



EarthCARE 2026 Science and Validation workshop

8–12 June 2026 | Rhodes House | Oxford, UK

CPR vertical Doppler velocity validation using WINDAS profiler network

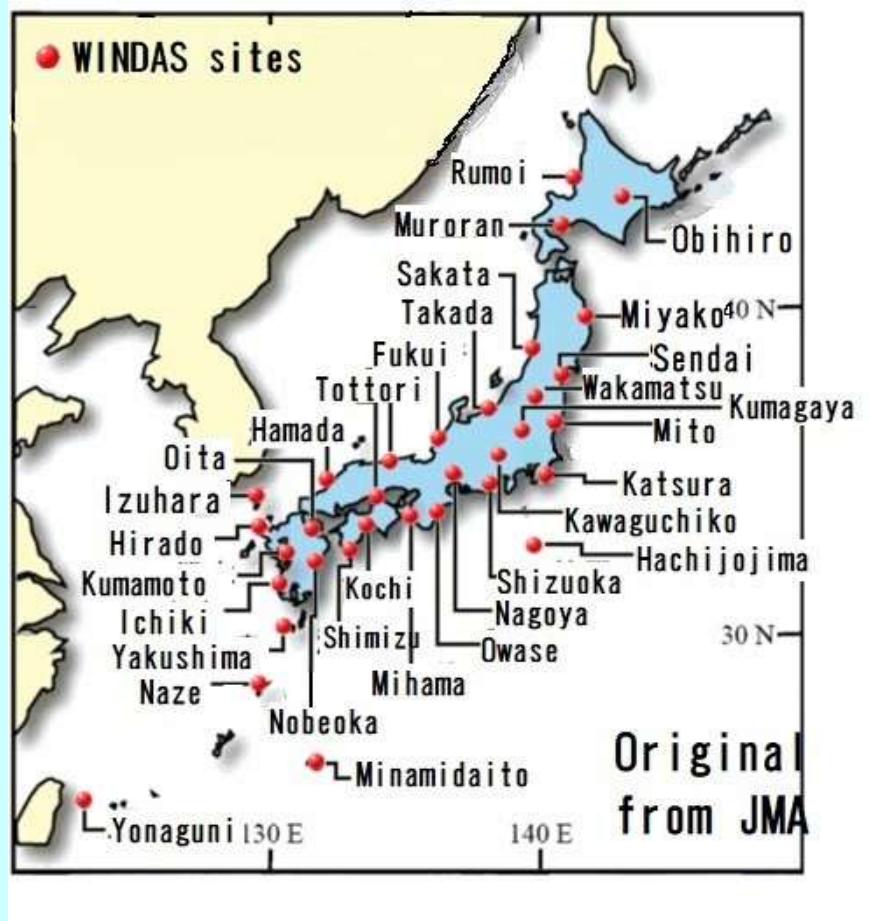
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Introduction



WINDAS is L-band wind profiler network operated by Japan Meteorological Agency. 33 wind profilers are operating around Japan and observing upper wind velocity including vertical velocity. L-band wind profiler can detect echoes from atmospheric turbulence and hydrometer particle. For validation of vertical velocity of CPR, vertical velocity from ice or snow echoes observed by WINDAS can be compare with CPR. Comparing with simultaneous observation is more suitable for validation, but it needs time for accumulating cases. Instead, we show time and space averaged vertical velocity profiles of CPR and WINDAS here.

JMA wind profiler network (WINDAS)



33 sites are now working

WINDAS: 1.357GHz Wind profiler

Main target: **atmospheric turbulence**

Horizontal wind profile with good height and time resolution (300m, 10min)

