



Evaluation of COWVR as a Cost-Effective Sensor for Providing Climate Data Records of Ocean Vector Winds and Other Air-Sea Variables

IOVWST Meeting

2024-05-29

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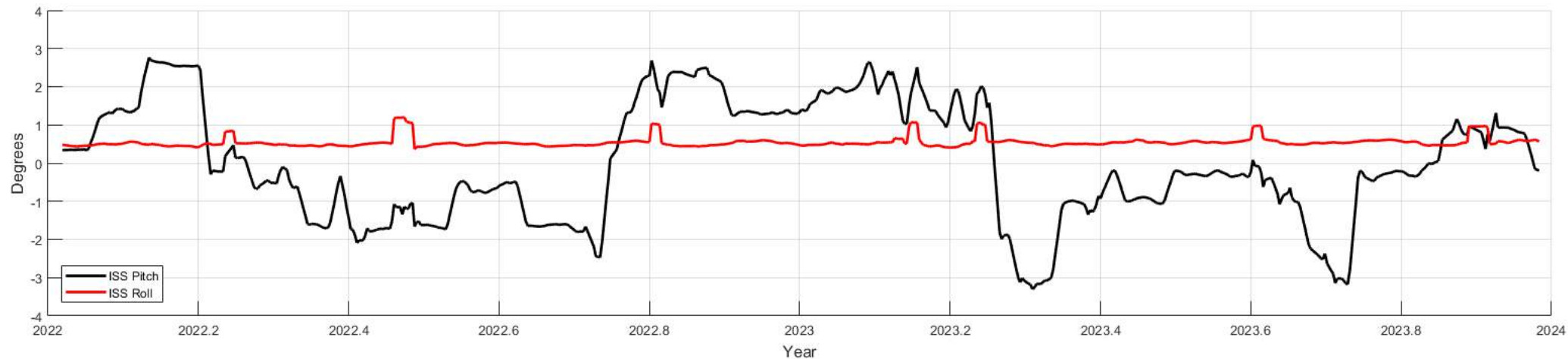
Acknowledgements: this work is supported by NASA OVVST



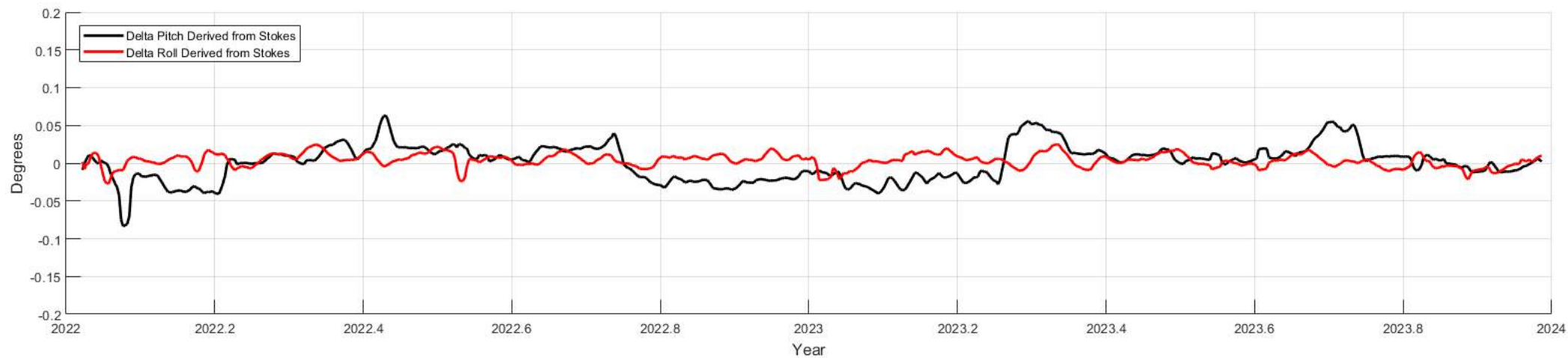
Timeseries of COWVR Pitch and Roll Angles



As reported

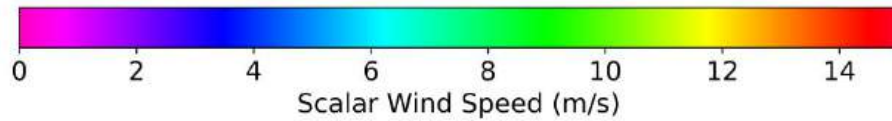
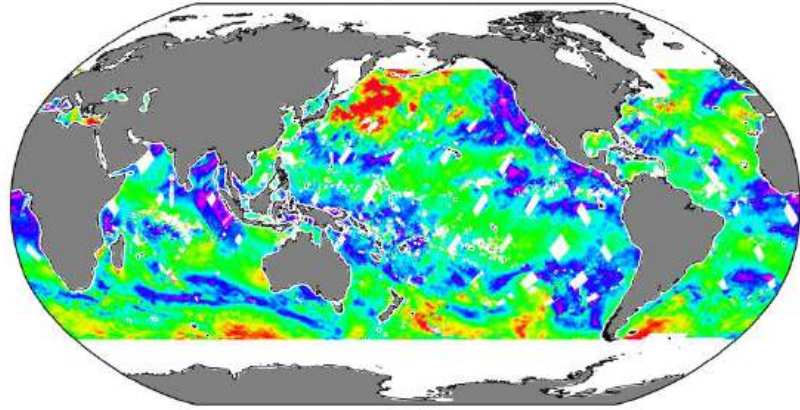


Adjustment derived from measured vs modeled 2nd/3rd Stokes TBs

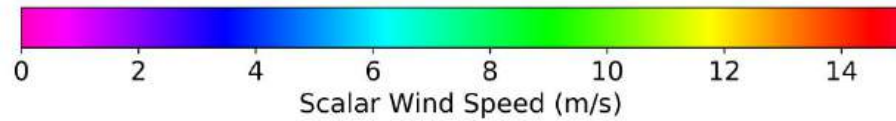
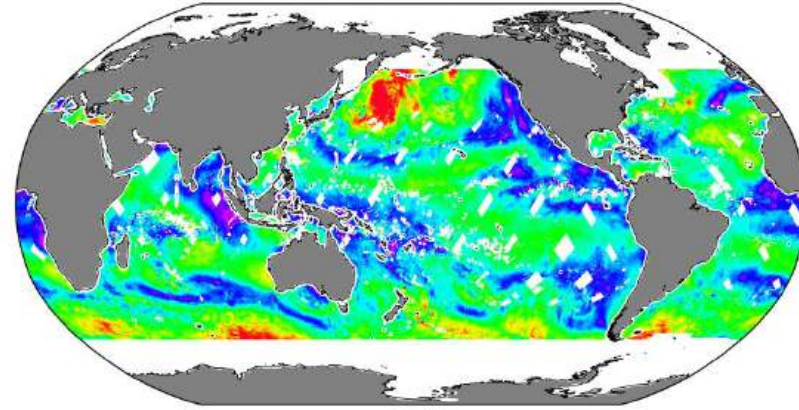




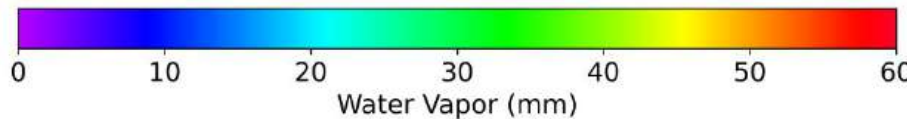
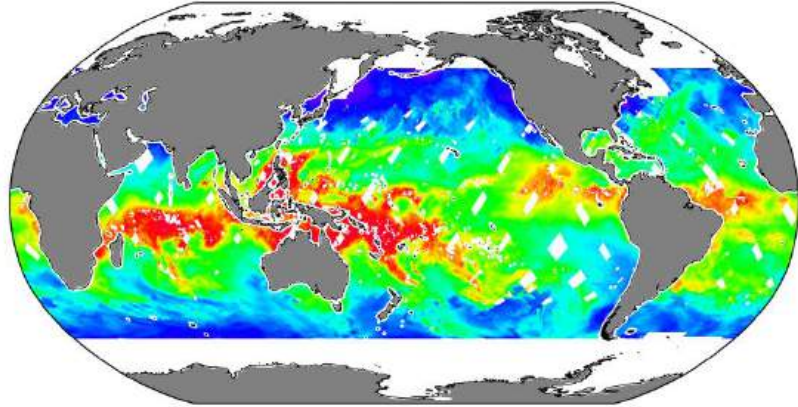
COWVR
2022-01-25 to 2022-01-27



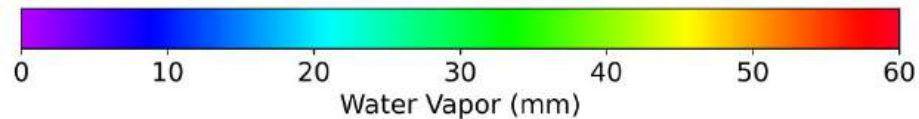
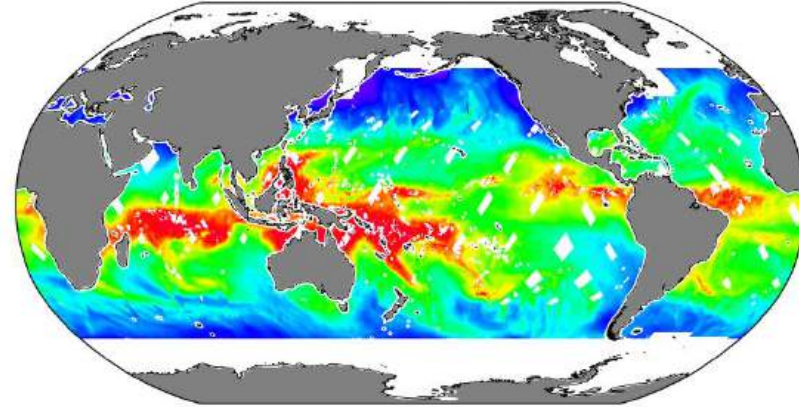
AMSR2
2022-01-25 to 2022-01-27



COWVR
2022-01-25 to 2022-01-27

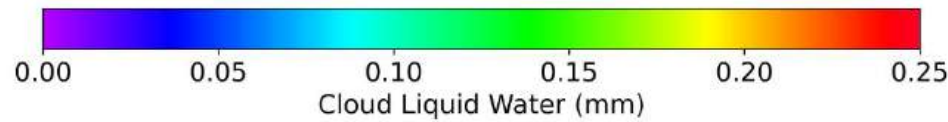
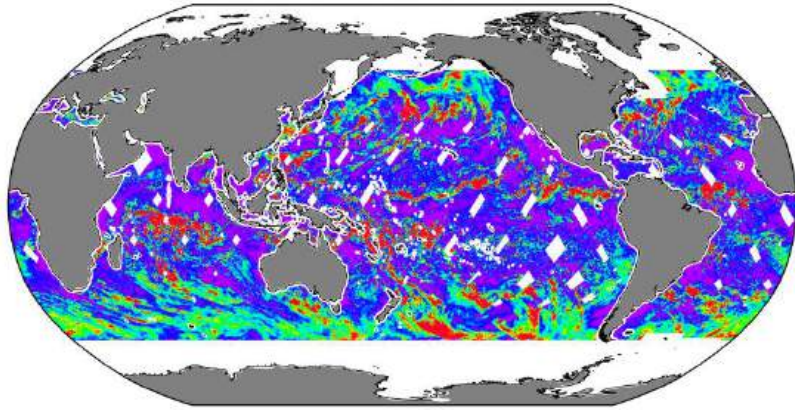


