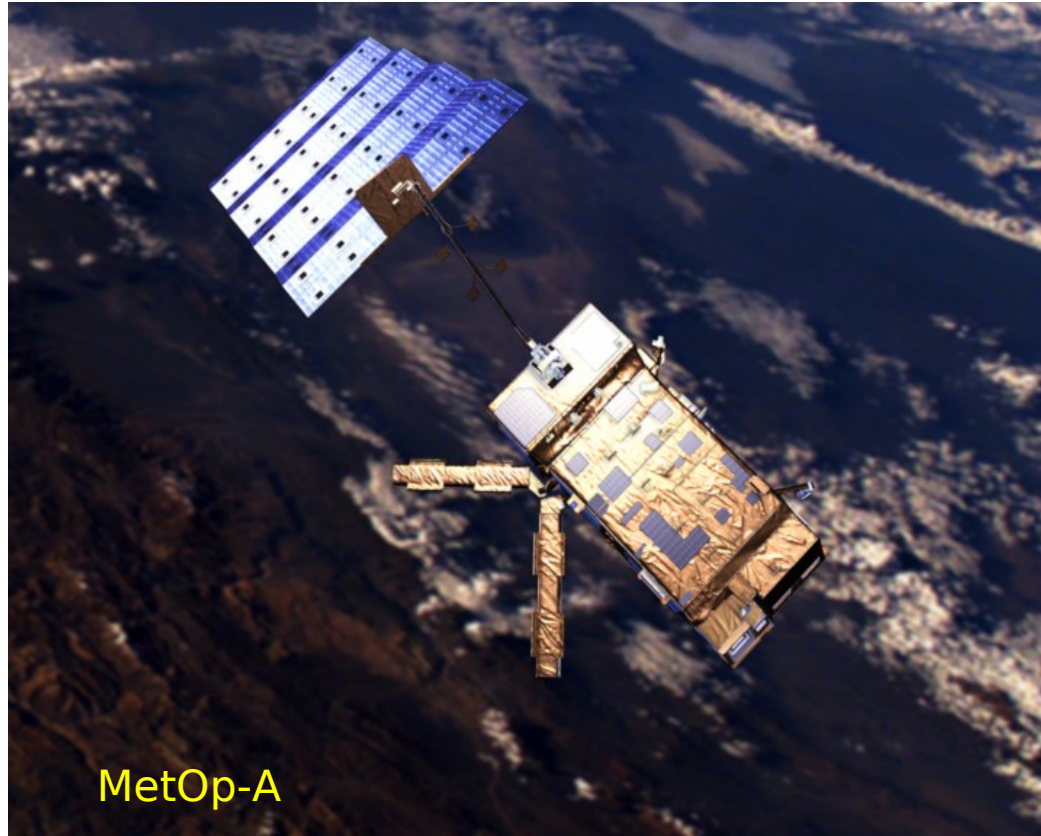


# Evaluation of ASCAT Winds by Assessing their Self-consistency



MetOp-A

Naoto EBUCHI

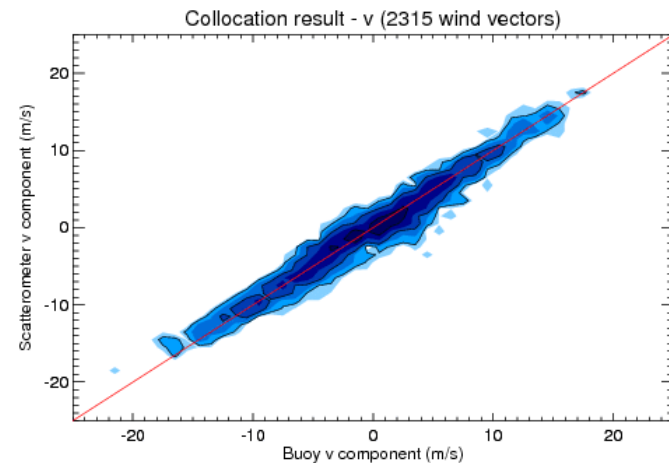
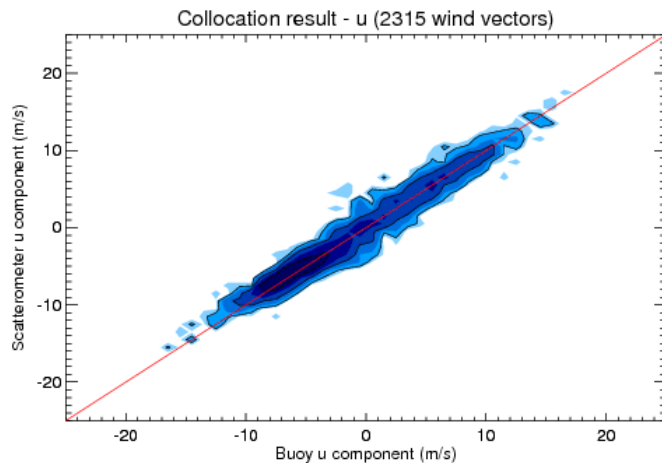
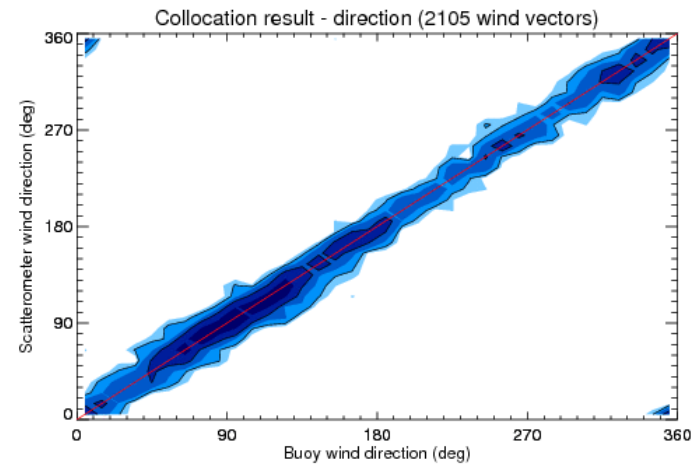
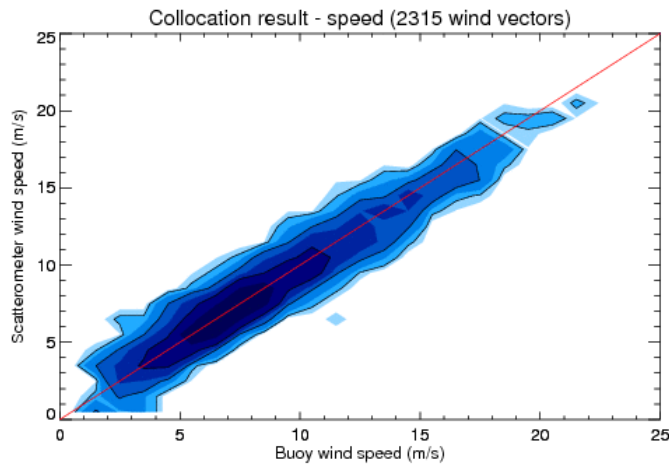
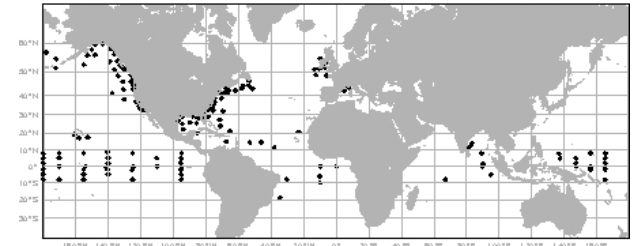
Institute of Low Temperature Science, Hokkaido University

*ebuchi@lowtem.hokudai.ac.jp*

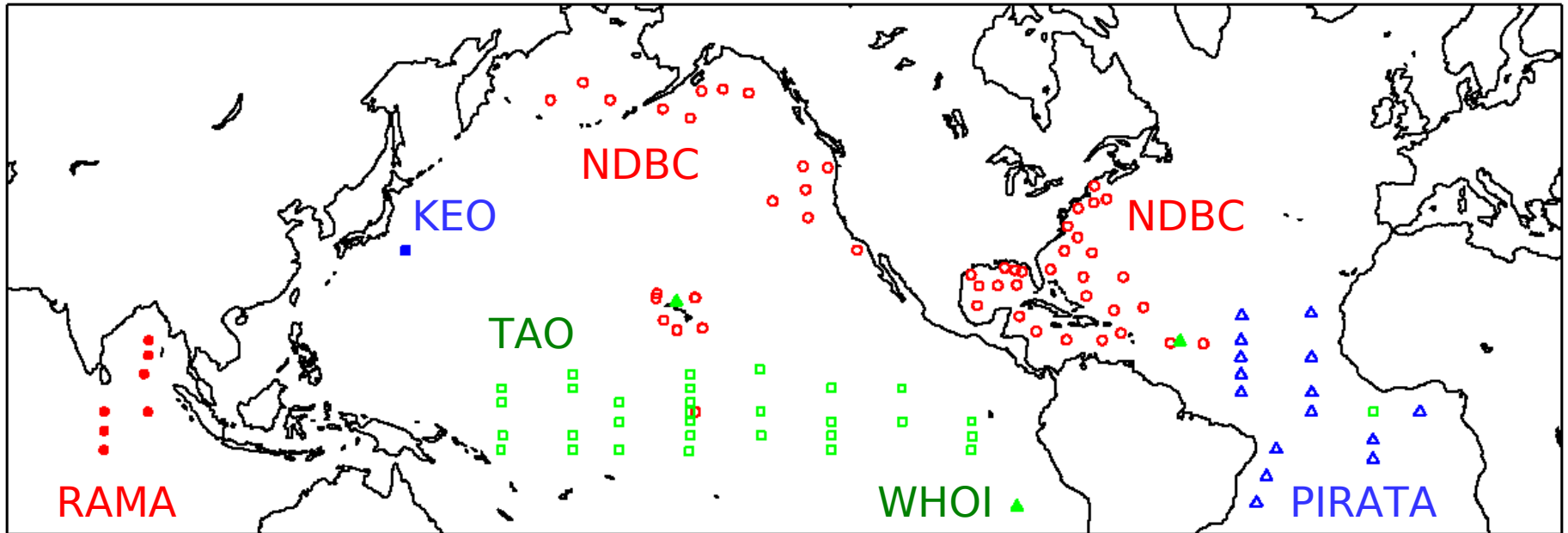
# Outline

- Comparison of ASCAT wind vectors with data from ocean buoys
- Assessment of statistical distributions of ASCAT wind speeds and directions
  - Global wind speed histograms
  - Directional distributions relative to antenna beams