Sub target: **Ice cloud and rain**

Vertical velocity of cloud & rain particle

EarthCARE Doppler validation

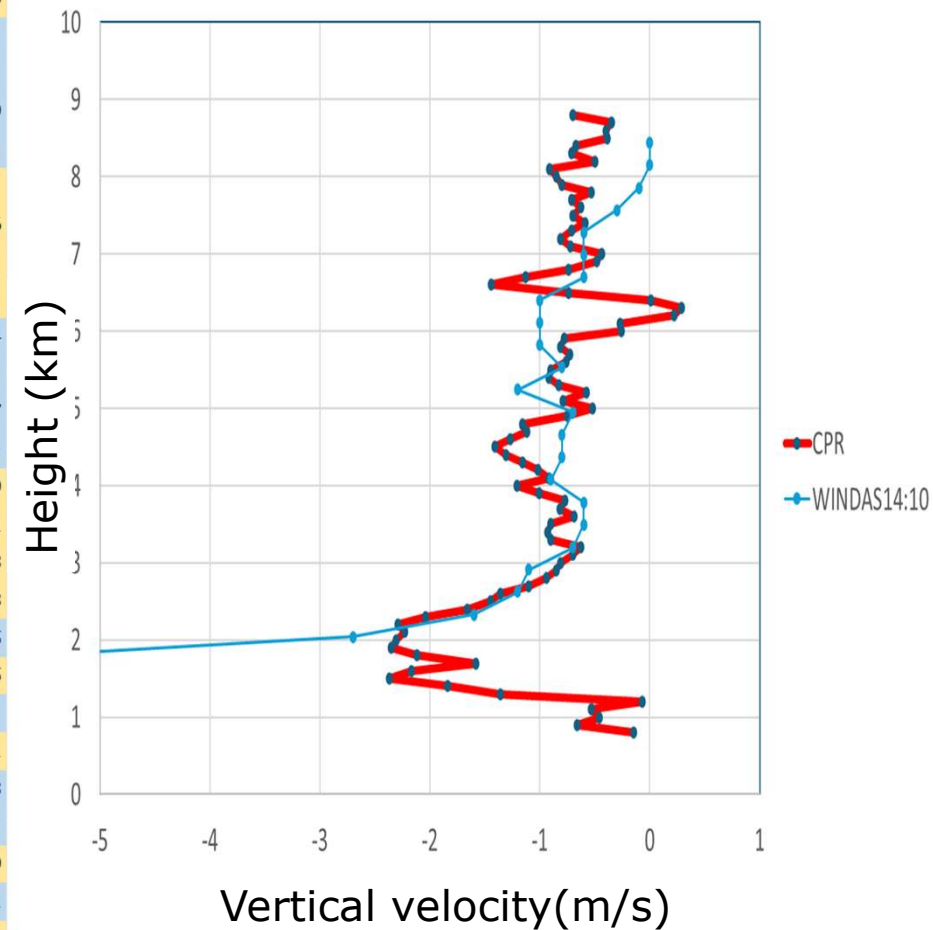


We thank JMA for providing very valuable data for CPR Doppler validation.

Simultaneous comparison of WINDAS and CPR doppler velocity

Pass time(UTC)	Orbit	Frame	Site name	Latitude	Longitude	Distance(km)	Elevation	Azimuth
通過時刻 (UTC)	軌道番号	フレーム	地点名	衛星近接緯	衛星近接経	距離(km)	衛星仰角	衛星方位
2025/01/01 04:52	3380	D	Obihiro	42.927626	143.16842	3.6	89.45	279.23
2025/01/01 16:46	3388	B	Kouchi	33.570726	133.554374	0.5	89.92	60.14
2025/01/03 16:35	3419	B	Owase	34.078936	136.247858	5.1	89.22	78.56
2025/01/05 16:24	3450	B	Kawaguchiko	35.486608	138.659231	9.4	88.57	260.39
2025/01/05 16:24	3450	B	Takada	37.107893	138.248743	0.2	89.96	55.83
2025/01/06 05:13	3458	D	Owase	34.065355	136.230224	3.4	89.48	98.2
2025/01/08 04:59	3489	D	Rumoi	43.936596	141.681685	4.1	89.37	105.36
2025/01/08 05:00	3489	D	Wakamatsu	37.493923	139.882088	2.6	89.61	284.2
2025/01/11 05:32	3536	D	Yakushima	30.379529	130.690704	3.2	89.52	97.27
2025/01/12 16:31	3559	B	Nagoya	35.152381	136.857107	10	88.48	259.84
2025/01/14 16:20	3590	B	Kumagaya	36.156817	139.417086	3.4	89.49	77.75
2025/01/15 17:00	3606	B	Yakushima	30.372917	130.606281	5.1	89.23	257.07
2025/01/15 17:00	3606	B	Ichiki	31.704611	130.298481	2.3	89.65	257.5
2025/01/17 04:57	3629	D	Sendai	38.253261	140.949666	4.8	89.28	101.89
2025/01/17 04:57	3629	D	Mito	36.384517	140.466006	0.4	89.93	331.41
2025/01/17 04:58	3629	D	Hachijoujima	33.141193	139.667875	10.6	88.39	281.53
2025/01/18 05:39	3645	D	Hirado	33.362613	129.541464	1	89.85	282.73
2025/01/18 16:00	3652	B	Obihiro	42.904703	143.100311	9.3	88.58	257.75
2025/01/23 05:59	3723	D	Yonagunijima	24.477213	122.955187	5.7	89.13	281.35
2025/01/23 16:17	3730	B	Wakamatsu	37.501455	139.988191	7	88.93	77.9
2025/01/26 04:52	3769	D	Obihiro	42.926743	143.177305	2.9	89.56	279.61
2025/01/26 16:45	3777	B	Kouchi	33.56765	133.544563	0.4	89.93	260.83
2025/01/28 16:34	3808	B	Owase	34.076257	136.237094	4.1	89.38	79.89
2025/01/29 05:24	3816	D	Shimizu	32.704508	133.122908	10.8	88.36	101.09
2025/01/30 16:24	3839	B	Takada	37.103892	138.22862	1.6	89.75	258.81
2025/01/31 05:12	3847	D	Owase	34.066277	136.204985	1.2	89.82	109.73

