



ESA-JAXA Pre-Launch EarthCARE Science and Validation Workshop

13 – 17 November 2023 | ESA-ESRIN, Frascati (Rome), Italy

Validation Plan for CPR ECO Product

H. Horie, Y. Hagihara, K. Kanemaru and Y. Ohno
NICT

CPR Overview and CPR L1b/L2a CPR ECO Products



CPR: The first satellite-borne Doppler weather radar

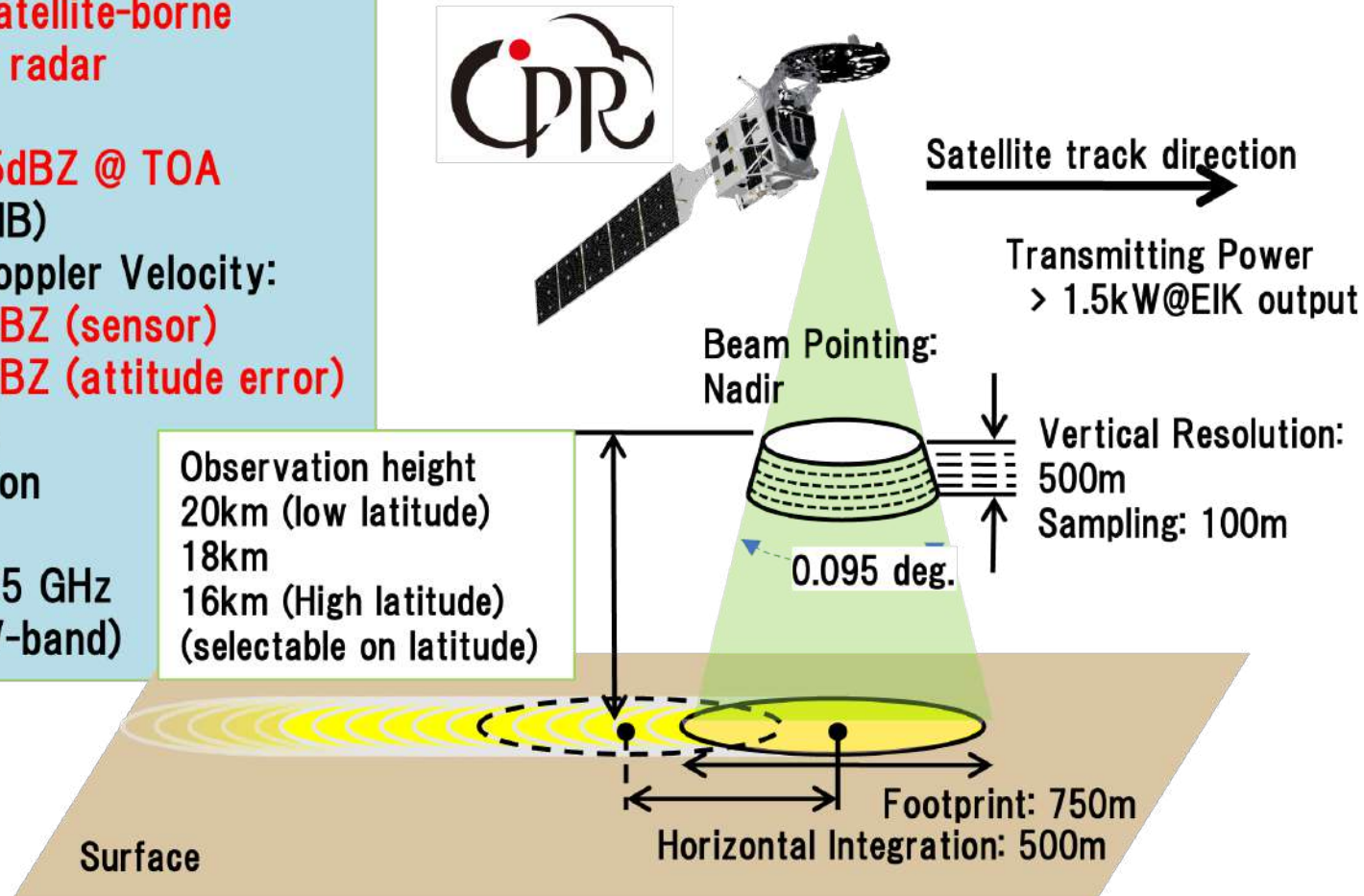
Specification*:

■ Sensitivity: **-35dBZ @ TOA**
(Calibration: 1dB)

■ Accuracy of Doppler Velocity:
<1.0m/s @ **-19dBZ (sensor)**
<1.3m/s @ **-19dBZ (attitude error)**

* Uniform cloud,
10km integration

Frequency: **94.05 GHz**
(W-band)



CPR L1b Product (Major Items):
Reflectivity Factor (Z factor)
Doppler Velocity (Vd)
Surface related product

CPR L2a (CPR ECO) Product:
Integrated Z factor (1/10km)
Integrated Vd (1/10km)

PIA: Path Integrated Attenuation
Clutter Echo
Vd folding/NUBF correction

Major Calibration/Validation Items
Z factor
Doppler Velocity



CPR Calibration Area

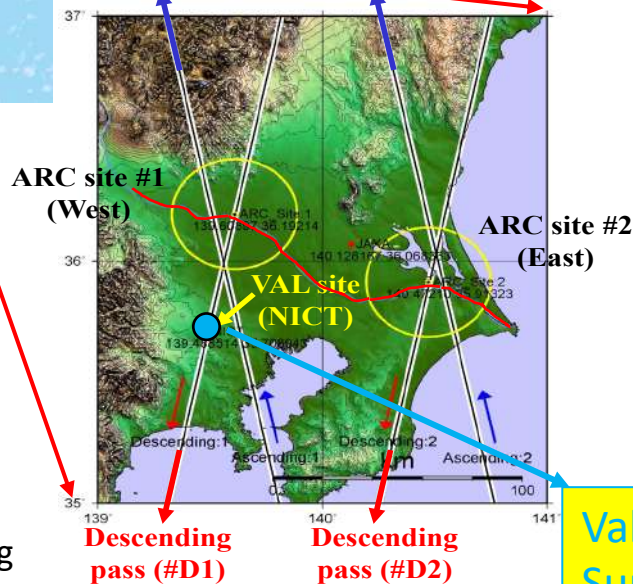


External Calibration using ARC is one of most important tasks for CPR Products. The bank of Tone-river is used.