# Monthly Report on Buoy Comparison by KNMI

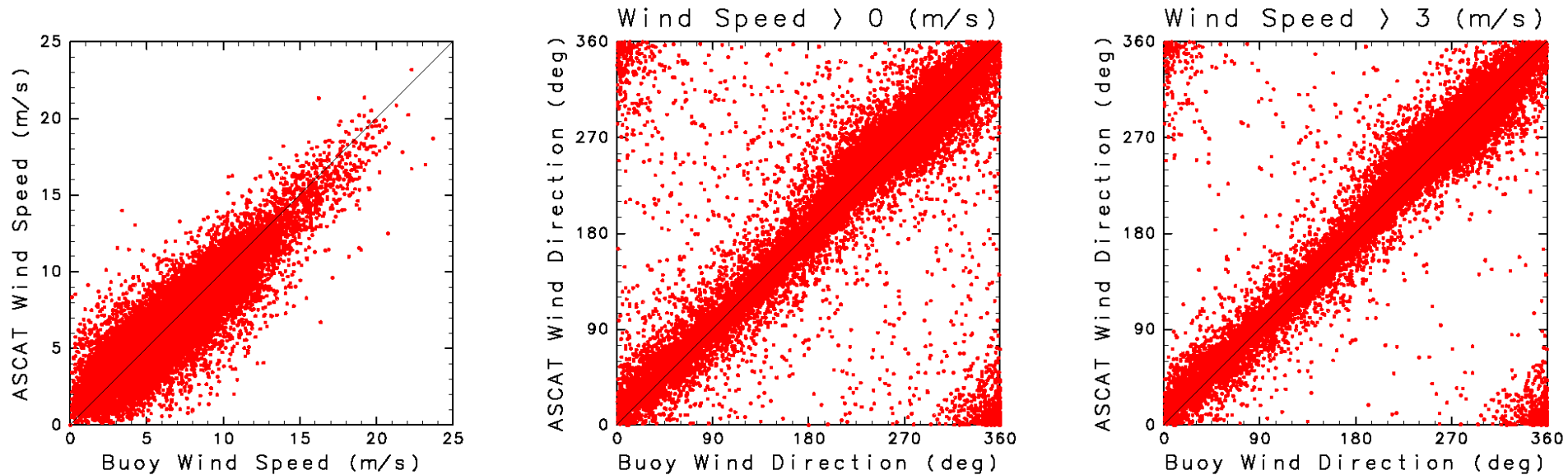


# Buoy Data for Comparison with ASCAT



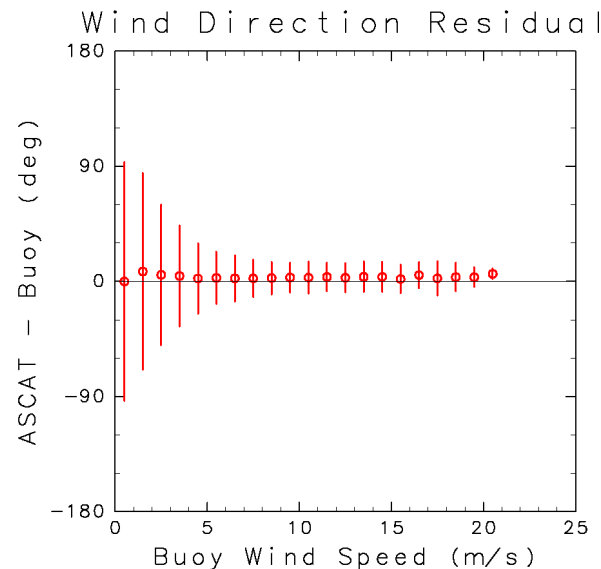
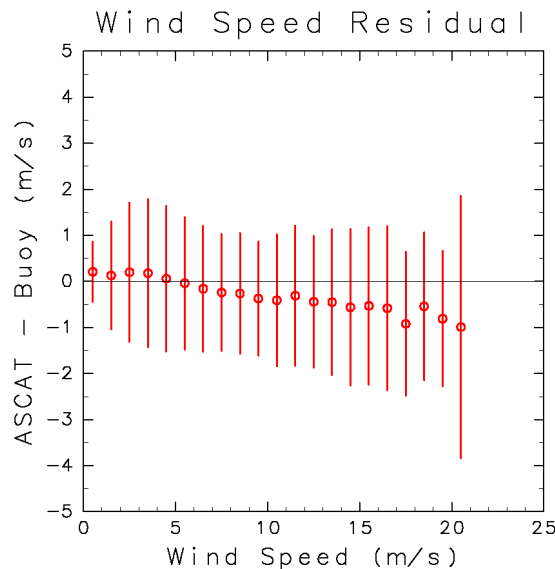
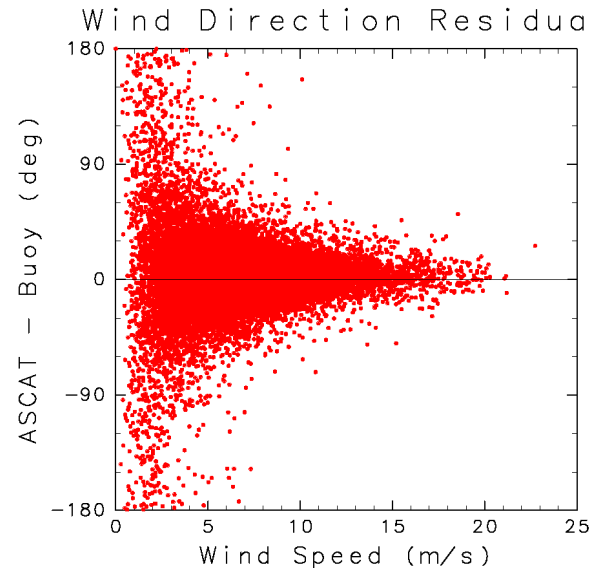
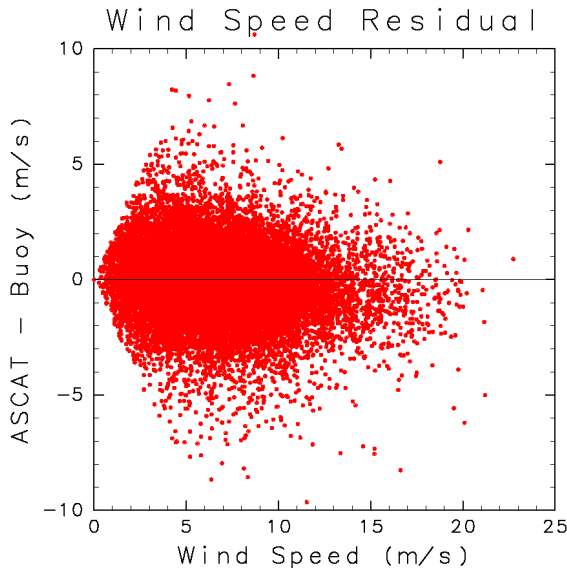
- Data Period
  - From 20 Nov. 2008 to 31 Dec. 2010
- Collocation
  - $\Delta r < 12.5$  km,  $\Delta t < 10$  min.
- Height and Stability Collections
  - Liu and Tang (1996) Code
  - 10-m height Neutral Equivalent Wind

# Comparison of ASCAT Winds with Buoy Data



	#	Bias	RMS	Correlation
Wind Speed (m/s)	27,247	-0.15	1.42	0.885
Wind Direction (deg.)				
U > 0 m/s	26,976	3.0	26.2	0.957
U > 3 m/s	23,750	2.7	17.4	0.979
U > 5 m/s	18,672	2.7	14.1	0.985

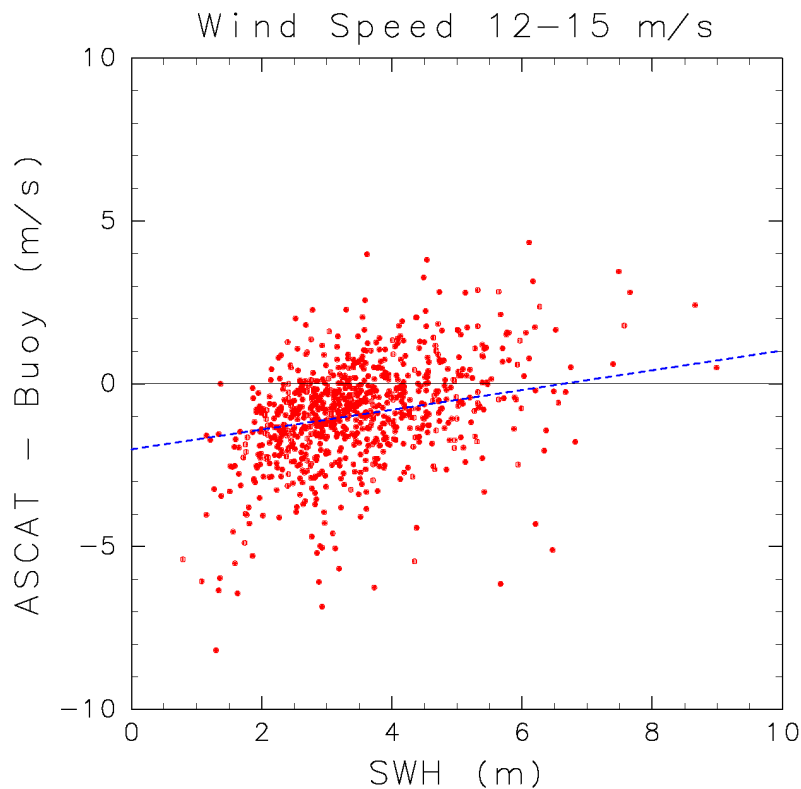
# Residuals of Wind Speed and Direction



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

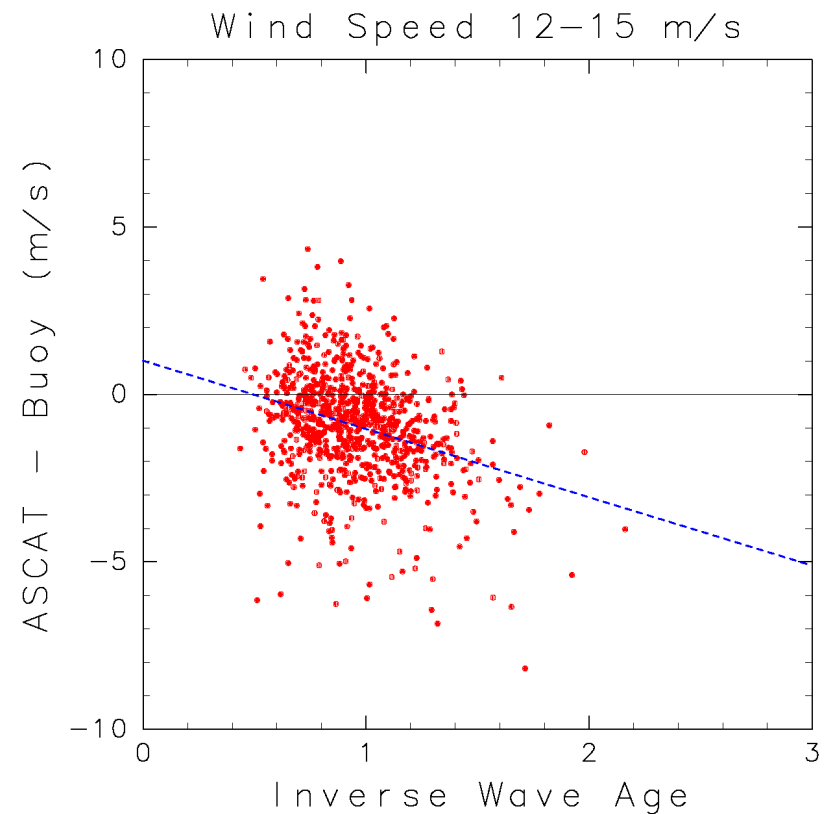
# Dependence of Wind Speed Residual on Wave Parameter