2025/1/6 OWASE & CPR Vertical velocity profile



Statistical analysis of CPR Doppler velocity

Period: JAN 2025 –DEC 2025

CPR L2 Echo product version: vCc

jsg_doppler_velocity_1km_with_correction_bias_cor

(1km averaged Doppler velocity, simple unfolding, beam pointing bias error is corrected using surface velocity)

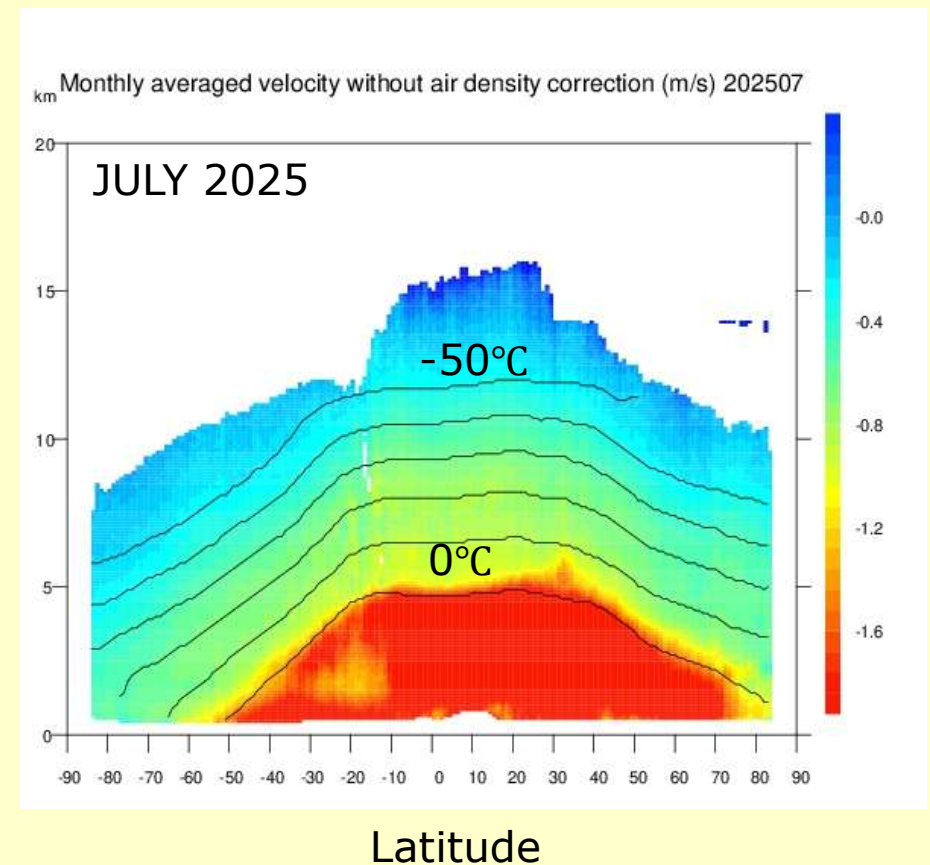
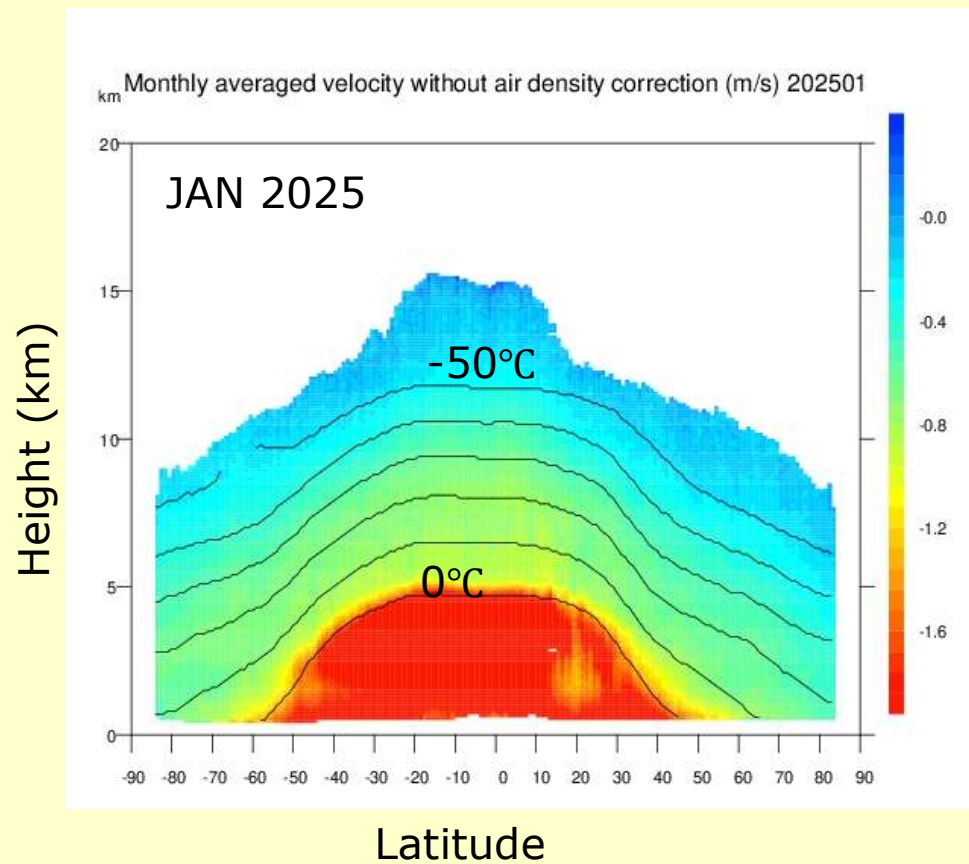
Filtering:

