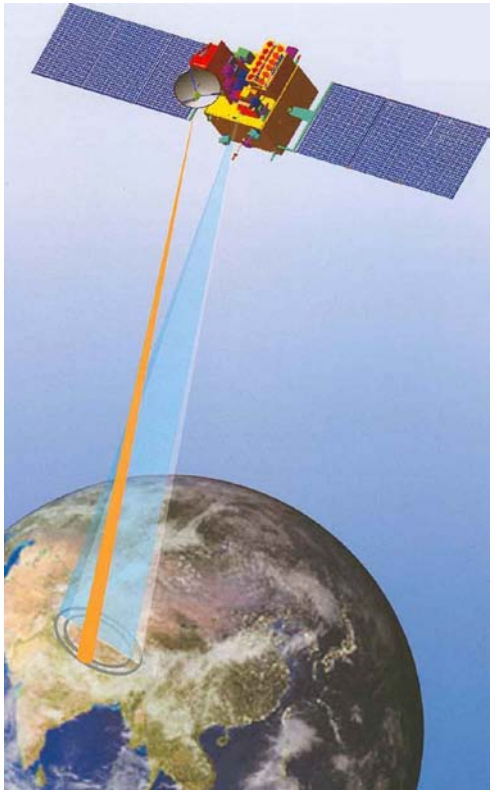
Evaluation of Marine Surface Vector Winds observed by Oceansat-2 Scatterometer

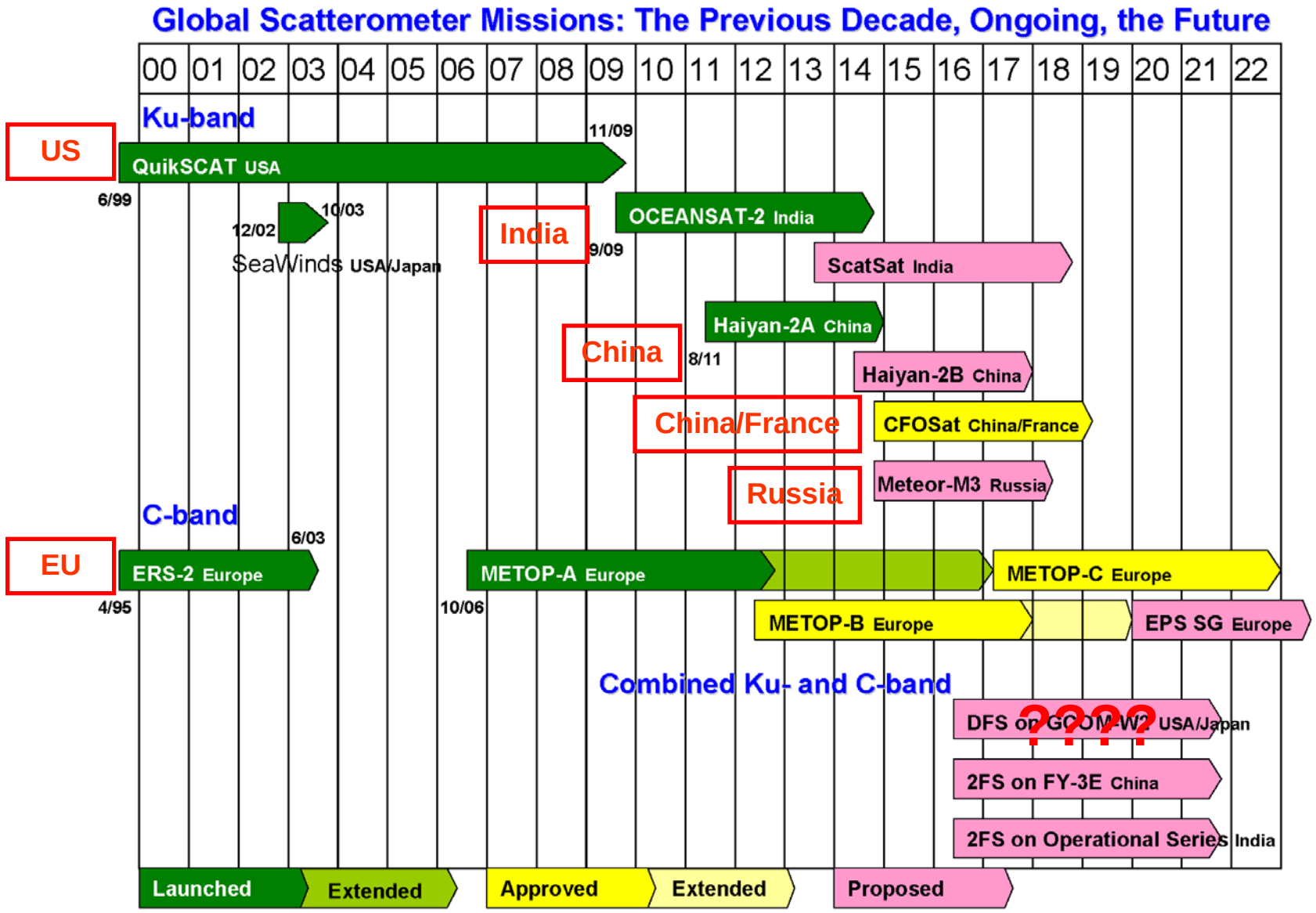


Naoto EBUCHI

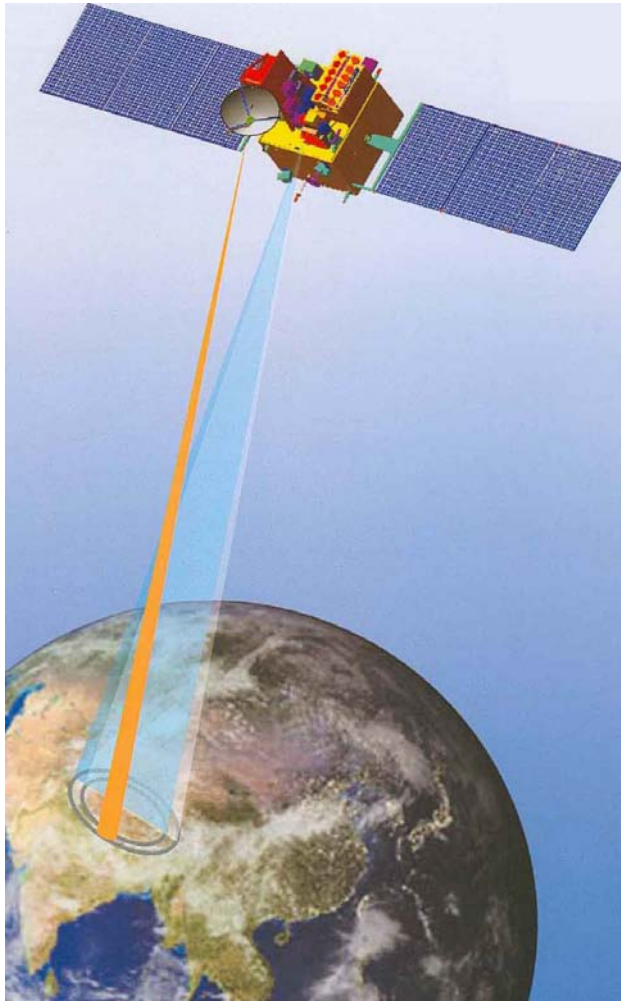
Institute of Low Temperature Science, Hokkaido University

ebuchi@lowtem.hokudai.ac.jp

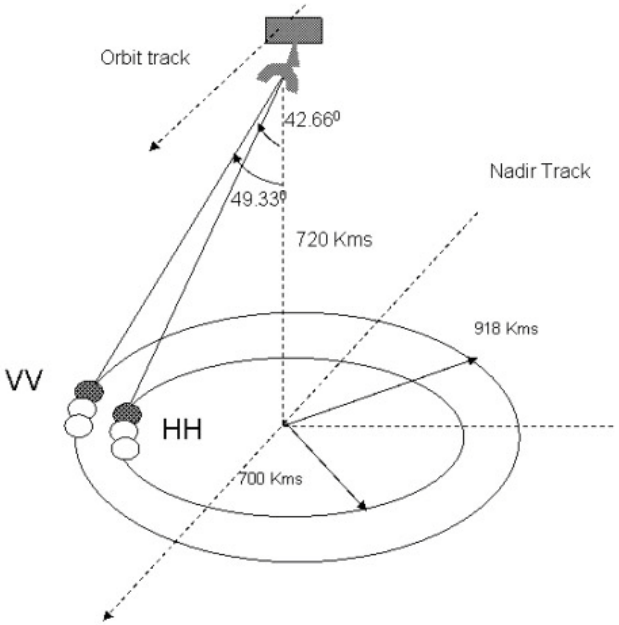
Spaceborne Scatterometer Missions



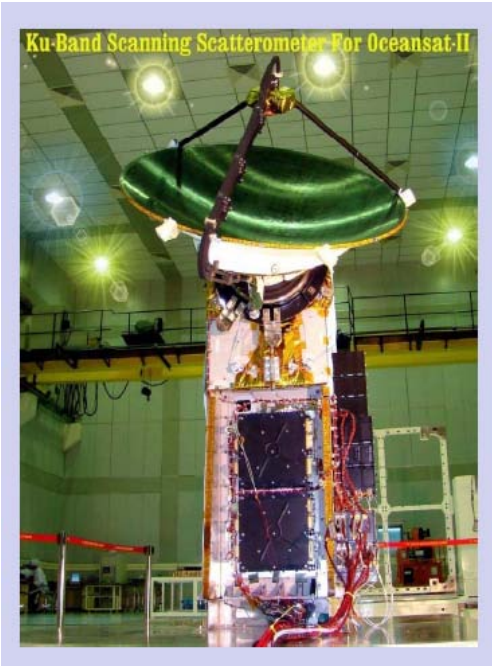
Oceansat-2 Scatterometer (OSCAT)



Ku-band (13.51 GHz)
Scanning dual pencil beam
VV and HH pol
50 km resolution
1800 km swath



Oceansat-II Scatterometer Viewing Geometry

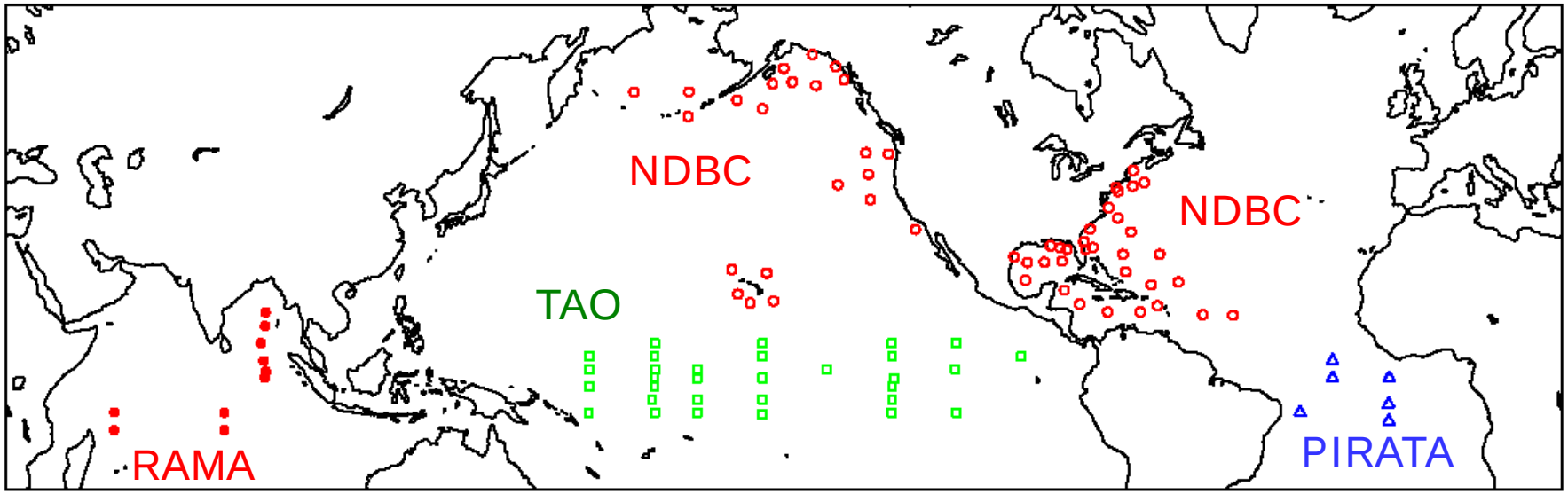


Outline

- Comparison of OSCAT wind vectors with data from ocean buoys

- Assessment of statistical distributions of OSCAT wind speeds and directions
  - Global wind speed histograms
  - Directional distributions relative to antenna beams

Buoy Data for Comparison with OSCAT



- Data Period

  - From 1 Jan. 2011 to 31 Mar. 2012

- Collocation

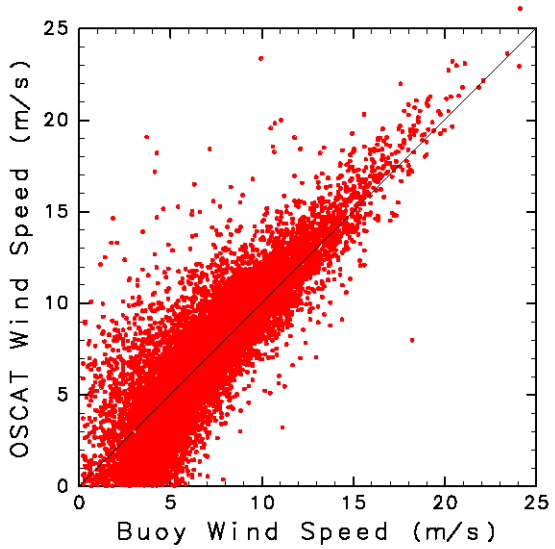
  - $\Delta r < 12.5$ km, $\Delta t < 10$ min.