Significant Wave Height



Correlation Coefficient = 0.300

Inverse Wave Age



Correlation Coefficient = -0.311

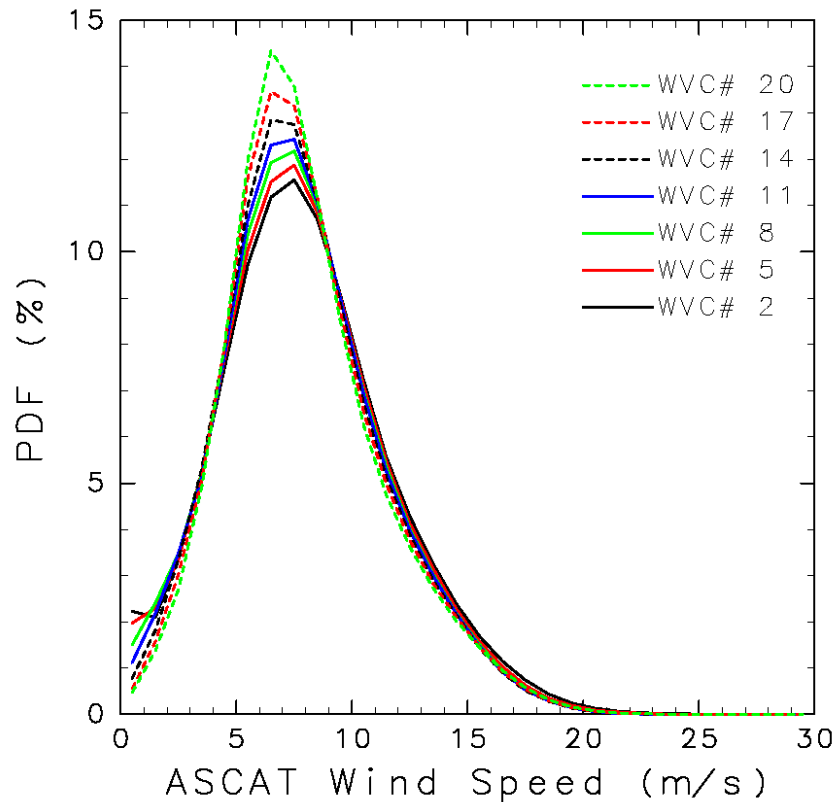
# Calculation of Global Statistics of ASCAT Wind Speeds and Directions

- ASCAT 25 km Swath Products (L2)
- 1 Jan. 2010 – 31 Dec. 2010 (1 year)
- Global ocean, 60°S – 60°N
- Collocated ECMWF winds (Non-EN wind)
- 156 million data points

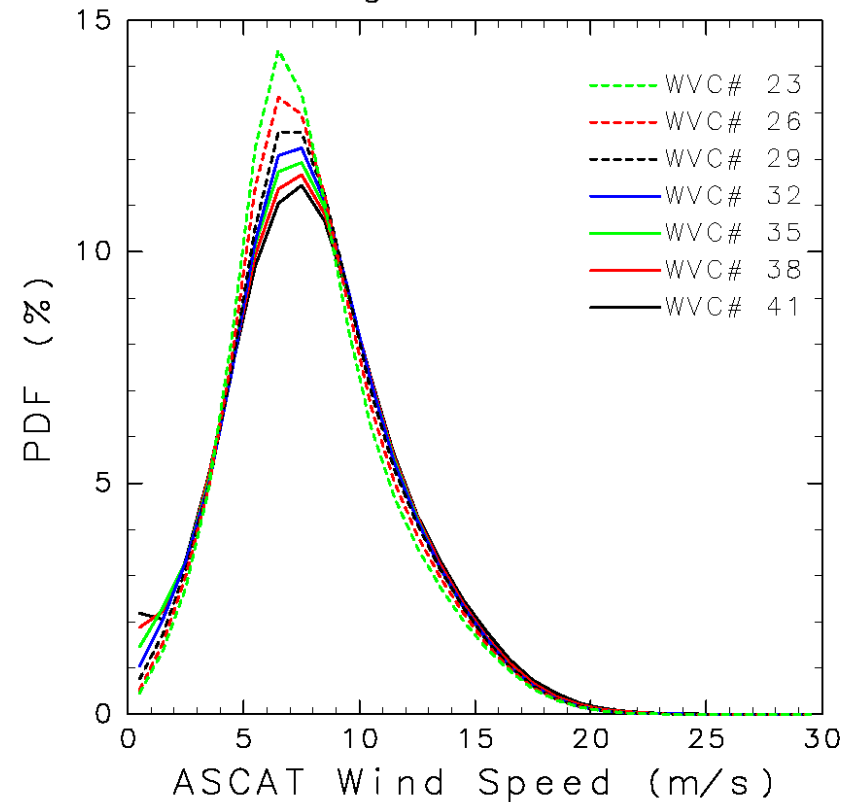


# ASCAT Global Wind Speed Histograms

Left Swath



Right Swath

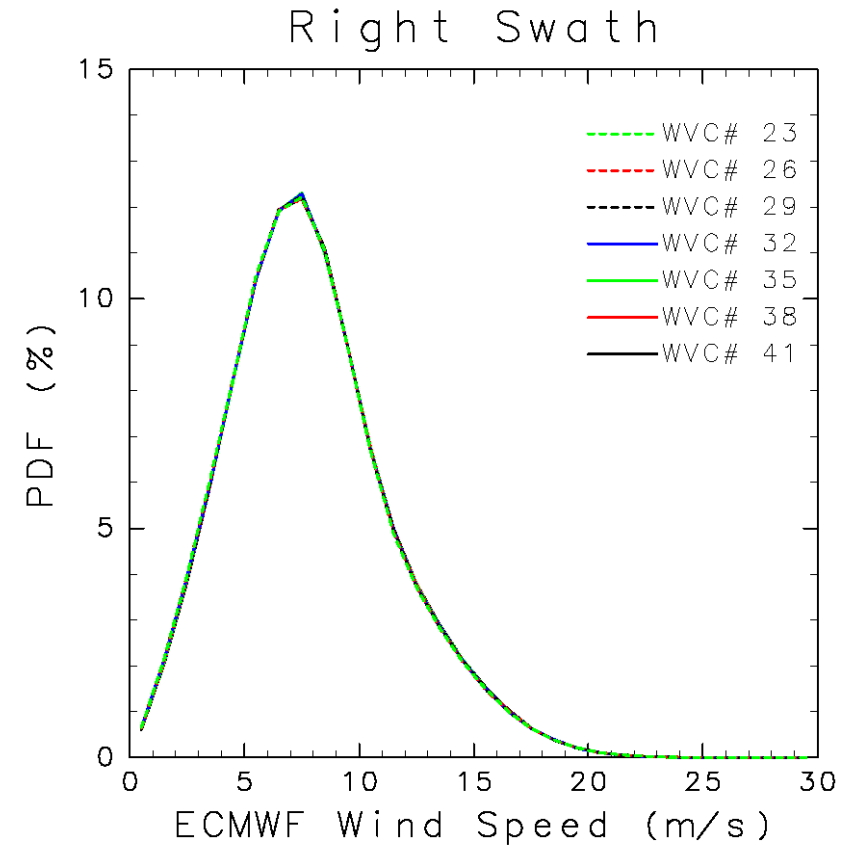
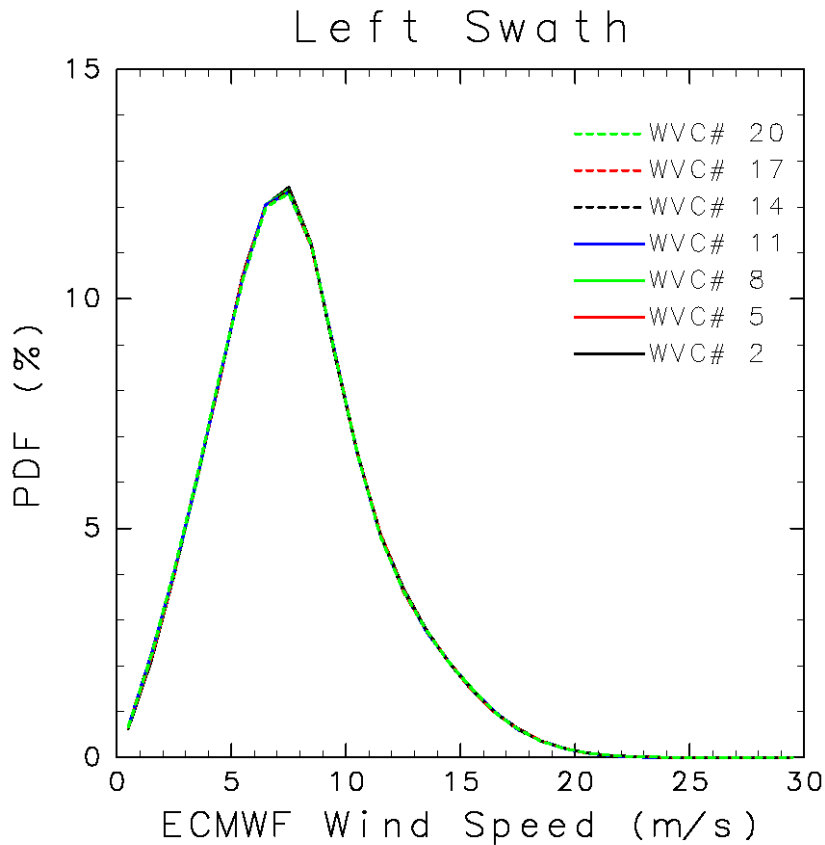


Period: 1 Jan. 2010 – 31 Dec. 2010 (1 year)