cloud echo (radar reflectivity $>-30\text{dBZ}$) existing more than 10 range bin continuously

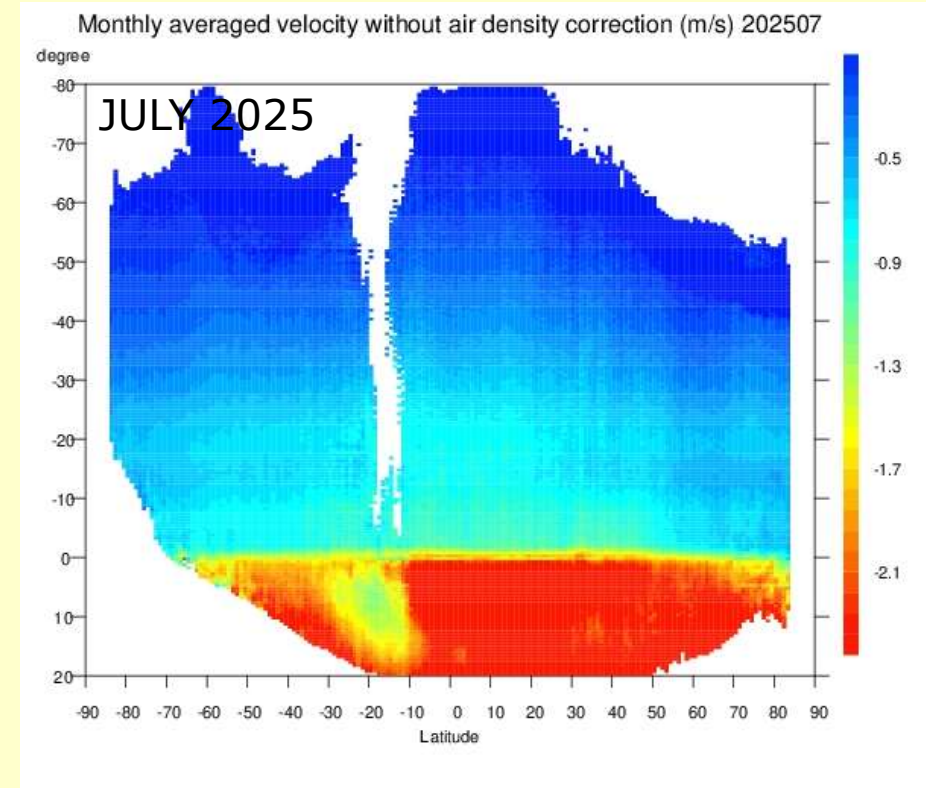
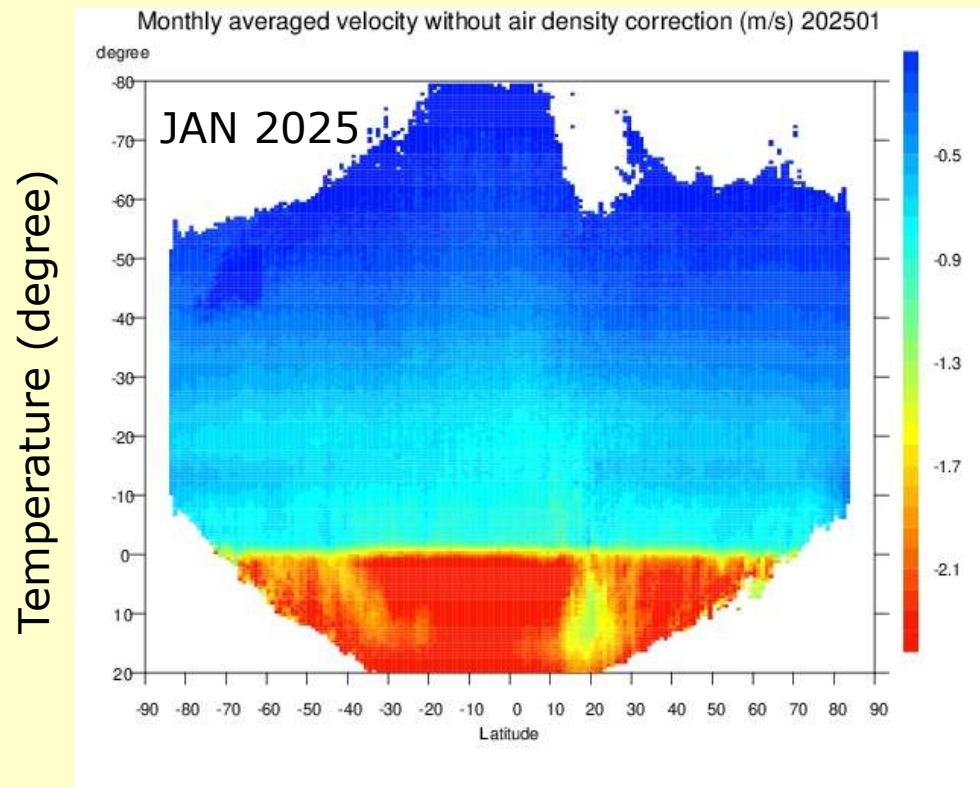
Statistics:

