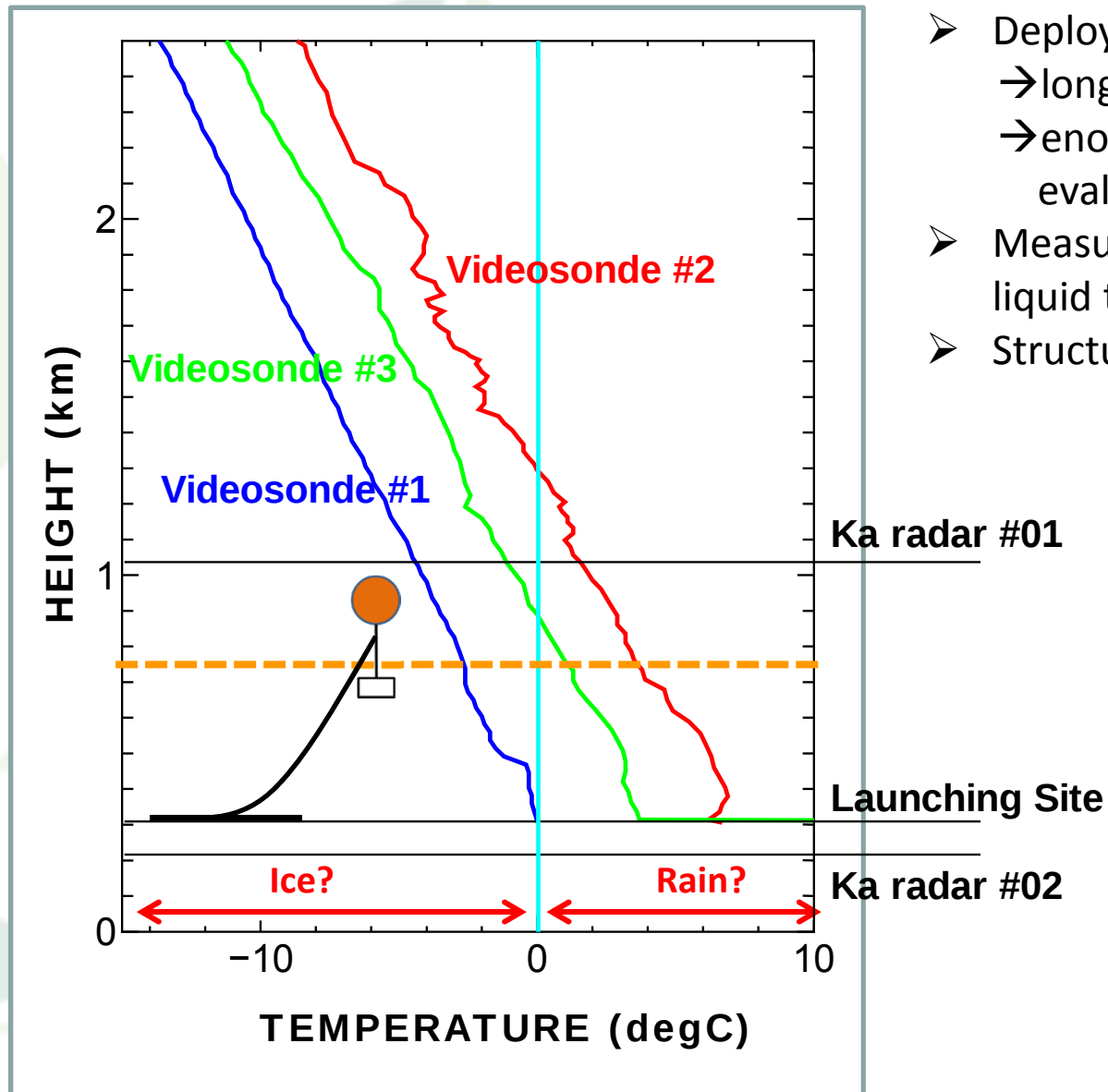


Temperature Profiles



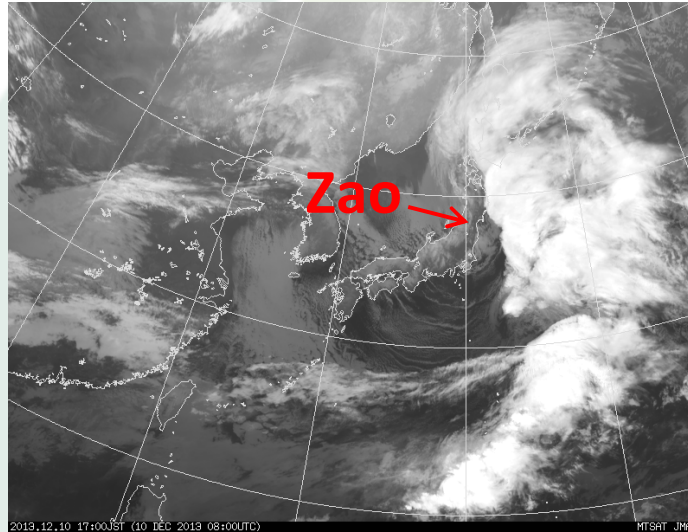
- No.1 → snow at surface
- No.2 → rain at surface
0°C level was above Ka radar #1 site
- No.3 → good for detection of the melting layer, but precipitating cloud was very shallow and could not get enough data