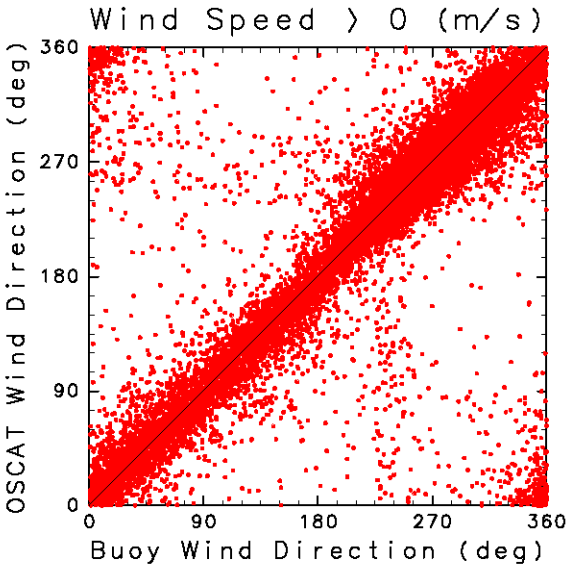
- Height and Stability Collections

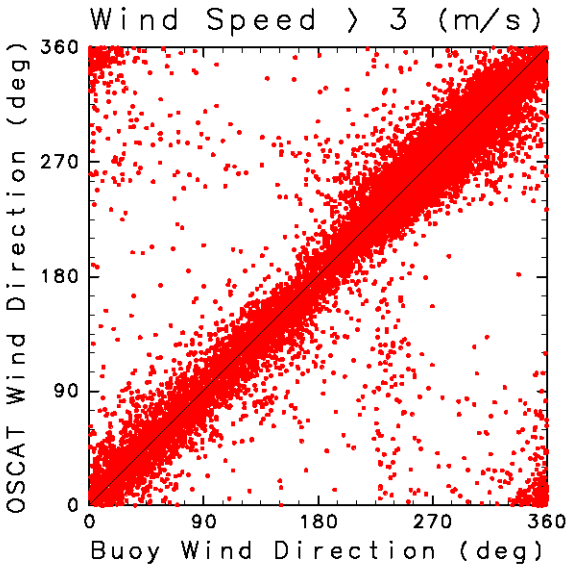
  - Liu and Tang (1996) Code
  - 10-m height Equivalent Neutral Wind Speed

Comparison of OSCAT Winds with Buoy Data

Ver. 1.3



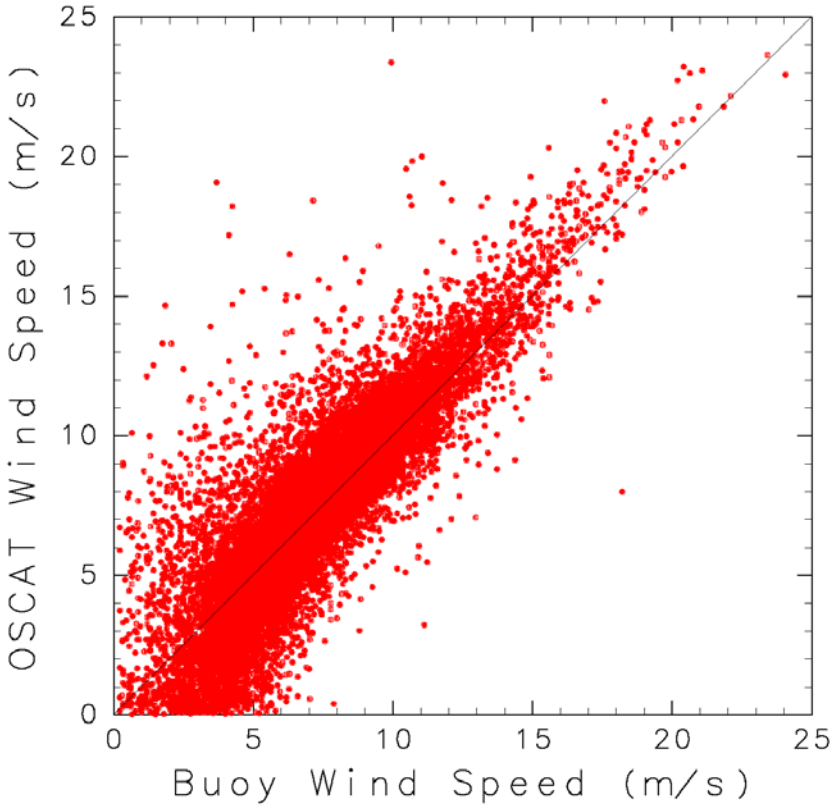


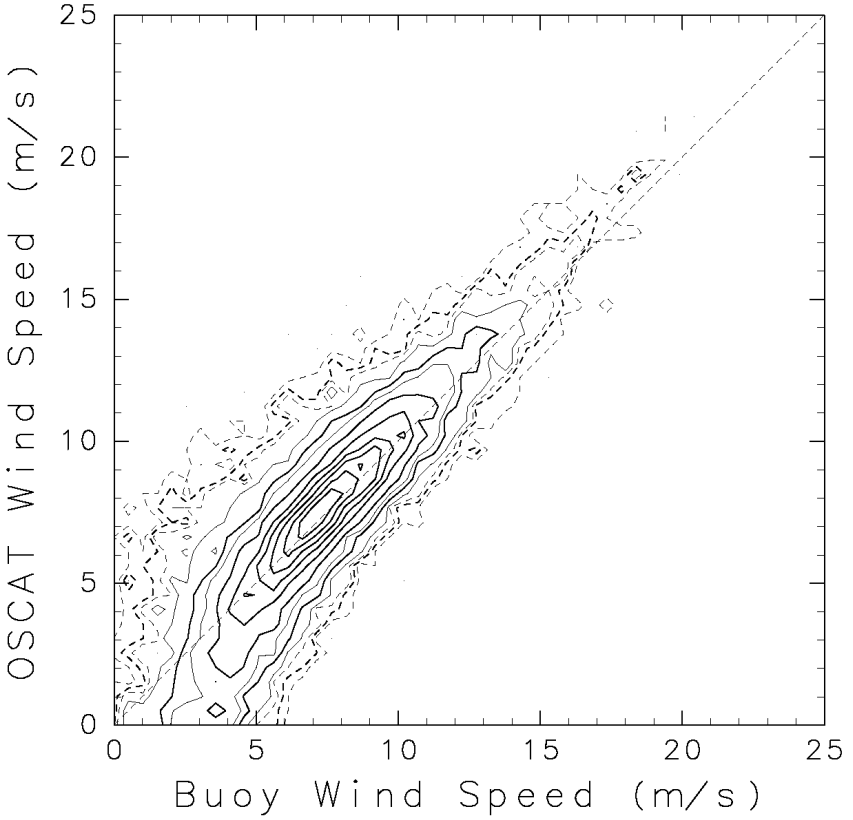


	#	Bias	RMS	Correlation
Wind Speed (m/s)	19,216	0.16	1.61	0.863
Wind Direction (deg.)				
U > 0 m/s	19,129	-0.1	30.9	0.947
U > 3 m/s	17,104	-0.2	24.7	0.964
U > 5 m/s	14,356	-0.1	21.2	0.973

Comparison of OSCAT Wind Speed with Buoy Data

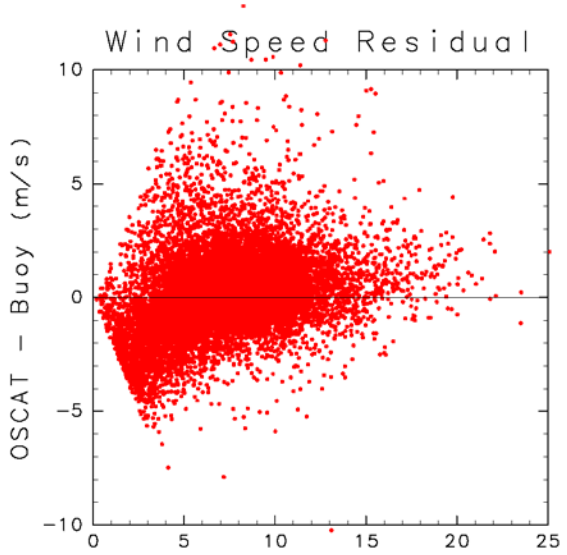
Ver. 1.3

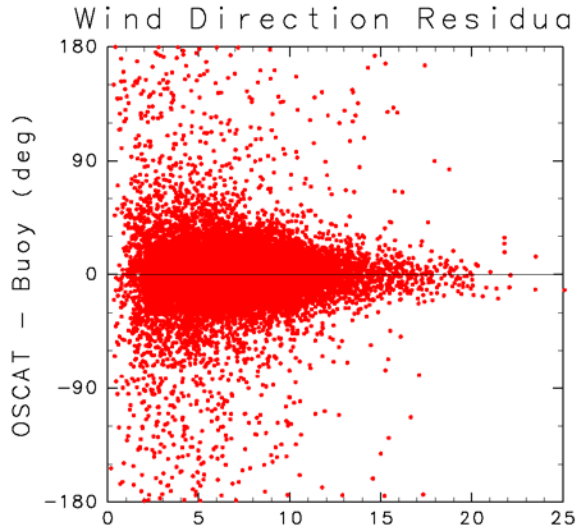


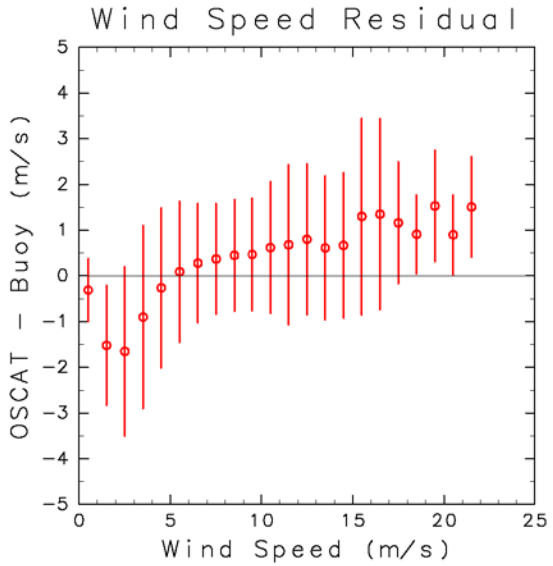


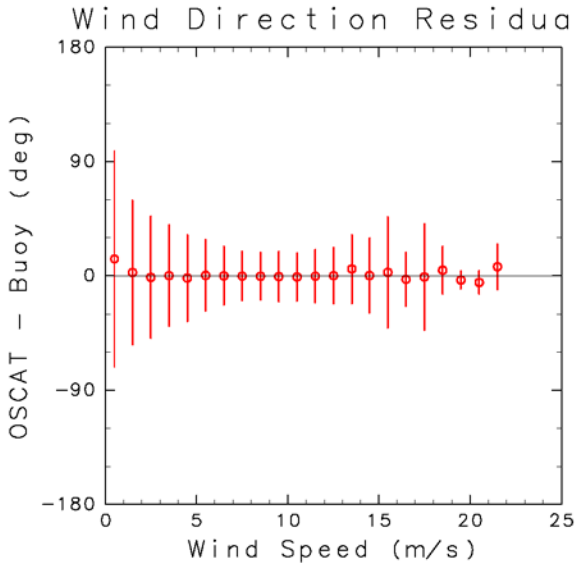
Residuals of Wind Speed and Direction

Ver. 1.3









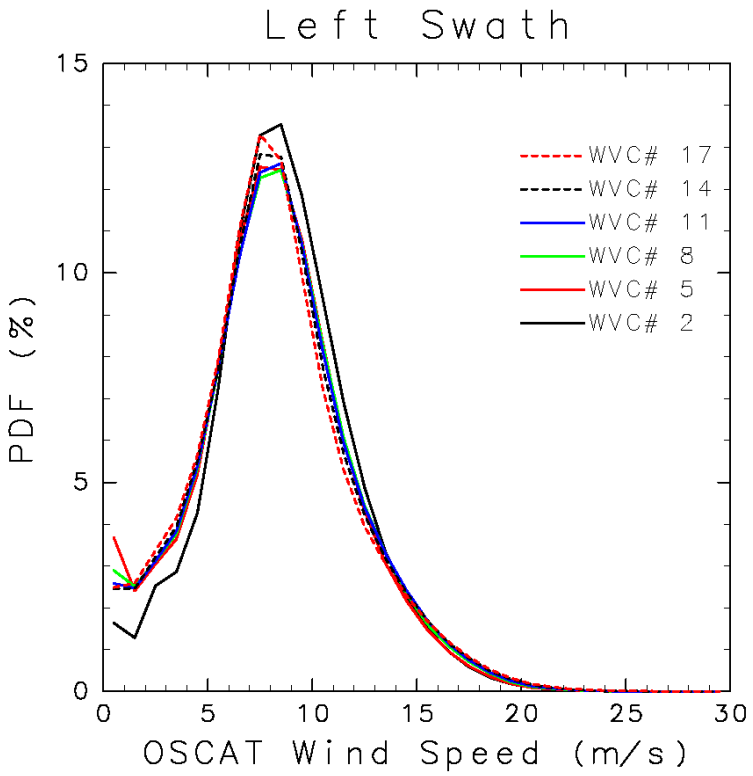
Binning wind speed = $(U_{buoy} + U_{scat})/2$