AMSR2
2022-01-25 to 2022-01-27

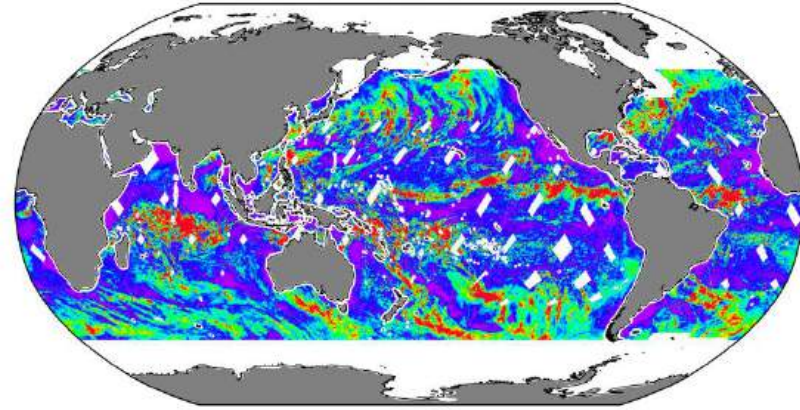




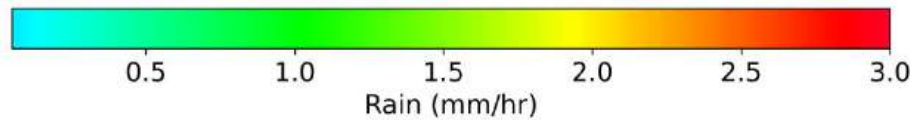
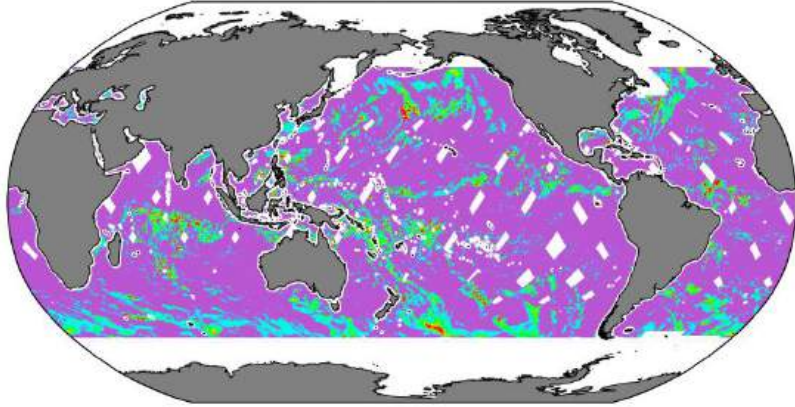
COWVR
2022-01-25 to 2022-01-27



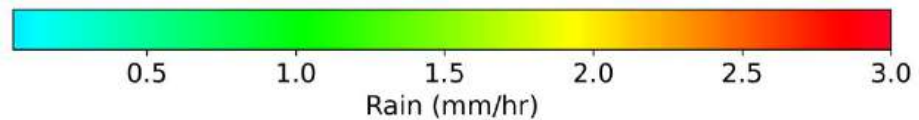
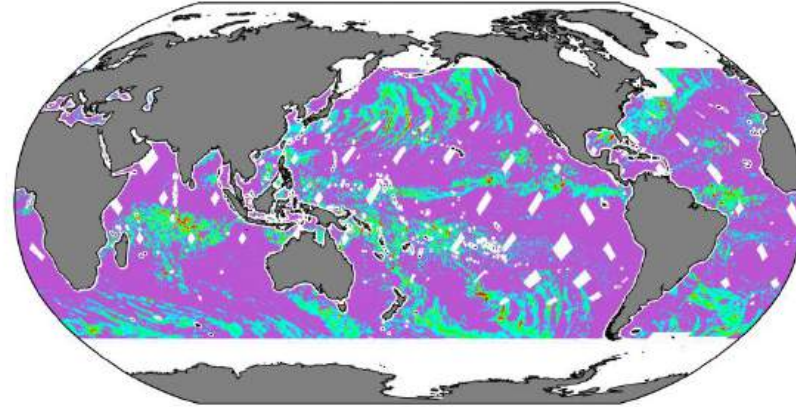
AMSR2
2022-01-25 to 2022-01-27



COWVR
2022-01-25 to 2022-01-27



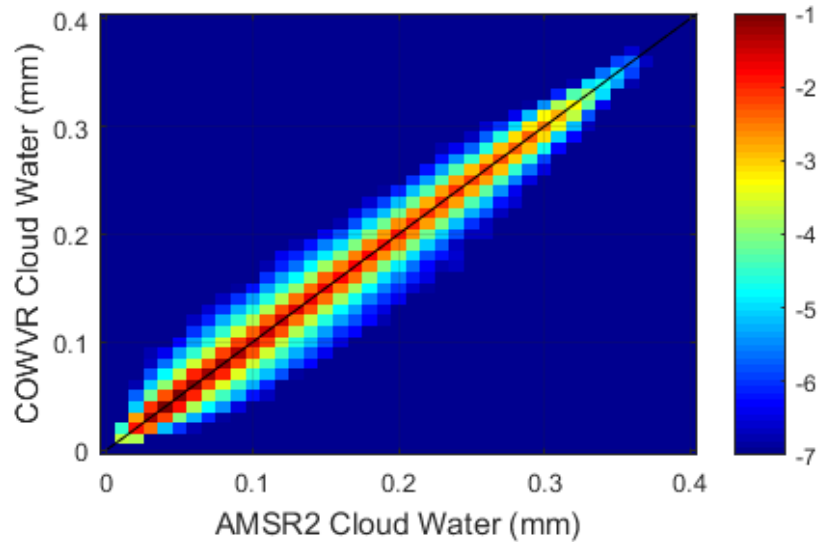
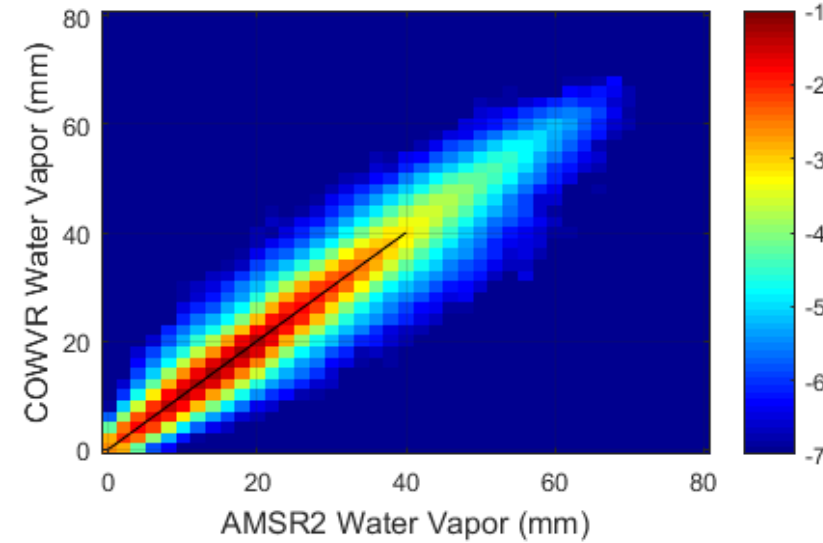
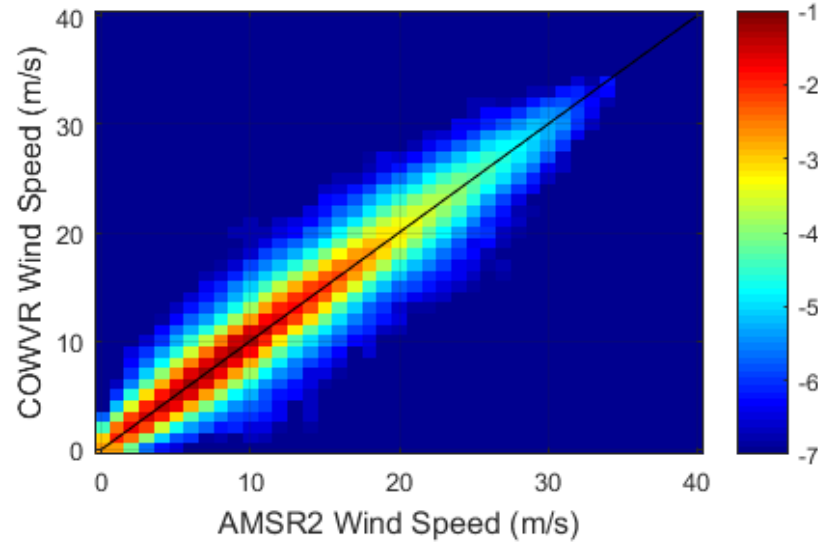
AMSR2
2022-01-25 to 2022-01-27





COWVR AS-ECV Comparisons

Remote Sensing Systems



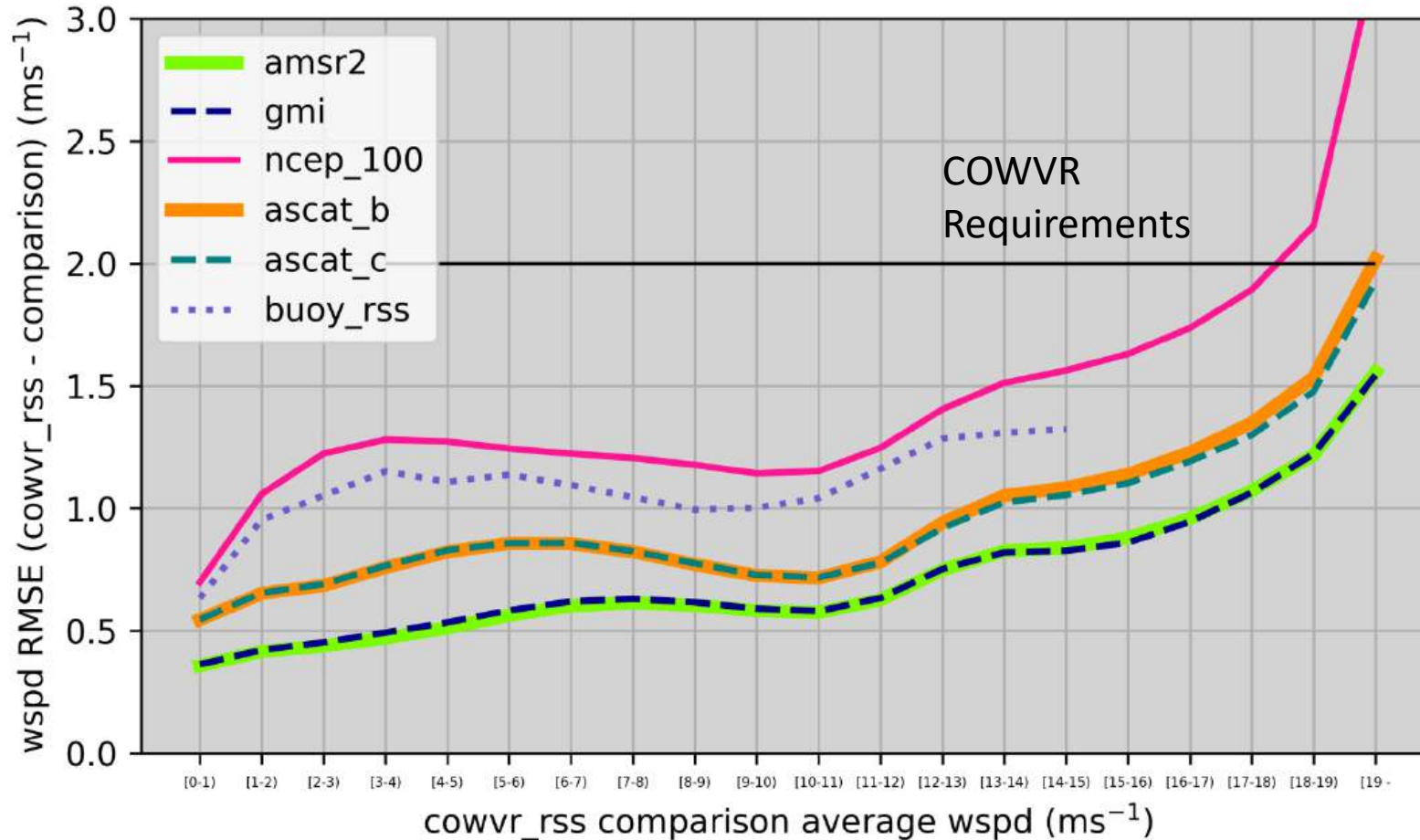
COWVR – AMSR2
1-hour collocations for 2022 – 2023

	Mean	Std. Dev.
Wind speed (m/s)	-0.007	0.810
Water vapor (mm)	-0.034	1.018
Cloud water (mm)	0.001	0.020

