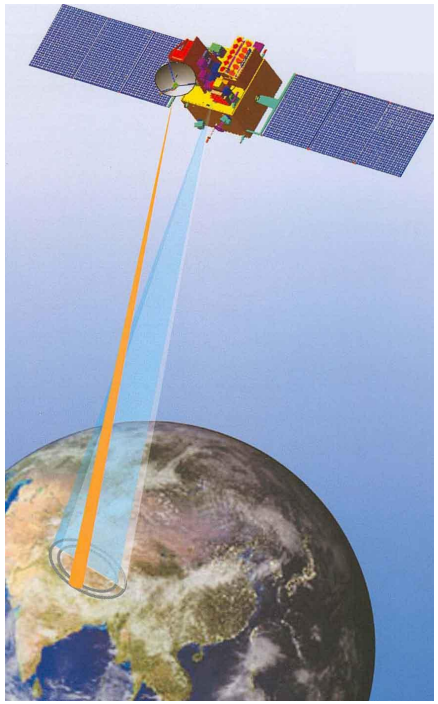
Intercomparison of Four Ocean Vector Wind Products from OCEANSAT-2 Scatterometer



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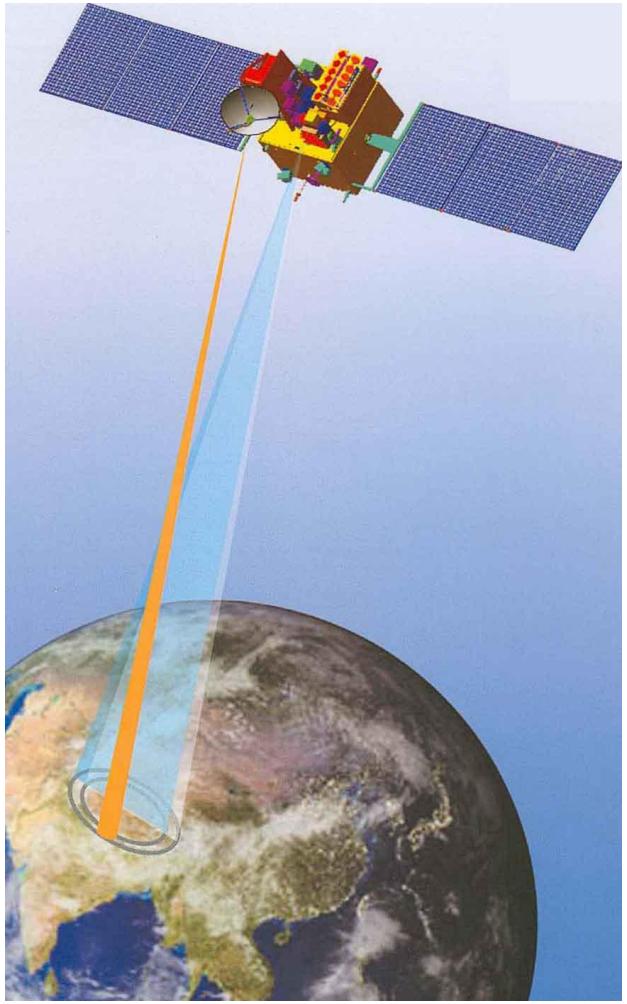
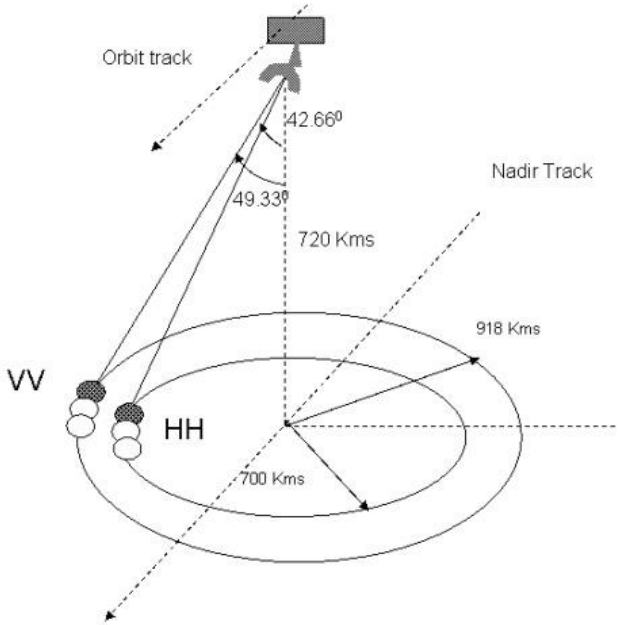
Oceansat-2 Scatterometer (OSCAT)