Zonal average (1 degree bin), monthly average

Monthly zonal averaged CPR velocity

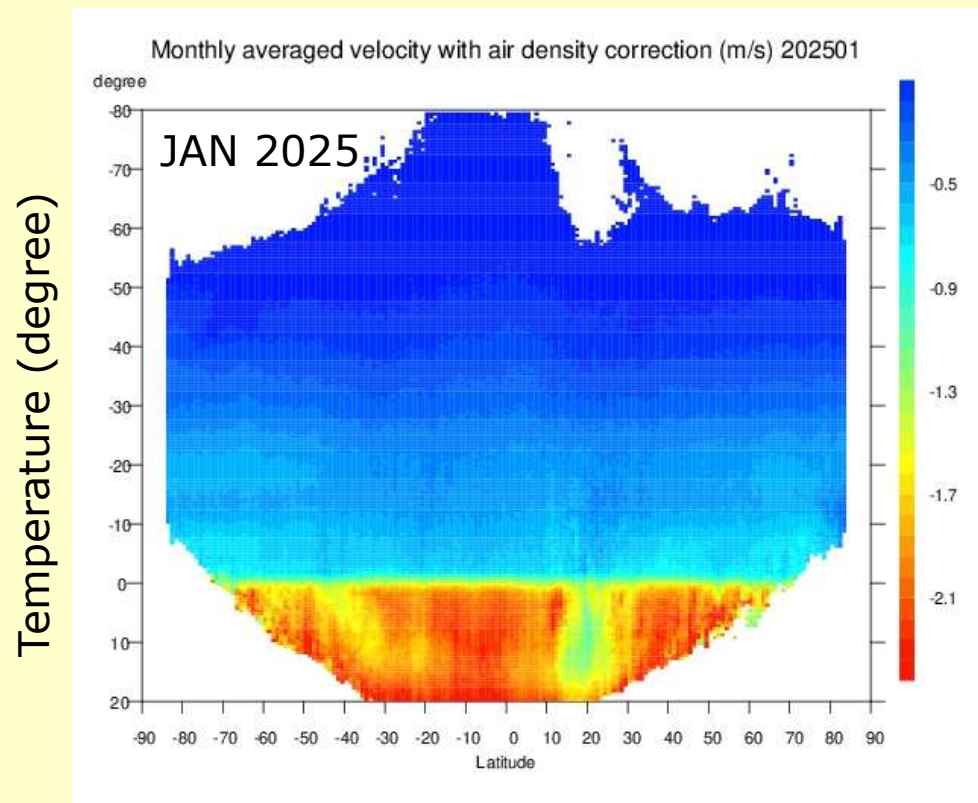


Monthly zonal averaged CPR velocity

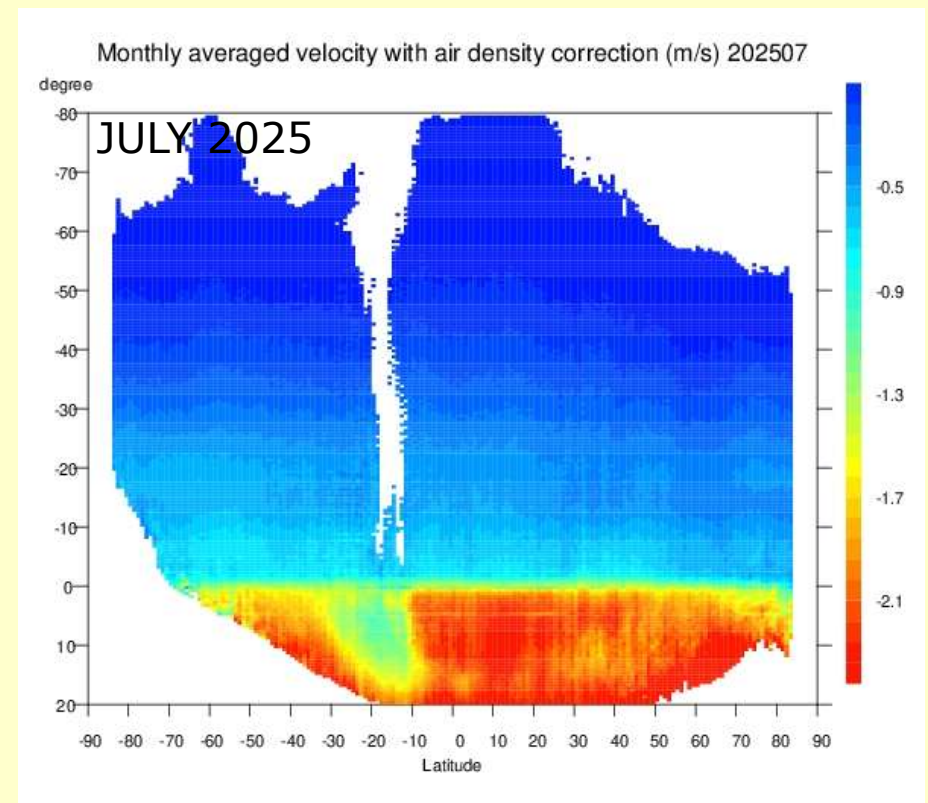


Monthly zonal averaged CPR velocity

Air density correction: velocity at 1000hPa 0°C

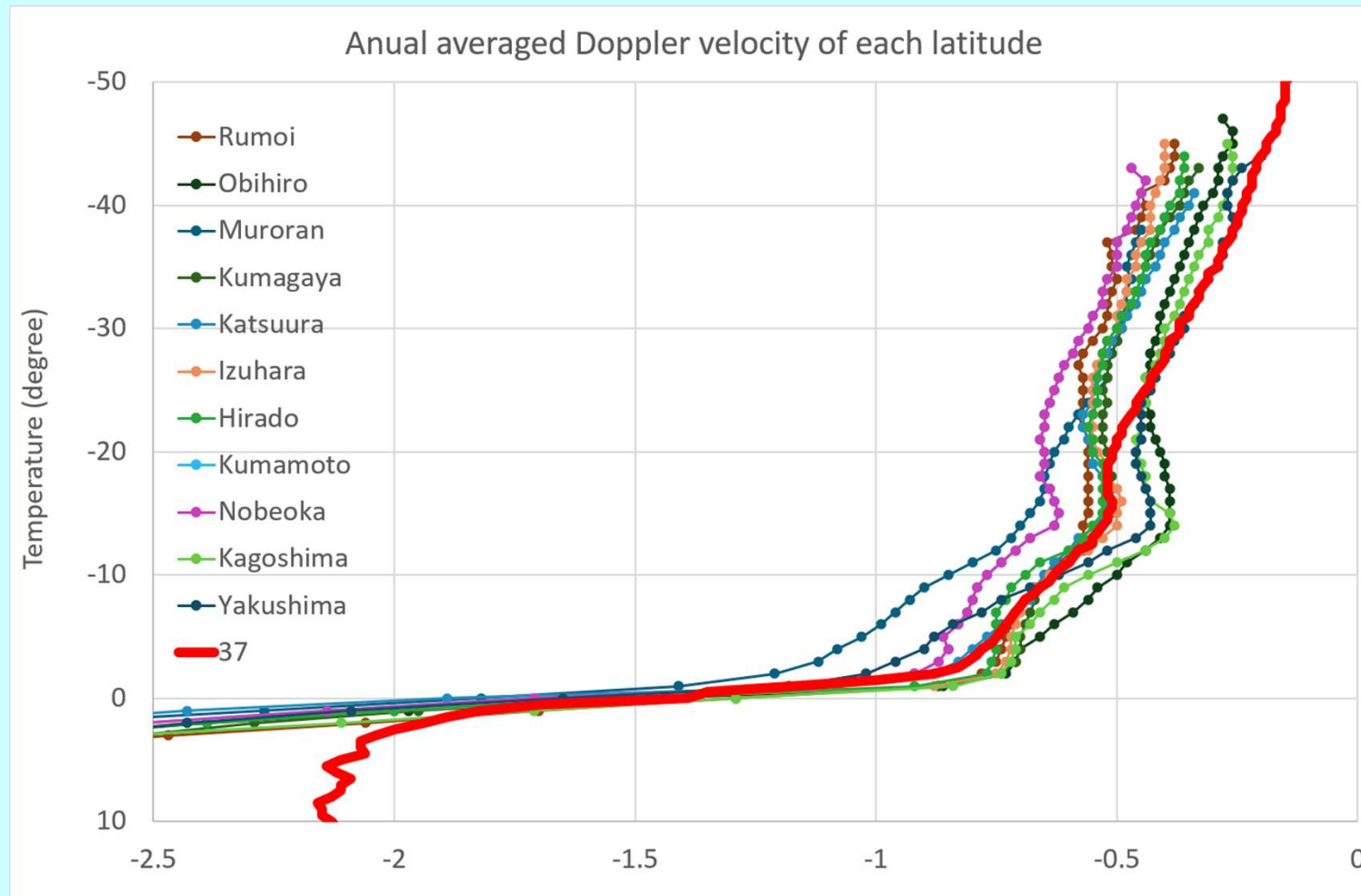