GMI comparisons look nearly the same
Note color bar scale is logarithmic



Wind Speed Comparison



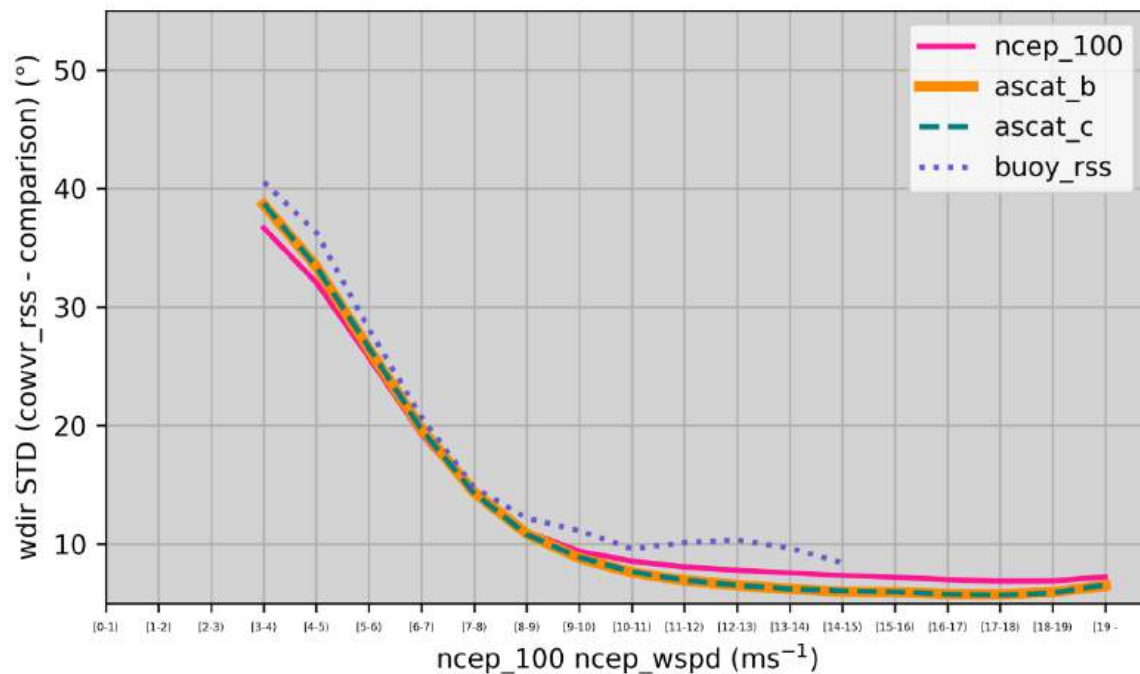
COWVR V901 Collocations for 2022-01-08 – 2023-12-26
1 hour maximum time difference

Excluded: rain, RFI, severe sun glint, single-look retrievals
For buoys only: excluded winds > 15 m/s

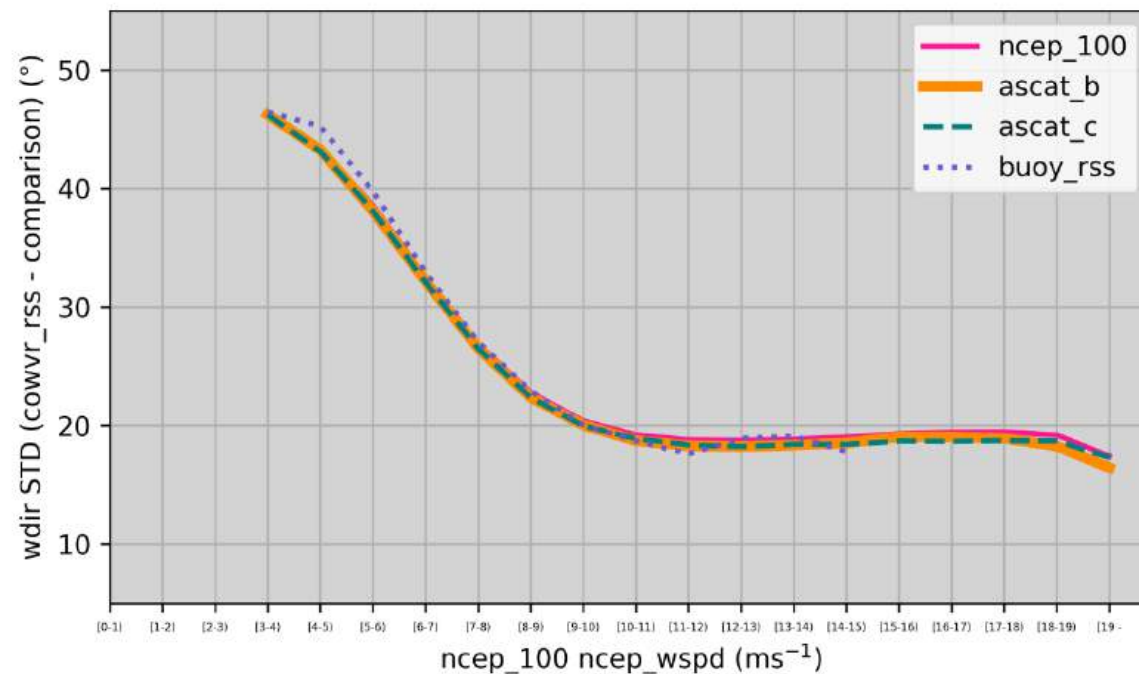


Wind Direction Comparison

Two Looks



One Look

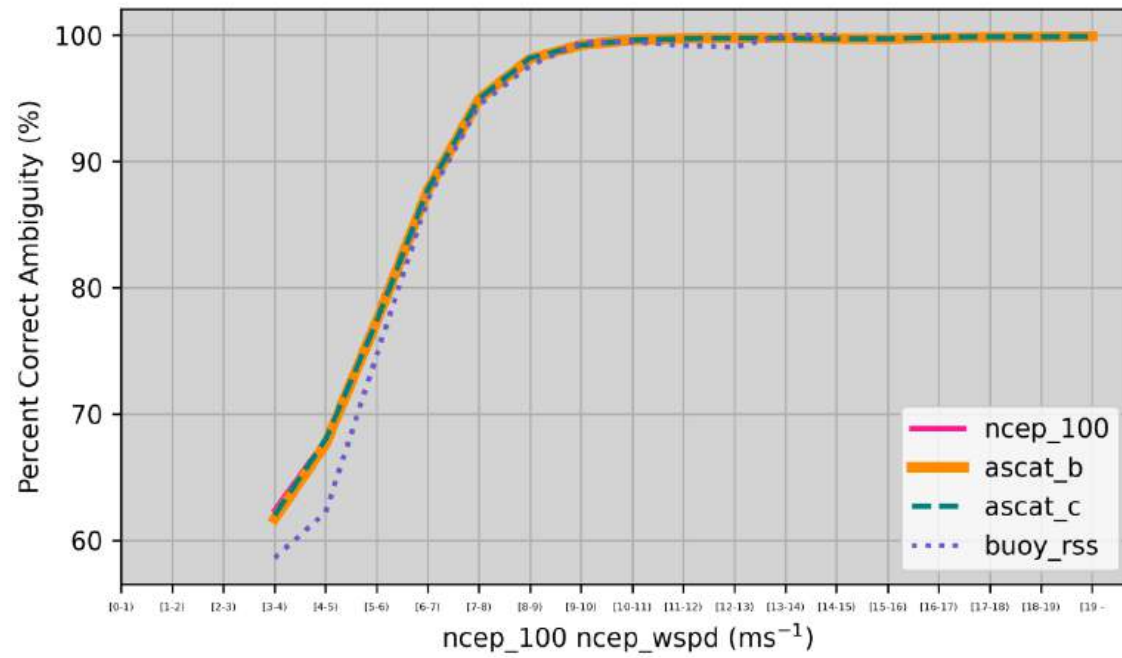


First-rank (lowest chi-squared value) ambiguity shown, direction errors $> 90^\circ$ excluded

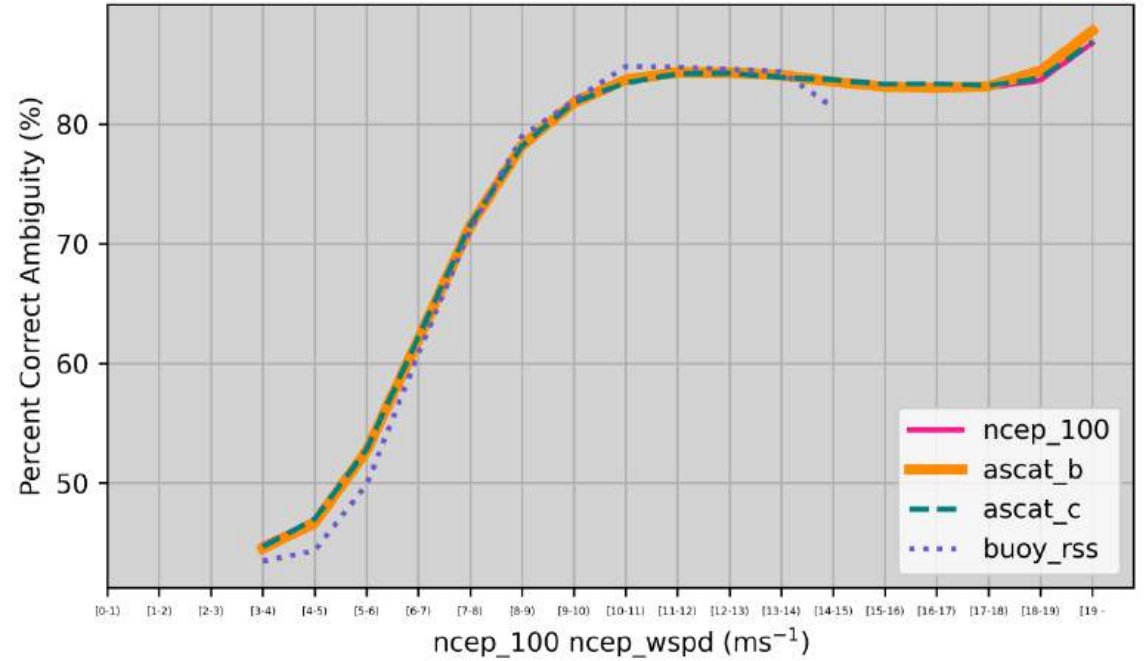


Ambiguity Skill

Two Looks



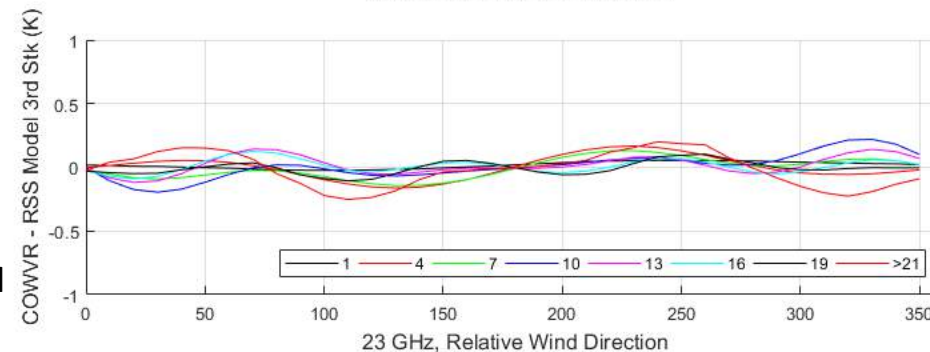
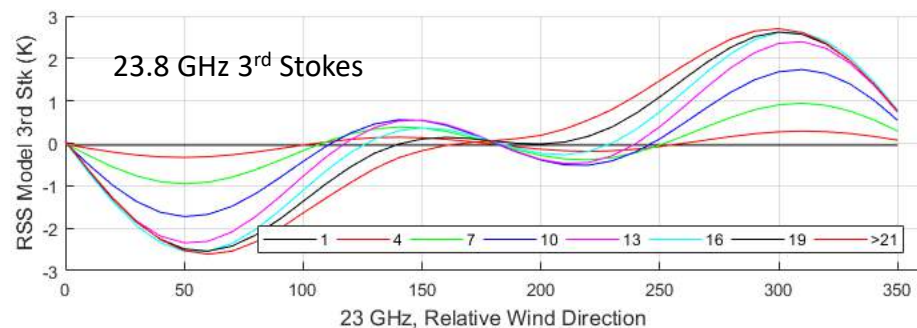
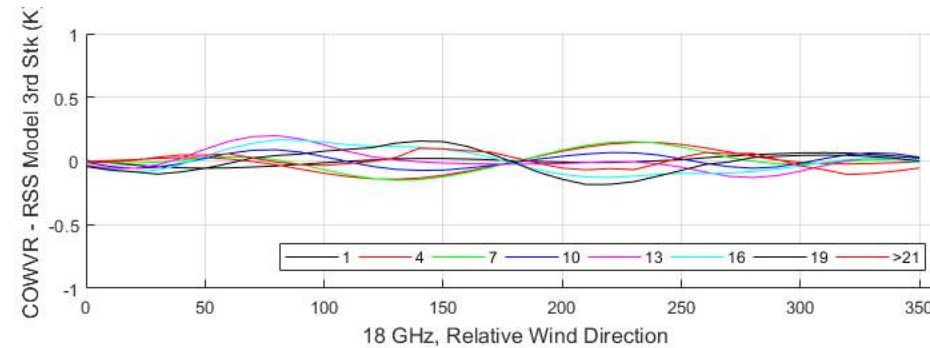
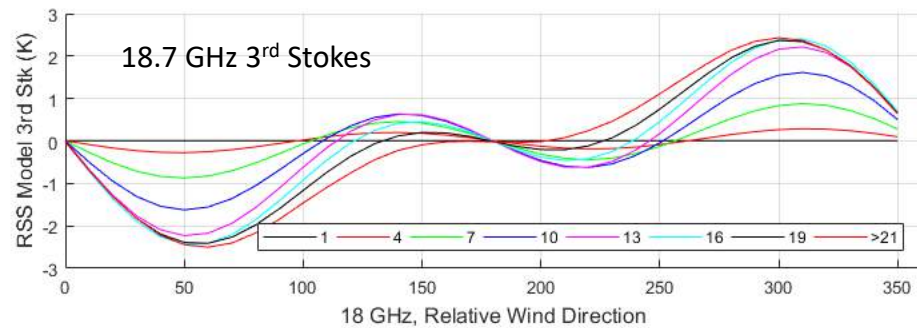
One Look