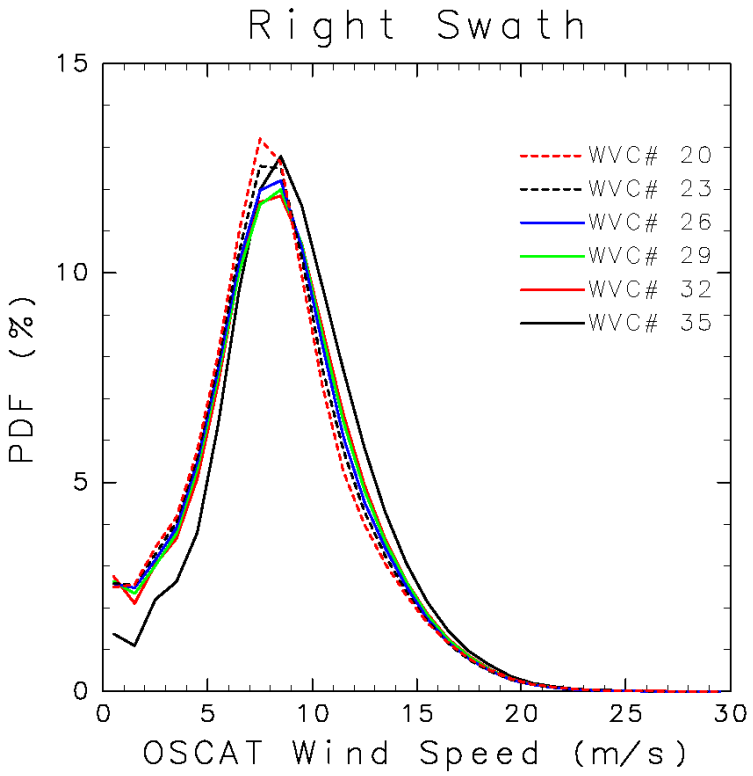
Calculation of Global Statistics of OSCAT Wind Speeds and Directions

- OSCAT 25 km Swath Products (L2)
- 1 Jan. 2011 – 31 Dec. 2011 (1 year)
- Global ocean, 60^{o}S – 60^{o}N
- Collocated ERA-interim winds (Non-EN wind)
- 51 million data points

OSCAT Global Wind Speed Histograms

Ver. 1.3



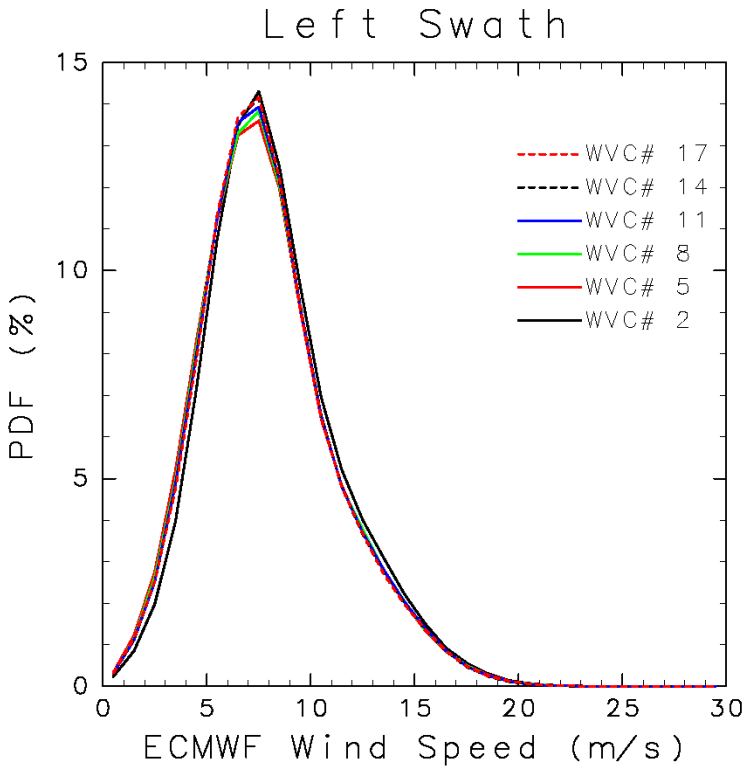


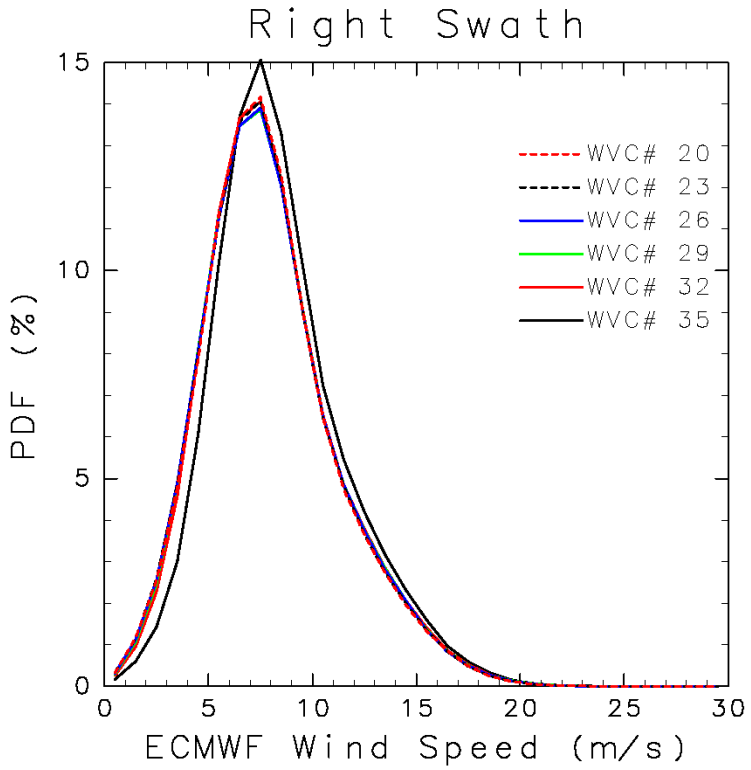
Period: 1 Jan. 2011 – 31 Dec. 2011 (1 year)

Area: global ocean, 60^{o}S – 60^{o}N

Bin size: 1 m/s

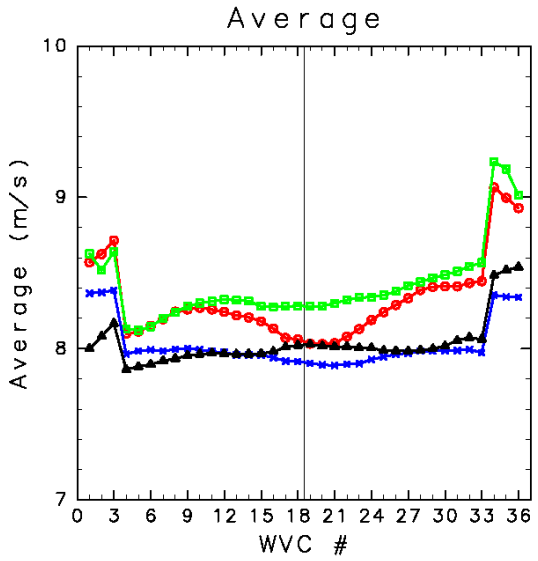
ERA-interim Wind Speed Histograms



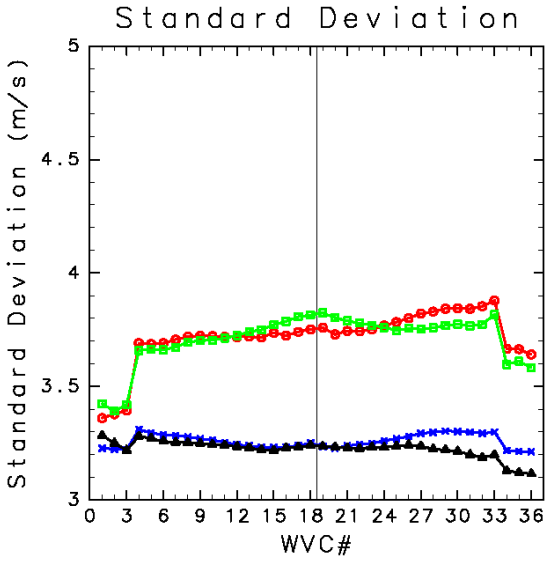


Collocated with OSCAT observations

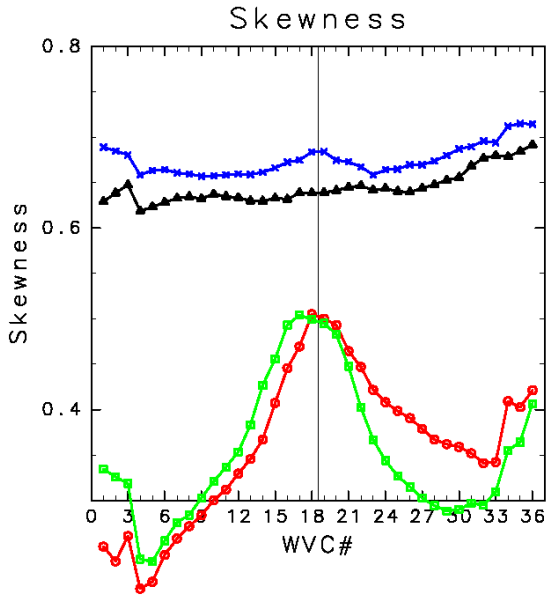
Statistics of OSCAT Wind Speed Distribution

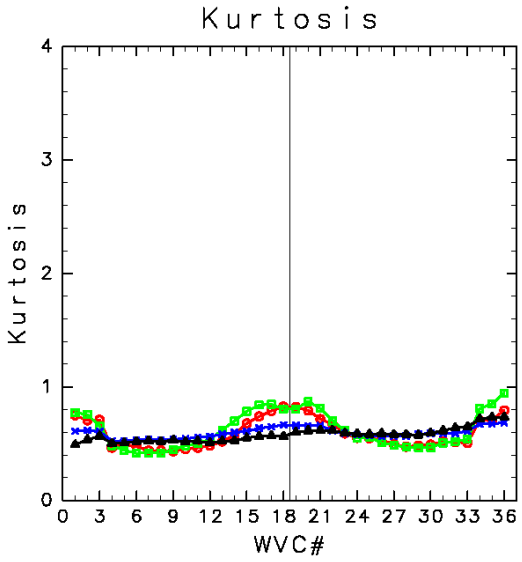


OSCAT/Dec
OSCAT/Asc
ECMWF/Dec
ECMWF/Asc



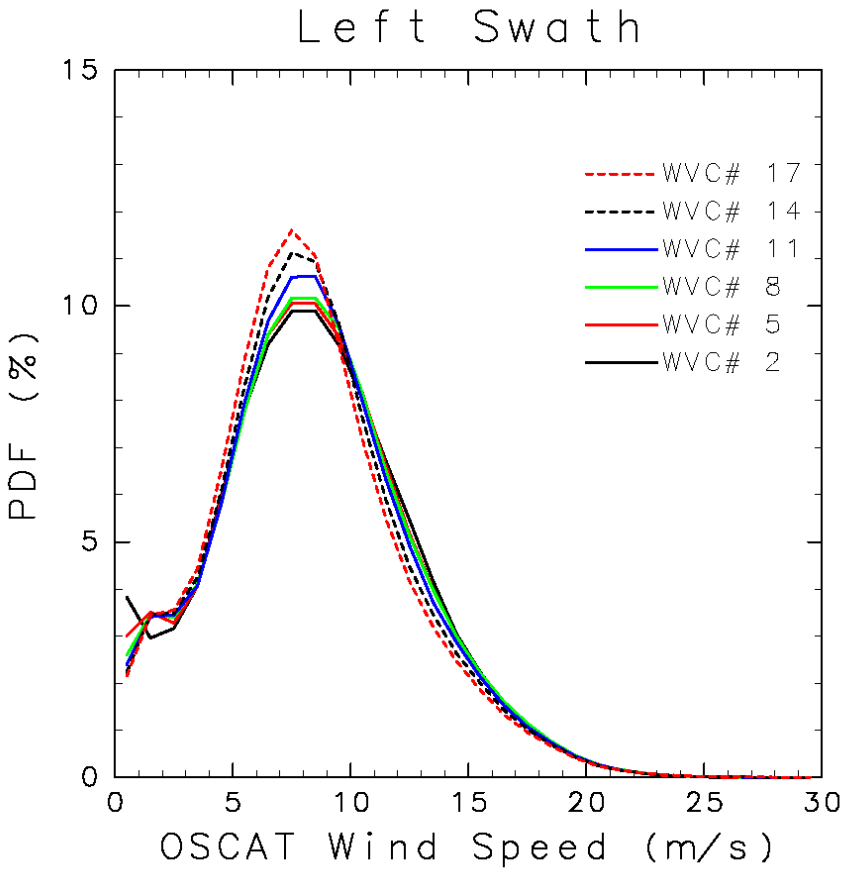
Ver. 1.3

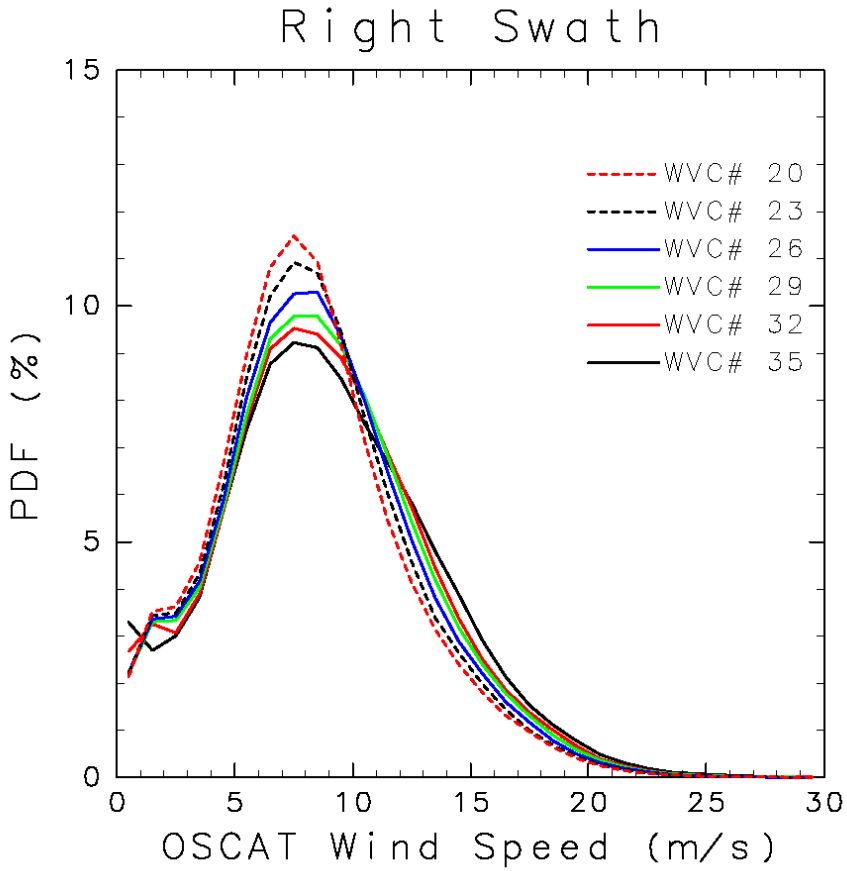




OSCAT Global Wind Speed Histograms

Old Version





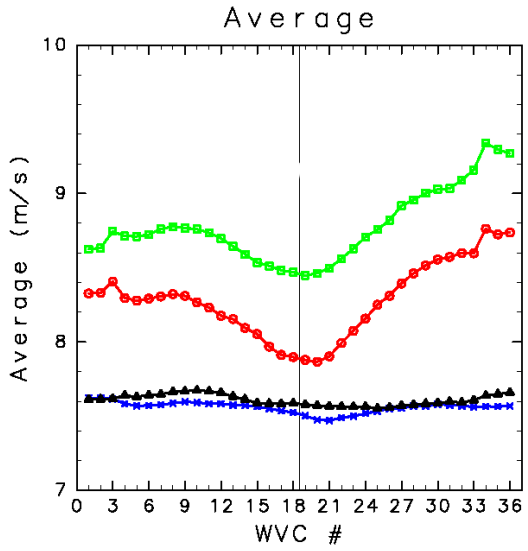
Period: 1 Jan. 2010 – 31 Dec. 2010 (1 year)