Temperature Profiles

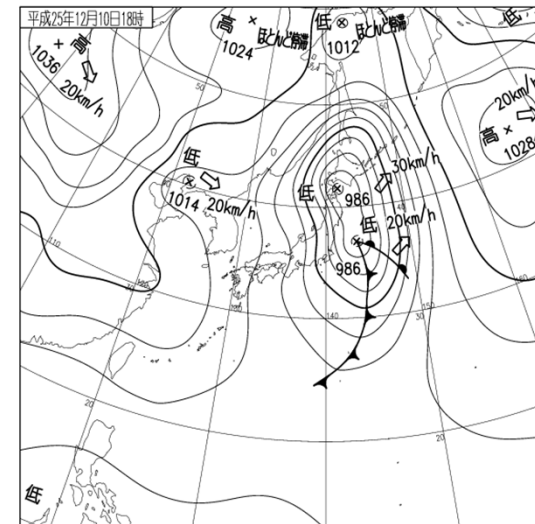


- Deploy a tethered videosonde
 - long time observation
 - enough data for quantitative evaluation
- Measurement of particle from liquid to ice
- Structure of melting layer

Case of Videosonde #2 on December 10, 2013



Satellite IR image at 18JST



Surface weather chart at 18JST

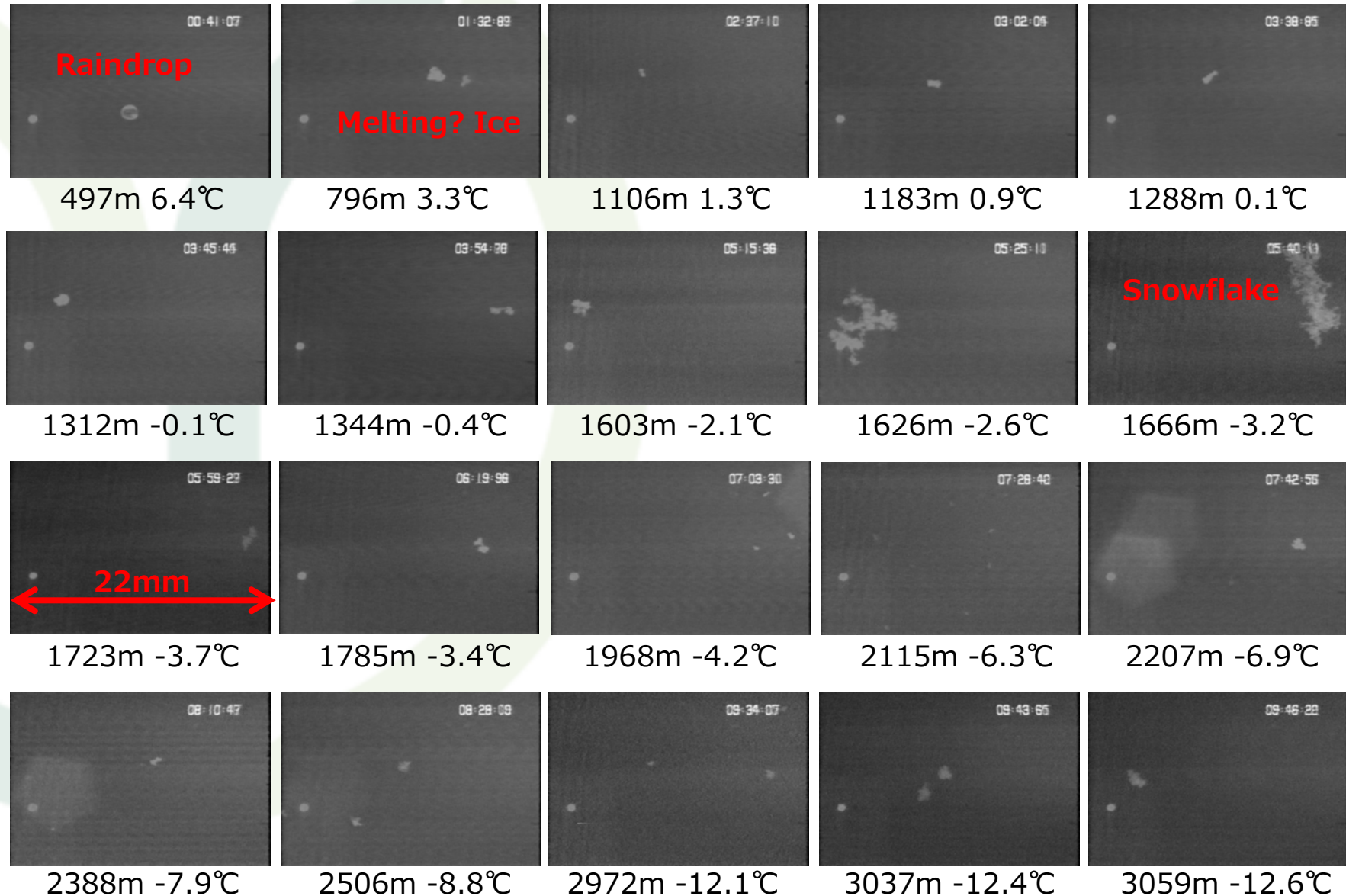
No.2

Videosonde #2 was launched at 17:39JST on Dec.10, 2013

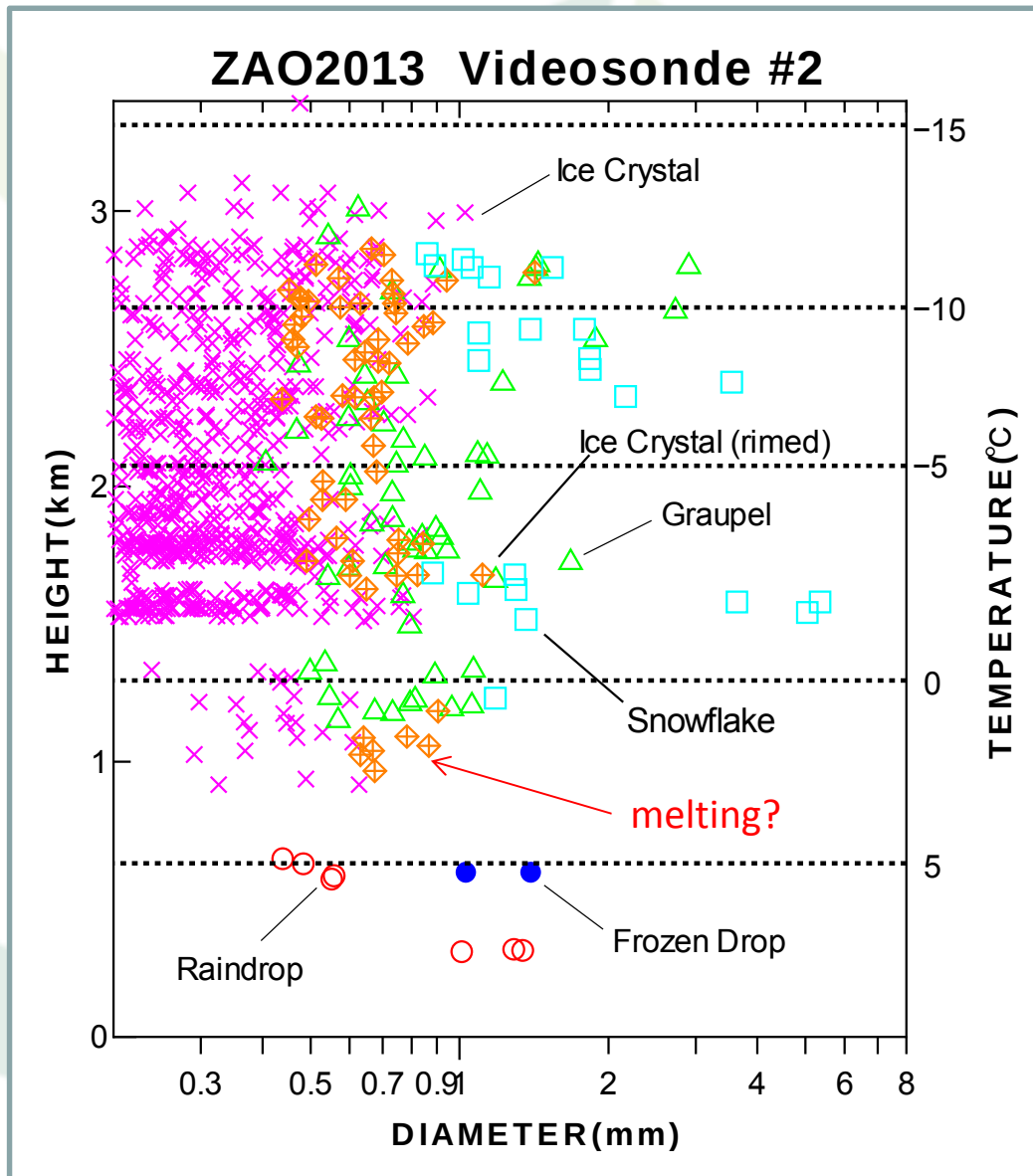
After the passage of developing low, snow clouds with the cold air outbreak
Temperature was still high and we had rain at ground.

No wind. Moderate rain. Surface temperature 6.7°C. Cloud top 4km (-16°C).