Kanto Area

Ascending pass (#A1)

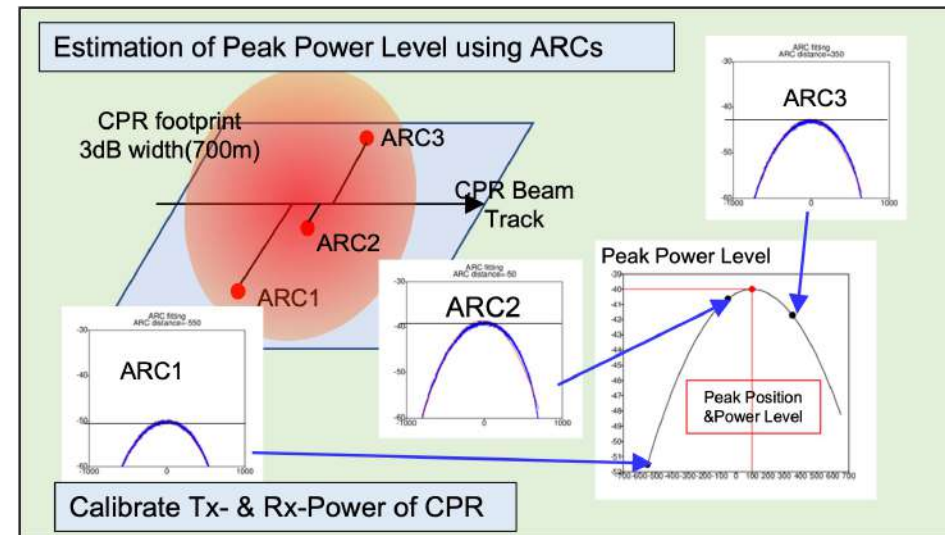
Ascending pass (#A2)



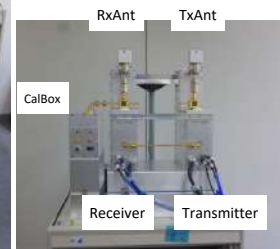
Recommended ANX Longitude: 0.55 to 0.60 deg. due to have a opportunity 2 times / one repeat cycle (25days)

SEA SURFACE CALIBRATION
In addition, the calibration using Sea Surface Scattering is also considered.