Area: global ocean, 60°S – 60°N

Bin size: 1 m/s

Statistics of OSCAT Wind Speed Distribution

Old Version

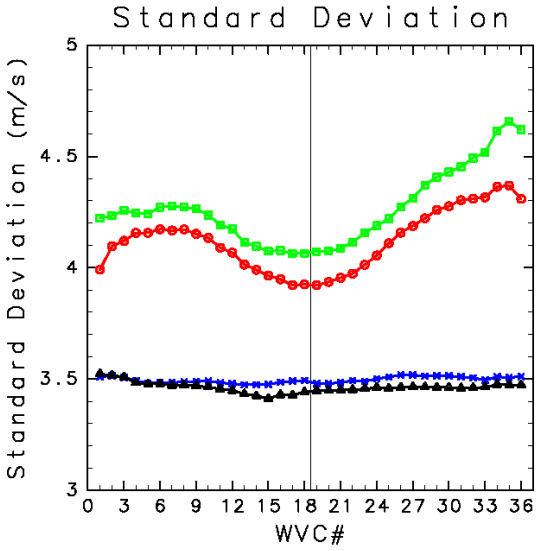


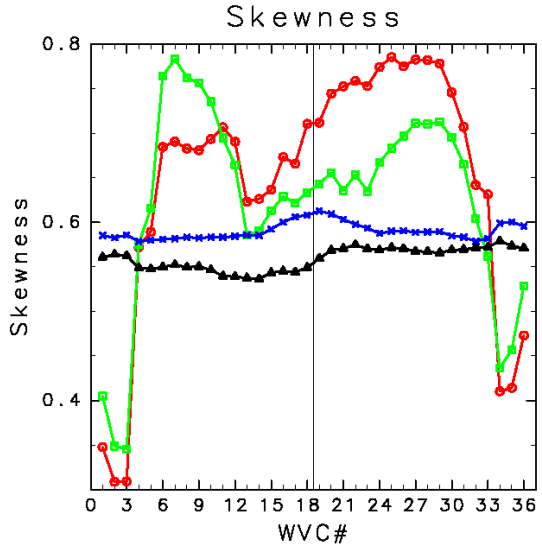
OSCAT/Dec

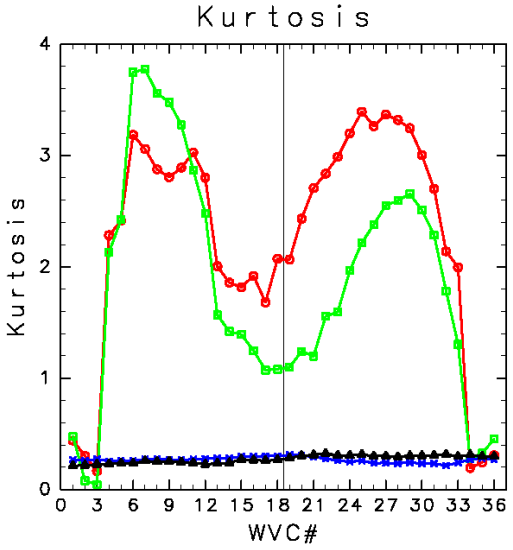
OSCAT/Asc

ERA/Dec

ERA/Asc



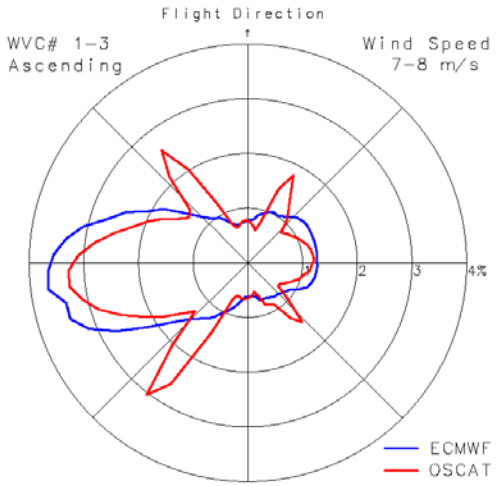




OSCAT Wind Direction Histograms

Ver. 1.3

WVC# 1-3



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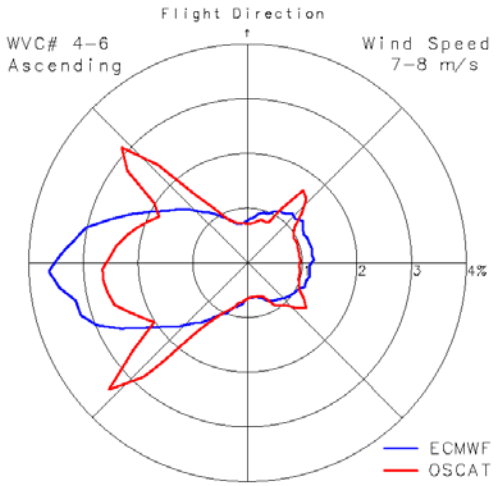
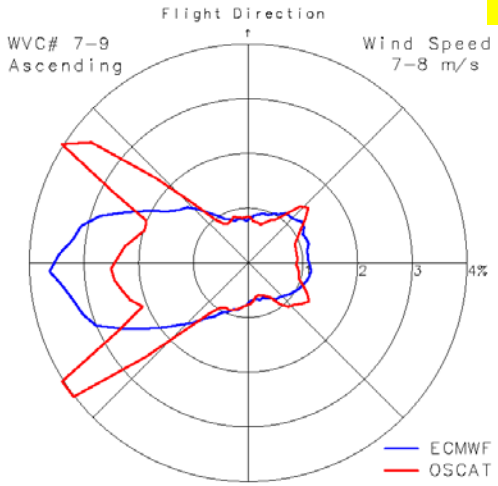


WVC# 7-9



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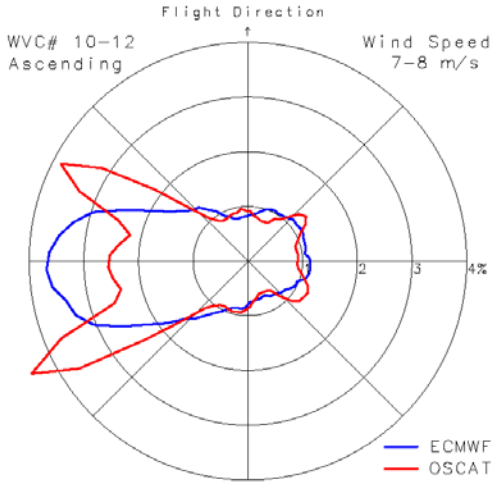
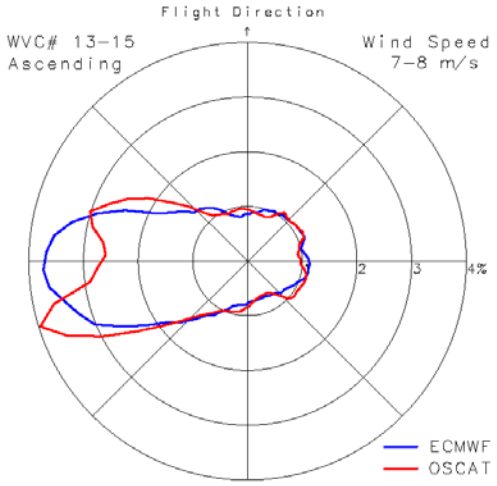


WVC# 13-15



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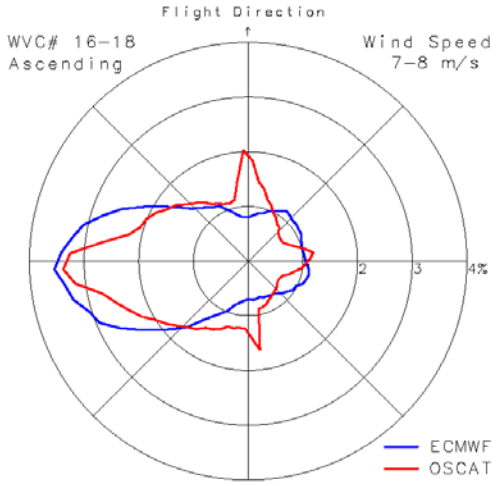


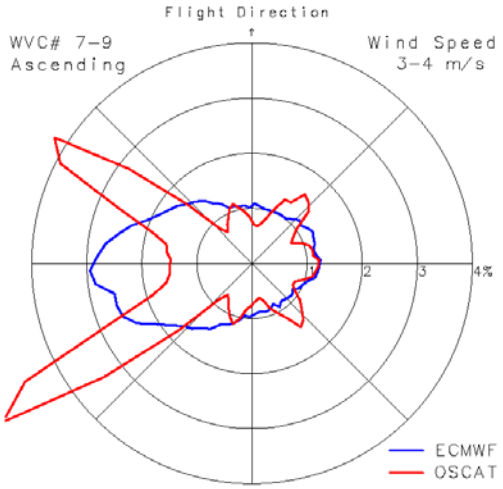
ERA
OSCAT

Left Swath, Wind Speed Range: 7-9 m/s, Ascending Paths

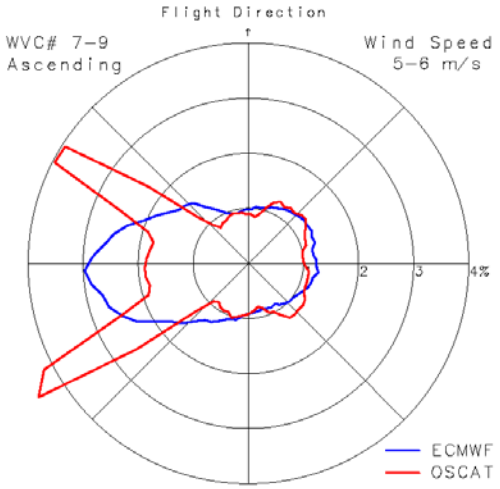
Wind Speed Dependence of Wind Direction Histograms (Mid Cells)