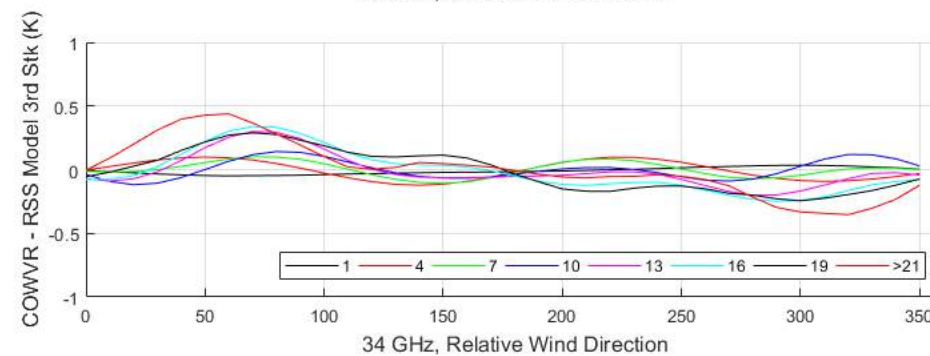
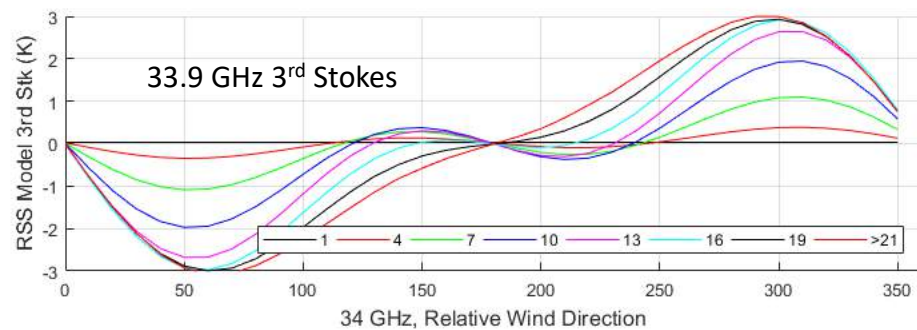


Polarimetric GMF Derived from WindSat Works Well for COWVR

No changes required (at least for now)



Colors are different wind speed bins (m/s)

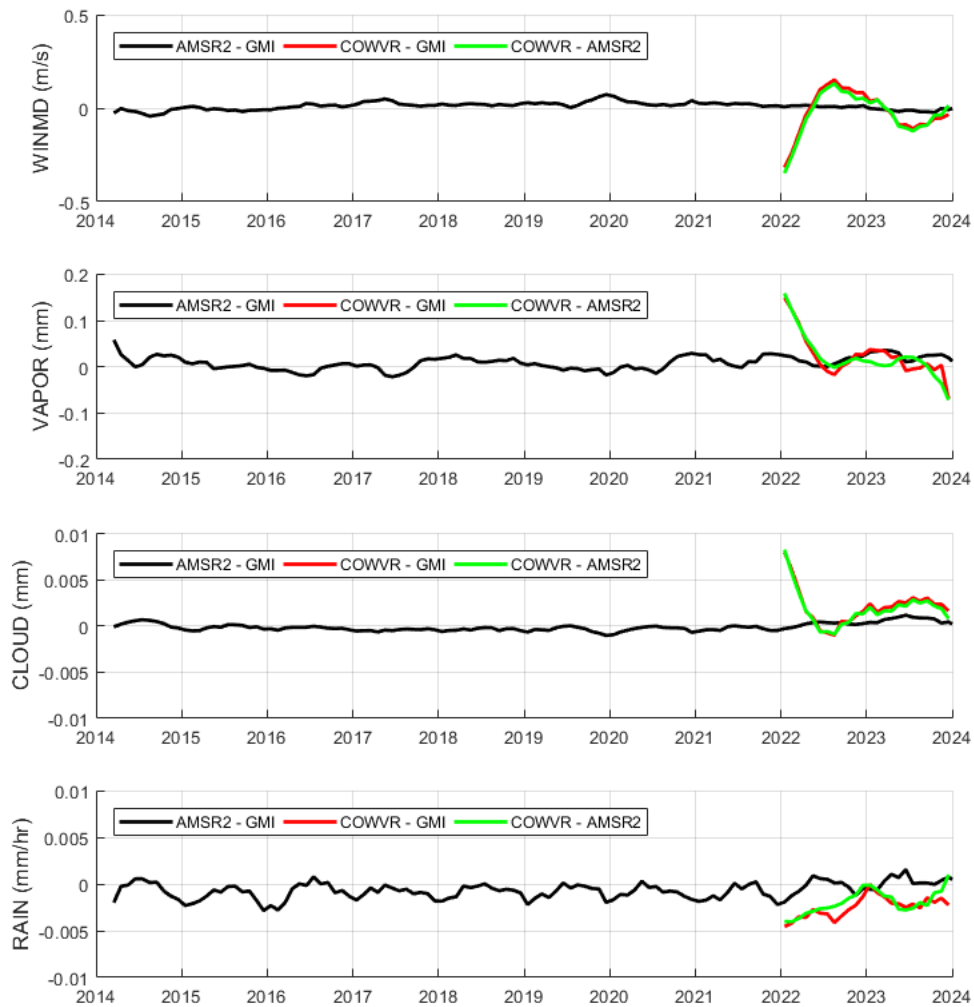


RSS Model

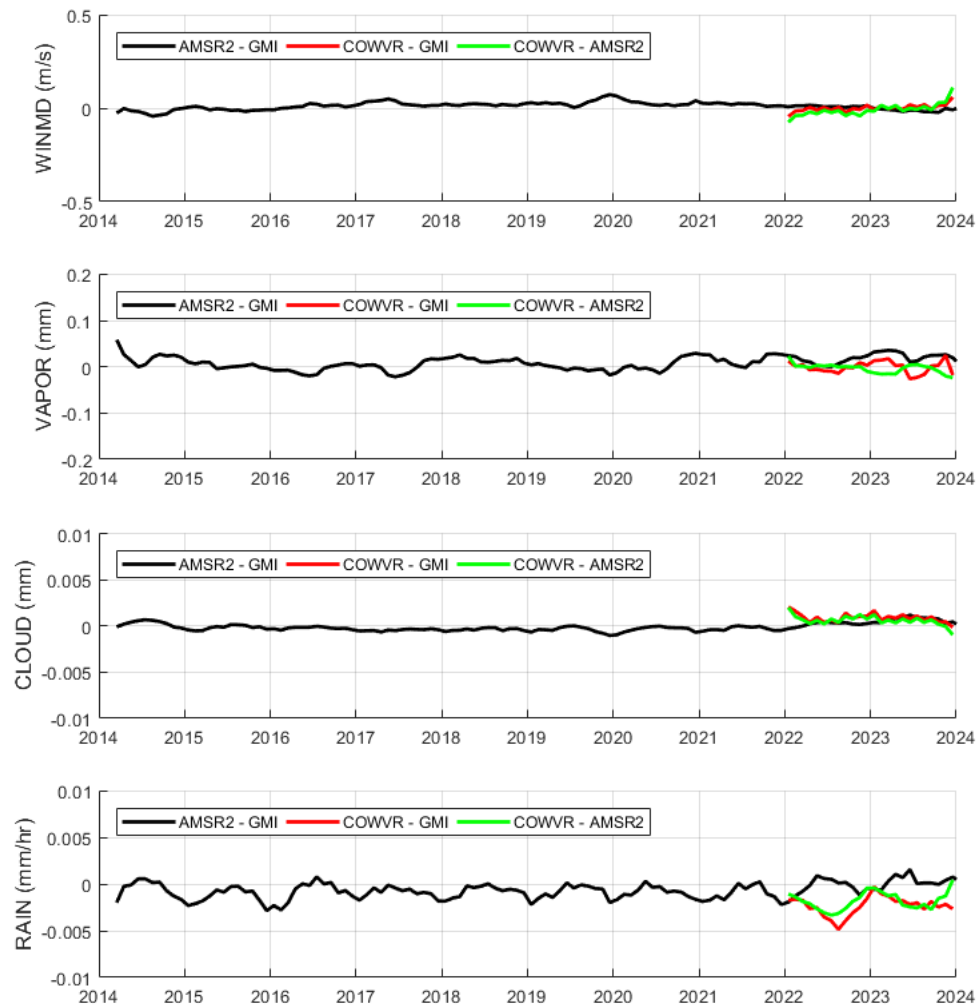
COWVR Measurements Minus RSS Model



Timeseries of COWVR, AMSR2, GMI AS-ECV Differences



No Time Correction

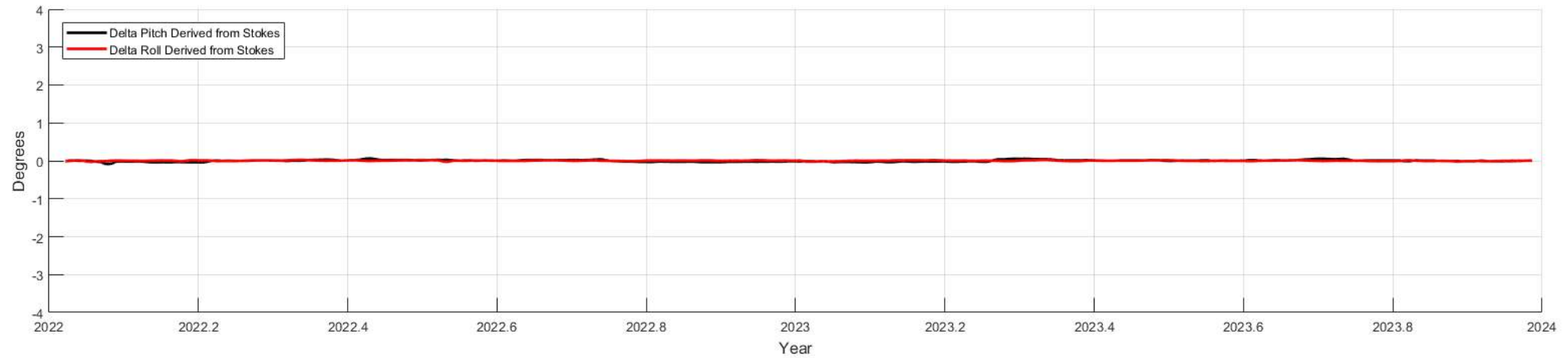
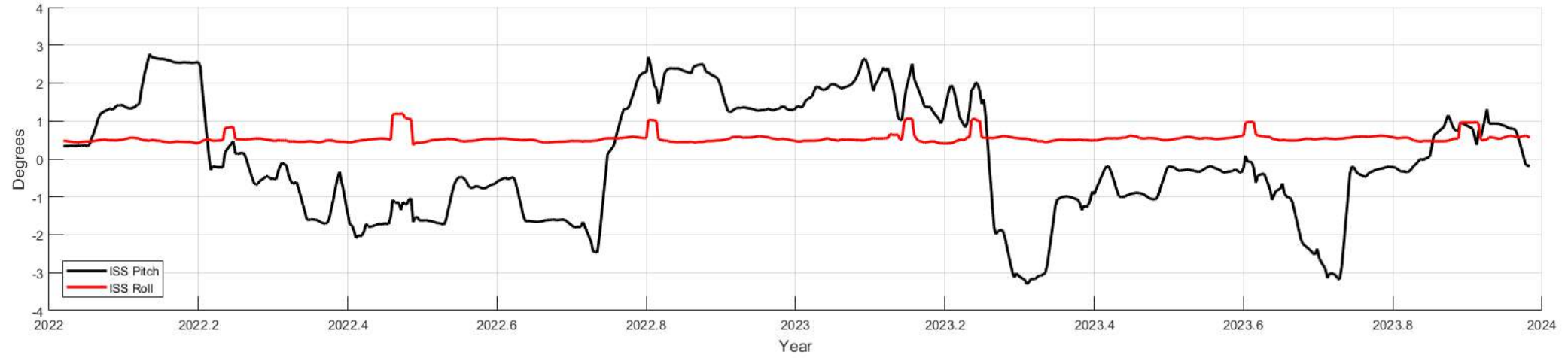