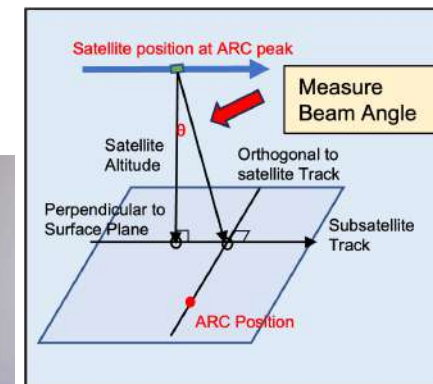
Peak Level Estimation using ARC



ARC: Active Radar Calibrator



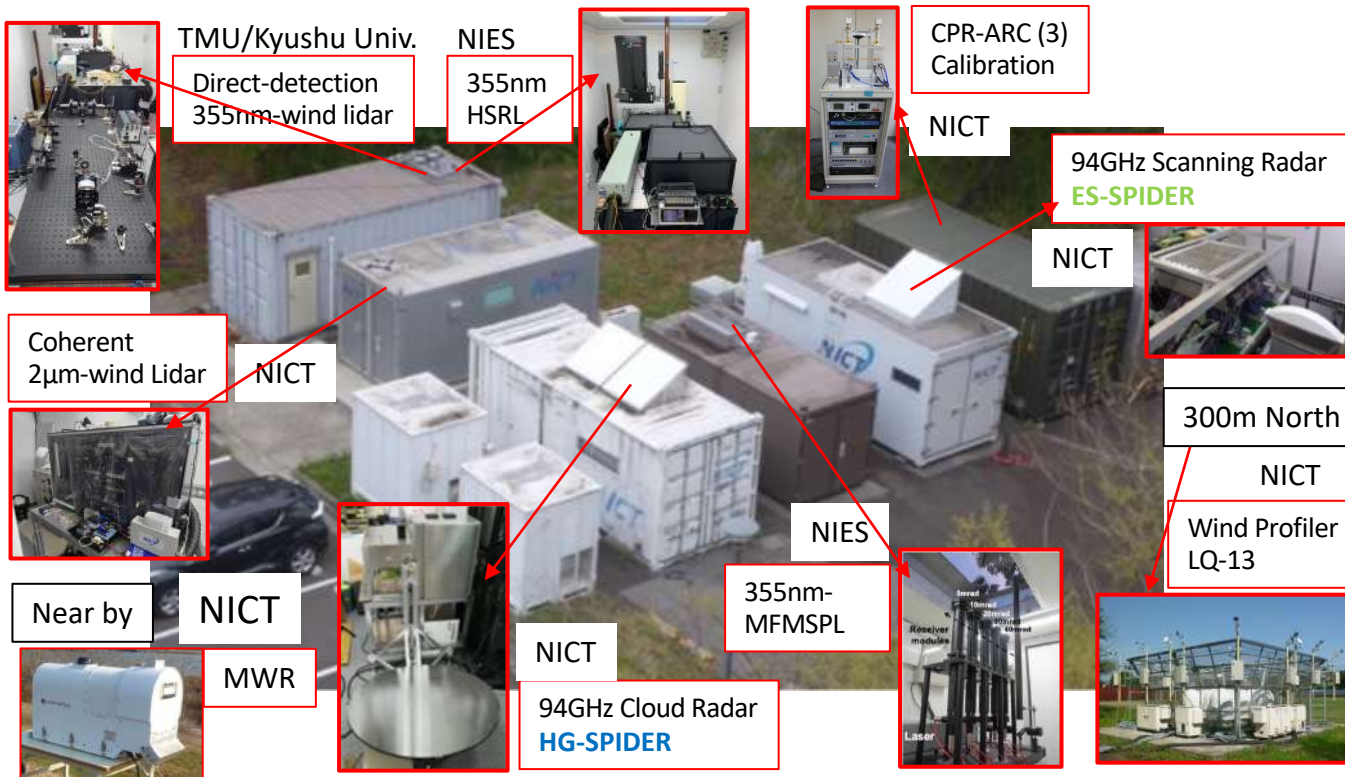
Beam Position Estimation



NICT Koganei (Validation Super Site in Japan)



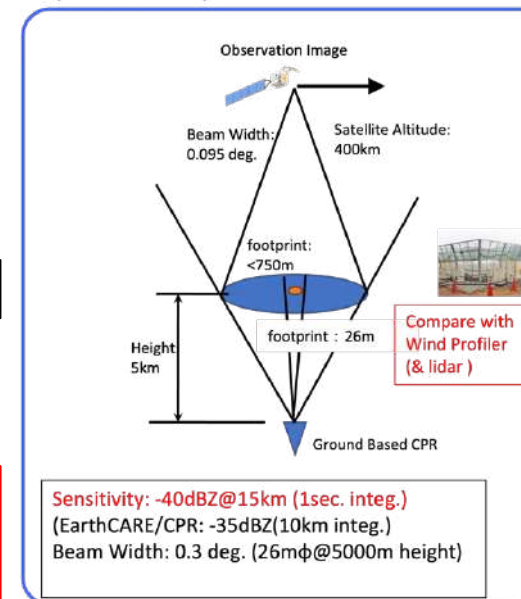
NICT W-band Cloud Radar for Validation at Koganei Super Site



Compare using ground-based radar for Z factor and Doppler Velocity.

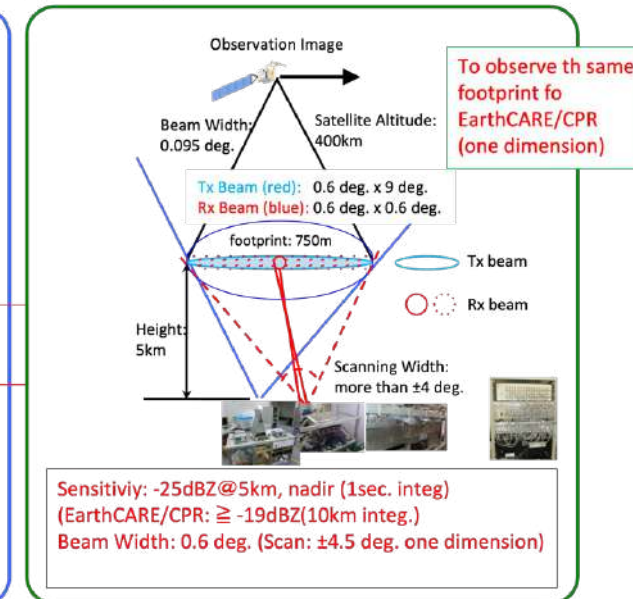
Evaluate NUBF for Doppler Velocity measurement.

High-sensitivity Ground-based CPR (HG-SPIDER)



To Validate Reflectivity(Z) and Doppler Velocity

Electronic-Scanning CPR (ES-SPIDER)