Area: global ocean, 60°S – 60°N

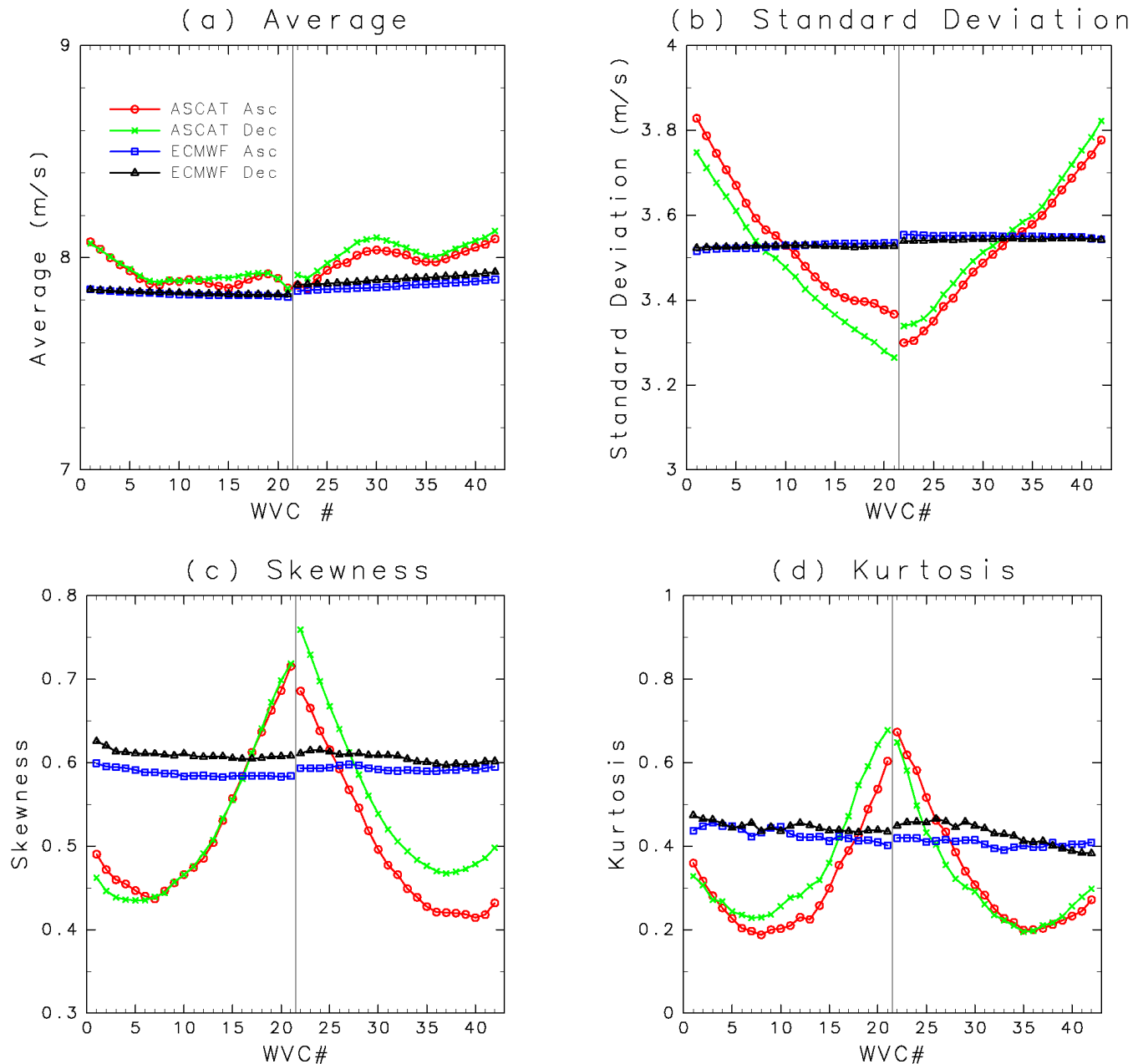
Bin size: 1 m/s

# NWP Model Wind Speed Histograms

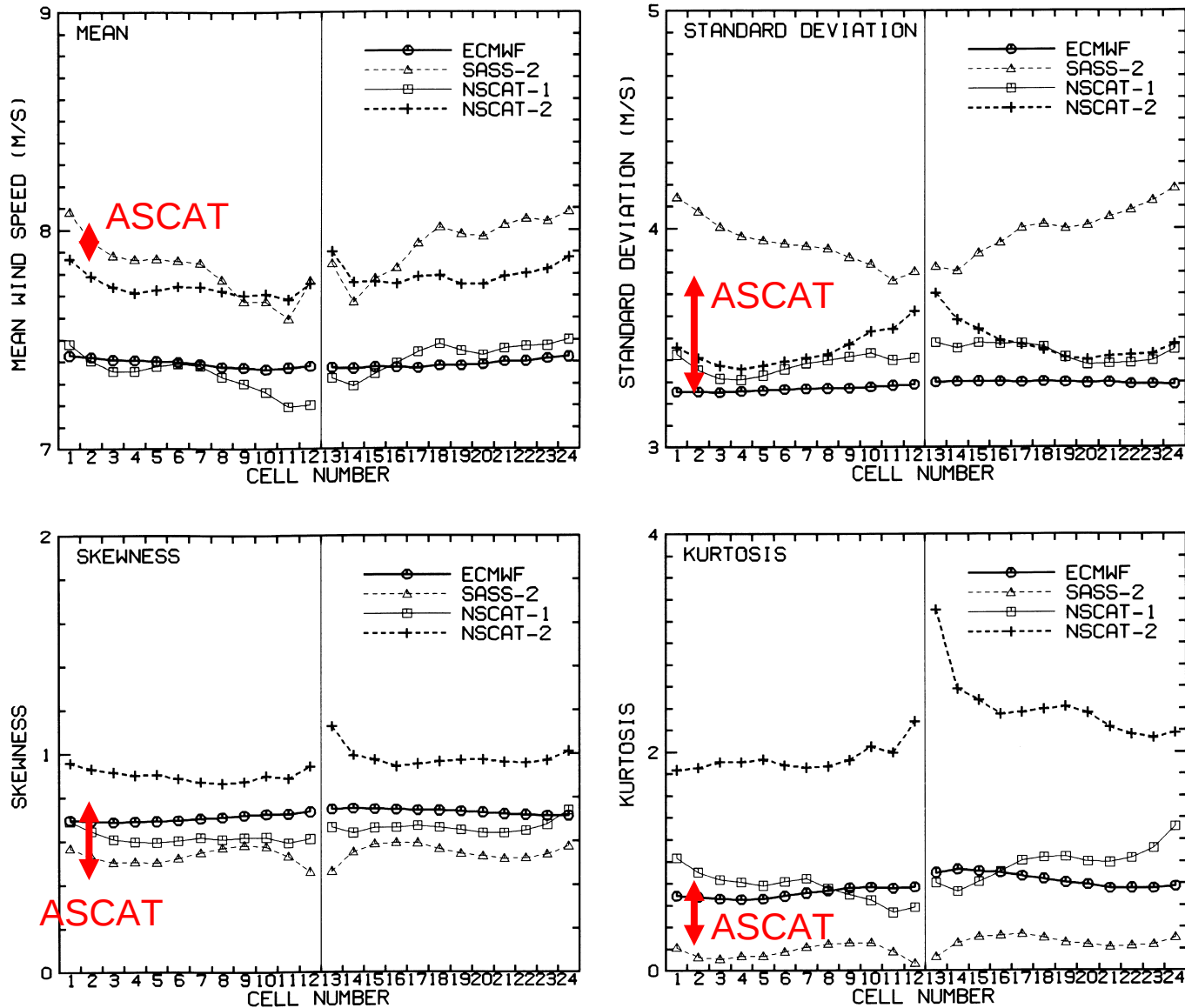


Collocated with ASCAT observations

# Statistics of ASCAT Wind Speed Distribution

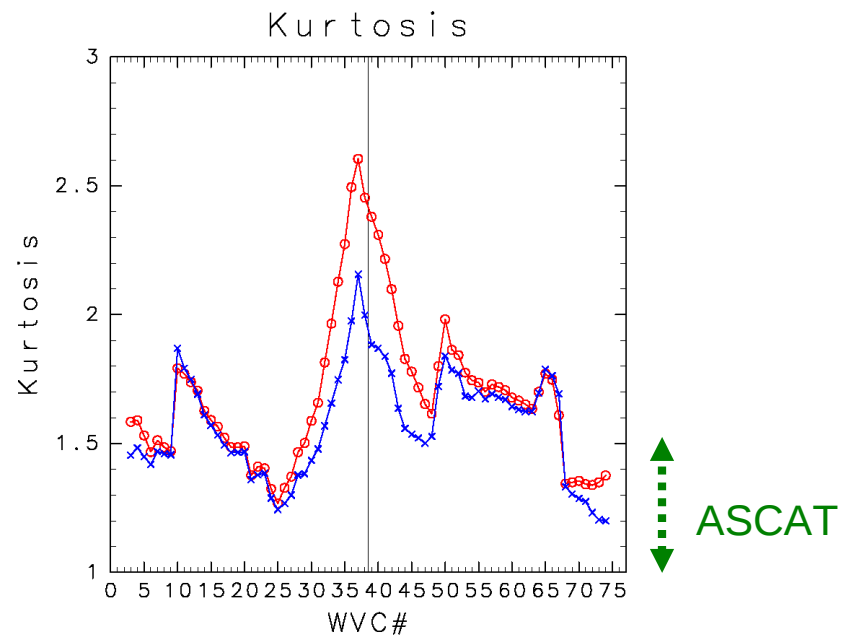
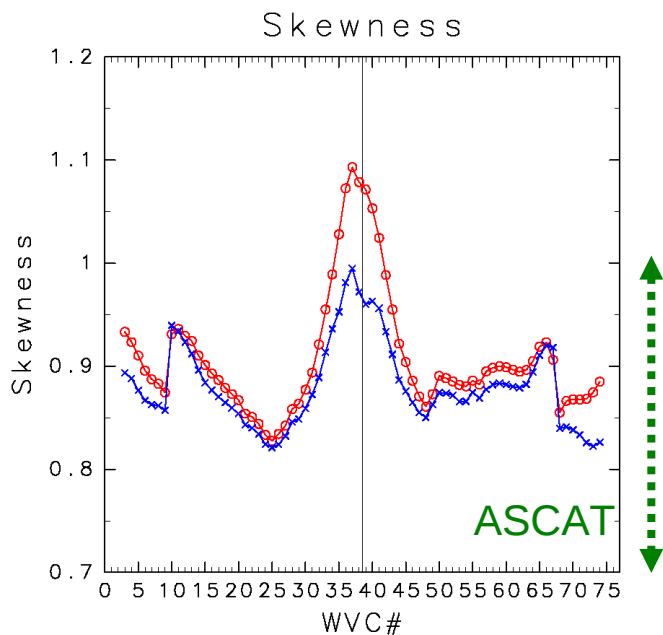
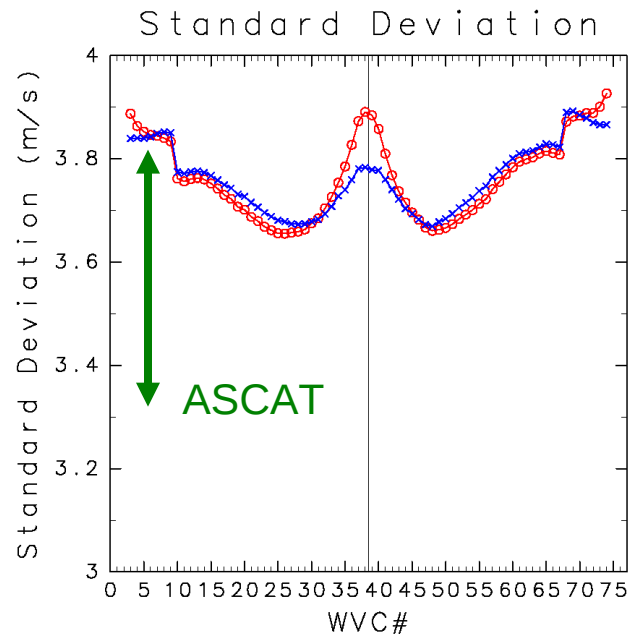
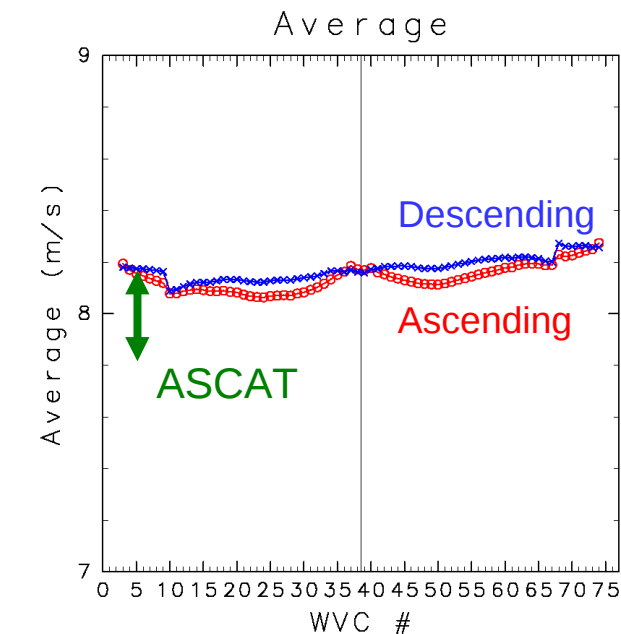