Precipitation Particle Images (Videosonde #2)



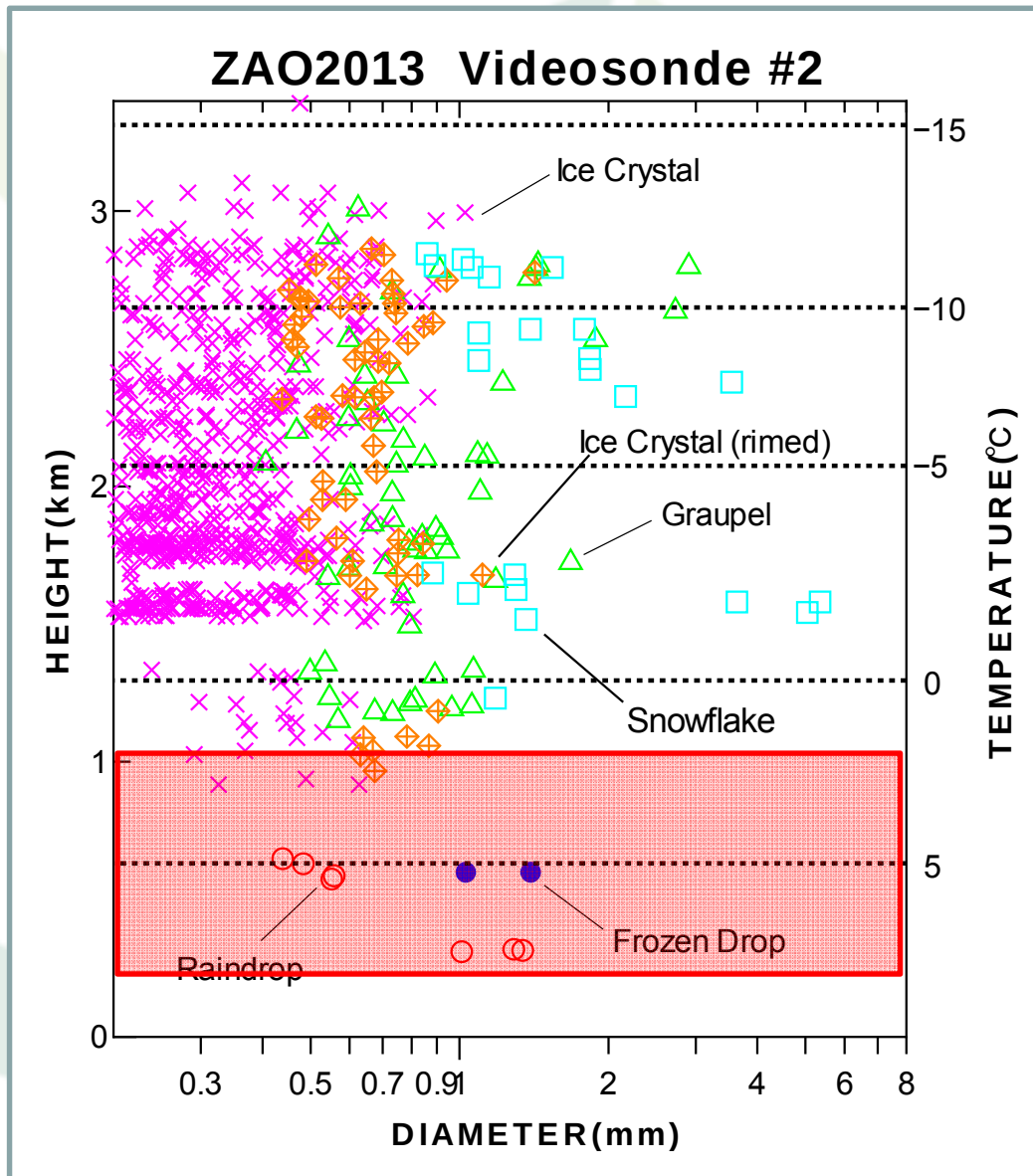
Case of Videosonde #2 on December 10, 2013



- Not so many raindrops
- Just below 0°C level, smooth outline particles → melting?
- Snowflakes over 0°C level
- 0°C level was 1226m in altitude (ASL)