Ver. 1.3

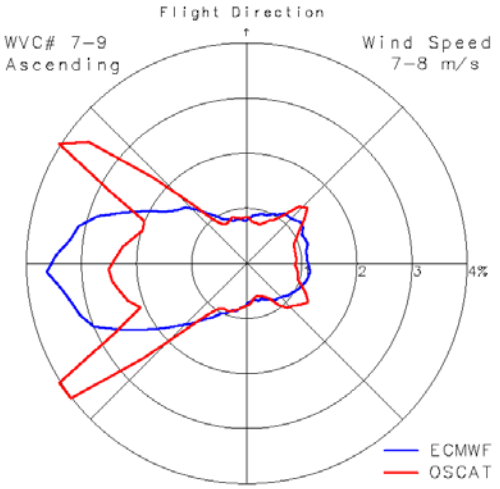
3-5 m/s



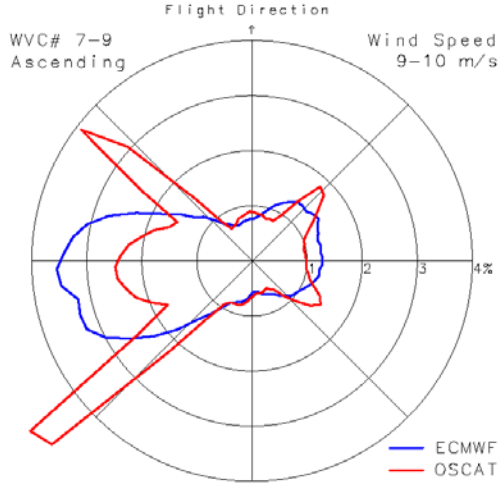
5-7 m/s



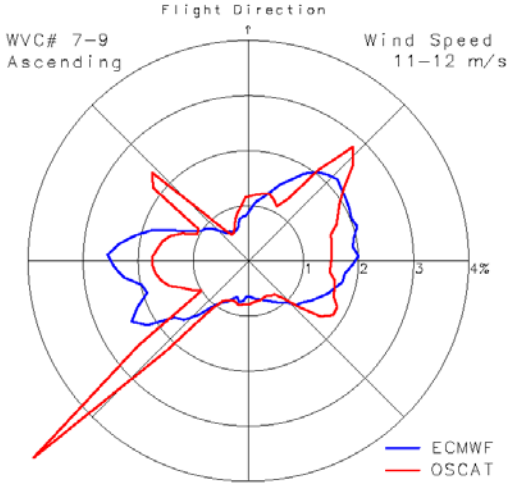
7-9 m/s



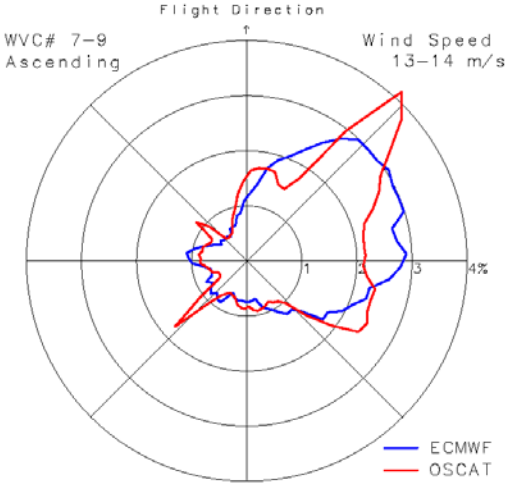
9-11 m/s



11-13 m/s



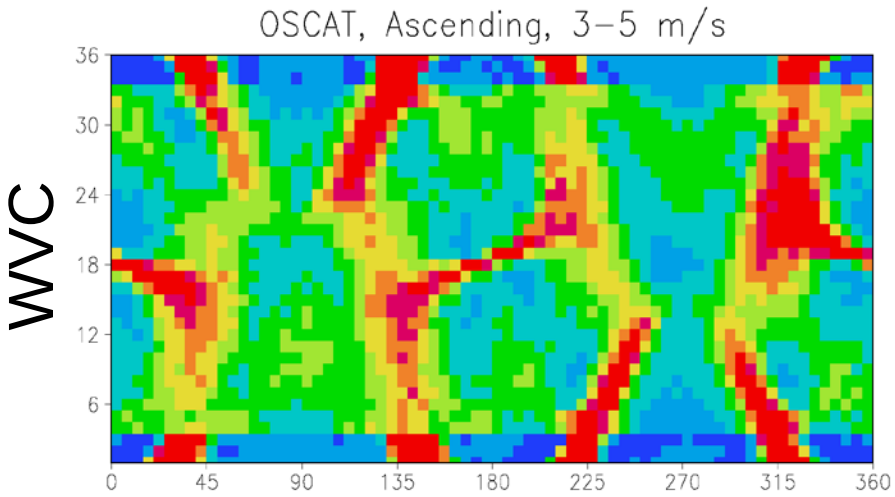
13-15 m/s

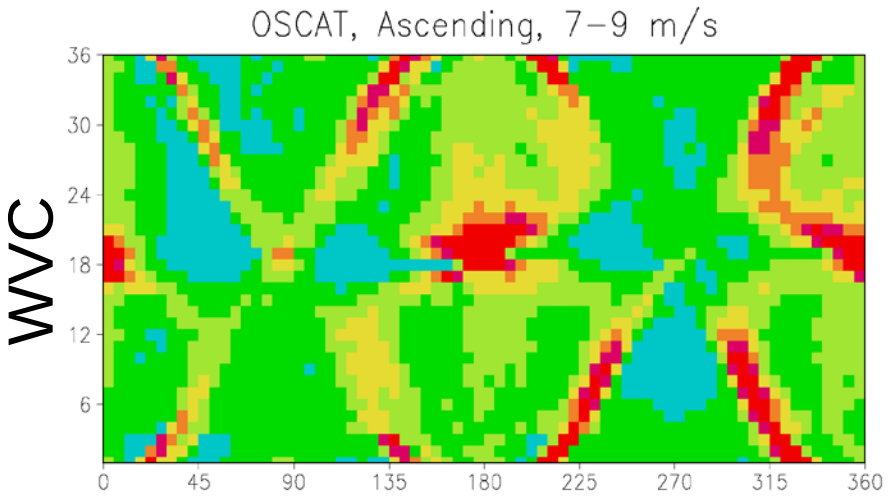


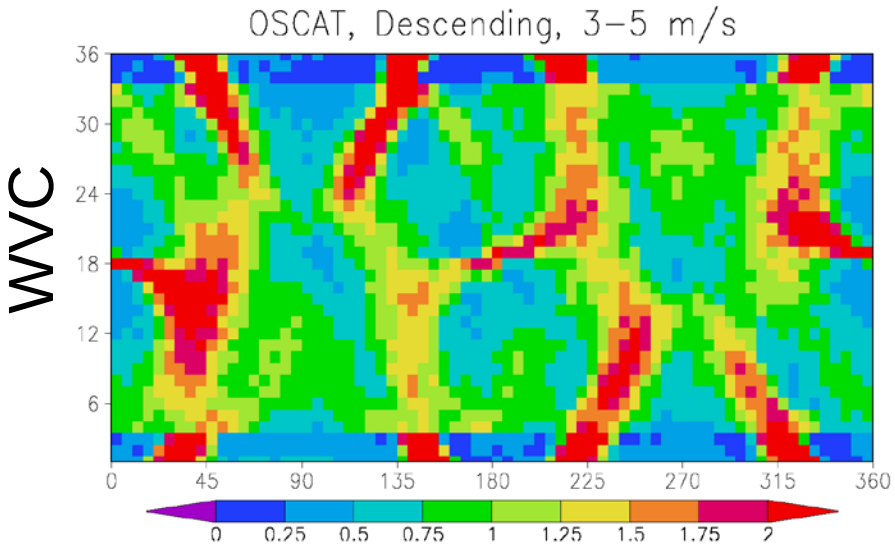
ERA
OSCAT

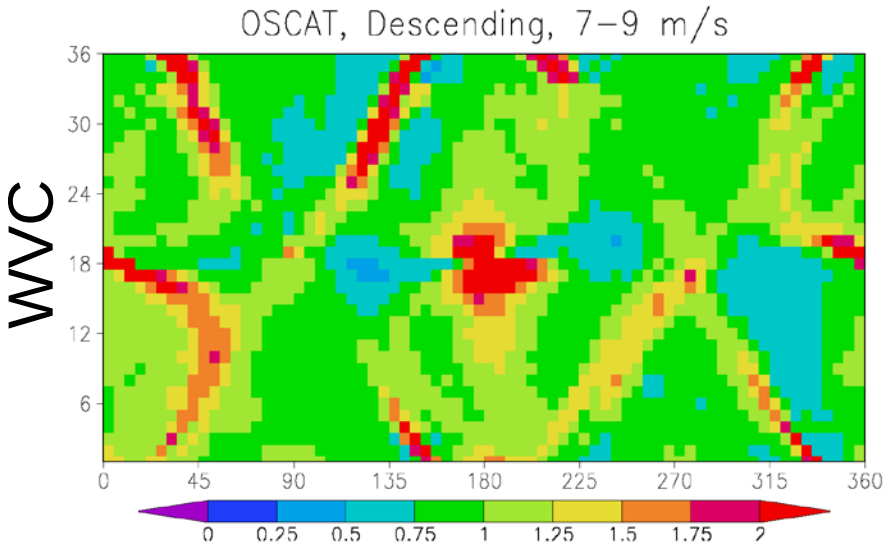
WVC#: 7-9 (Left Mid Swath)

OSCAT Wind Direction Histograms

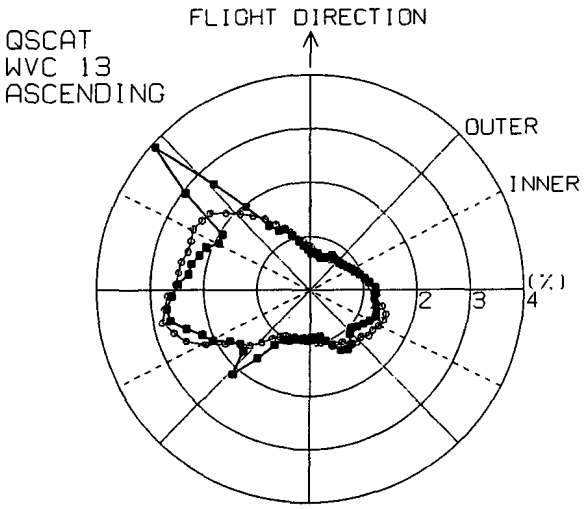


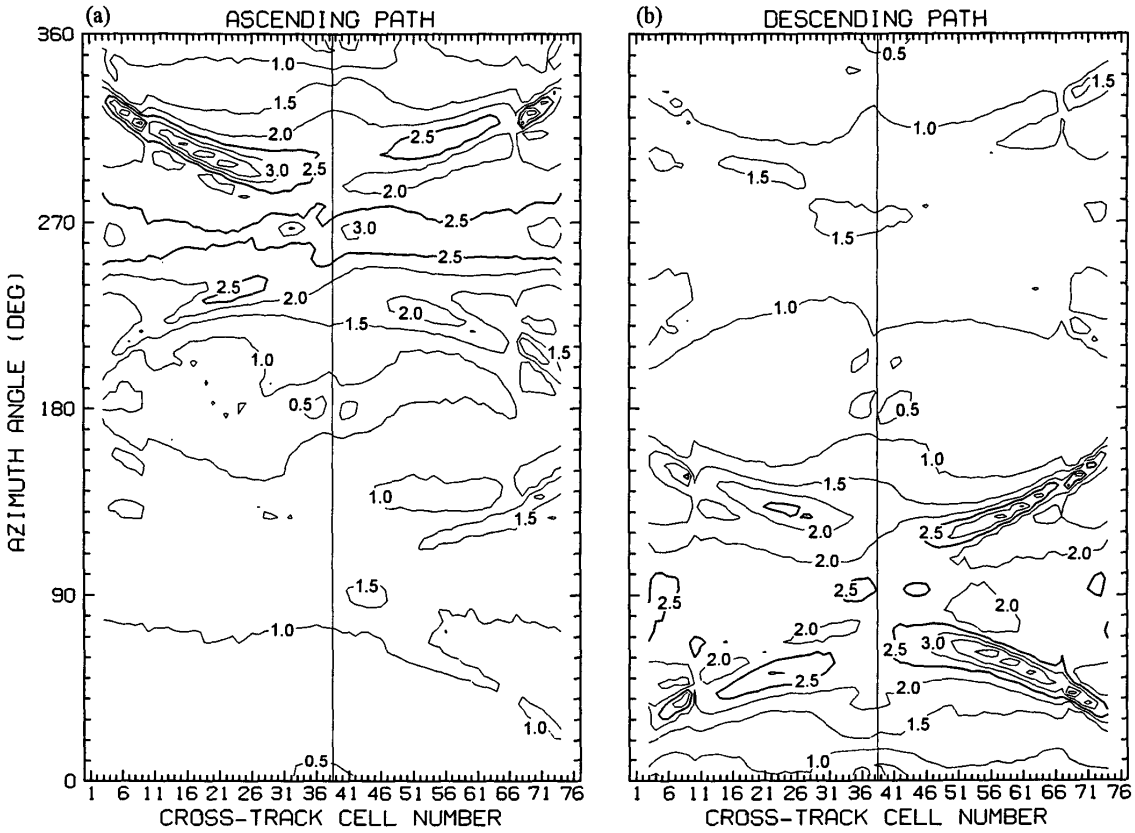






Histograms of QSCAT Wind Directions





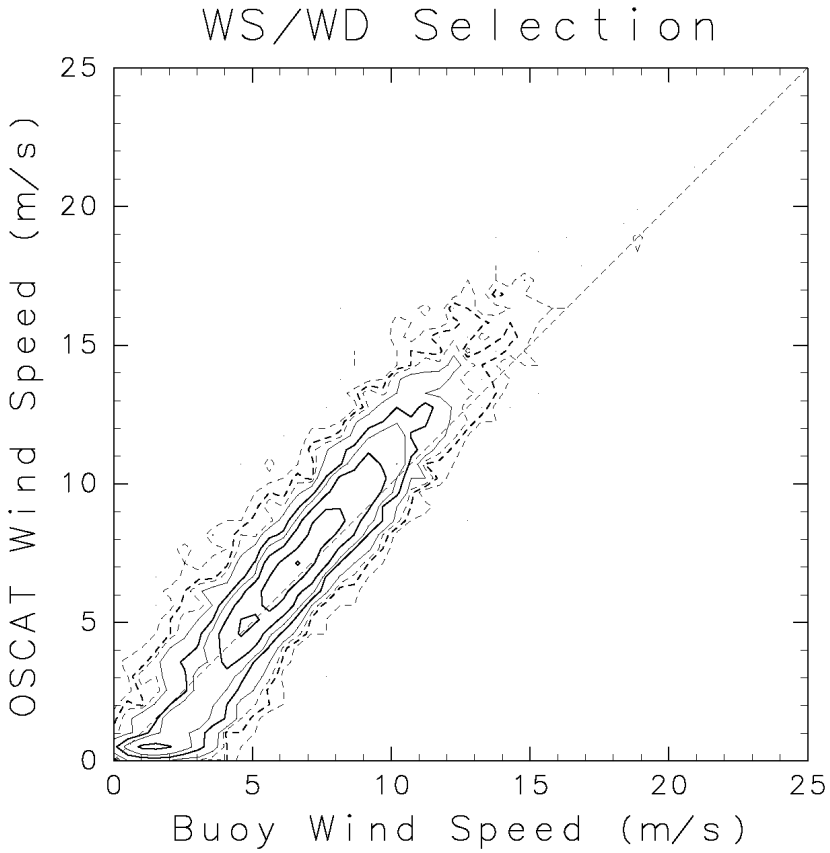
(Ebuchi, *Proc. IGARSS 2000*, 2000)

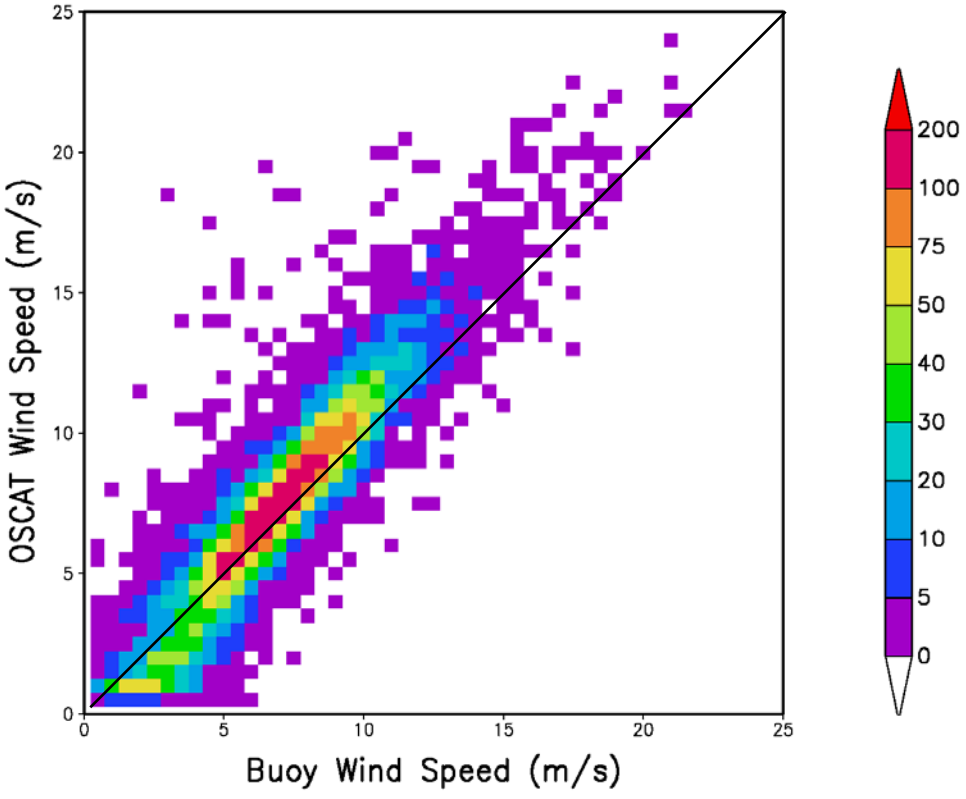
Summary

- OSCAT wind speeds and directions agrees with buoy observations in general.
- However, OSCAT underestimate the wind speed at low wind speed, and overestimate at high wind speed.
- OSCAT global wind speed histogram exhibits excess of very low wind speed data.
- Differences of wind speed histograms with the WVC location, ascending/descending paths, and right/left swaths, found in the previous versions have been reduced significantly.
- Directivity relative to the antenna beams is very significant for OSCAT wind directions.