# Statistics of NSCAT Wind Speed Distribution



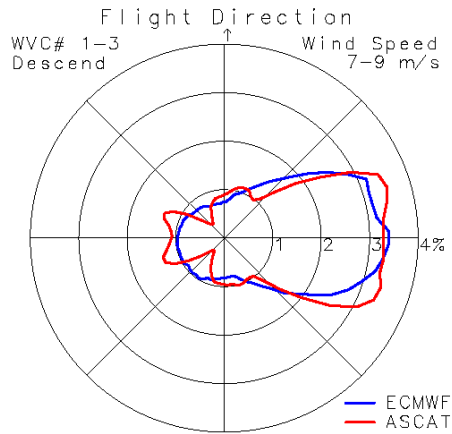
(Ebuchi, *J. Oceanogr.*, 2000)

# Statistics of QSCAT Wind Speed Distribution

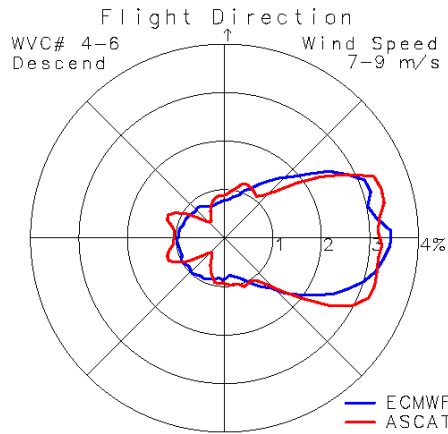


# ASCAT Wind Direction Histograms

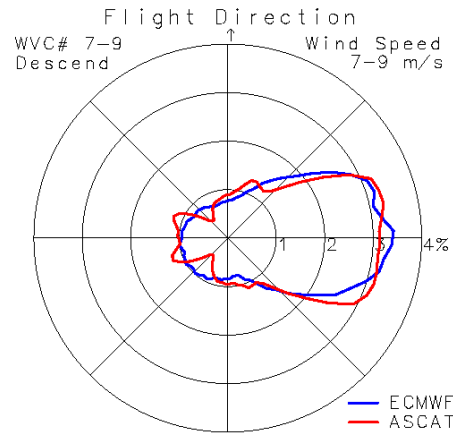
WVC# 1-3



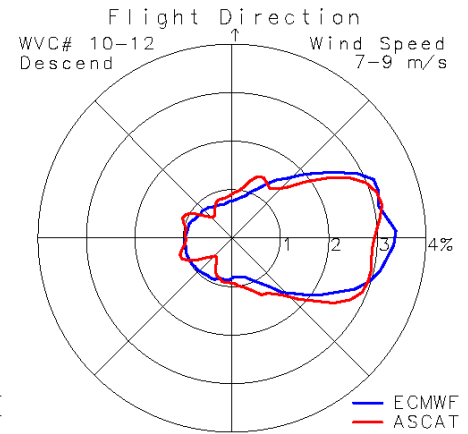
WVC# 4-6



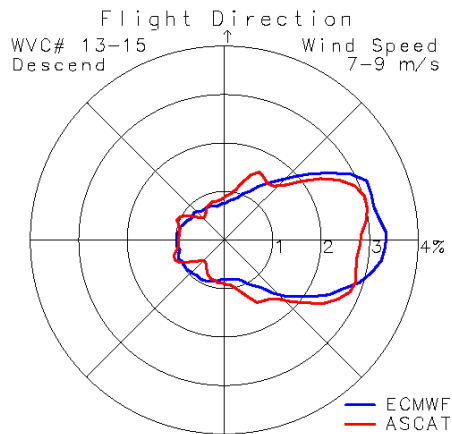
WVC# 7-9



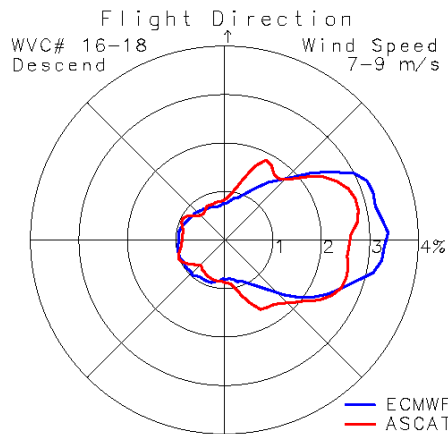
WVC# 10-12



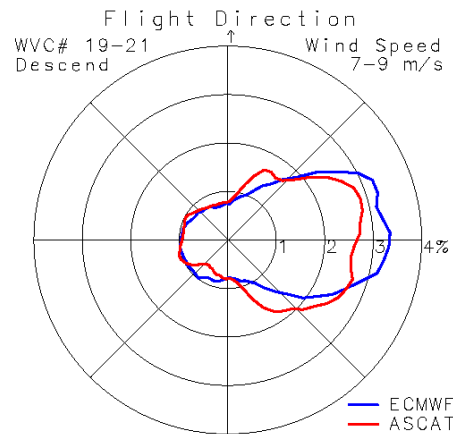
WVC# 13-15



WVC# 16-18



WVC# 19-21

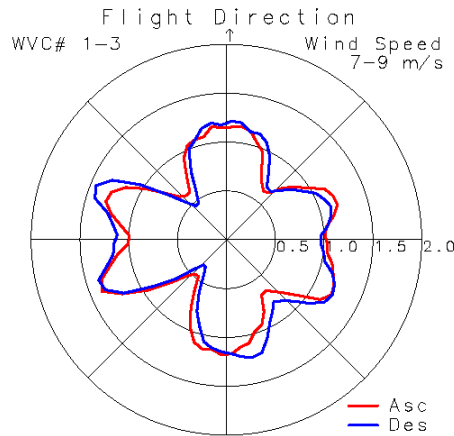


NWP Model  
ASCAT

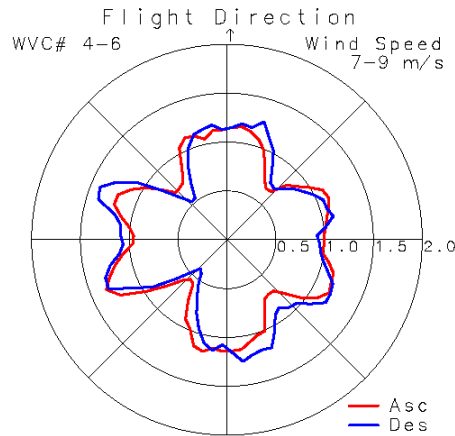
Left Swath, Wind Speed Range: 7-9 m/s, Descending Paths