Size-height diagram of precipitation particle obtained by videosonde #2

Case of Videosonde #2 on December 10, 2013



Unfortunately (again and again),
melting layer was not between
two Ka radars

← 0°C level 1226m ASL

← Ka radar #01 1026m ASL

← Ka radar #02 230m ASL

Videosonde observations in Zao

2013.10～2013.12@Mt.Zao

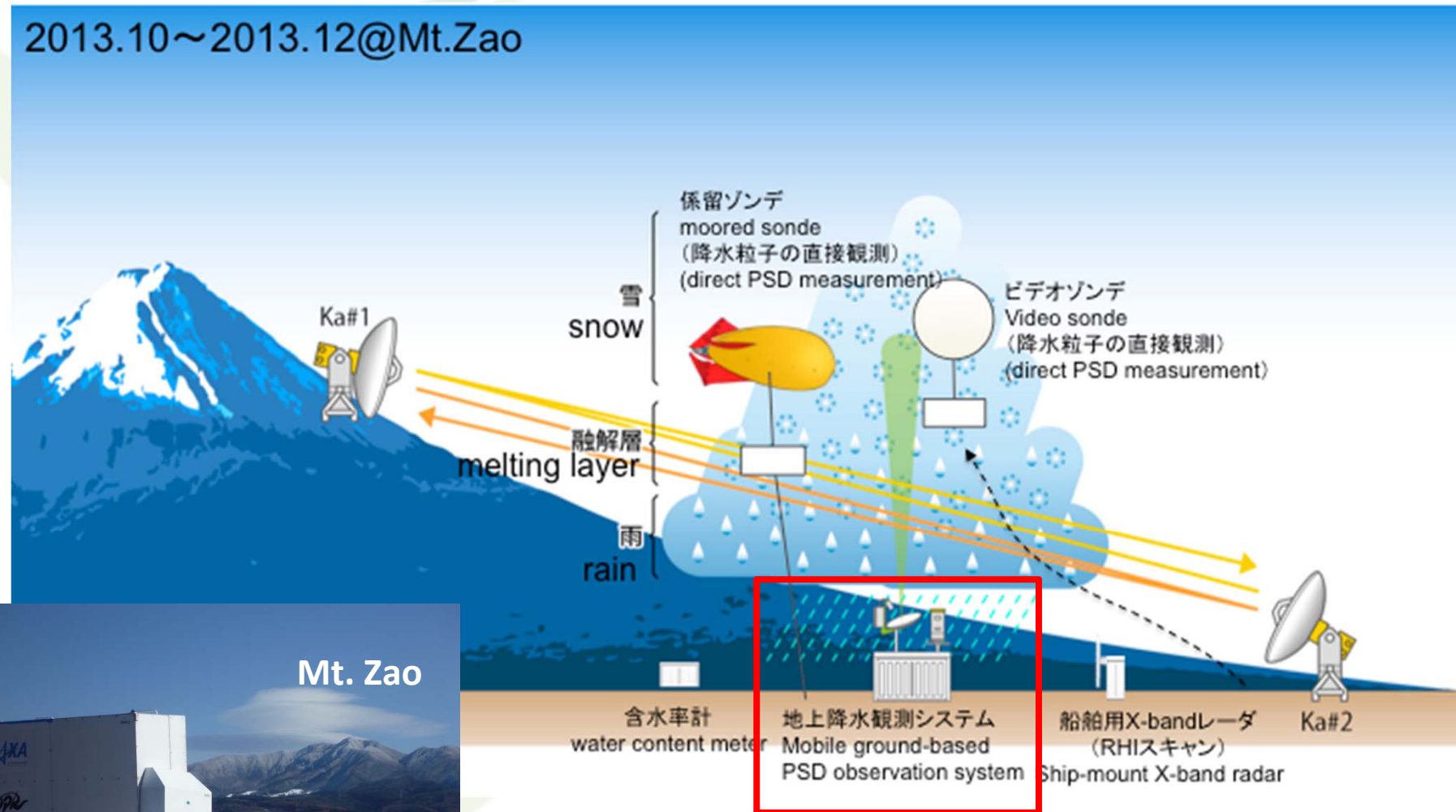


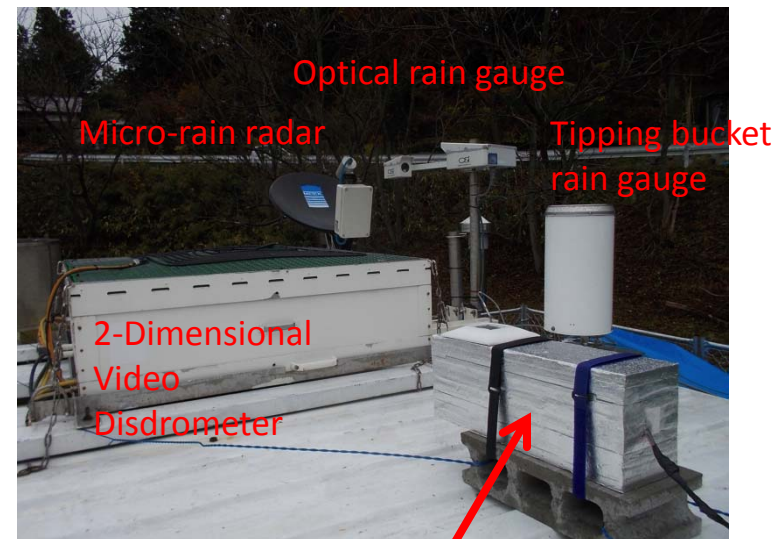