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



Oceansat-II Scatterometer Viewing Geometry

Four Data Sets

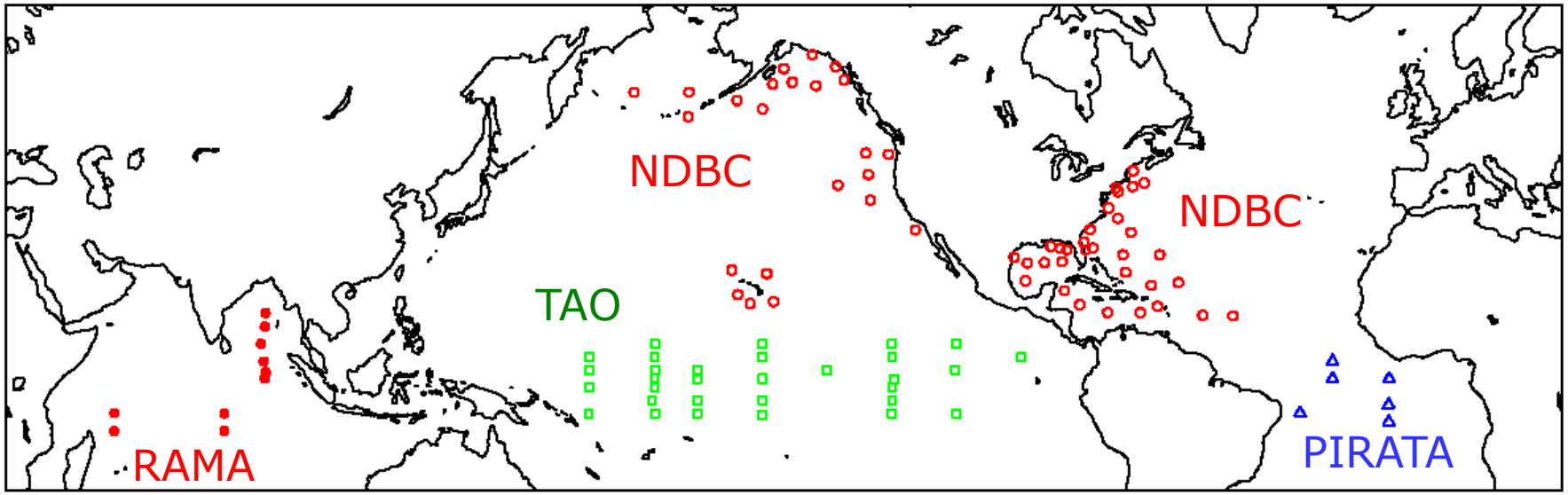
1. ISRO/NRSC (ver. 1.3)
   - 50 km resolution
   - 1 Jan. 2011 – 31 Mar. 2012 (15 months)
2. NOAA/NESDIS
   - 25 km resolution
   - 1 Jan. 2012 – 31 Mar. 2012 (3 months)
3. KNMI/OSI SAF
   - 50 km resolution
   - 1 Dec. 2012 – 31 Mar. 2013 (4 months)
4. JPL/PODAAC
   - 12.5 km resolution
   - 1 Jan. 2011 – 31 Dec. 2011 (12 months)
   - Rain correction + Cross-track bias correction