Drift in T_B Removed with 60-day Running Average

Appendix: extra slides

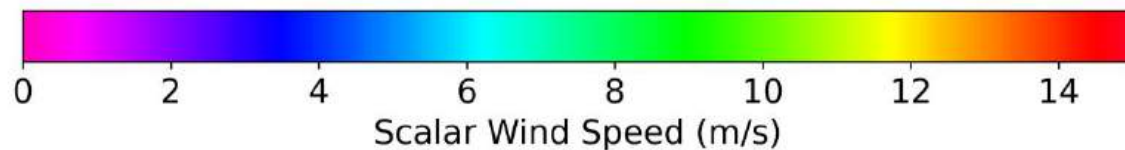
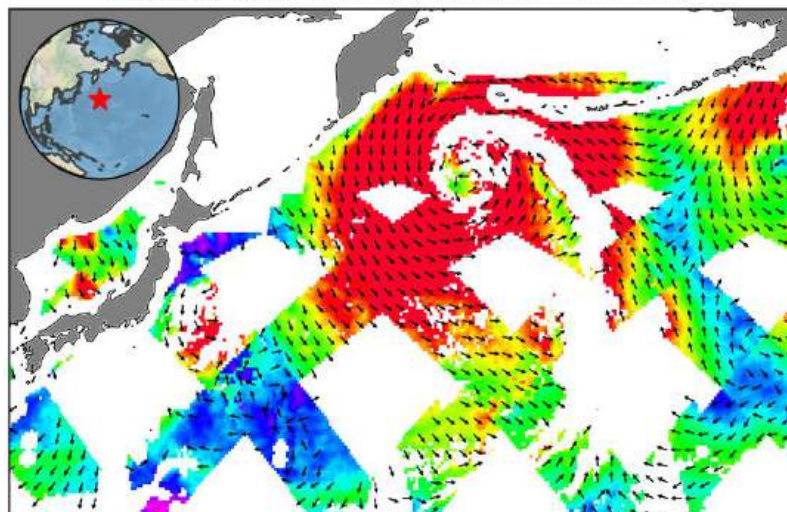


Same as a previous slide but y-axis scale on top and bottom frames are the same.
This shows how small the delta pitch and delta roll adjustments are.

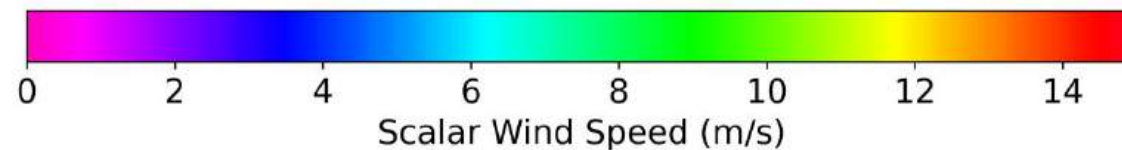
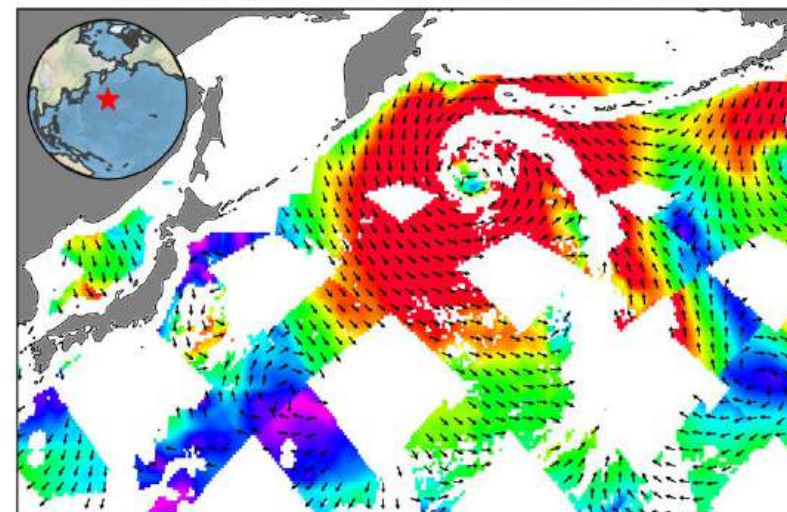




COWVR
2022-01-26 to 2022-01-26

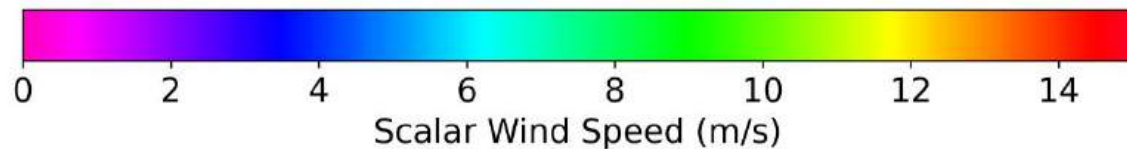
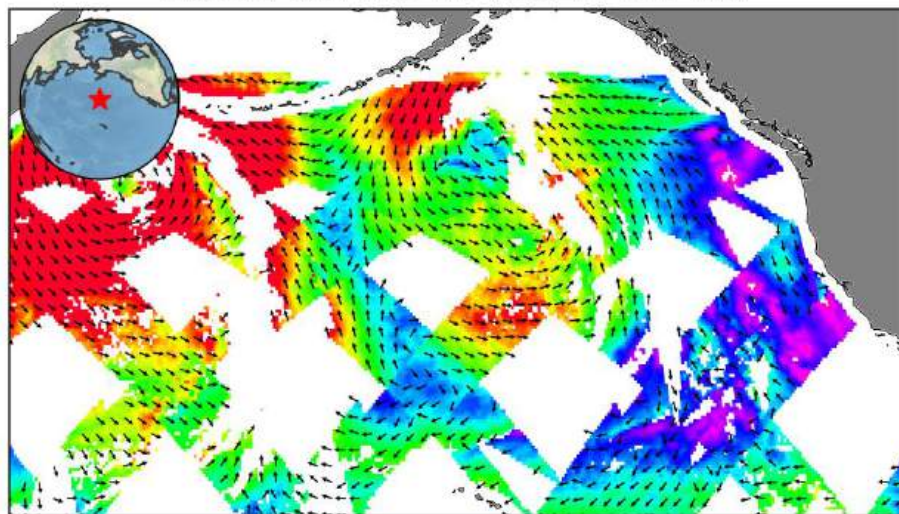


NCEP
2022-01-26 to 2022-01-26

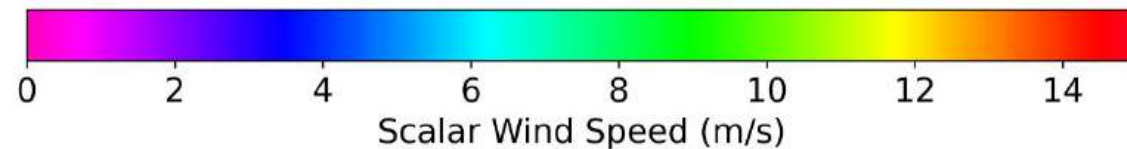
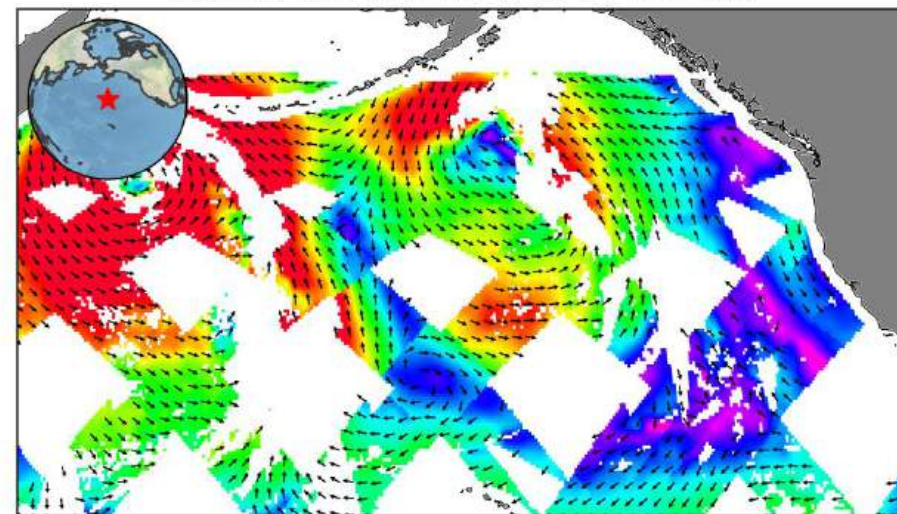




COWVR
2022-01-26 to 2022-01-26



NCEP
2022-01-26 to 2022-01-26



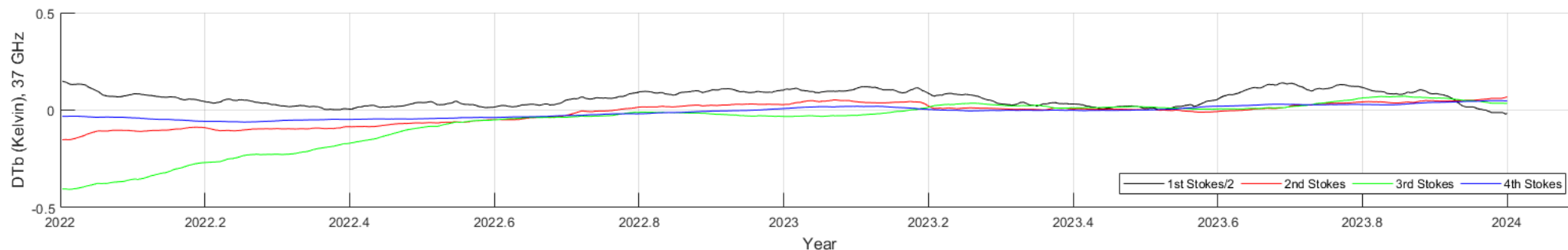
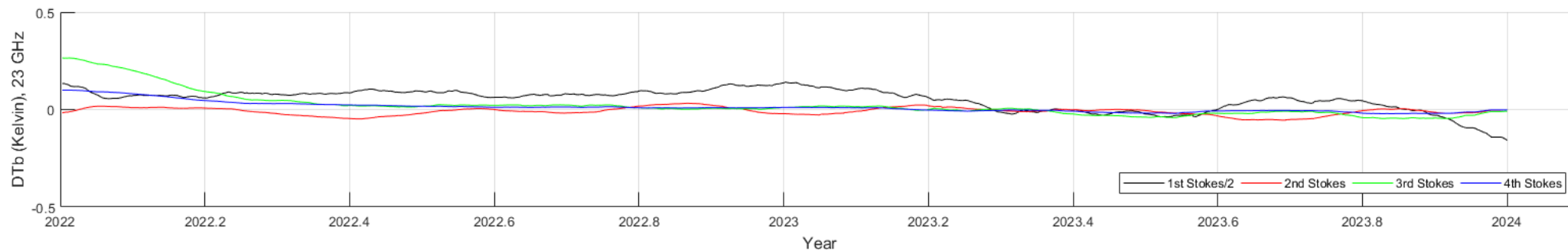
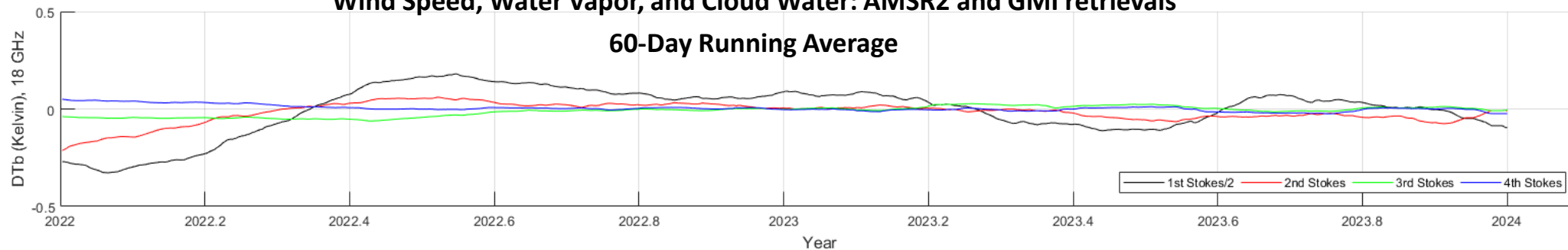