# Normalized ASCAT Wind Direction Histograms

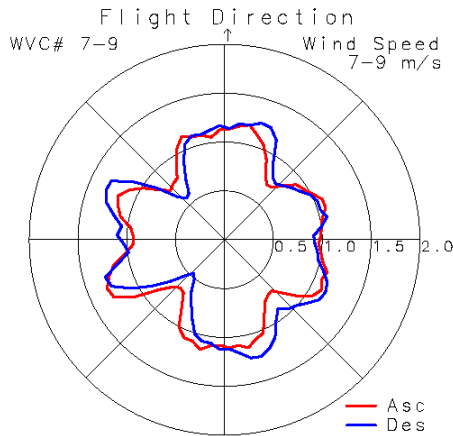
WVC# 1-3



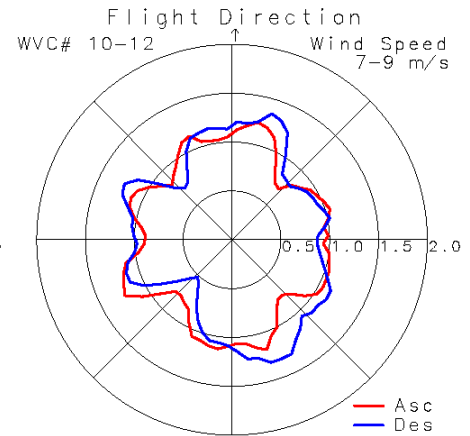
WVC# 4-6



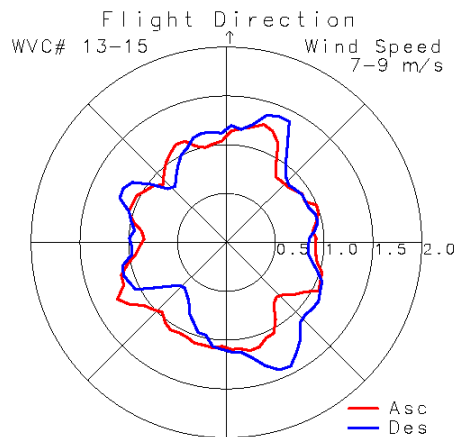
WVC# 7-9



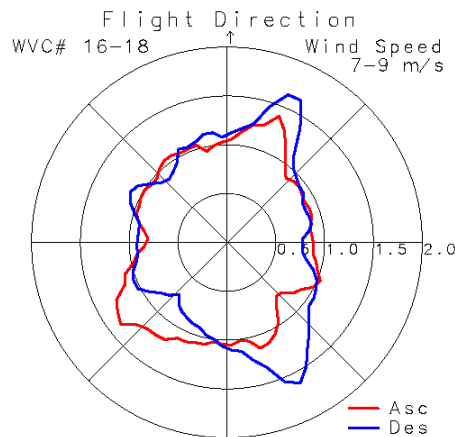
WVC# 10-12



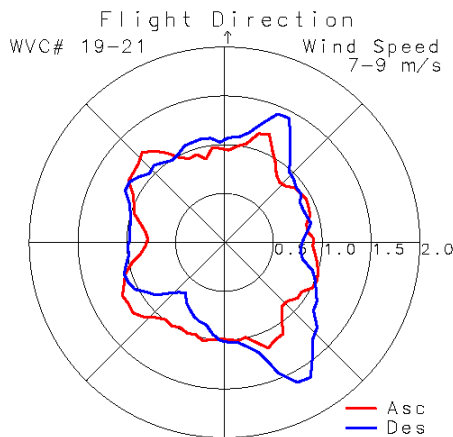
WVC# 13-15



WVC# 16-18



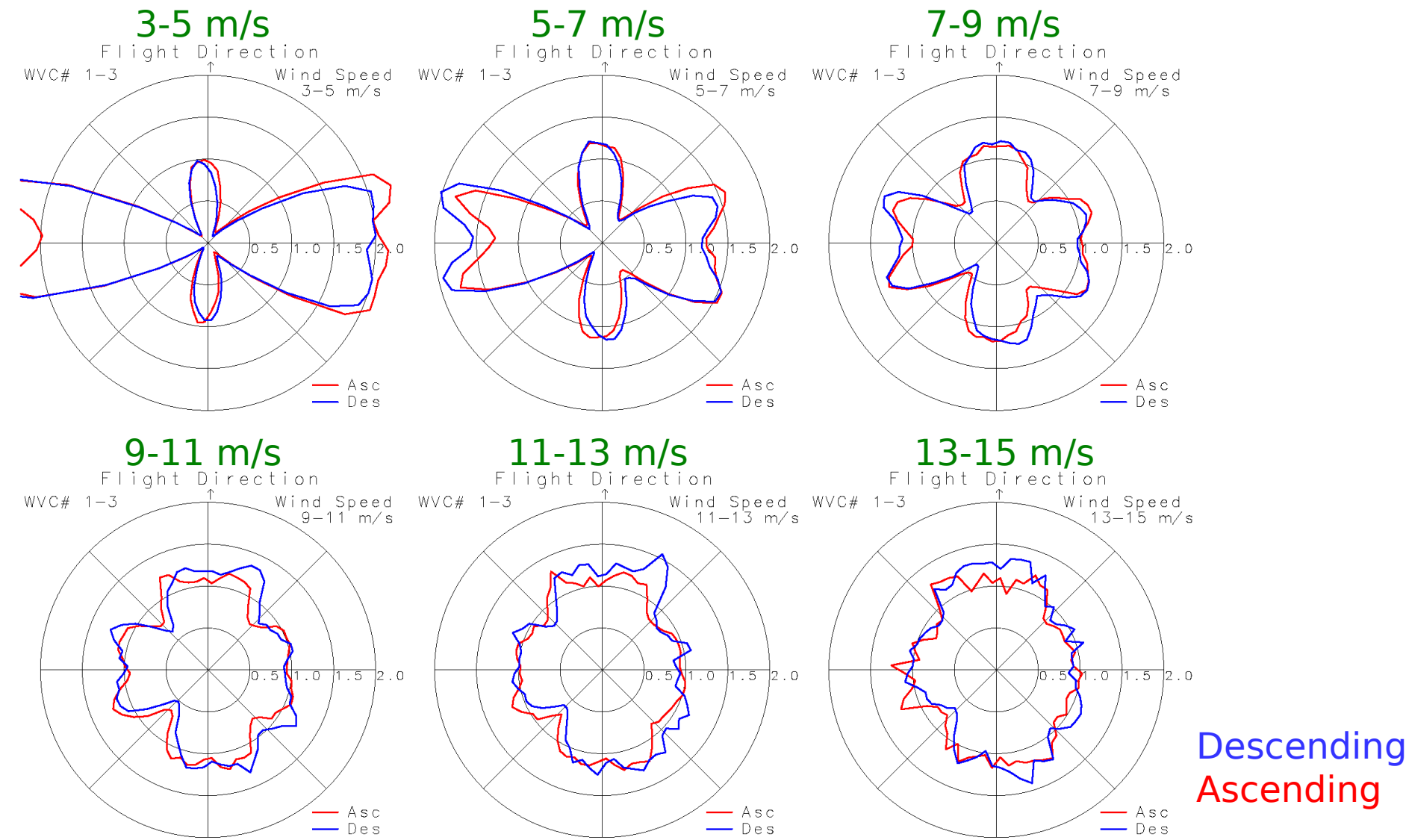
WVC# 19-21



Descending  
Ascending

Normalized (ASCAT/NWP), Left Swath, Wind Speed Range: 7-9 m/s

# Wind Speed Dependence of Normalized Wind Direction Histograms (Outer Cells)

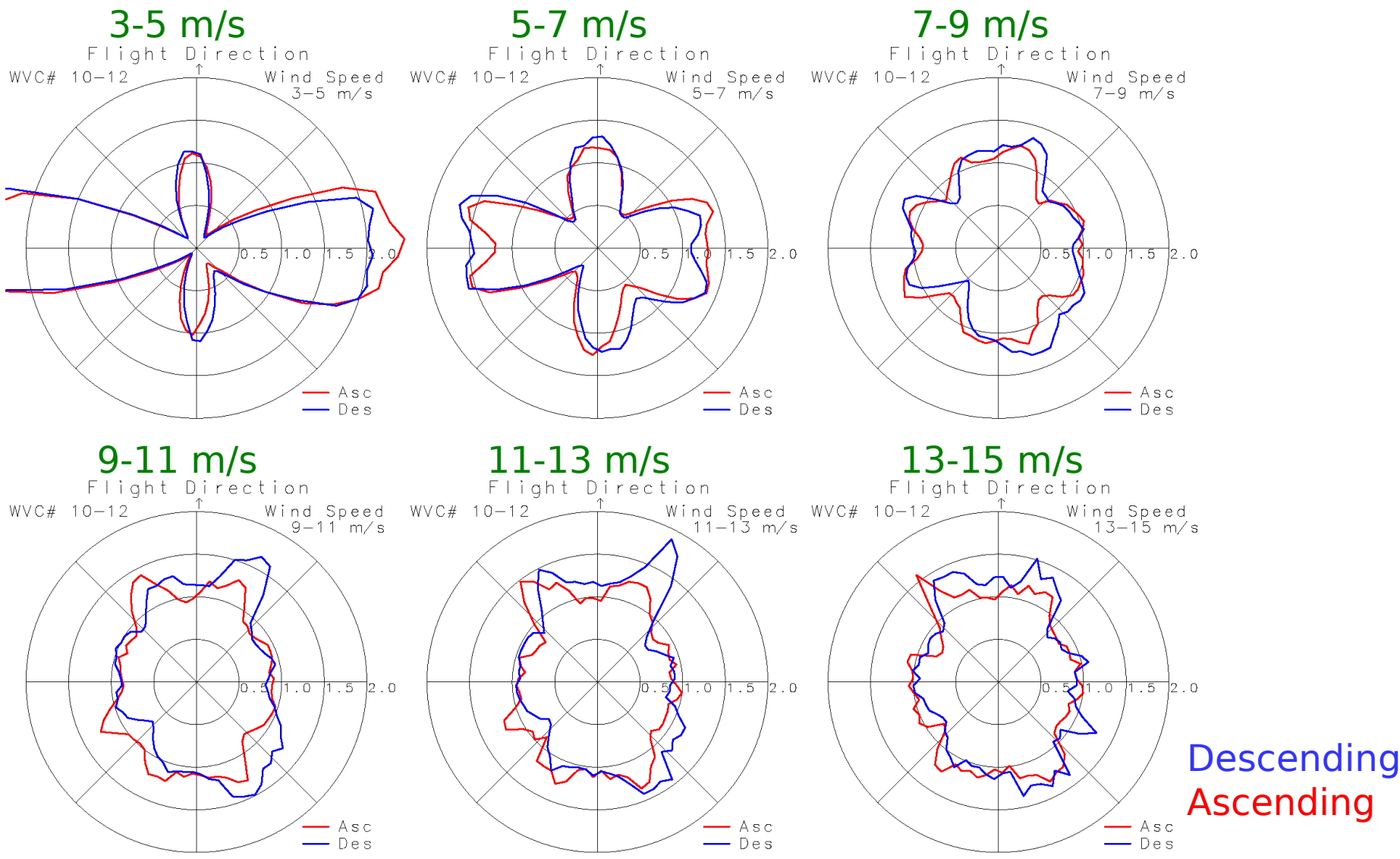


Descending  
Ascending

Normalized (ASCAT/NWP), WVC#: 1-3 (Left Outer Swath)



# Wind Speed Dependence of Normalized Wind Direction Histograms (Mid Cells)

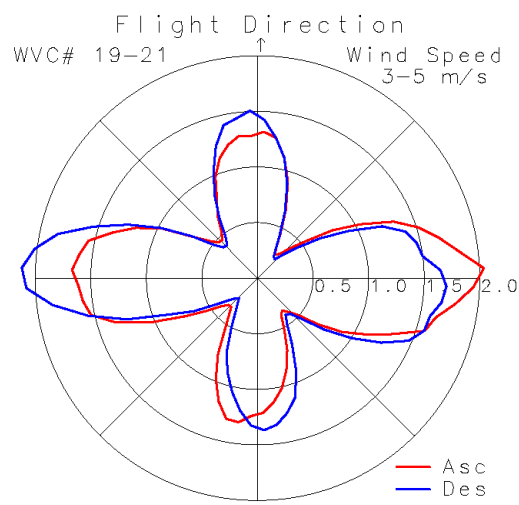


Descending  
Ascending

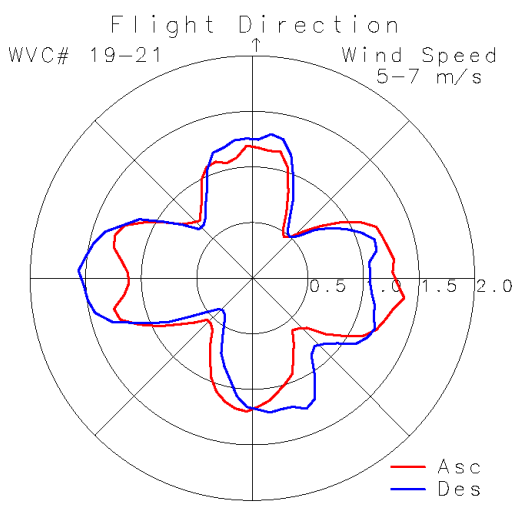
Normalized (ASCAT/NWP), WVC#: 10-12 (Left Mid Swath)