Outline

- Comparisons with buoy data

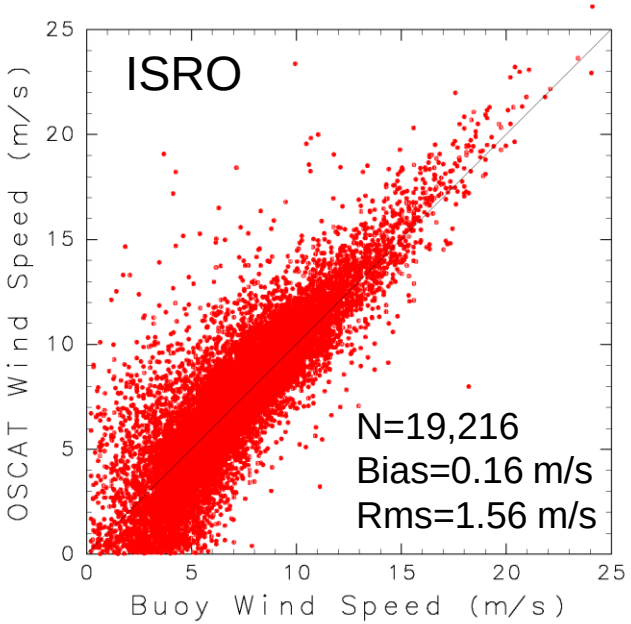
- Assessment of statistical distributions of wind speeds and directions
  - Global wind speed histograms
  - Directional distributions relative to antenna beams