Photo from Ka radar #2 site

(3) Ground-based videosonde

(3) Ground-based videosonde

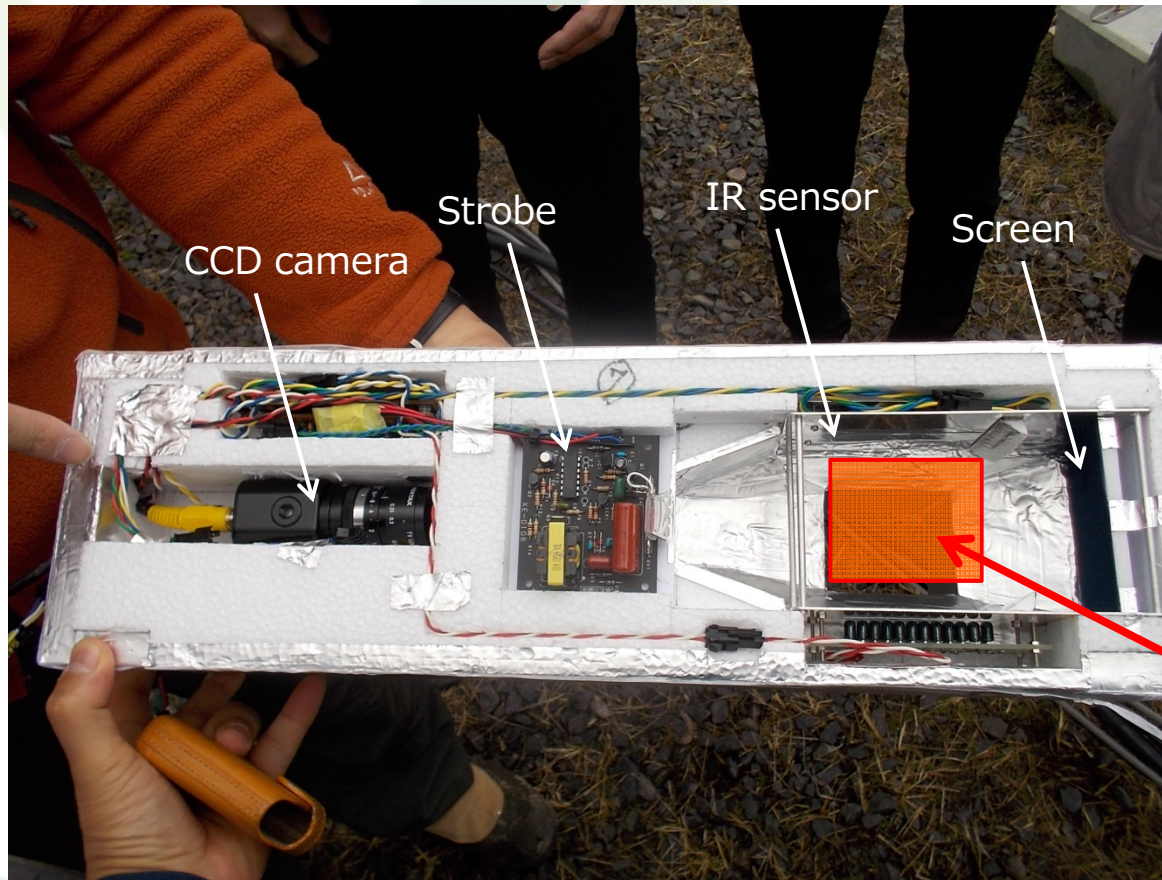


Mobile ground-based PSD observation system by
Dr. Nakagawa (NICT)



Ground-based Videosonde

(3) Ground-based videsonde



Videsonde in snow

Particle capturing area
(improved)

50mm X 60mm

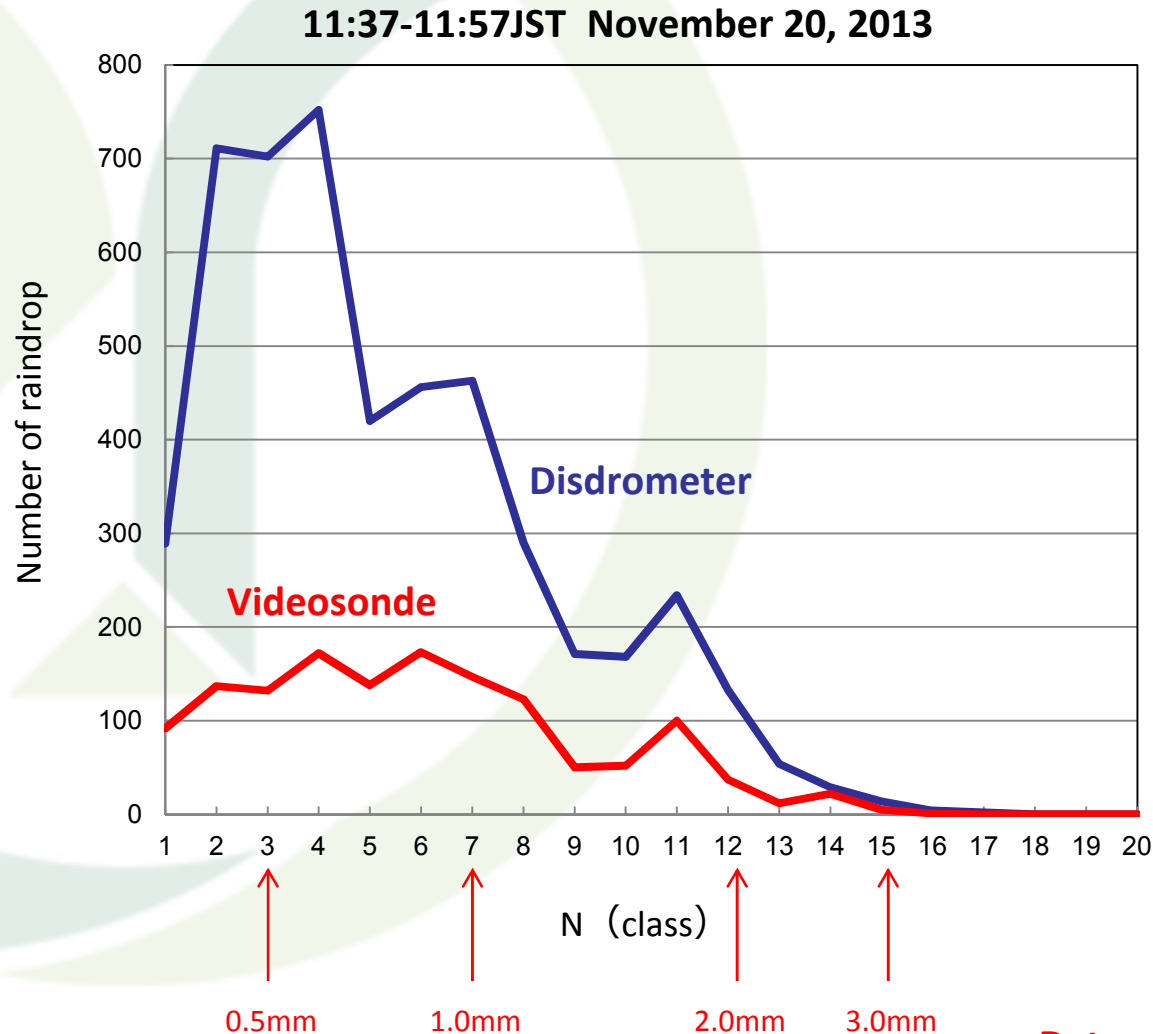
*launching videsonde (22mm×30mm)