Timeseries of COWVR T_B Minus RTM

SST and Wind Direction: NCEP

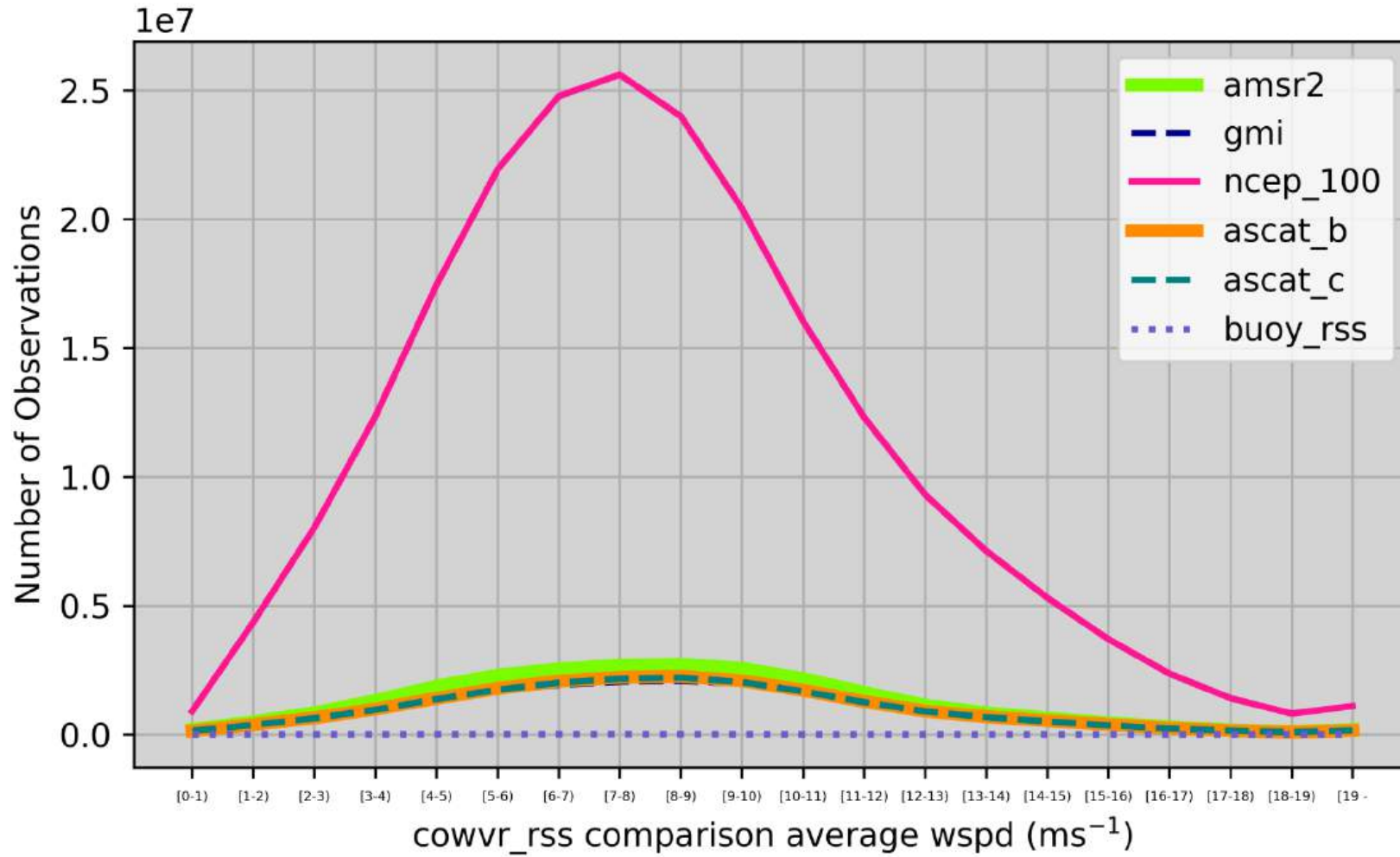
Wind Speed, Water Vapor, and Cloud Water: AMSR2 and GMI retrievals

60-Day Running Average





Wind Speed Comparison: Number of collocations





Wind Speed Comparison



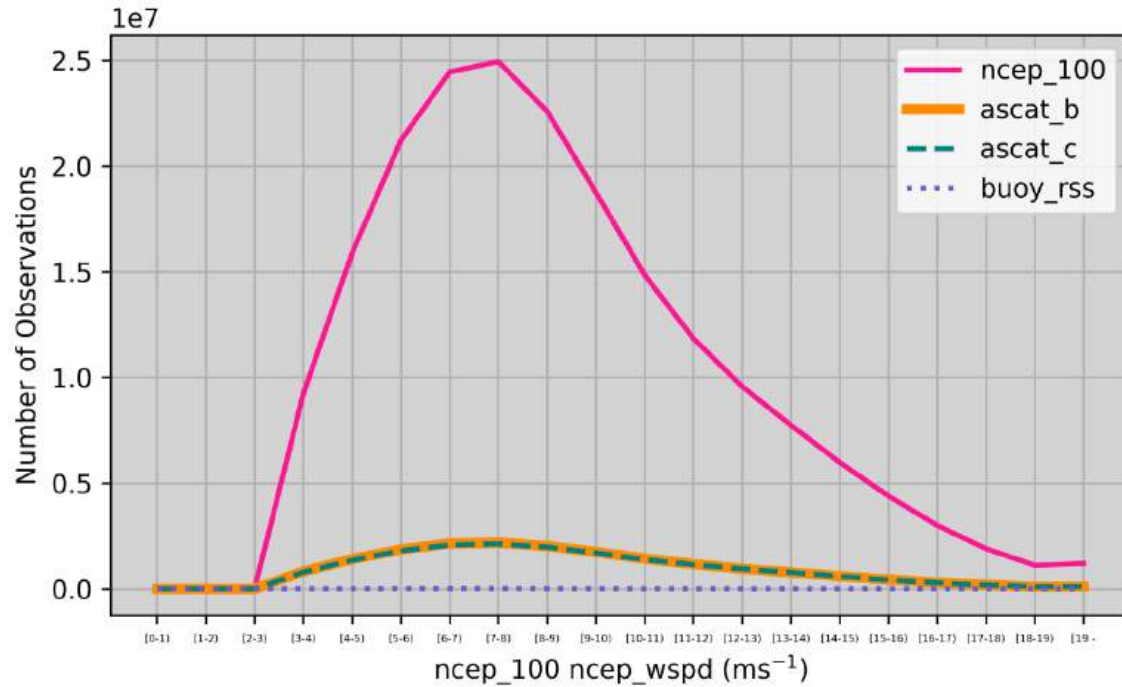
AMSR2 RMSE	0.36	0.42	0.44	0.47	0.51	0.56	0.60	0.61	0.60	0.58	0.57	0.63	0.75	0.83	0.84	0.88	0.96	1.07	1.22	1.56
GMI RMSE	0.36	0.42	0.45	0.49	0.53	0.58	0.62	0.63	0.62	0.59	0.58	0.63	0.75	0.82	0.83	0.86	0.95	1.06	1.22	1.54
NCEP 1-deg RMSE	0.70	1.06	1.22	1.28	1.27	1.24	1.22	1.21	1.18	1.14	1.15	1.25	1.40	1.51	1.56	1.63	1.74	1.89	2.15	3.24
ASCAT-B RMSE	0.54	0.65	0.68	0.76	0.82	0.86	0.86	0.82	0.77	0.73	0.72	0.78	0.94	1.05	1.08	1.14	1.23	1.35	1.53	2.02
ASCAT-C RMSE	0.55	0.65	0.69	0.77	0.83	0.86	0.86	0.82	0.77	0.73	0.72	0.78	0.92	1.02	1.05	1.10	1.19	1.30	1.48	1.93
Buoy RSS RMSE	0.63	0.95	1.05	1.15	1.11	1.14	1.09	1.05	0.99	1.00	1.04	1.16	1.28	1.31	1.32					

Each column corresponds to a wind speed bin in the previous figures
Units are in m/s