To Evaluate non-uniformity with antenna footprinting

Sensitivity -40dBZ @ 15km height for integration 1 seconds

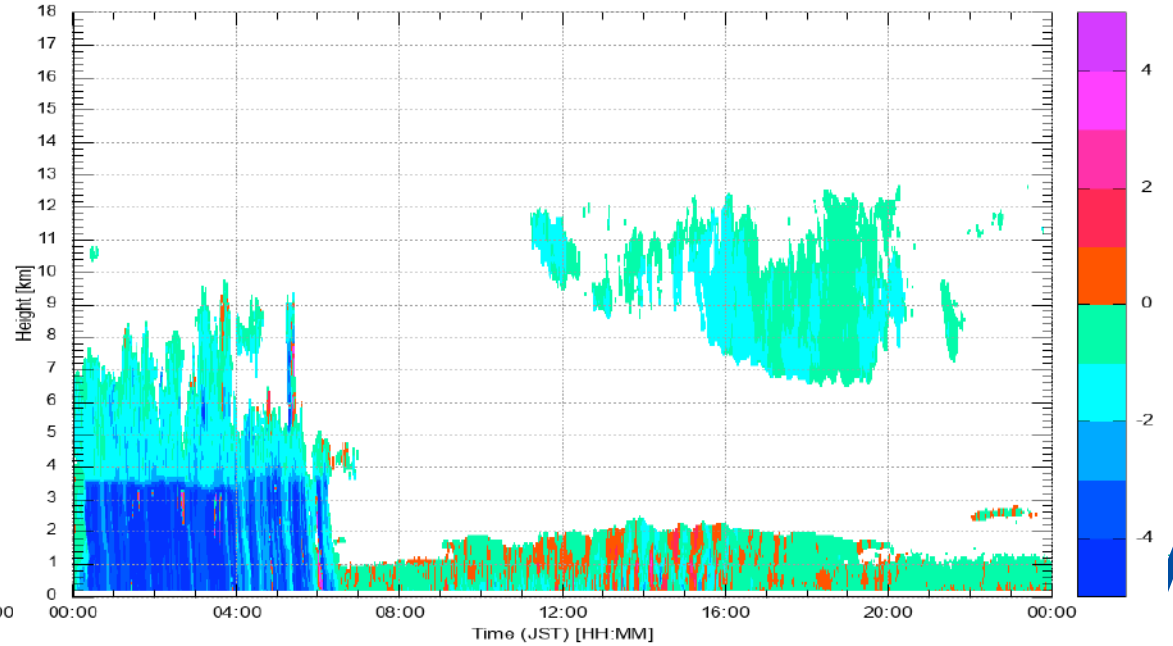
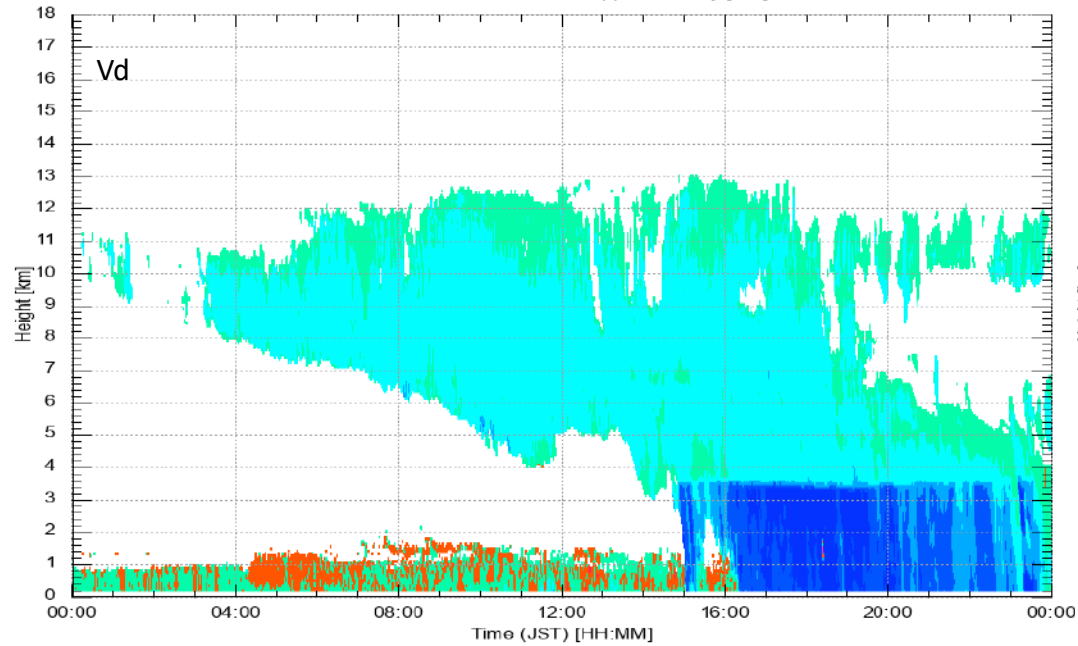