Videsonde improved for ground-based measurement
(top view), same as a videsonde for the tethered balloon

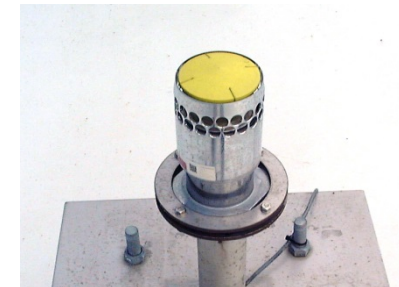
For quantitative evaluation of tethered videsonde, comparison with other
ground-based rain gages / disdrometers.

(3) Ground-based videsonde

Comparison with Disdrometer data



Videosonde
Sampling area = 30cm²



Disdrometer
(Joss-type)
Sampling area = 50cm³

Data accumulation will be needed !!!

Future Plan of Videosonde Observation

In 2014 (Early spring)

Intensive observation of melting layer in Zao, Yamagata

- Tethered videosonde
- Continuous launching of videosonde (if possible)
- Data accumulation for comparison between ground-based videosonde and disdrometer

We will try again !!!

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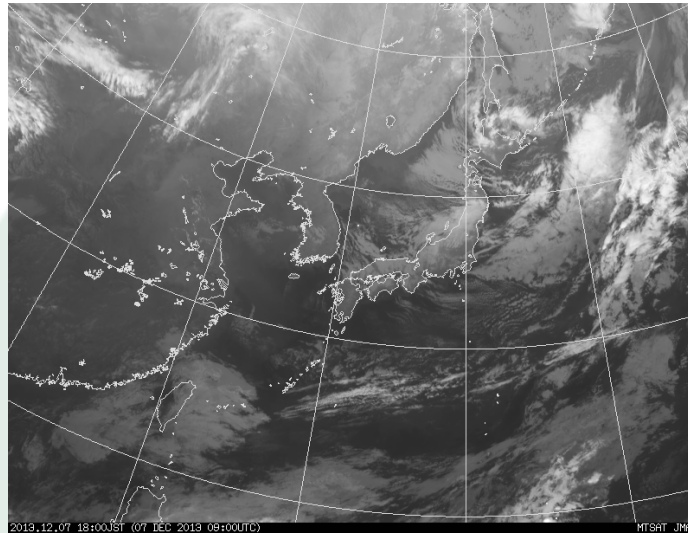


Mobile precipitation observation system (cont.)

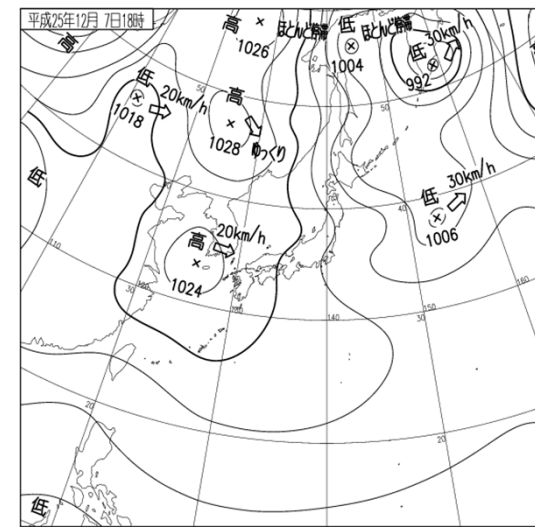
- 2Dimensional Video distrometer (2DVD)
 - Joss-type disdrometer
 - Optical rain gauge
 - Tipping bucket rain gauge
 - Micro-rain radar
 - Wind direction & speed
 - Thermo-hygrometer
 - Parsival (Laser Optical disdrometer)
 - POSS (Precipitation Occurrence S
- Environment CANADA) @ Sapporo