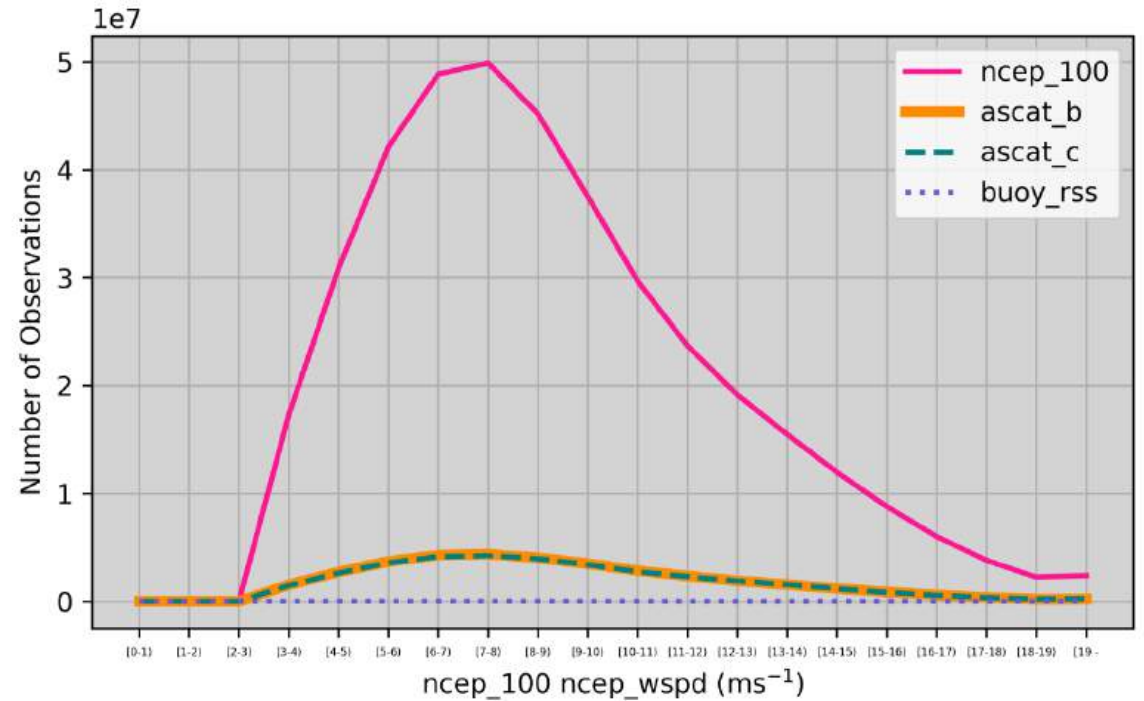


Wind Direction Comparison: Number of collocations

Two Looks



One Look

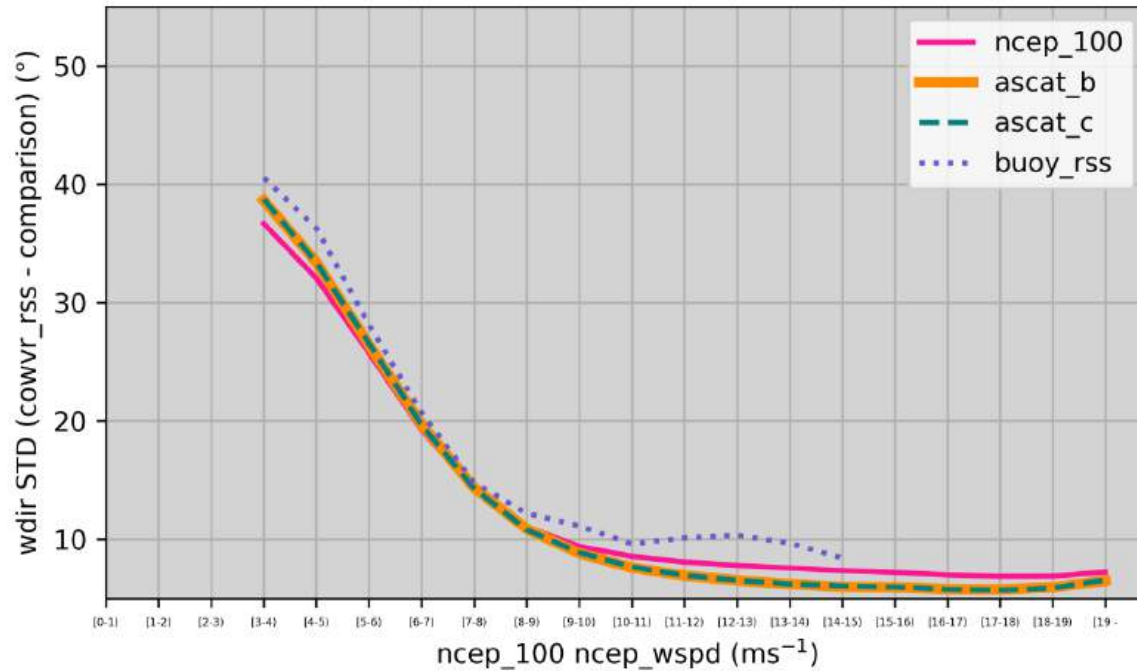


Wind speeds < 3 m/s omitted

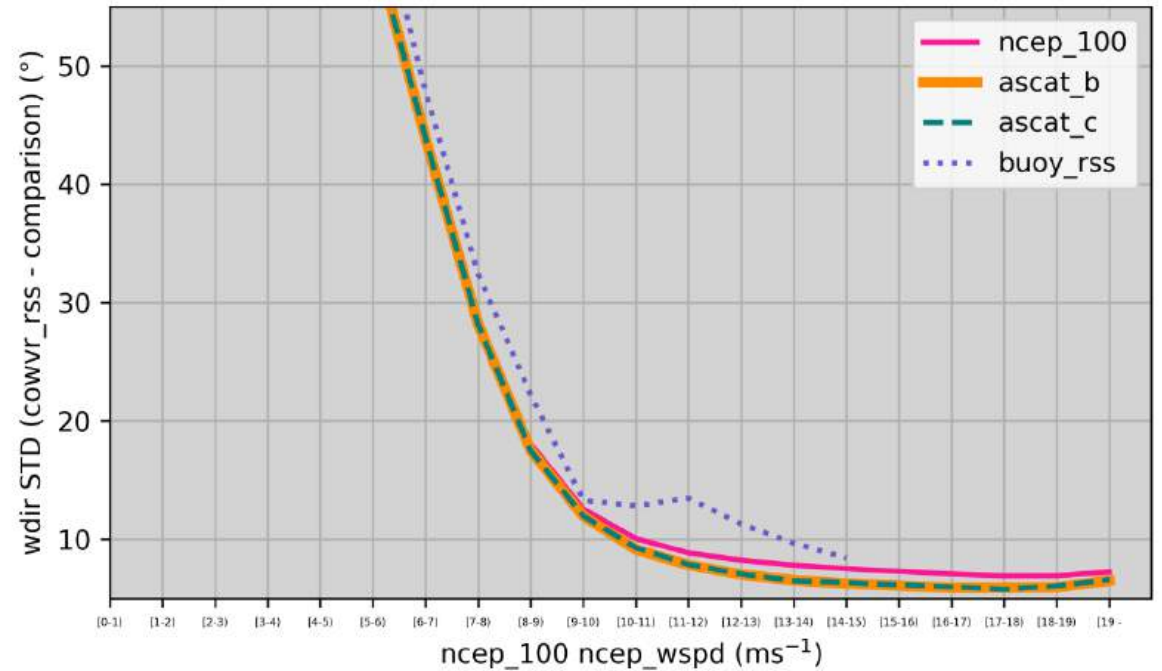


Wind Direction Comparison Two Looks

Ambiguity: first-rank (lowest sum-of-squares error)
(only within $\leq 90^\circ$)



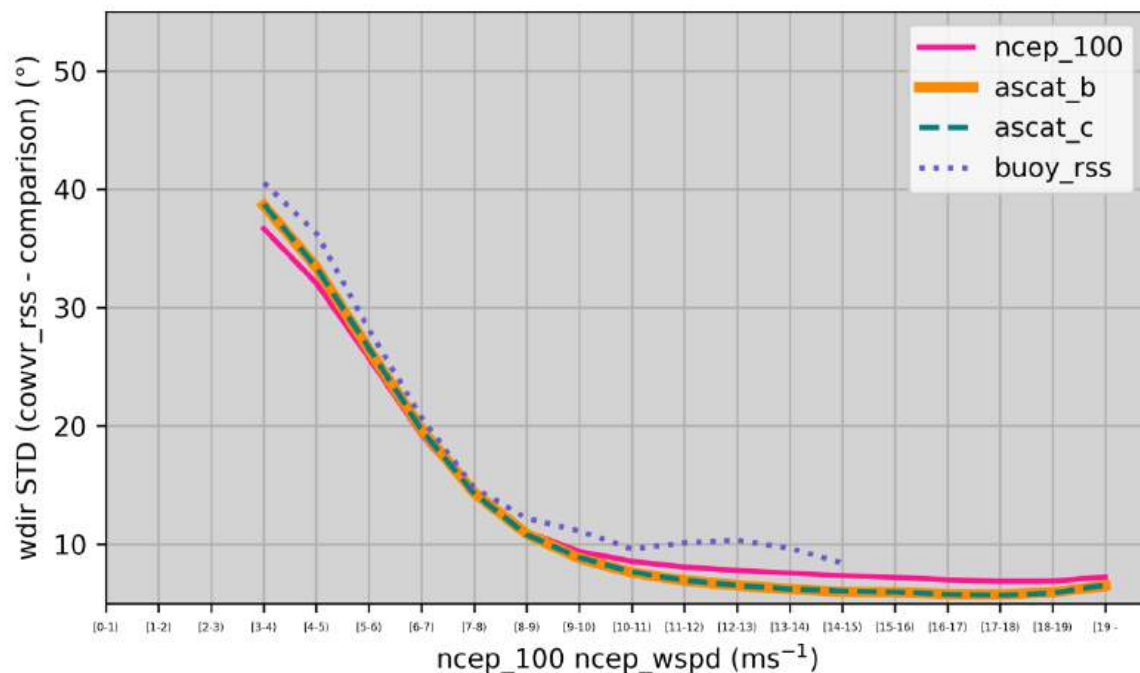
Ambiguity: first-rank (lowest sum-of-squares error)
(no exclusions)



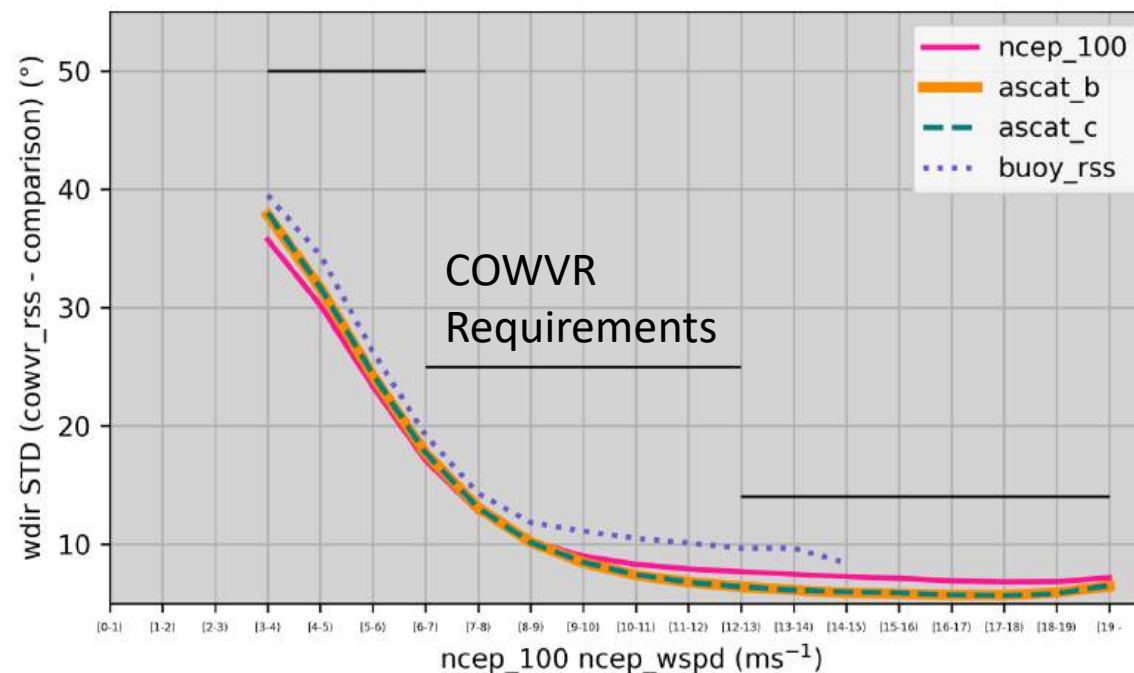


Wind Direction Comparison Two Looks

Ambiguity: first-rank (lowest sum-of-squares error)
(only within $\leq 90^\circ$)