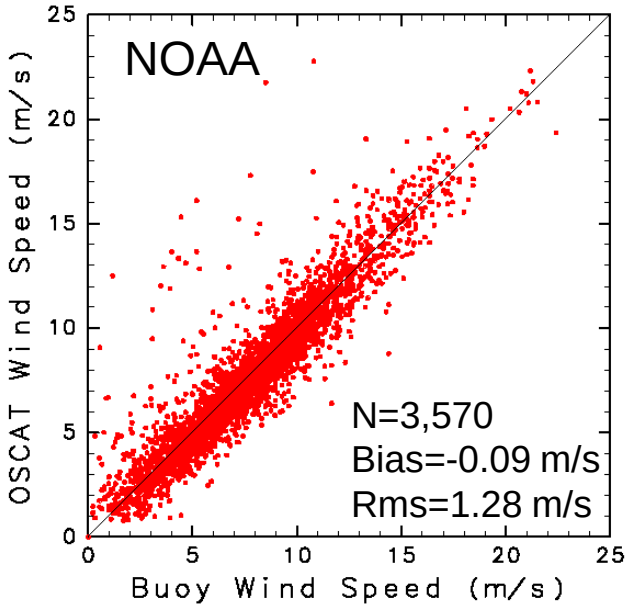
Buoy Data for Comparison with OSCAT

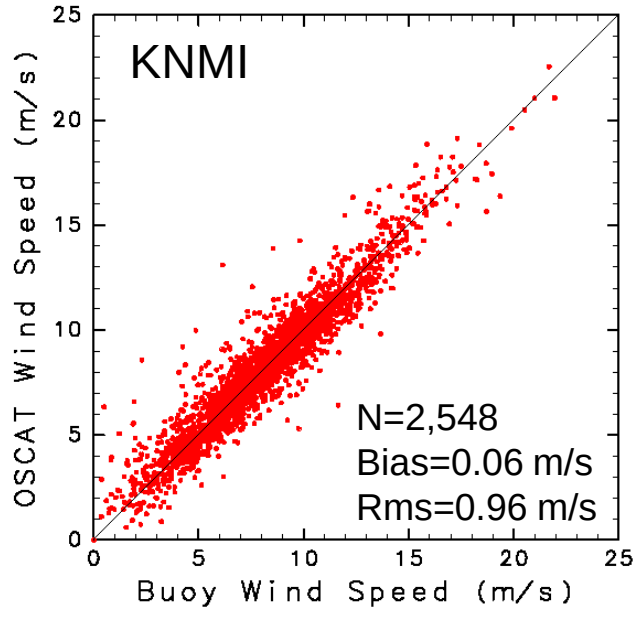


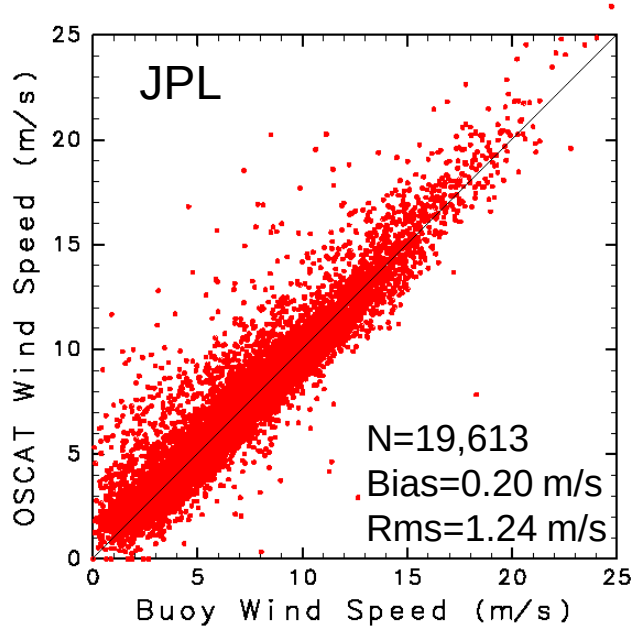
- Collocation
  - $\Delta r < 0.5$*spatial resolution, $\Delta t < 10$ min.
- Height and Stability Collections
  - Liu and Tang (1996) Code
  - 10-m height Equivalent Neutral Wind Speed

Comparisons of Wind Speed (1)