2013年12月7日の事例（ビデオゾンデ#1）



2013年12月7日18時の赤外雲画像



2013年12月7日18時の地上天気図

【No.1】

放球：17:41JST Dec.7

天気概況など：

弱い冬型で昼前から気球を準備し、放球のタイミングをはかっていたが、雨（みぞれ）は弱く、ビデオゾンデによる観測では「もったいない」ので待機した。気象庁レーダではエコー域は見え、XRAINで見えるか見えないかのエコーがかかっていた（放球のタイミングが難しい）。今思えば、このタイミングでも放球してよかったのかもしれないが、放球数の制限、夜間放球の制限等があったため躊躇した。15時ごろから中間サイトでは湿雪にかわる。その後、乾雪にかわる。**雪片はコンスタントに降り続く**。あまり大きな雪片ではないが、雪のケースでもデータをとっておきたかったので放球を判断した。

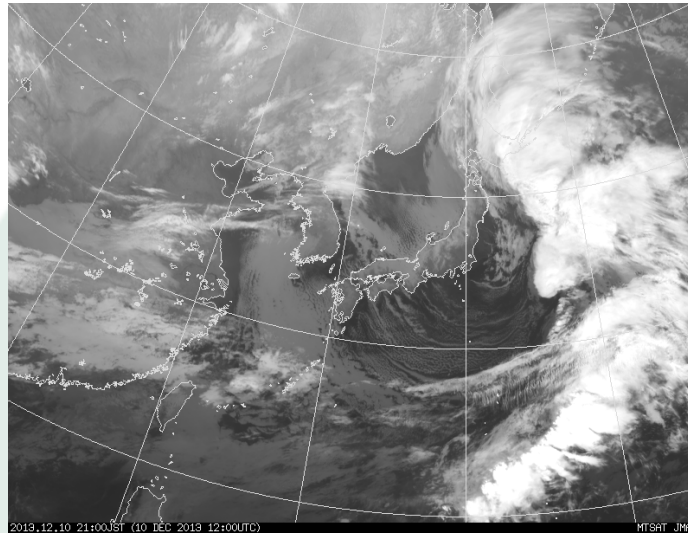
データ等：

地上気温0.1℃、地上では**雪片**、放球時にバルーンに雪が積もる、雲頂は4km程度、17.5kmで気球バースト、太平洋上に落下（最後まで受信できないので推定）

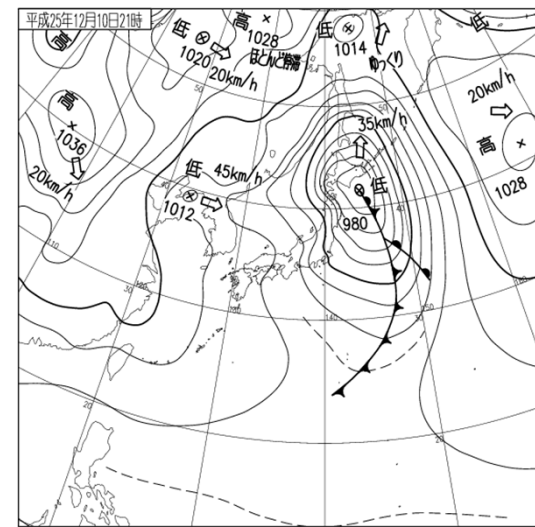
ビデオゾンデデータ：

大きな雪片はない、小さな雪が多数観測される（観測時のモニタリングによる）

2013年12月10日の事例（ビデオゾンデ#3）



2013年12月10日21時の赤外雲画像



2013年12月7日21時の地上天気図

【No.3】

放球：20:26JST Dec.10

天気概況など：

No.2に続いて、融解層が下がってくるのを待つ。**低気圧が通過し、寒気が入り、気温が下がってくる。**C-bandではエコーは見えない。XRAINは弱く小さいエコーがときどきかかり、弱い雨を降らせる。**雲が小さく、5～10分程度で抜ける**ため、放球のタイミングが難しい。融解層は海拔650m程度にあり、融解層は対向領域に入っている。

ある程度強い雨を待つが、月が雲間から見え隠れするような小さな雨雲。最後は、これが時間的にもラストチャンスだと判断して、小さいエコーの弱い雨に放球した。

データ等：

放球時は雨風ともに弱い。**地上気温は3.9℃**。雲は浅い。**0℃高度は750m**。太平洋上に落下（推定）。

ビデオゾンデデータ：

降水粒子はそこそこ見られたが多くはない。（詳細は未確認、モニタリング時の状況より）