# Wind Speed Dependence of Normalized Wind Direction Histograms (Inner Cells)

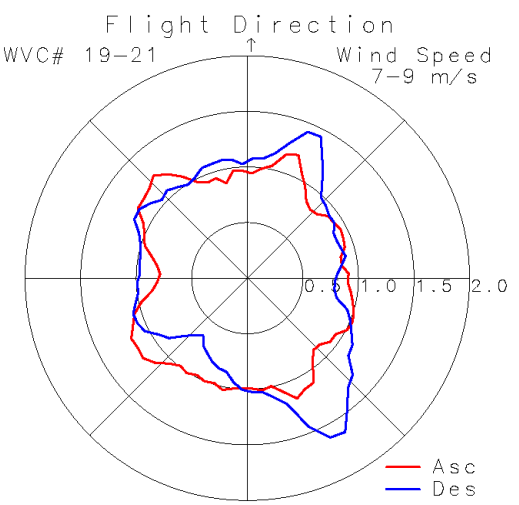
3-5 m/s



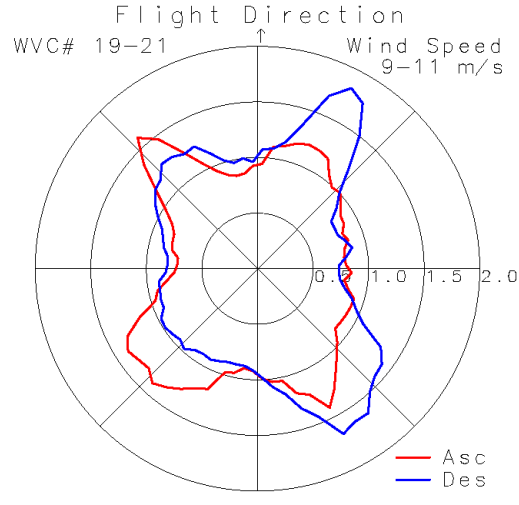
5-7 m/s



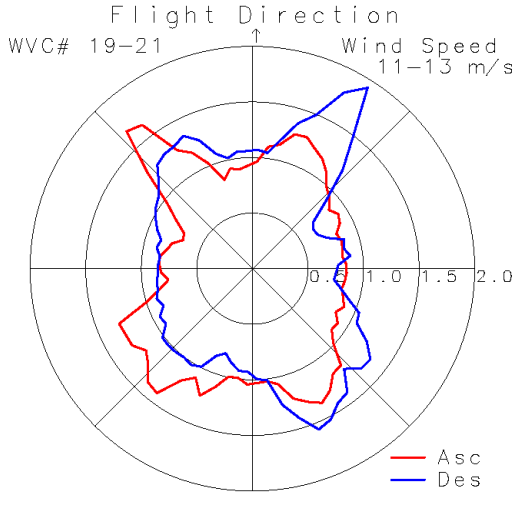
7-9 m/s



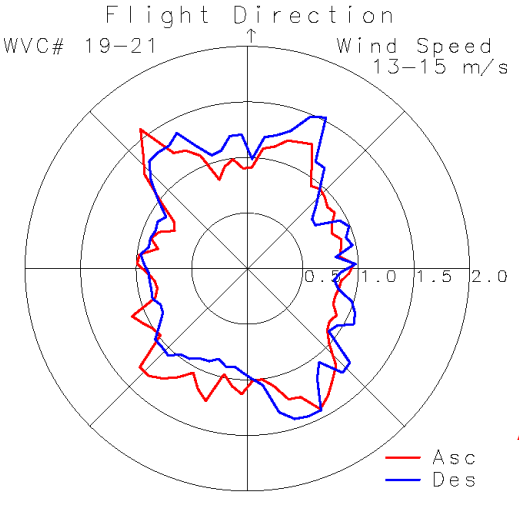
9-11 m/s



11-13 m/s



13-15 m/s

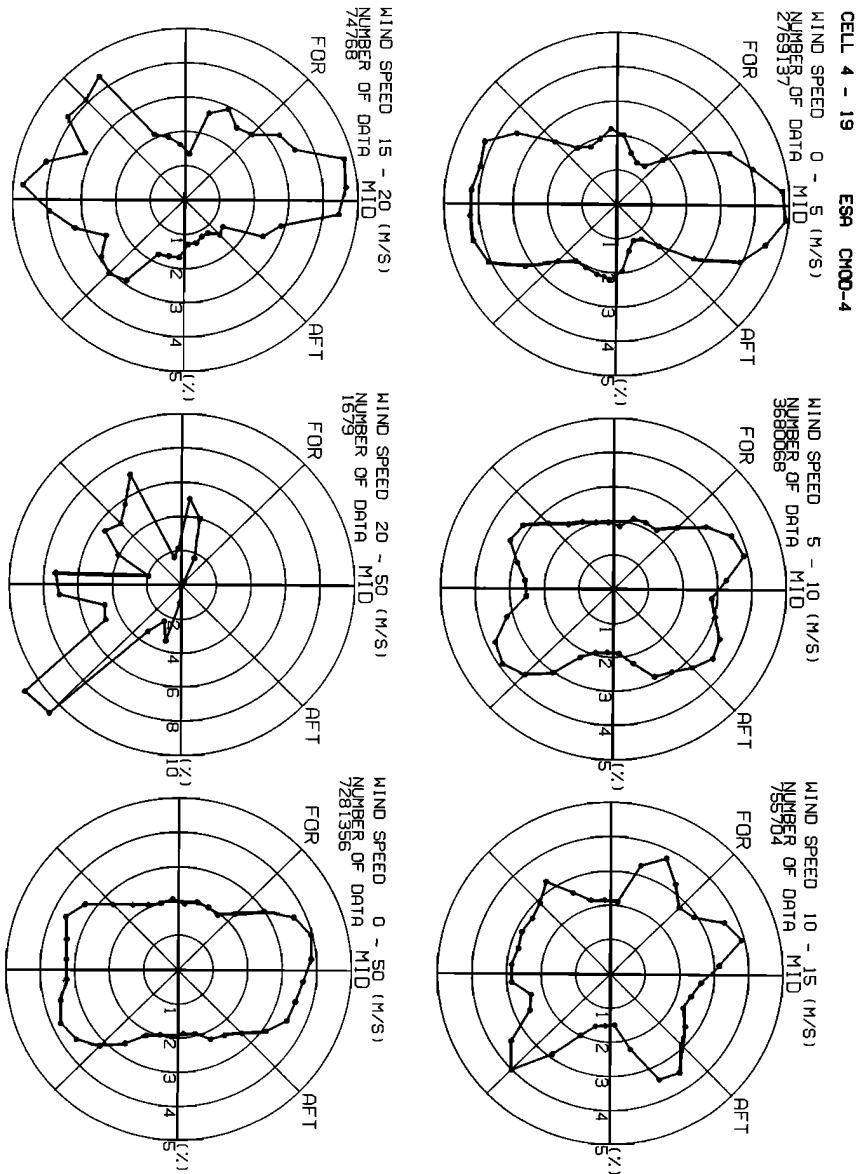


Descending  
Ascending

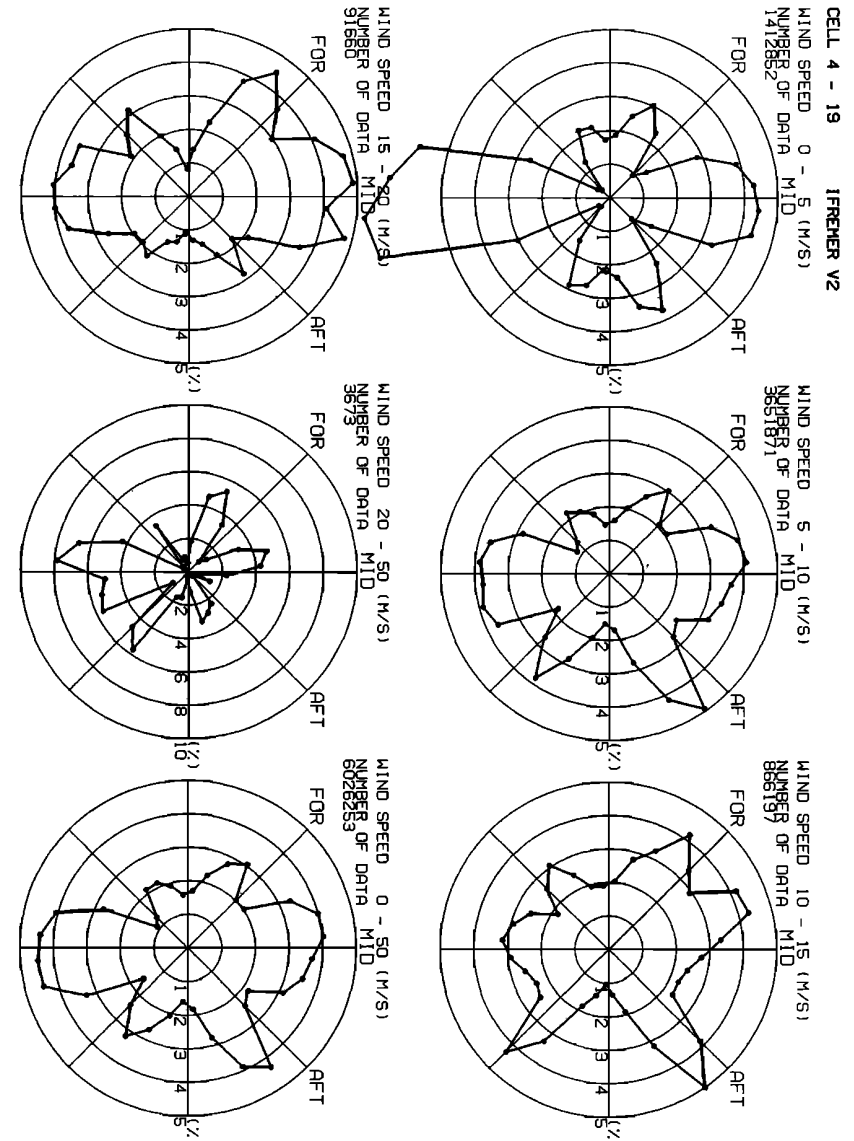
Normalized (ASCAT/NWP), WVC#: 19-21 (Left Inner Swath)

# Histograms of ERS-1 Wind Directions

## CMOD-4



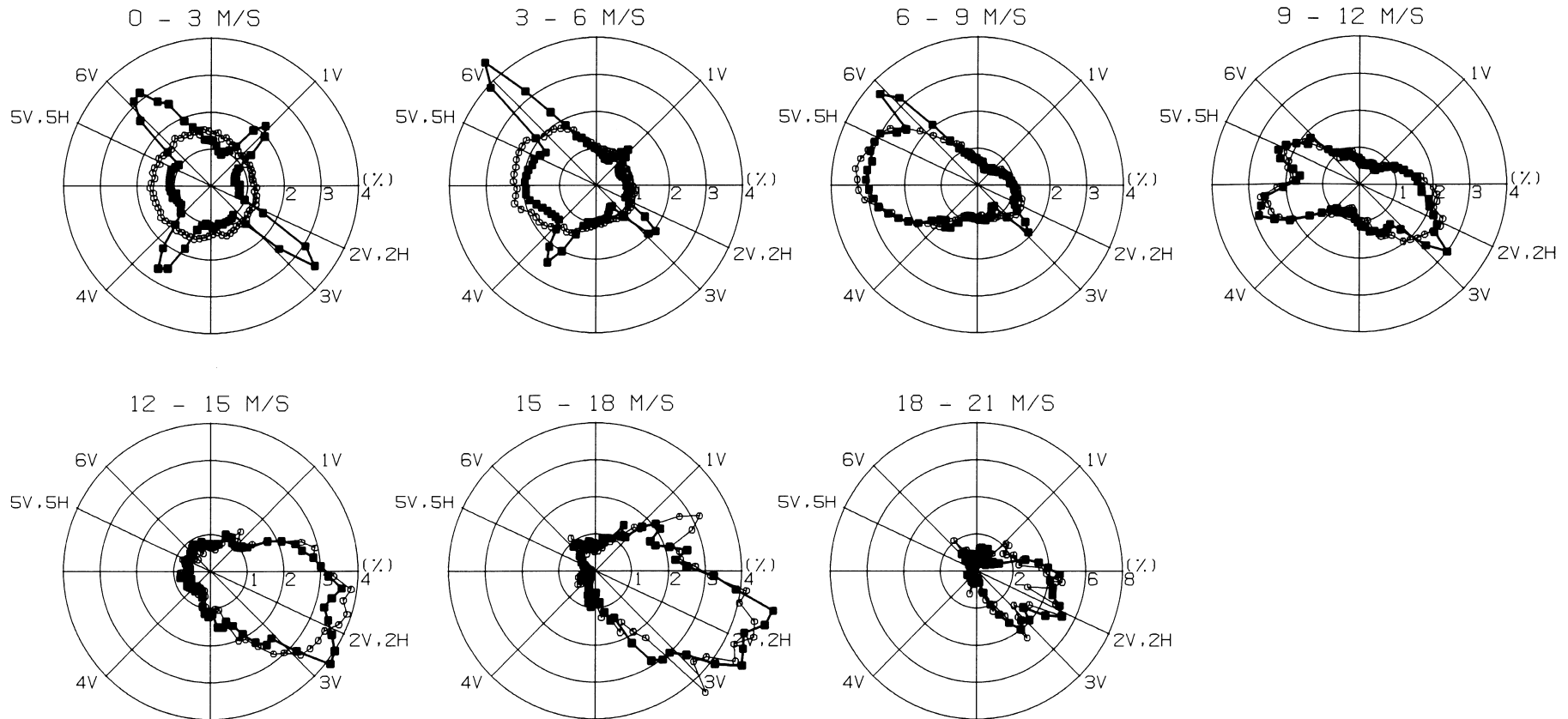
## CMOD-IFR2



(Ebuchi & Graber, *JGR*, 1998)