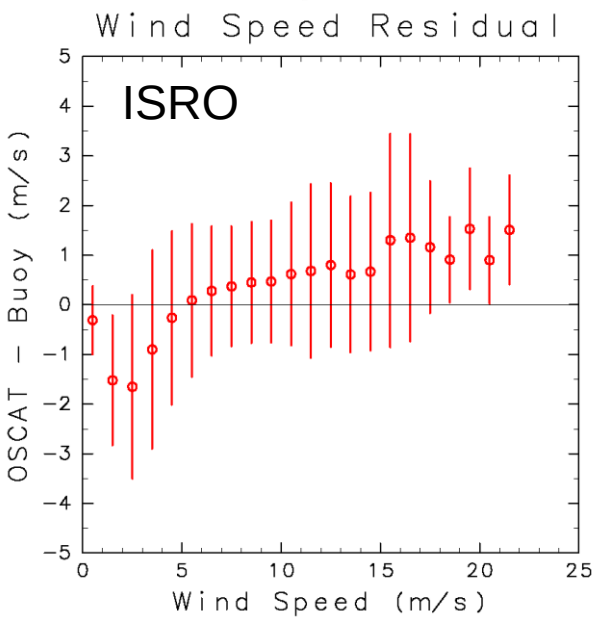


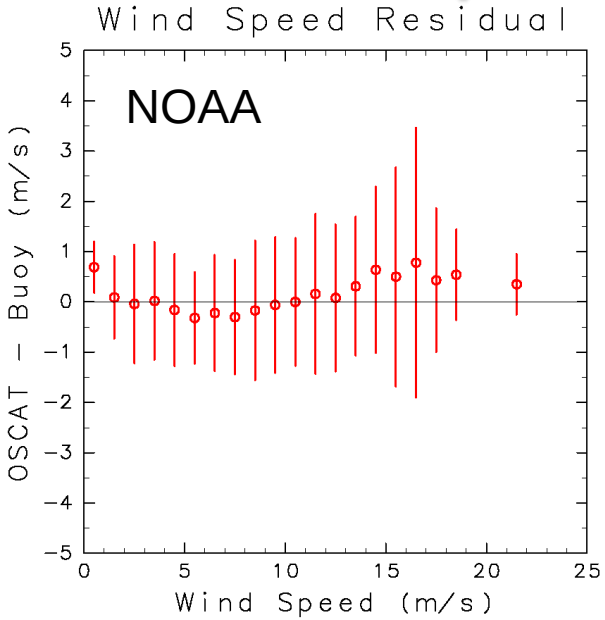


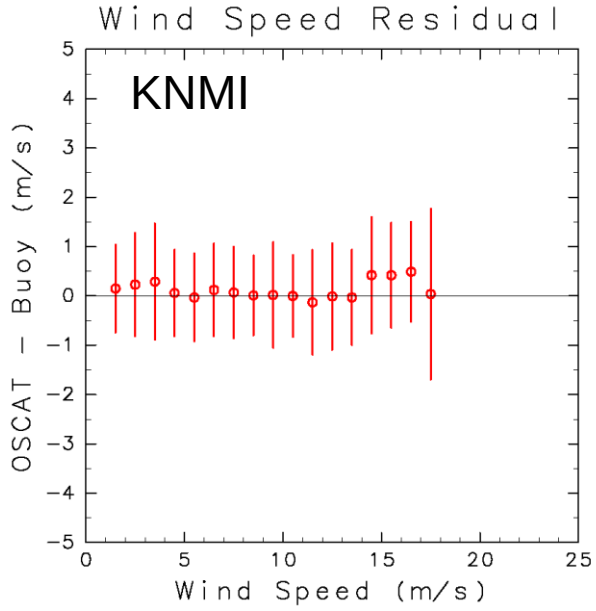


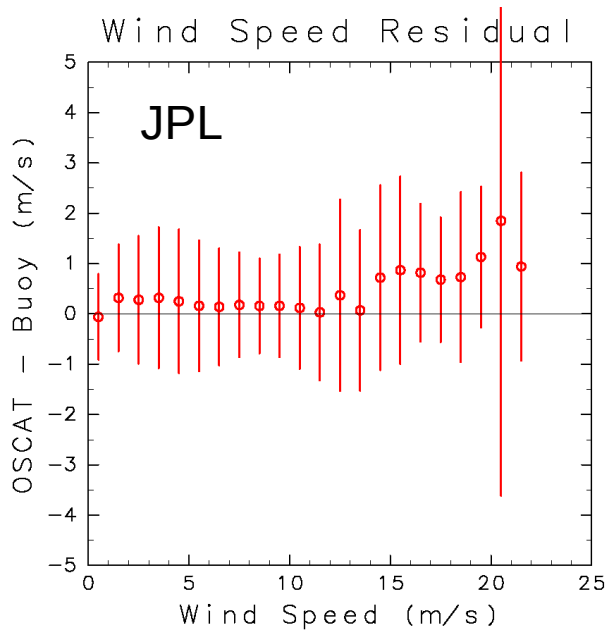


Comparisons of Wind Speed (2)