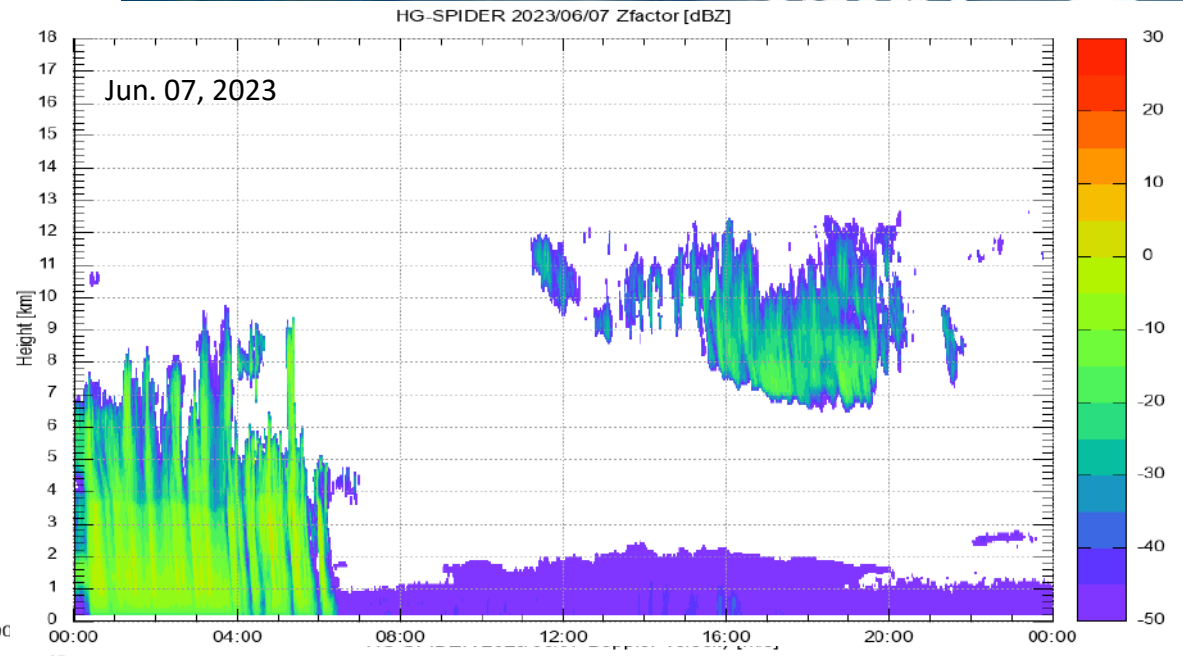
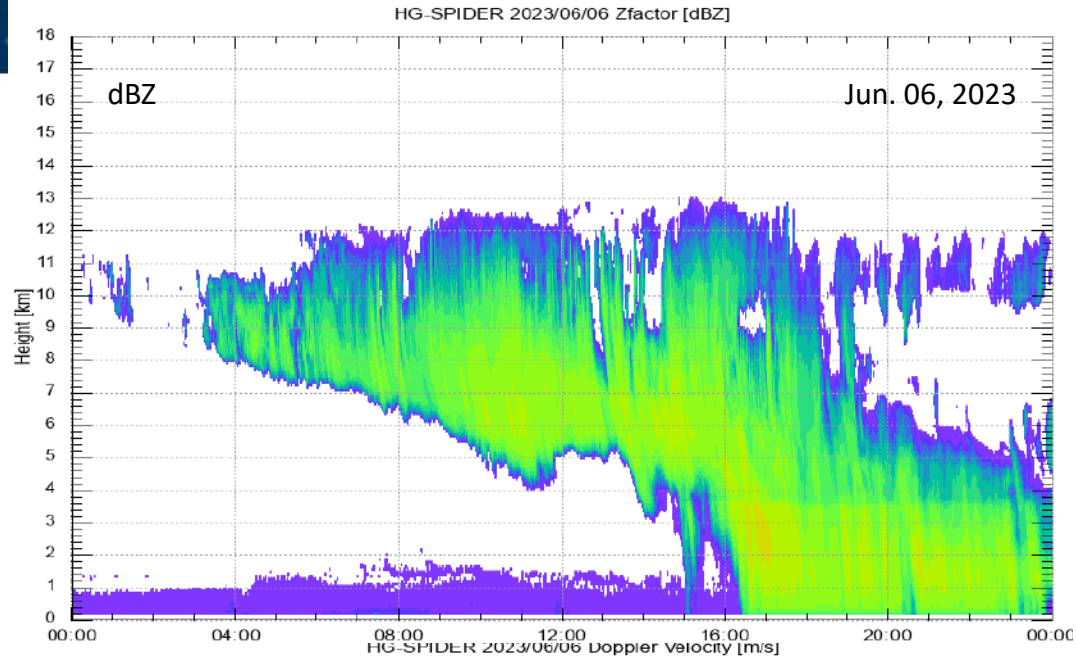
One Dimensional Scanning
 750m @ 5 km height
 Sensitivity: -26dBZ @ zenith
 -20dBZ @ scan edge