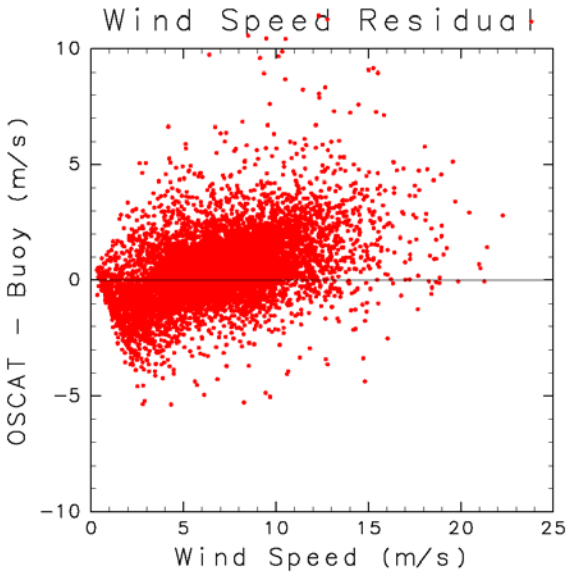
Comparison of wind speed

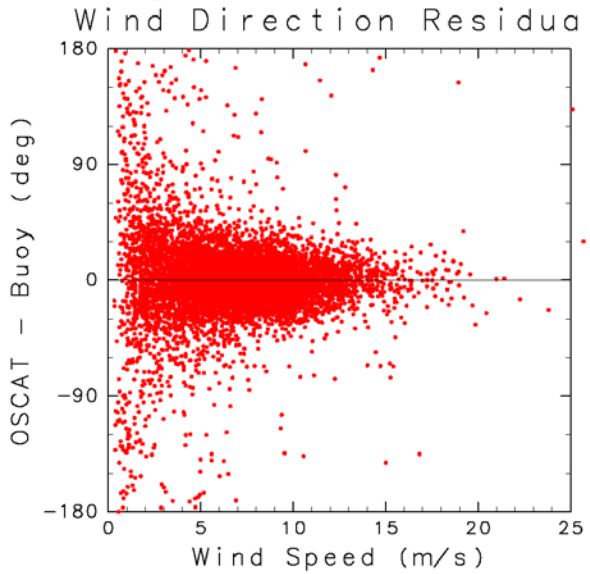
OSCAT old version



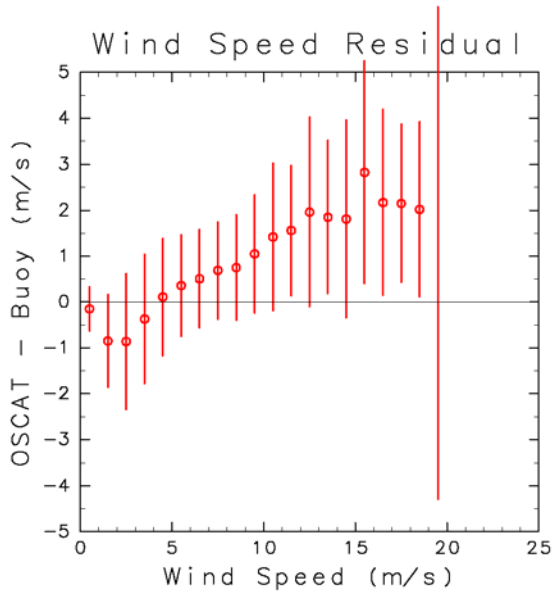


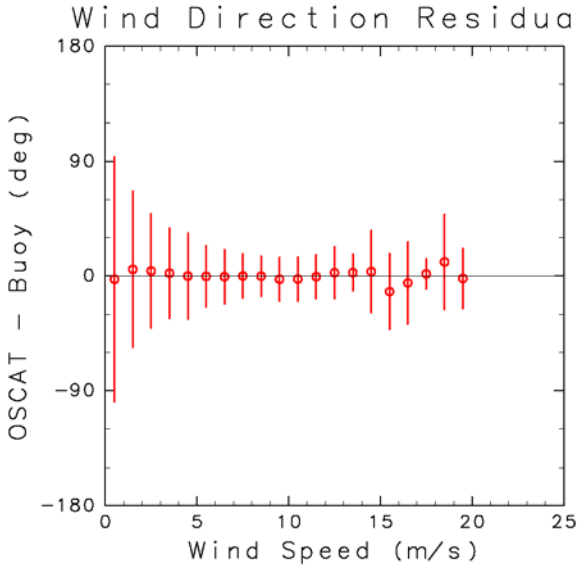
Residuals of Wind Speed and Direction





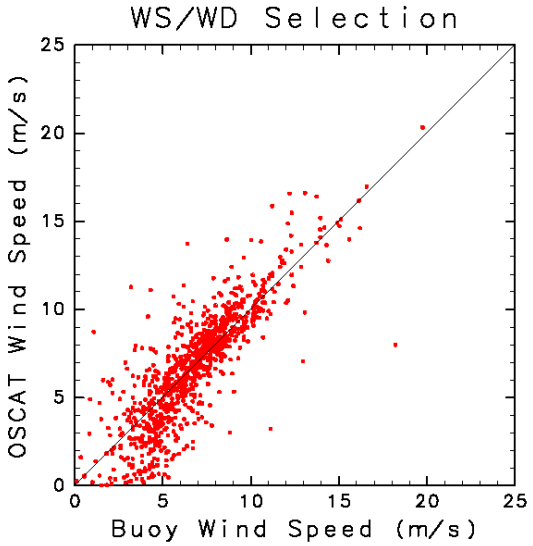
OSCAT
old version

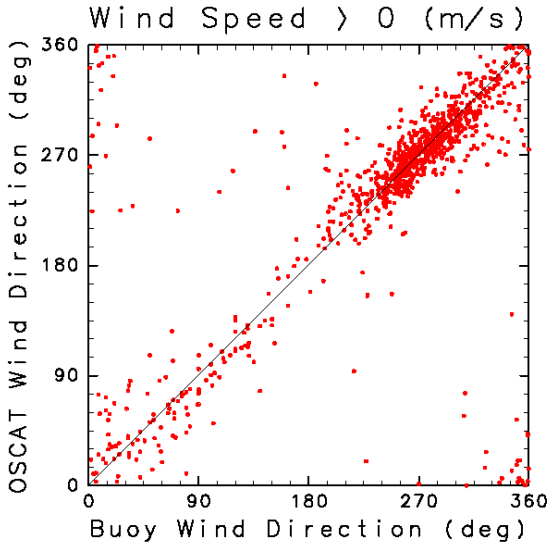


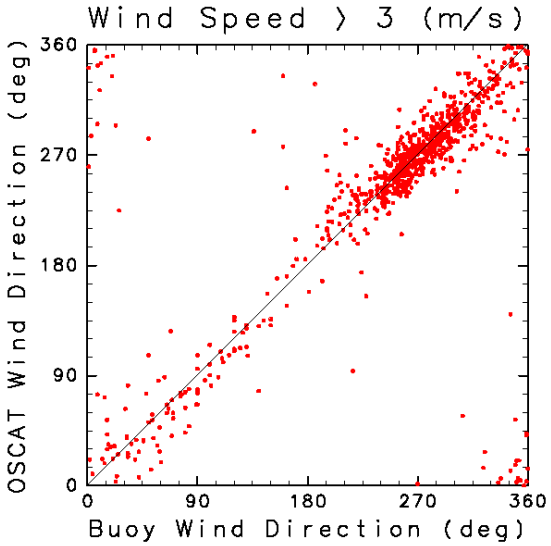


Binning wind speed = $(U_{buoy} + U_{scat})/2$

Comparison of OSCAT Winds with Buoy Data (Ver 1.2)

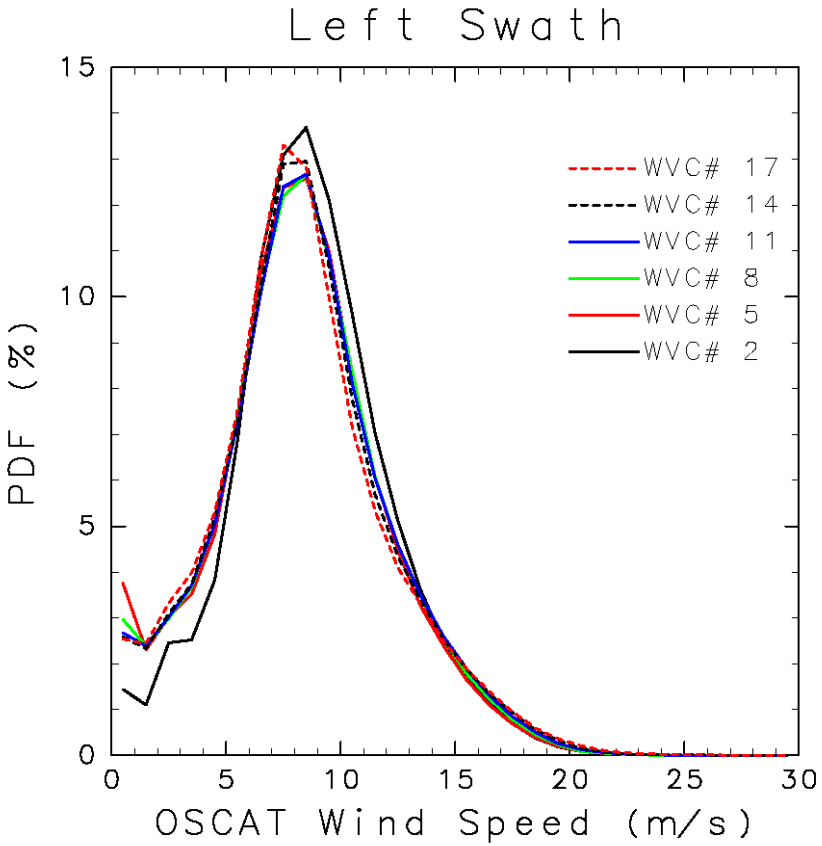


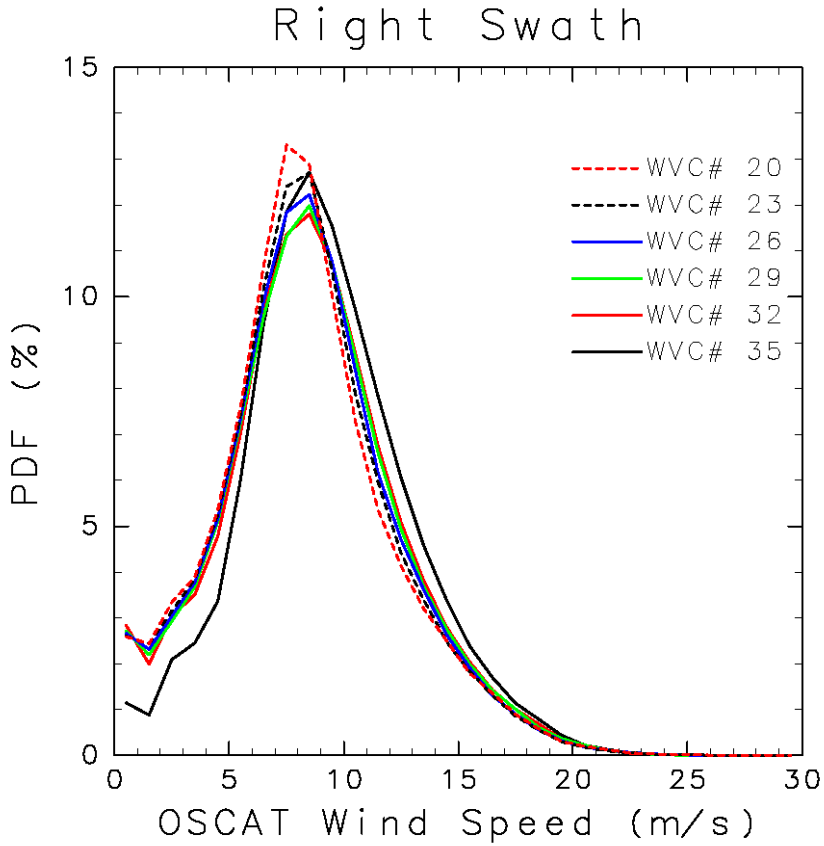




	#	Bias	RMS	Correlation
Wind Speed (m/s)	915	-0.03	1.85	0.815
Wind Direction (deg.)				
U > 0 m/s	915	1.3	35.1	0.925
U > 3 m/s	774	-0.1	26.9	0.953
U > 5 m/s	598	-0.9	23.5	0.961