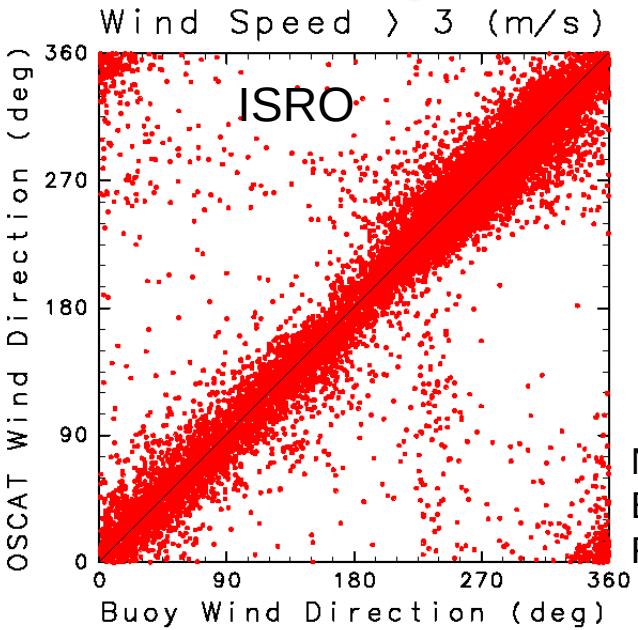




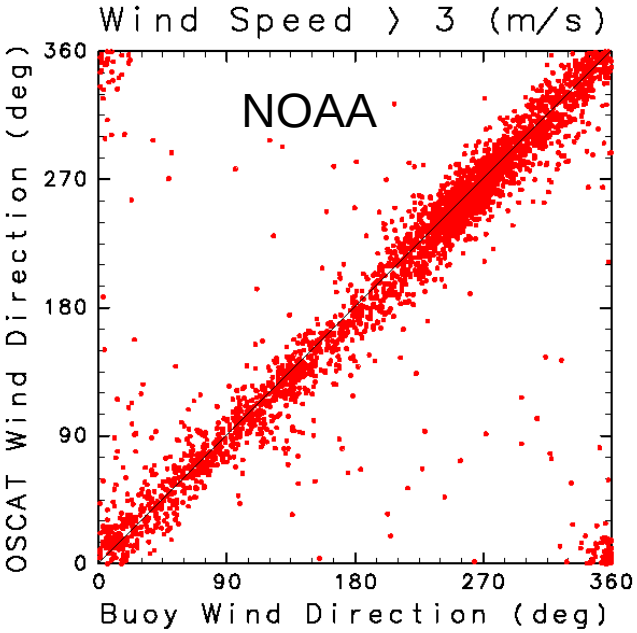


Binning wind speed
= $(U_{buoy} + U_{scat})/2$

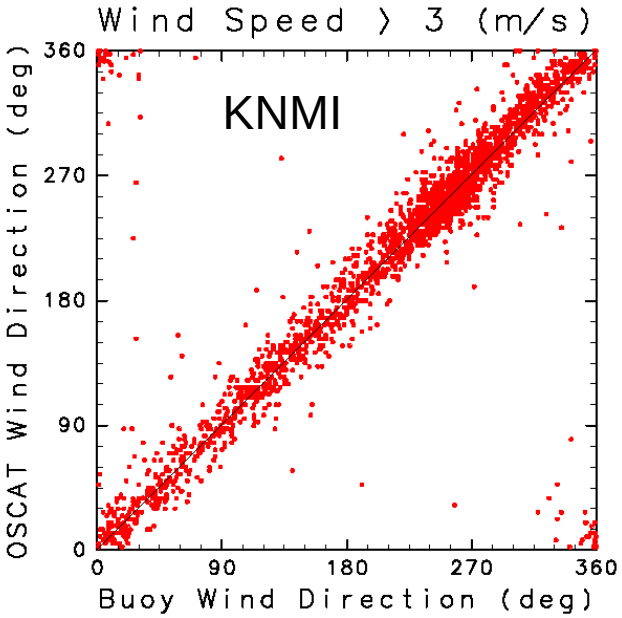
Comparisons of Wind Direction (1)