In addition, many Lidars (NICT, NIES, TMU and Kyushu-U) and other instruments* are operated here.

* MicroWave Radiometer, Wind Profiler, Sky-Camera, etc.



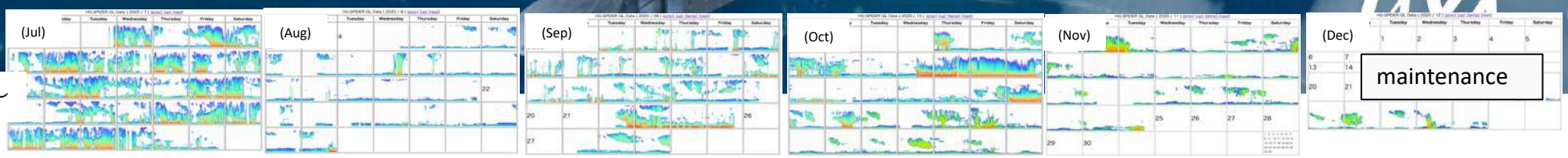
Example Data of HG-SPIDER



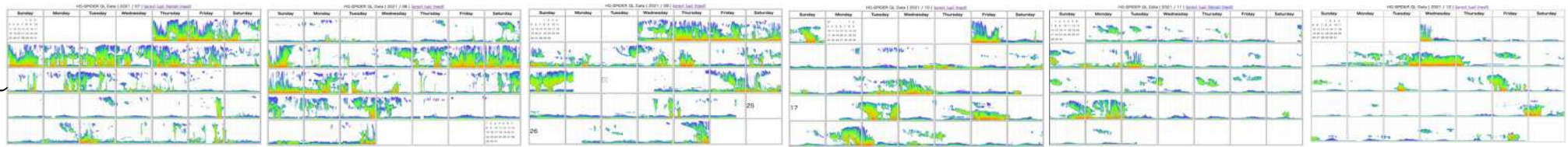
HG-SPIDER operation statistics



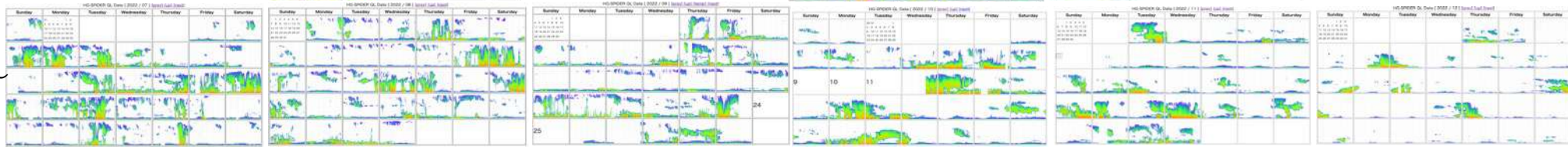
Jul. 2020 ~



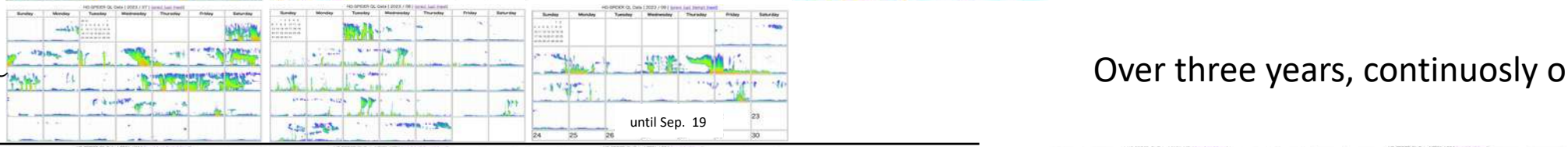
Jul. 2021 ~



Jul. 2022 ~

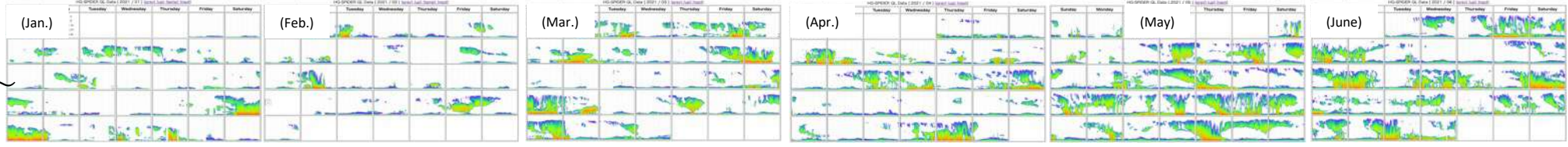


Jul. 2023 ~

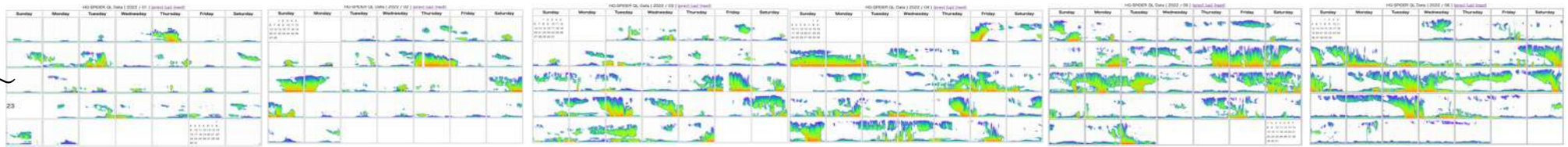


Over three years, continuously operated