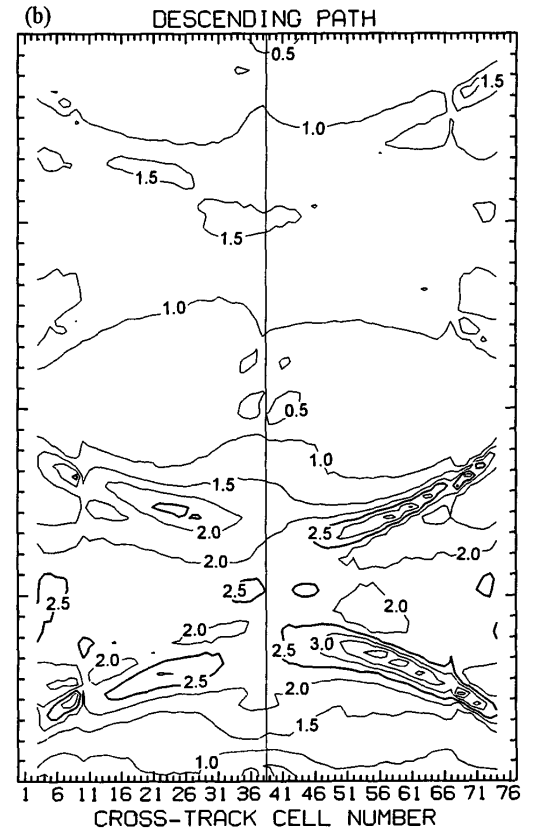
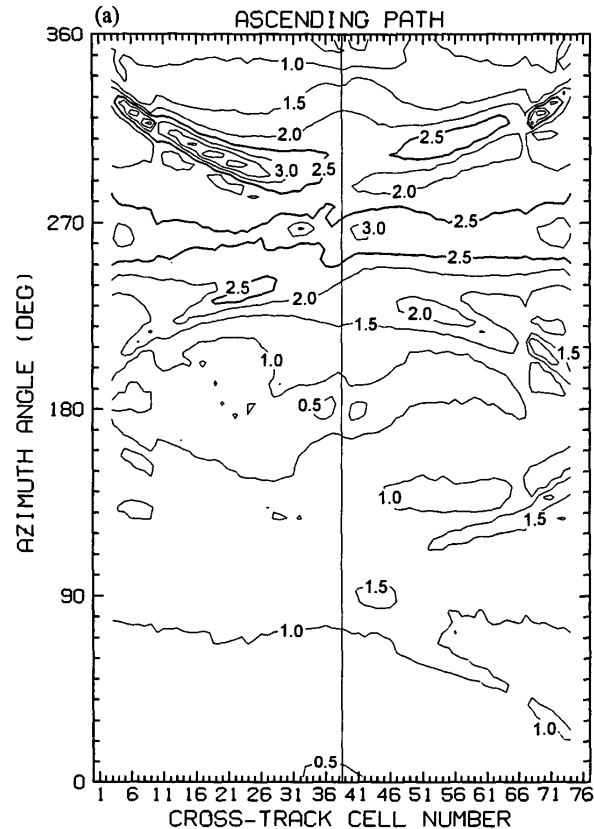
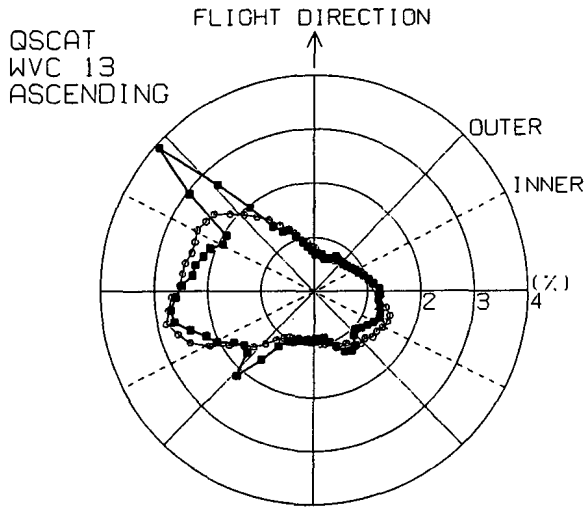
# Histograms of **NSCAT** Wind Directions

RIGHT SWATH, ASCENDING



(Ebuchi, *JGR*, 1999)

# Histograms of QSCAT Wind Directions



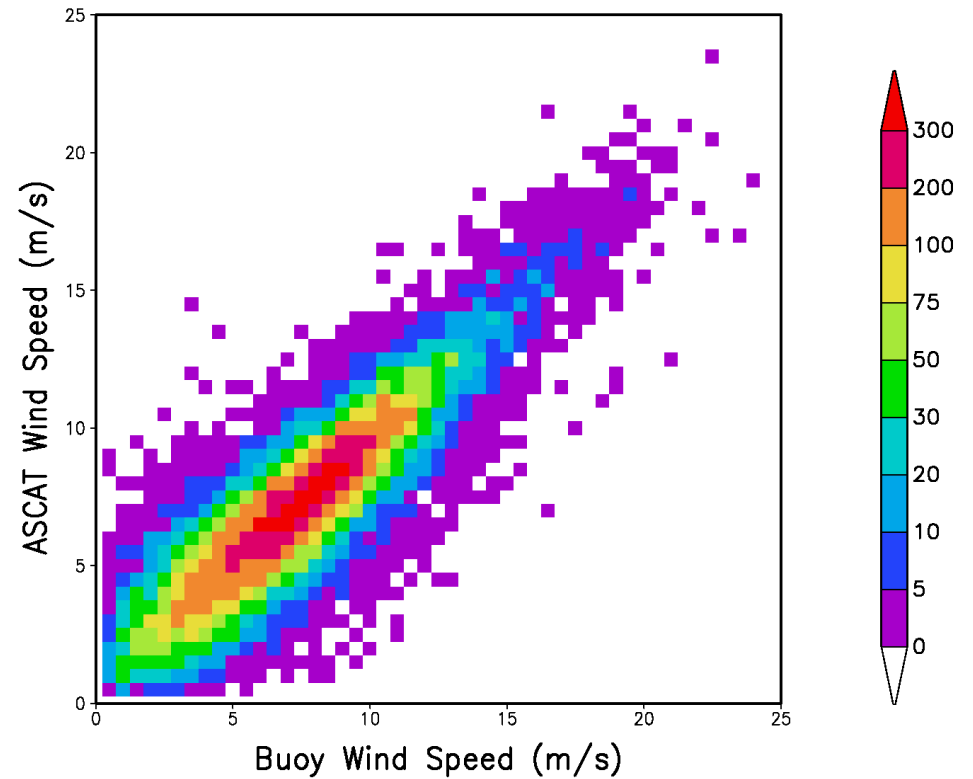
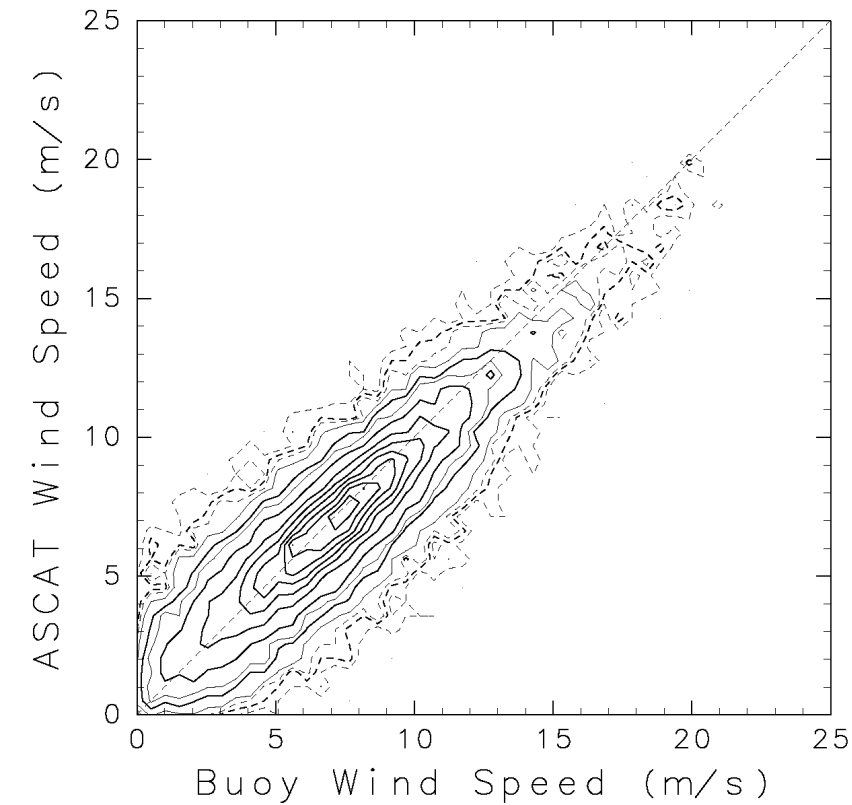
(Ebuchi, *Proc. IGARSS 2000*, 2000)

# Summary

- ASCAT wind speeds and directions agrees well with buoy observations in general.
- ASCAT global wind speed histogram varies with cross-track cell location. This trend is clearly represented by statistical parameters, such as standard deviation, skewness and kurtosis.
- Directivity relative to the antenna beams is discernible for ASCAT wind directions.
- At low wind speeds and the outer cells (high incidence), most of wind vectors aligned to the flight direction or mid-beam direction.
- These results suggest the needs for further refinements of the wind retrieval algorithms and the C-band GMF.



# Comparison of wind speed





# Residuals of Wind Speed and Direction