Latitude



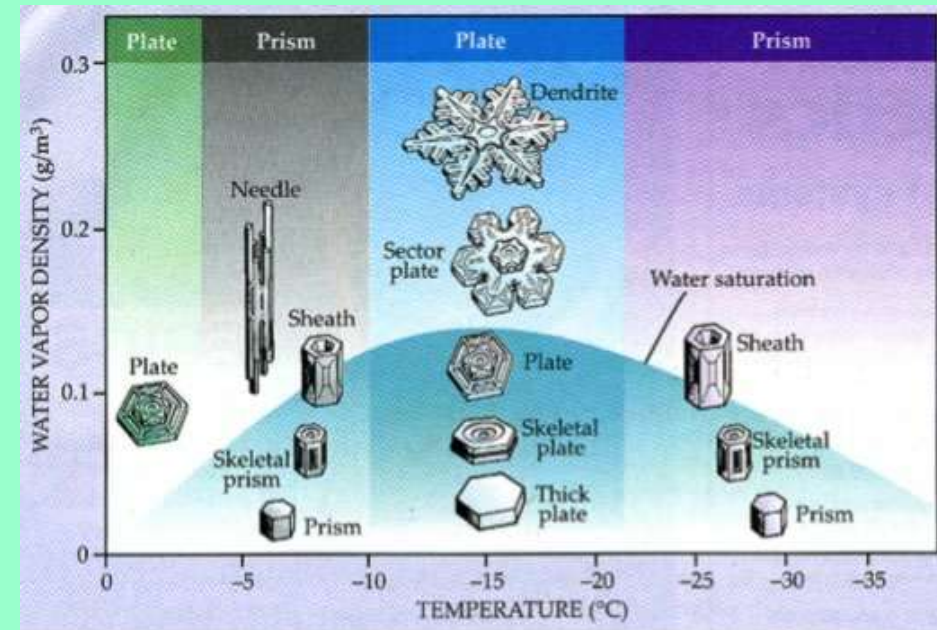
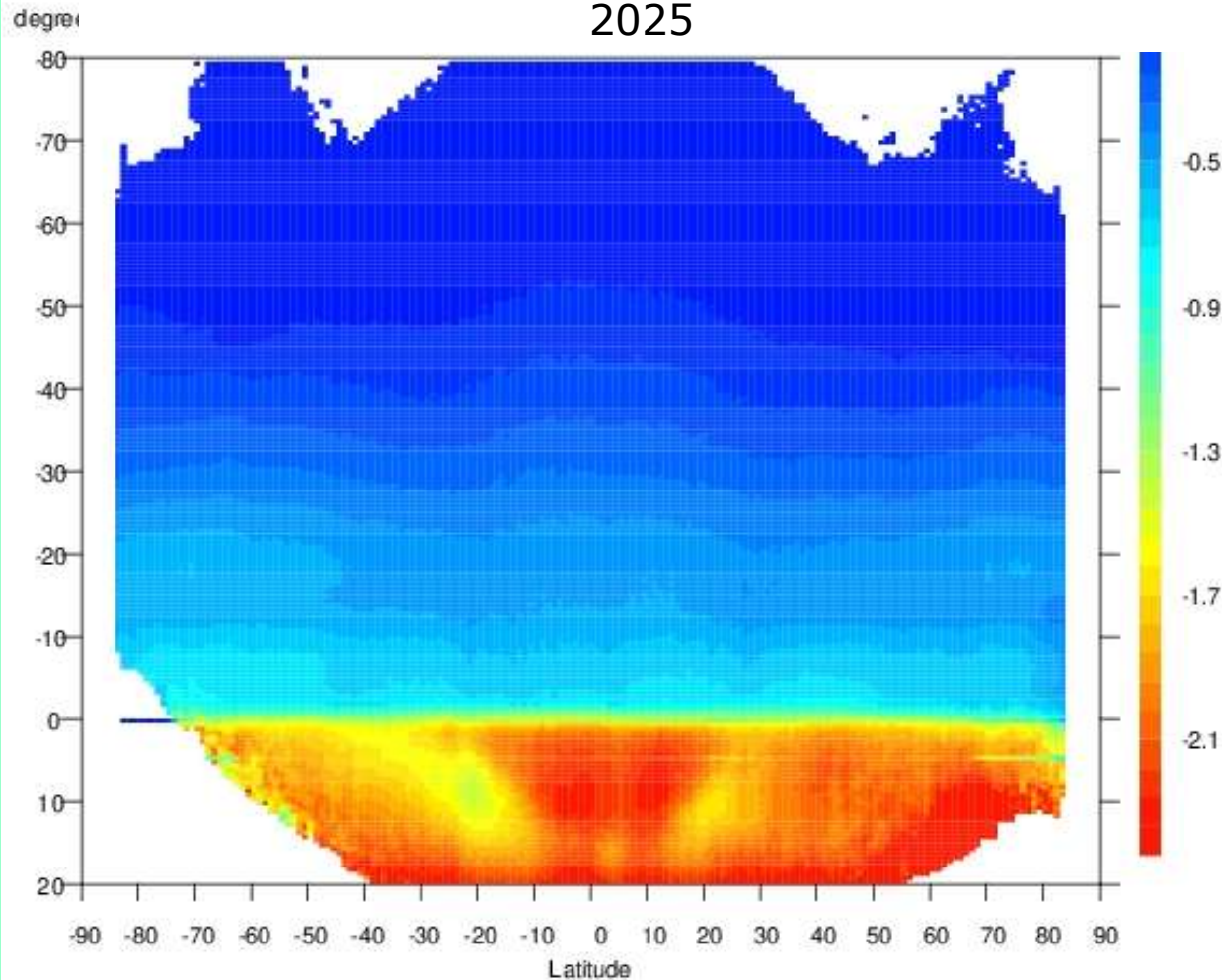
Latitude

Comparing CPR and WINDAS 2025 annual averaged velocity



Rather small fall velocity exist between $-10 \sim -20$ degree

Annual averaged velocity with air density correction
2025



Ice crystal habit

Furukawa and Wettlaufer (2007) Phys. Today 60,70-71.

<https://www2.lowtem.hokudai.ac.jp/ptdice/research.html>

Summary



- 1. When we draw vertical velocity profiles with air temperature instead of height, they show similar profiles above melting layer in all areas and all season.*
- 2. If we consider air density correction for terminal falling speed, variety of those profiles concentrate narrower.*
- 3. Time and space averaged WINDAS and CPR vertical velocities show very good agreement less than 0.5 m/s.*
- 4. In averaged velocity profile with temperature axis, rather slow falling velocity zone exist between -10 to -20 degree. We infer that this slow falling velocity is related existence of 2D-plate ice.*