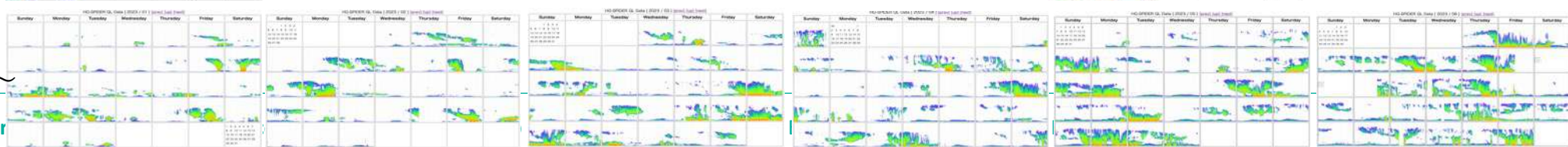
Jan. 2021 ~



Jan. 2022 ~



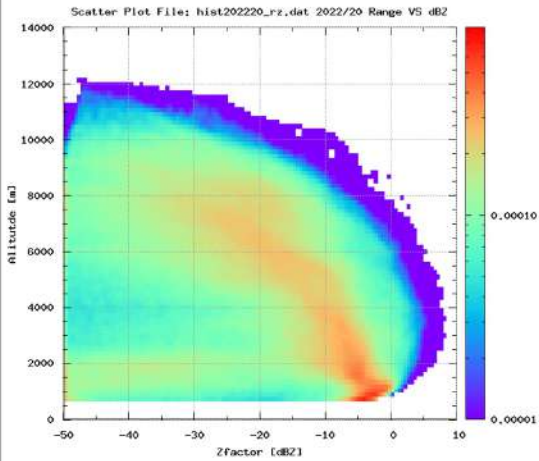
Jan. 2023 ~



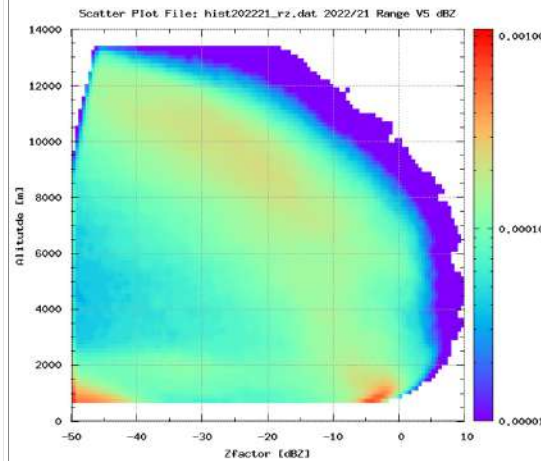
Seasonal Statistics of HG-SPIDER



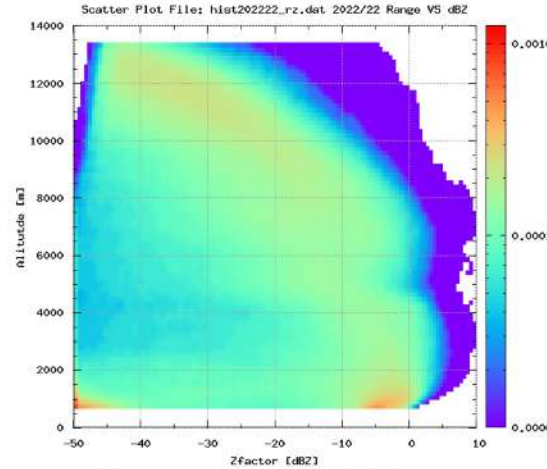
Winter, Alt-Z



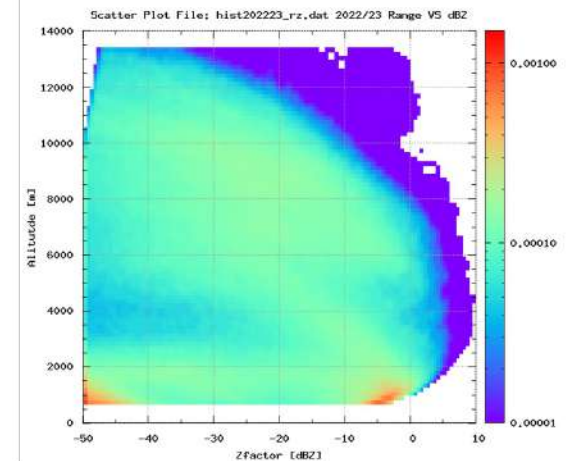
Spring, Alt-Z



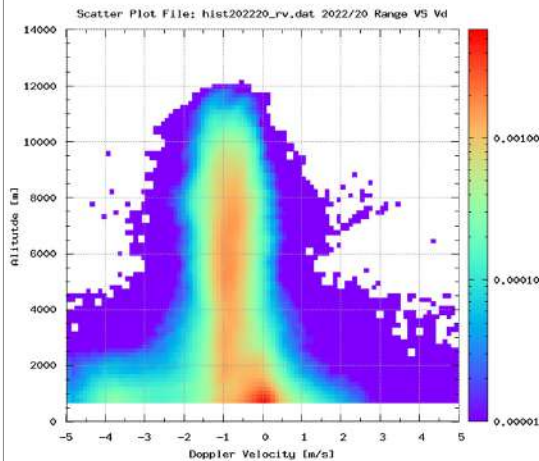
Summer, Alt-Z



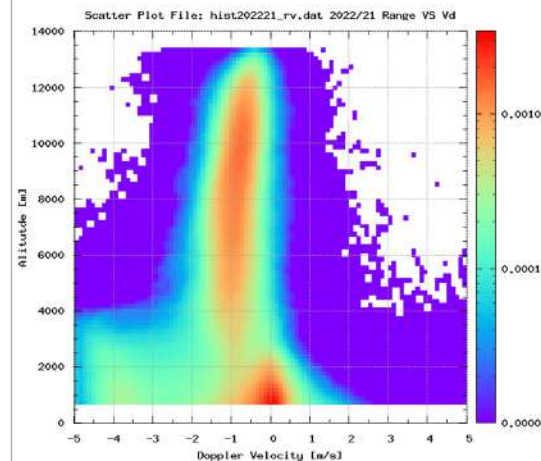
Fall, Alt-Z



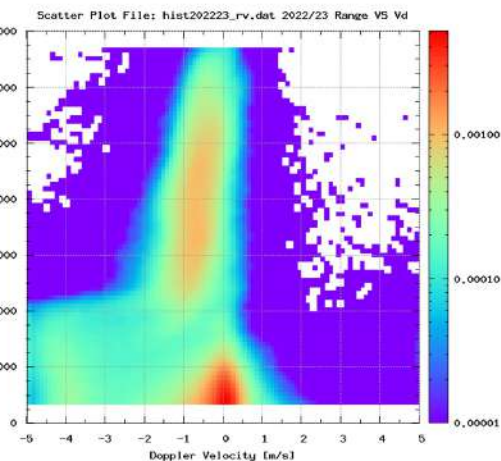
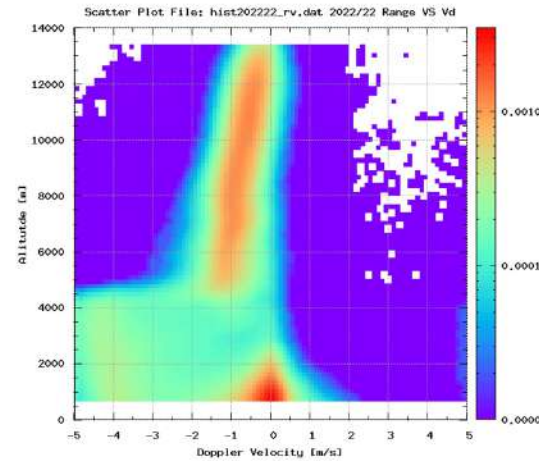
Winter, Alt-Vd