OSCAT Global Wind Speed Histograms (Ver. 1.2)



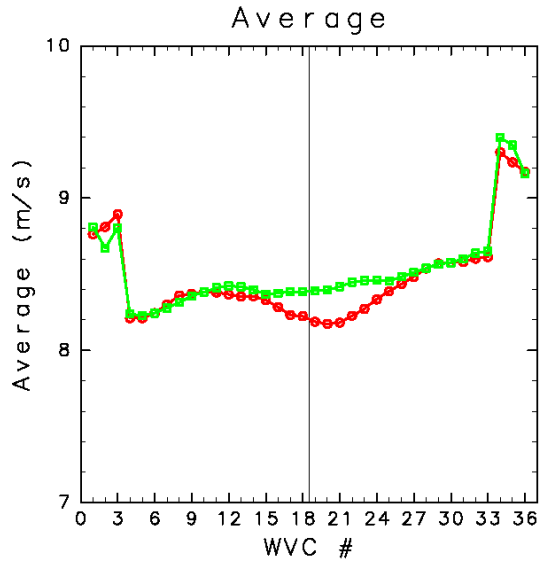


Period: 1 Jul. 2011 – 30 Sep. 2011 (3 months)

Global ocean, 60°S – 60°N

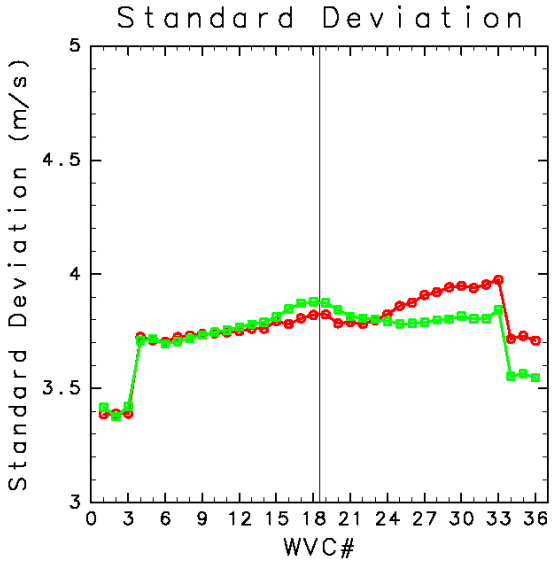
Bin size: 1 m/s

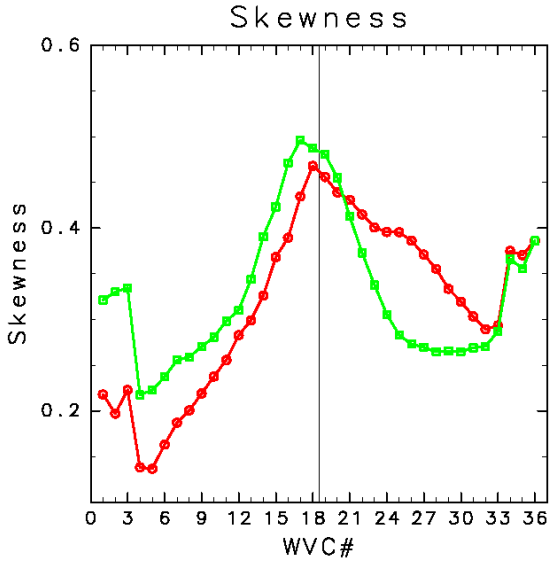
Statistics of OSCAT Wind Speed Distribution (Ver 1.2)

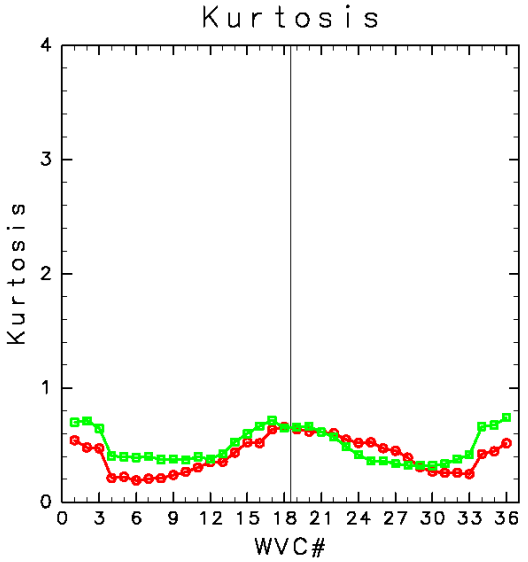


OSCAT Dec

OSCAT Asc



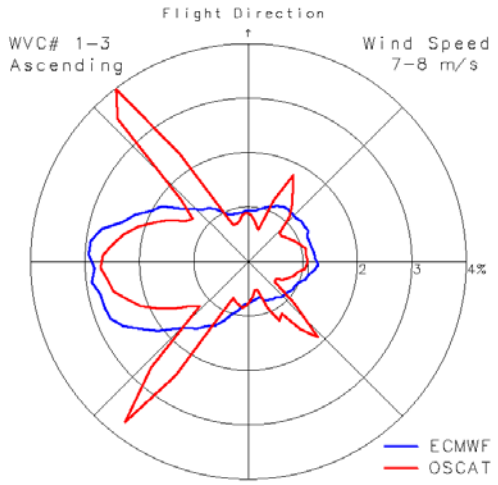




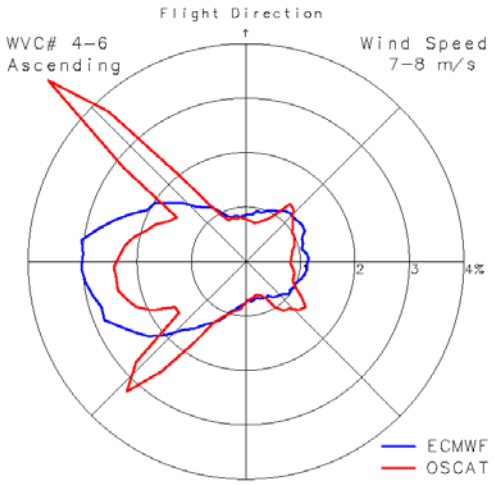
OSCAT Wind Direction Histograms

Old Version

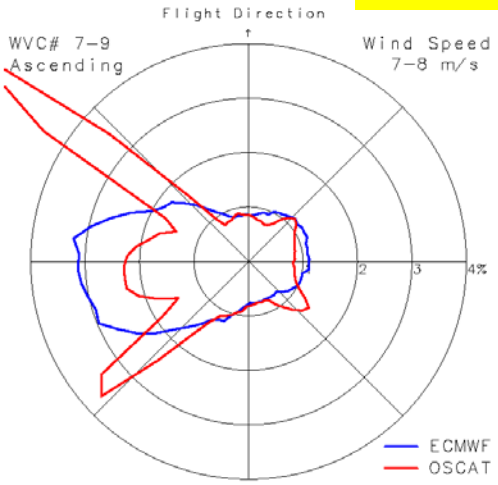
WVC# 1-3



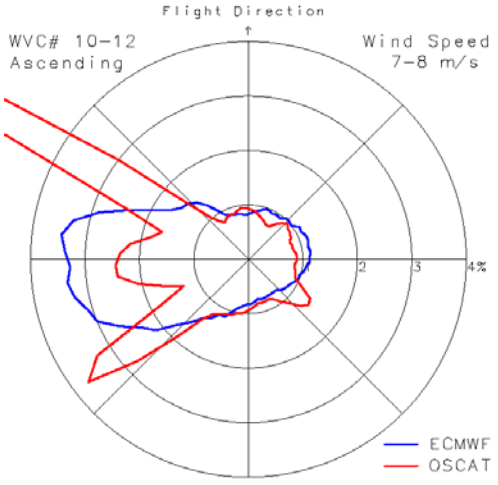
WVC# 4-6



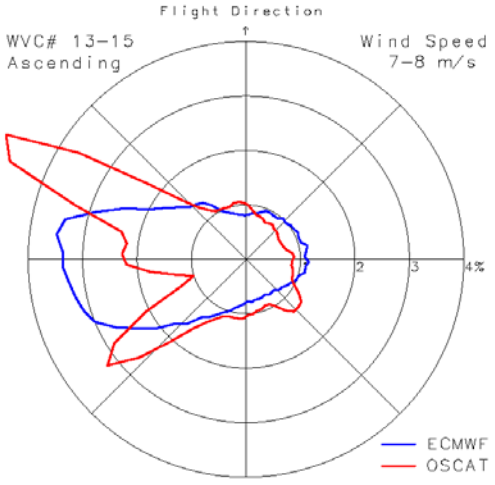
WVC# 7-9



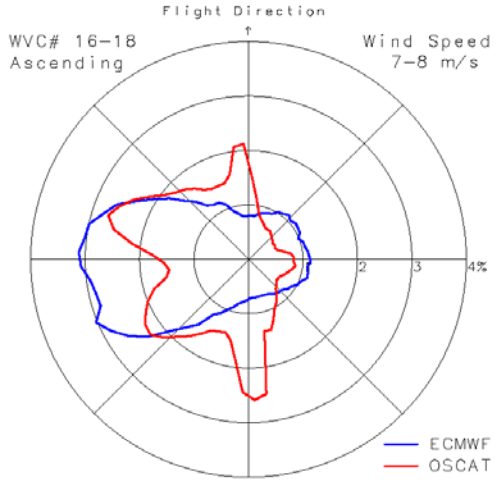
WVC# 10-12



WVC# 13-15



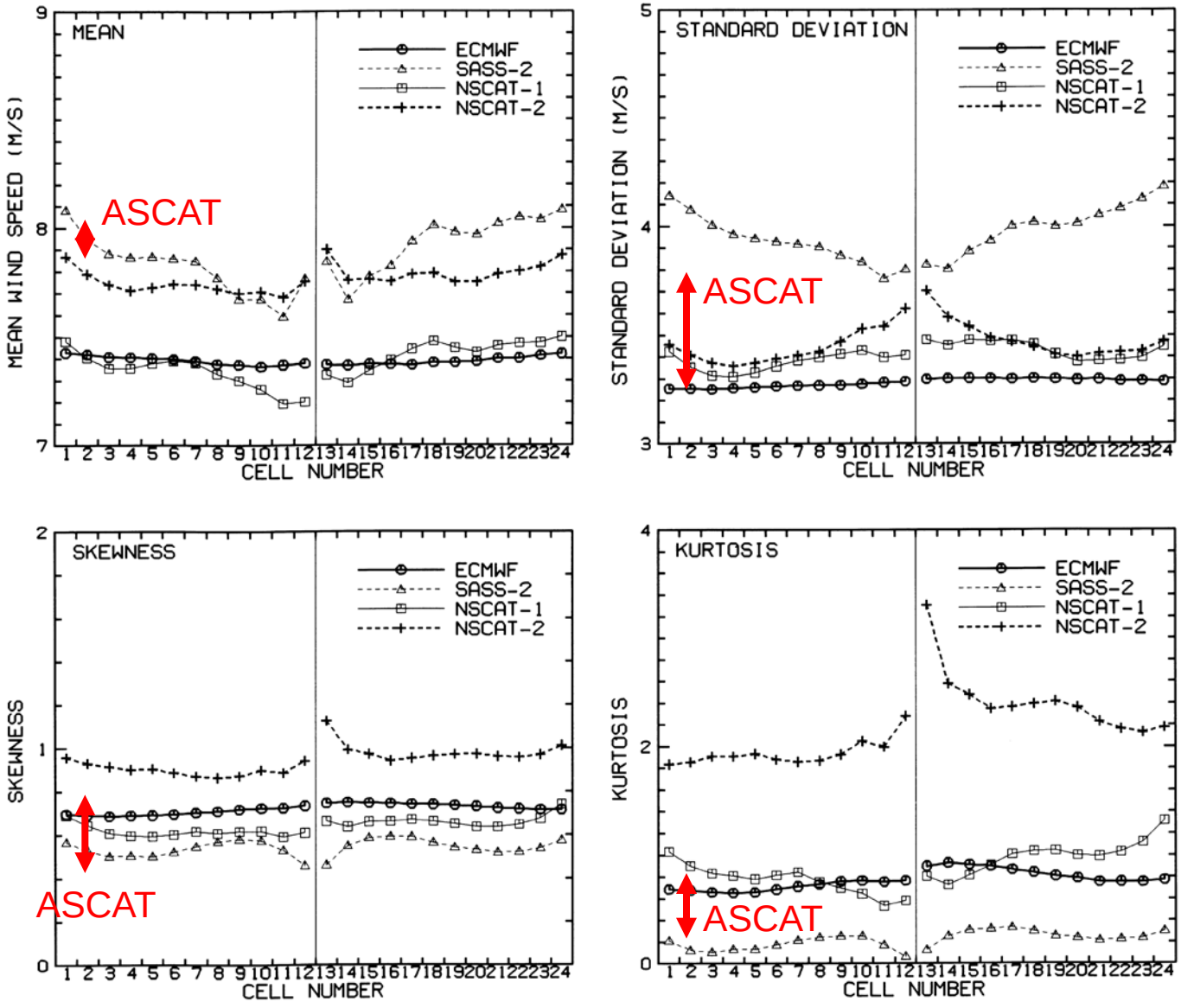
WVC# 16-18



ECMWF
OSCAT

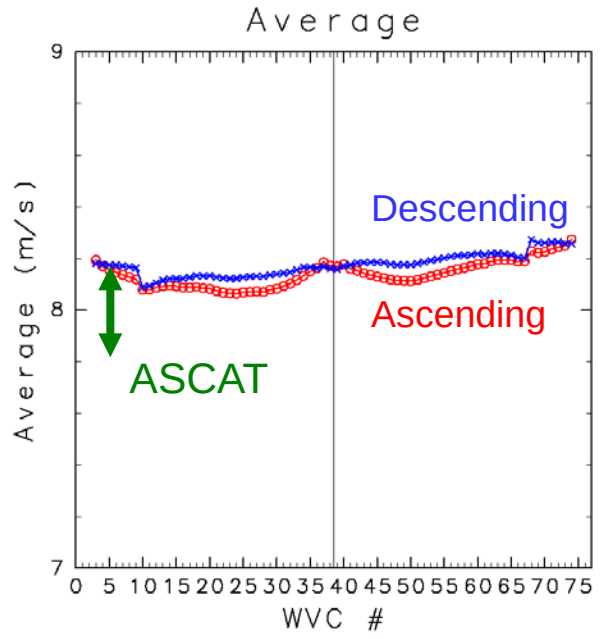
Left Swath, Wind Speed Range: 7-9 m/s, Ascending Paths