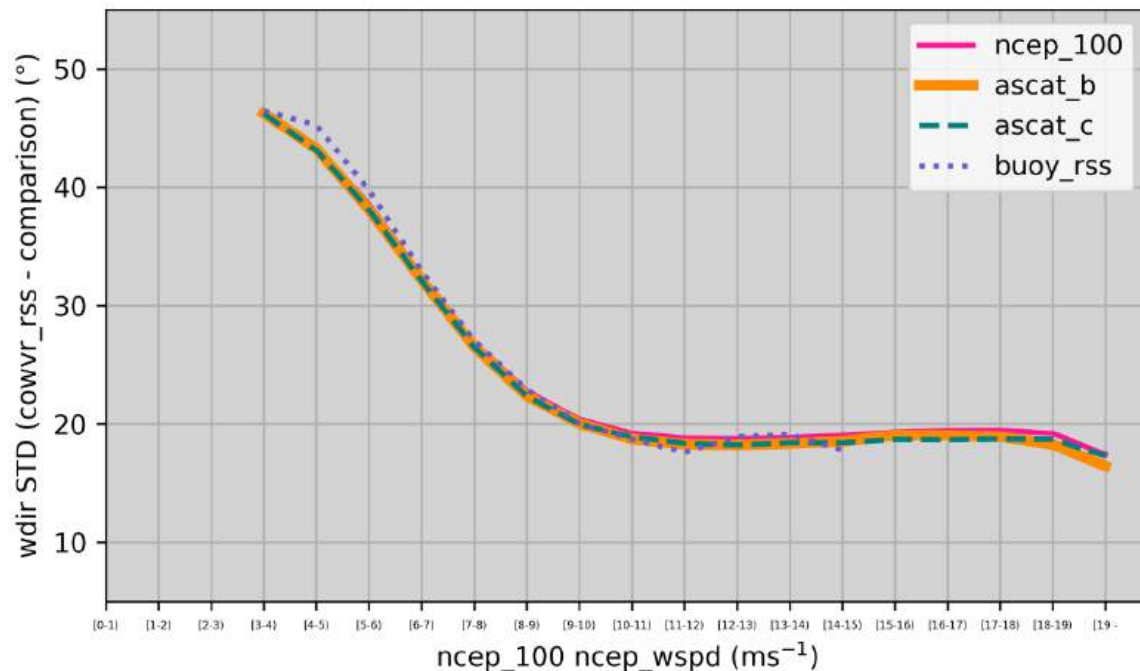
Ambiguity: closest to comparison



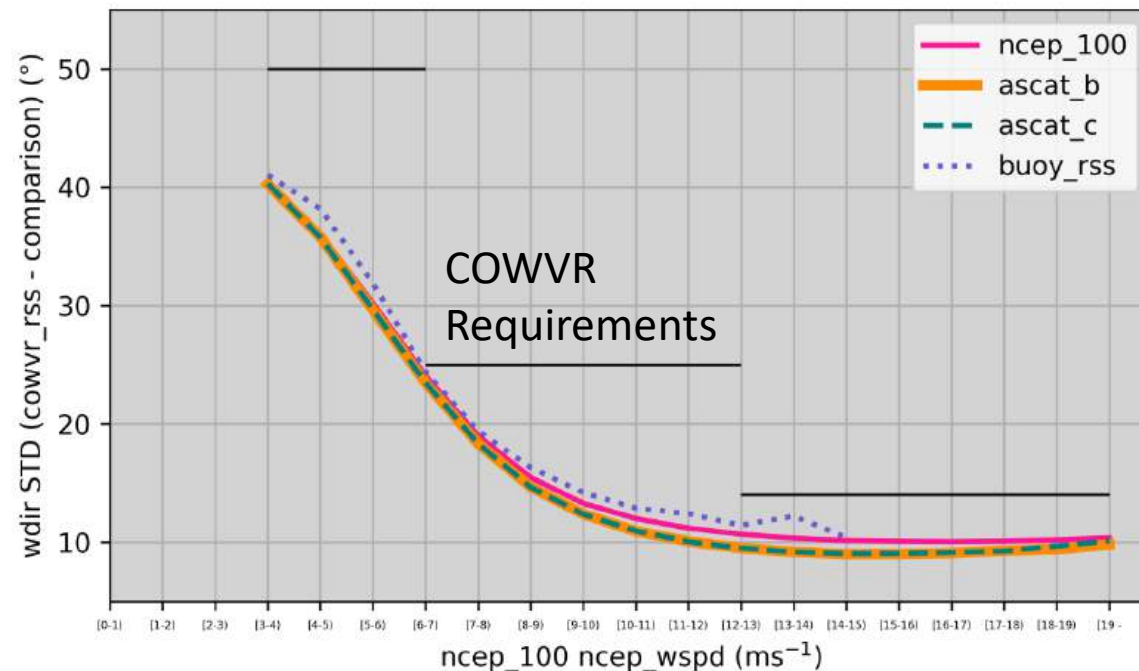


Wind Direction Comparison One Look

Ambiguity: first-rank (lowest sum-of-squares error)
(only within $\leq 90^\circ$)



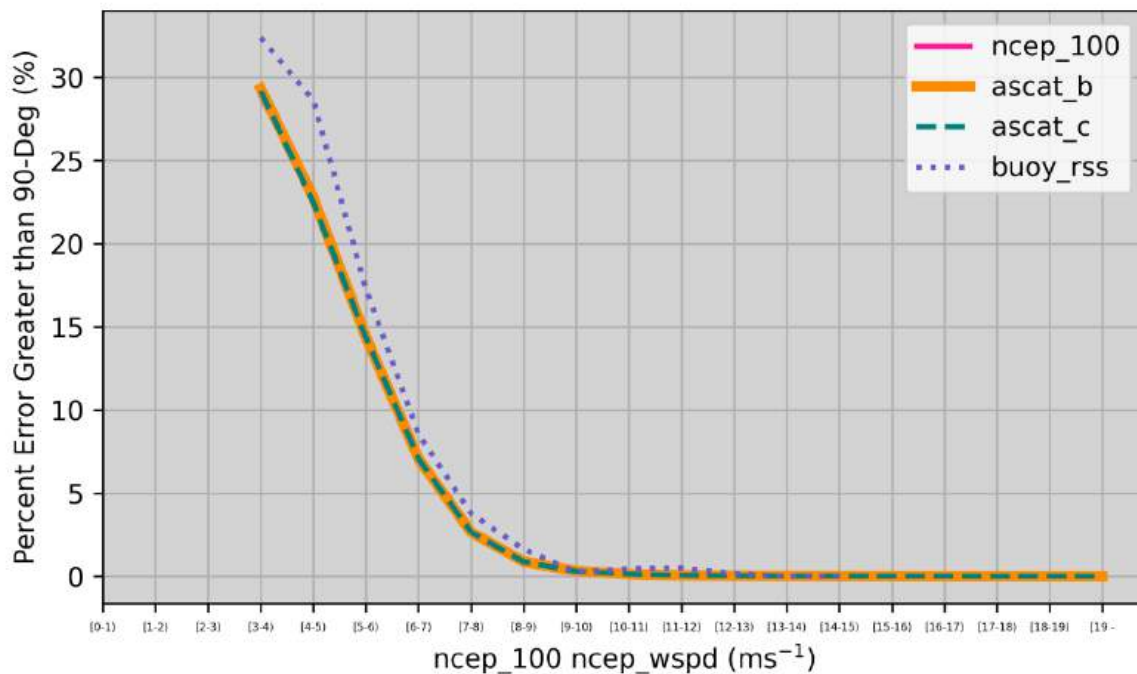
Ambiguity: closest to comparison



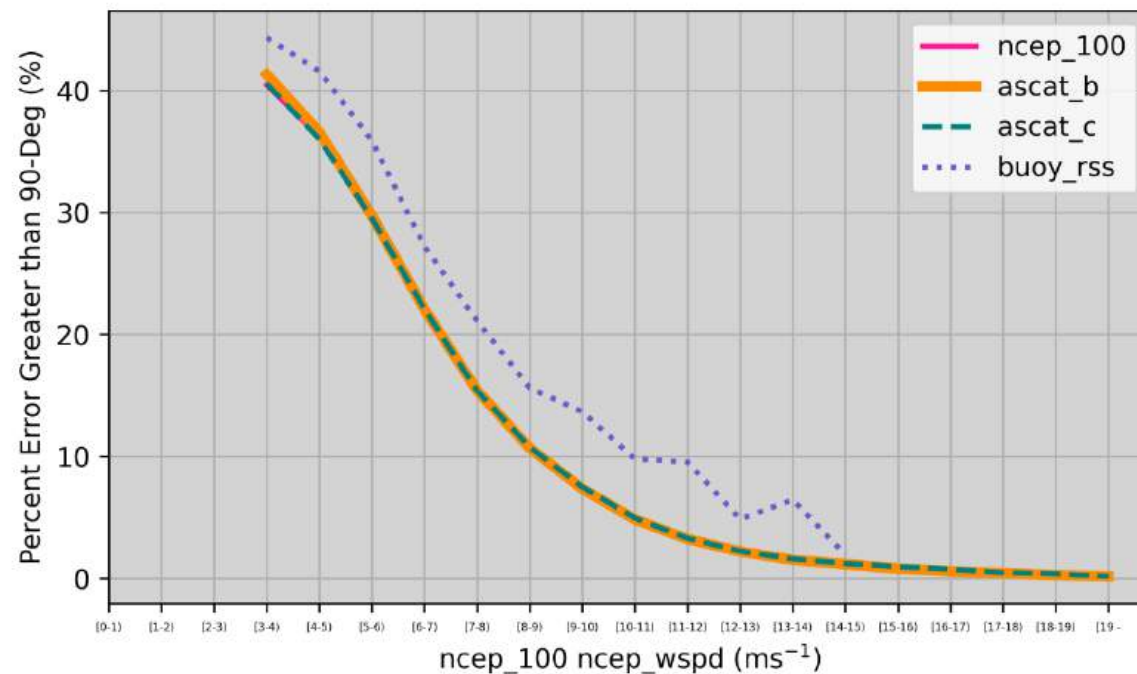


Wind Direction Comparison: Percentage > 90° error for first-rank ambiguity

Two Looks

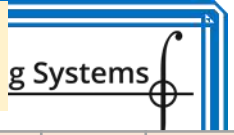


One Look





Wind Direction Comparison: Each column corresponds to a wind speed bin in the previous figures; units are in degrees



NCEP 1-deg: Closest to NCEP 1-deg STD	35.73	30.21	23.34	17.08	12.76	10.30	8.98	8.30	7.93	7.69	7.47	7.27	7.11	6.91	6.81	6.83	7.17
NCEP 1-deg: Lowest SOS (≤ 90 deg err) STD	36.68	32.06	25.76	19.24	14.15	11.05	9.40	8.55	8.08	7.80	7.56	7.36	7.20	6.99	6.87	6.88	7.23
NCEP 1-deg: Lowest SOS STD	83.19	74.70	61.40	44.59	44.59	18.06	12.56	10.05	8.85	8.23	7.82	7.51	7.30	7.06	6.91	6.92	7.24
NCEP 1-deg: 1-Look Closest to NCEP 1-deg STD	40.38	36.08	30.21	24.08	19.00	15.47	13.29	12.00	11.19	10.68	10.34	10.14	10.07	10.05	10.09	10.20	10.37
NCEP 1-deg: 1-Look Lowest SOS (≤ 90 deg err) STD	46.41	43.44	38.57	32.52	26.88	22.77	20.39	19.22	18.79	18.75	18.85	19.03	19.31	19.44	19.47	19.20	17.41
NCEP 1-deg: Skill	62.37	67.95	77.09	87.48	94.83	98.10	99.21	99.58	99.72	99.75	99.74	99.71	99.71	99.75	99.81	99.86	99.89
ASCAT-B: Closest to ASCAT-B STD	37.83	31.65	24.23	17.71	13.10	10.18	8.45	7.39	6.80	6.42	6.12	5.88	5.83	5.72	5.73	5.90	6.47
ASCAT-B: Lowest SOS (≤ 90 deg err) STD	38.64	33.41	26.44	19.71	14.36	10.87	8.81	7.6	6.93	6.53	6.21	5.97	5.94	5.80	5.76	5.93	6.49
ASCAT-B: Lowest SOS STD	83.31	74.63	60.75	43.88	28.19	17.51	11.96	9.13	7.83	7.02	6.54	6.25	6.08	5.90	5.90	5.95	6.51
ASCAT-B: 1-Look Closest to ASCAT-B STD	40.26	35.81	29.63	23.48	18.35	14.67	12.38	10.93	10.07	9.49	9.18	9.01	9.02	9.09	9.29	9.39	9.83
ASCAT-B: 1-Look Lowest SOS (≤ 90 deg err) STD	46.23	43.26	38.12	32.19	26.53	22.37	20.03	18.72	18.29	18.22	18.35	18.52	19.05	19.06	18.93	18.26	16.44
ASCAT-B: Skill	61.7	67.62	77.38	87.73	94.94	98.14	99.24	99.61	99.75	99.77	99.78	99.72	99.71	99.78	99.86	99.88	99.94
ASCAT-C: Closest to ASCAT-B STD	38.03	31.69	24.38	17.72	13.08	10.16	8.49	7.44	6.80	6.41	6.14	5.98	5.88	5.73	5.65	5.84	6.54
ASCAT-C: Lowest SOS (≤ 90 deg err) STD	38.74	33.38	26.59	19.64	14.31	10.80	8.88	7.66	6.94	6.53	6.23	6.06	5.96	5.78	5.70	5.88	6.57
ASCAT-C: Lowest SOS STD	83.01	74.15	60.68	43.87	28.14	17.46	11.97	9.28	7.87	7.06	6.50	6.34	6.15	5.98	5.78	6.06	6.59
ASCAT-C: 1-Look Closest to ASCAT-B STD	40.30	35.76	29.67	23.48	18.33	14.65	12.37	10.96	10.05	9.50	9.17	9.03	9.05	9.13	9.25	9.68	10.11
ASCAT-C: 1-Look Lowest SOS (≤ 90 deg err) STD	46.21	43.13	38.10	32.09	26.49	22.36	19.98	18.90	18.36	18.22	18.42	18.41	18.69	18.66	18.72	18.70	17.29
ASCAT-C: Skill	61.97	67.97	77.37	87.80	94.97	98.20	99.23	99.60	99.74	99.77	99.76	99.72	99.72	99.82	99.87	99.86	99.89
Buoy RSS: Closest to Buoy RSS STD	39.49	34.44	26.28	19.22	14.31	11.84	11.11	10.50	10.11	9.68	9.67	8.41					
Buoy RSS: Lowest SOS (≤ 90 deg err) STD	40.55	36.29	28.15	20.68	14.79	12.19	11.12	9.61	10.12	10.33	9.67	8.41					
Buoy RSS: Lowest SOS STD	87.09	82.82	65.74	47.85	32.41	22.22	13.30	12.83	13.48	11.29	9.67	8.41					
Buoy RSS: 1-Look Closest to Buoy RSS STD	41.03	38.19	31.89	24.40	19.40	16.32	14.19	12.89	12.42	11.43	12.21	10.40					
Buoy RSS: 1-Look Lowest SOS (≤ 90 deg err) STD	46.47	45.24	39.76	32.93	27.05	22.93	20.06	18.69	17.61	18.91	19.12	17.78					
Buoy RSS: Skill	58.59	62.2	74.69	87.05	94.46	97.60	99.41	99.47	99.20	99.06	100.	100.					