Spring, Alt-Vd



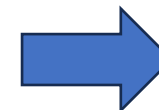
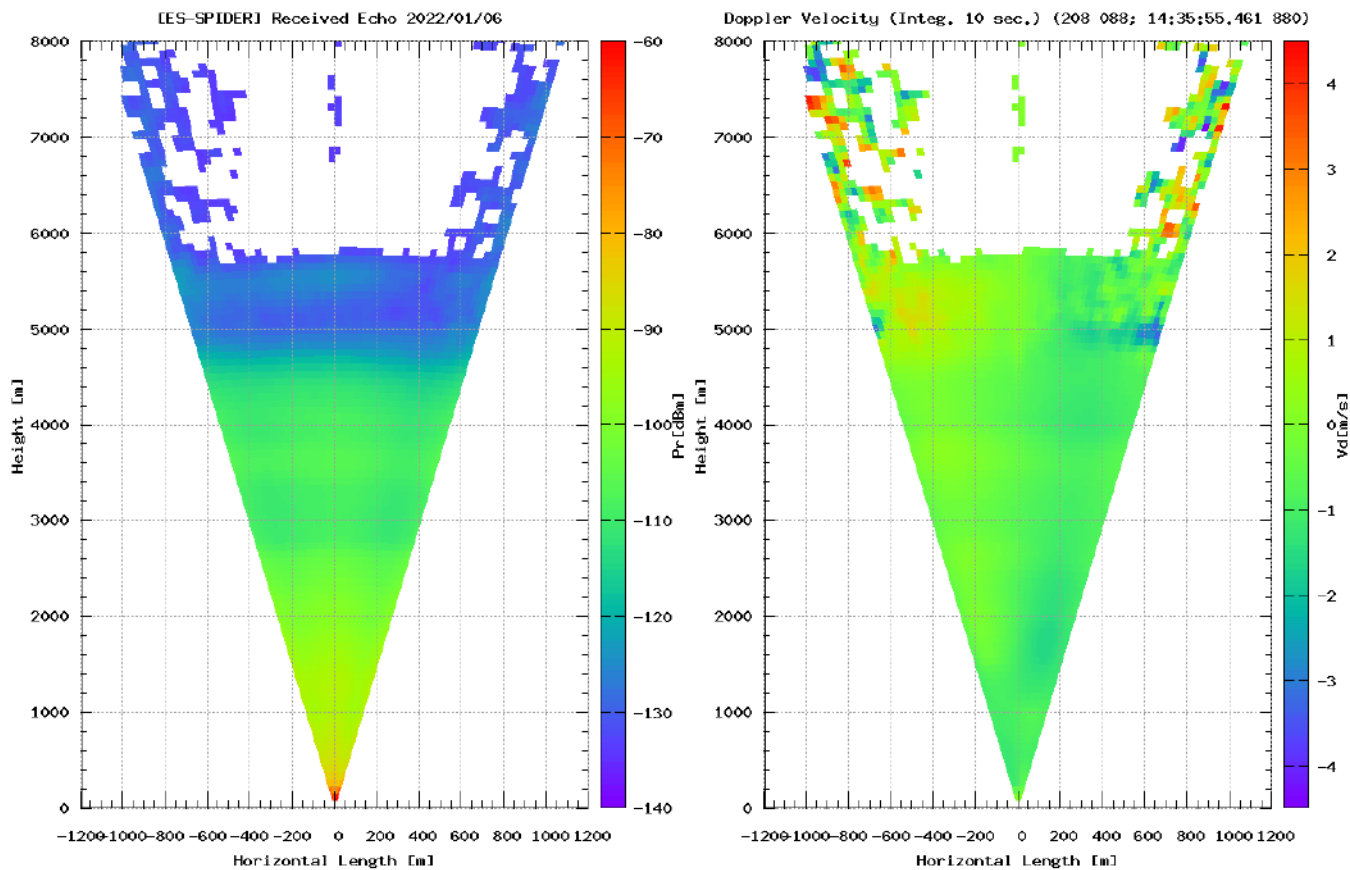
Summer, Alt-Vd



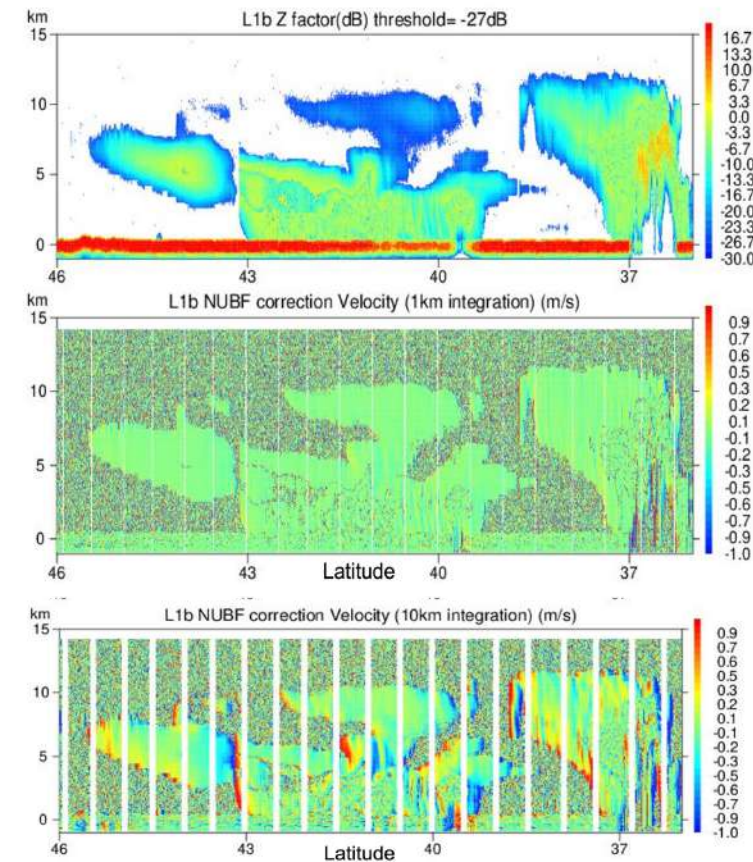
Example Data of ES-SPIDER



for NUBF evaluation



Doppler Velocity NUBF Correction



(Y. Ohno)





Prepare CALIBRATION for CPR L1b Product :

External Calibration(ARC)

Sea Surface Calibration

Prepare VALIDATION for mainly CPR L2a (CPR ECO) Product:

HG-SPIDER statistics comparison at NICT Koganei Validation Super Site

HG-SPIDER direct comparison with nearest Satellite Track

ES-SPIDER evaluate Doppler Velocity measurement error due to NUBF

OTHER ACTIVITY

WINDAS : Wind Profiler Network at JAPAN (JMA) (Y. Ohno, Presentation Fri., Poster 52)

Ka-band Cloud Profiling Radar Network (NIDS) (T. Ohigashi, Presentation Fri., Poster 49)

Multi-Parameter Phased Array Weather Radar (N. Takahashi, Poster 54)