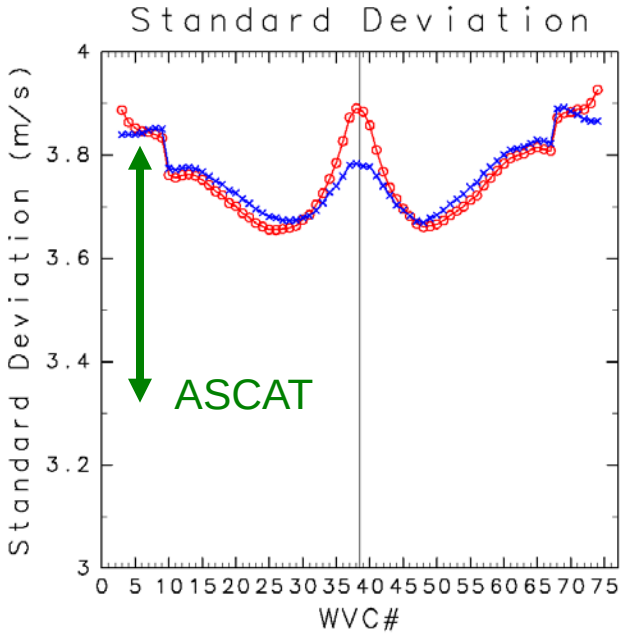
Statistics of NSCAT Wind Speed Distribution

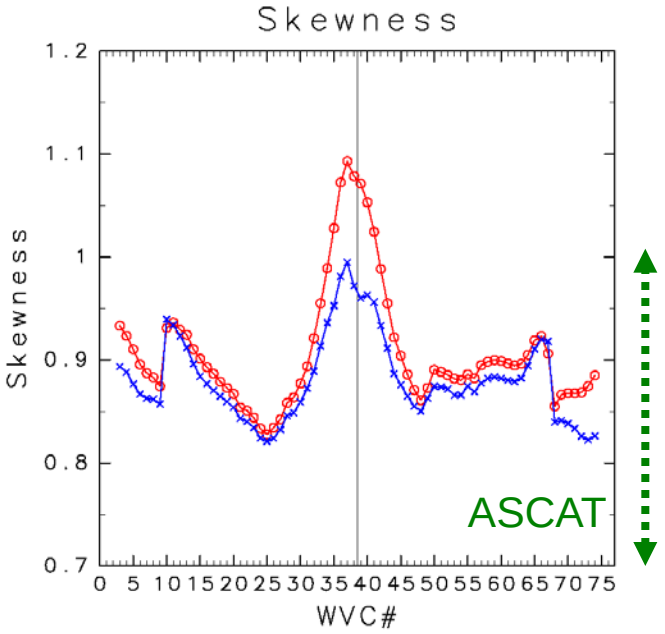


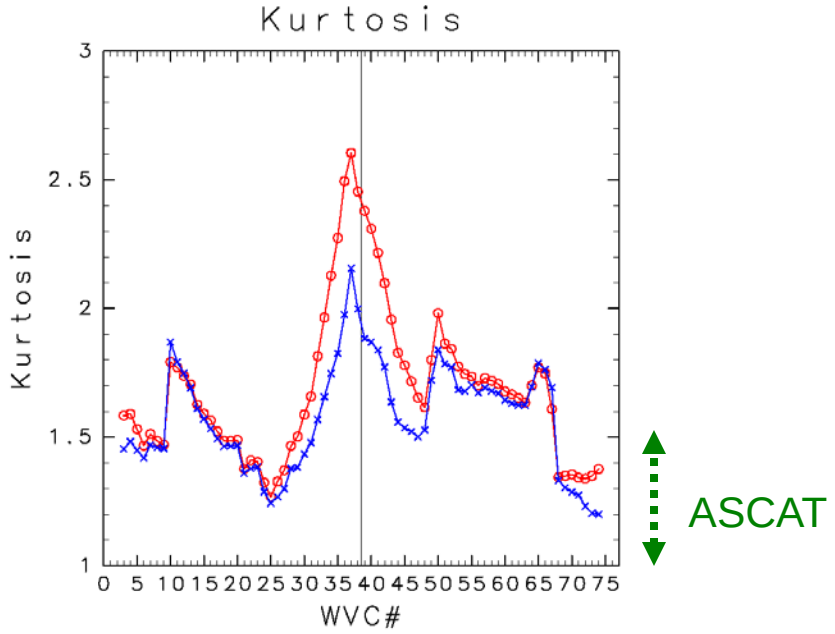
(Ebuchi, *J. Oceanogr.*, 2000)

Statistics of QSCAT Wind Speed Distribution



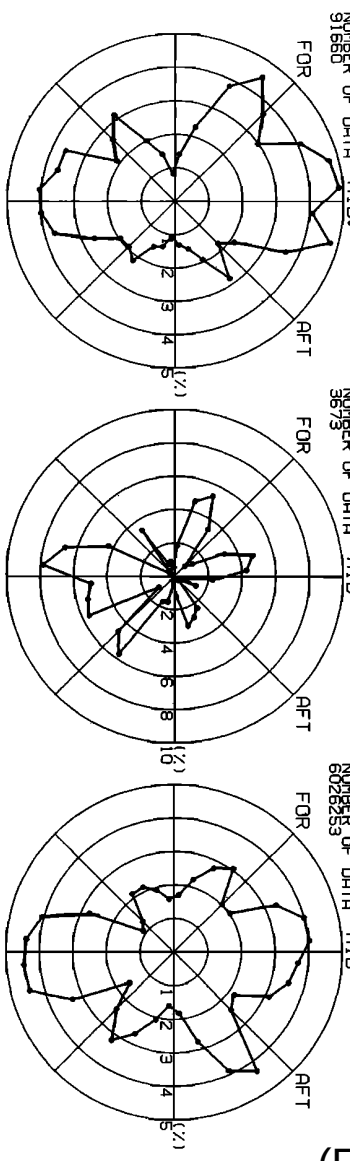




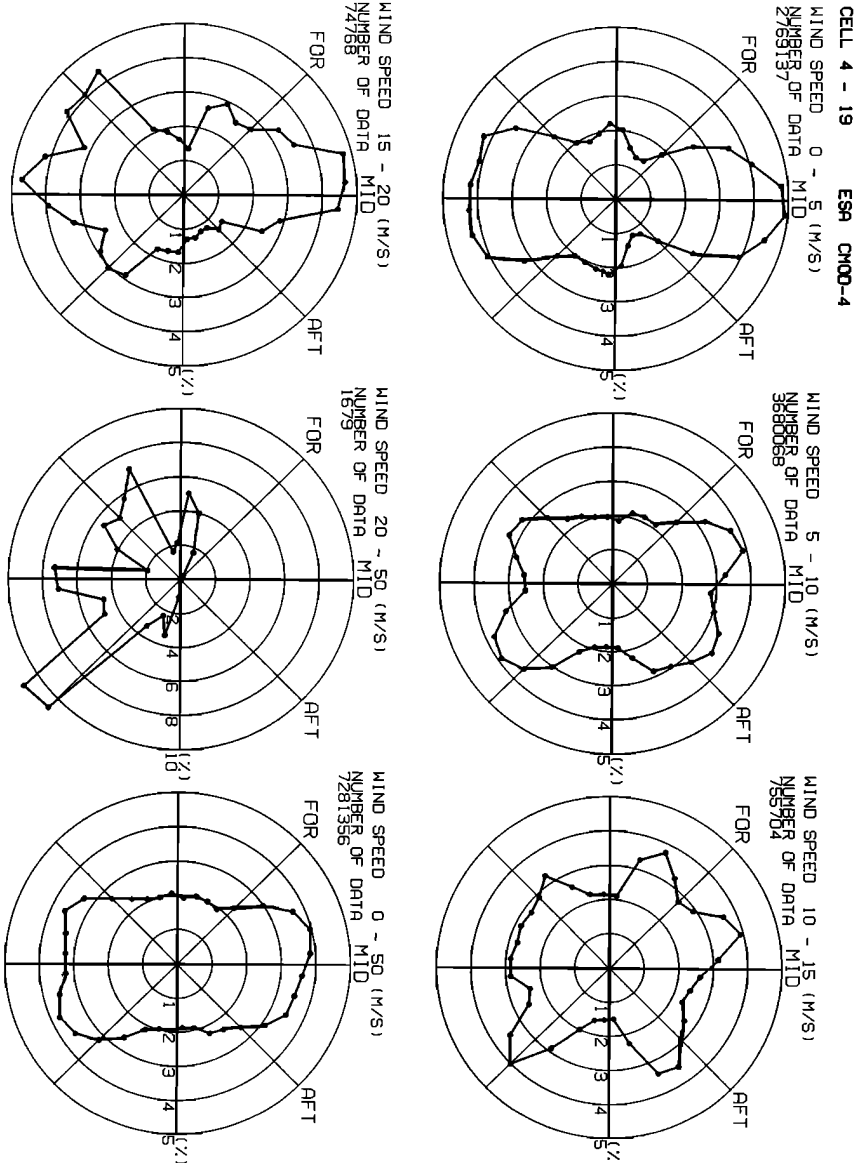


Histograms of ERS-1 Wind Directions

CMOD-IFR2

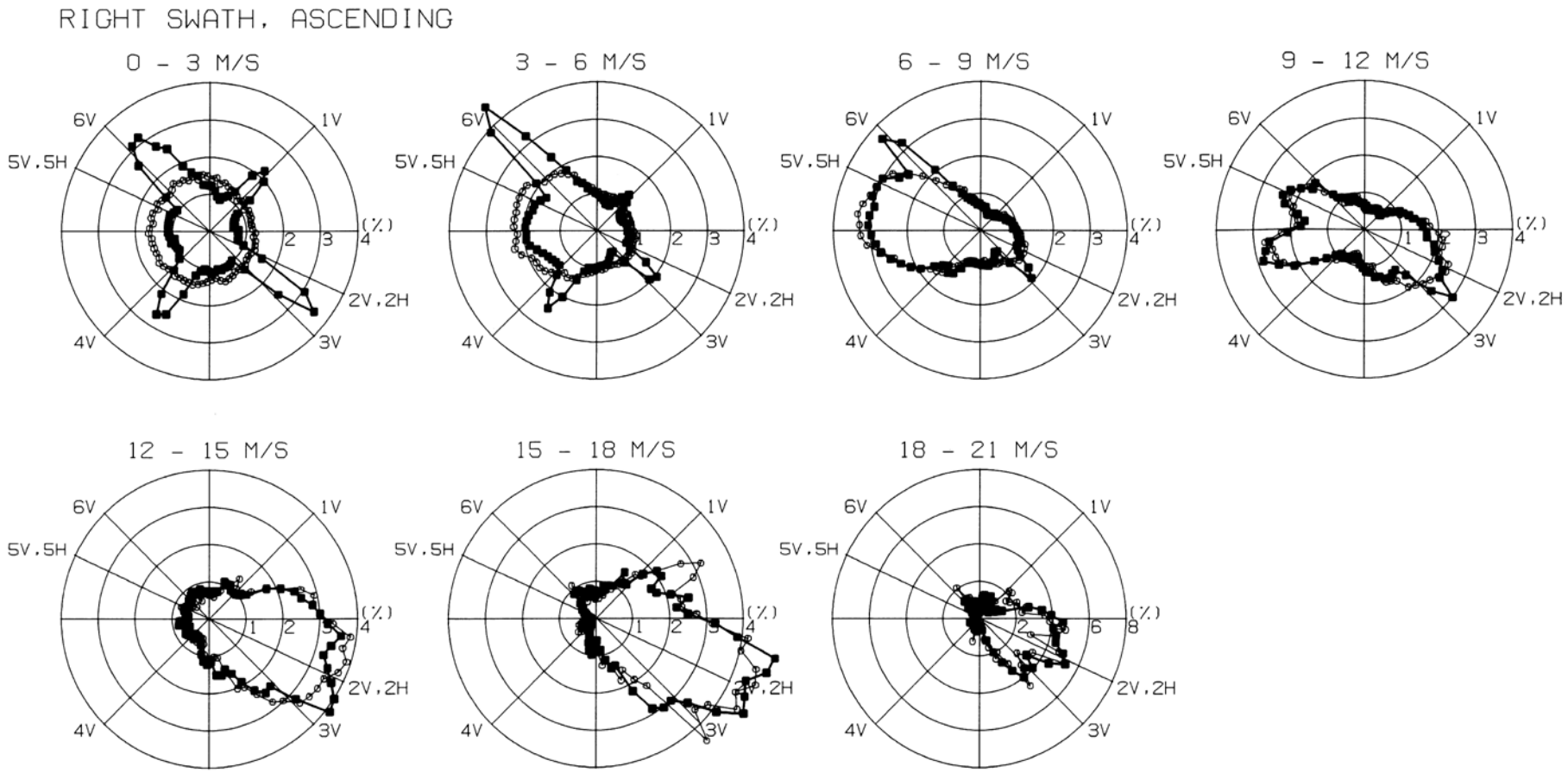


CMOD-4



(Ebuchi & Graber, *JGR*, 1998)

Histograms of NSCAT Wind Directions



(Ebuchi, *JGR*, 1999)