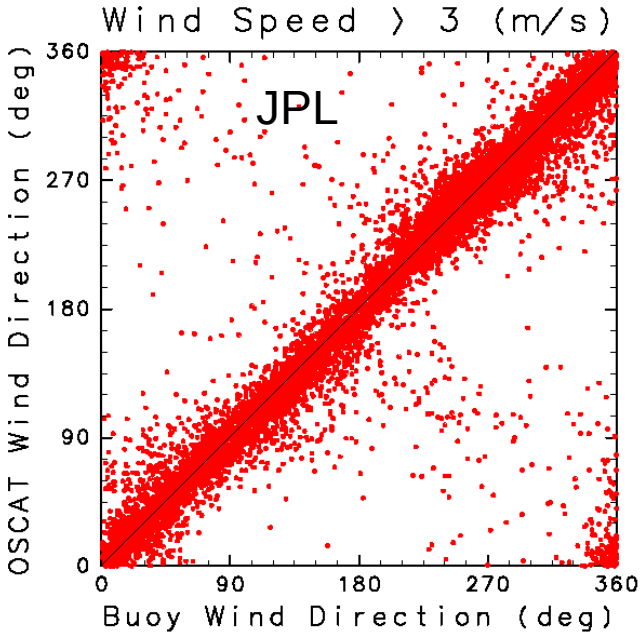
N=17,088
Bias=-0.2 deg
Rms=22.9 deg



N=3,205
Bias=-1.9 deg
Rms=19.7 deg



N=2,413
Bias=2.7 deg
Rms=16.1 deg

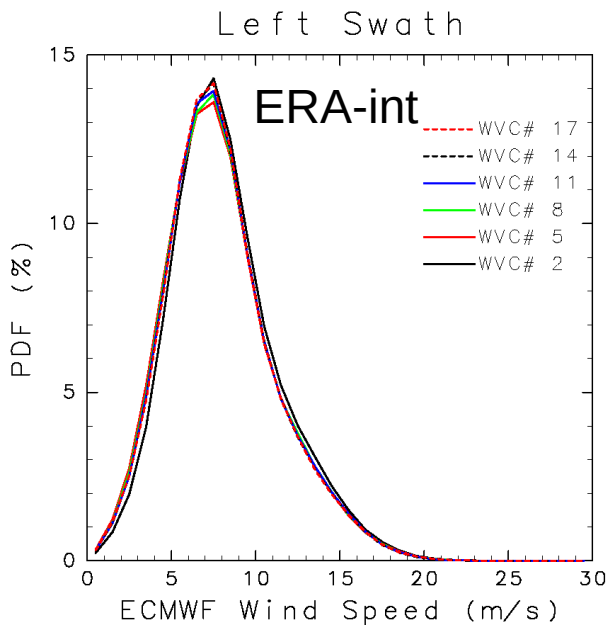


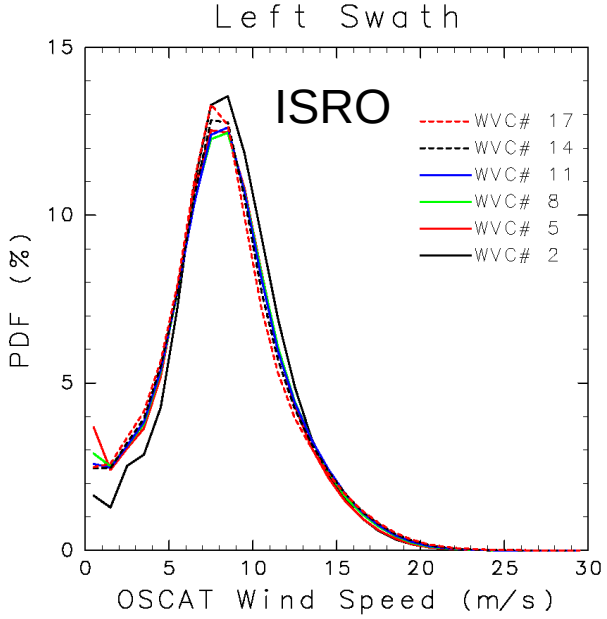
N=17,243
Bias=-1.0 deg
Rms=20.0 deg

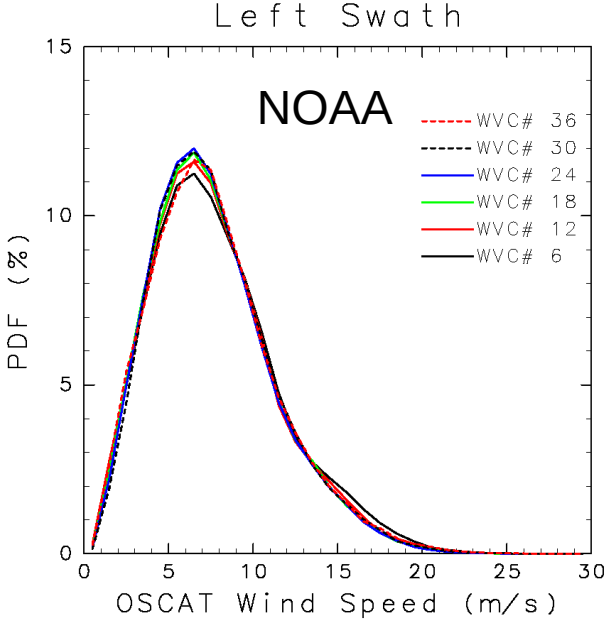
Statistics of Buoy Comparison

	ISRO	NOAA	KNMI	JPL
Spatial resolution	50	25	50	12.5
Wind Speed (m/s)				
Number of data	19,216	3,570	2,548	19,613
Bias	0.16	-0.09	0.06	0.20
Rms difference	1.56	1.28	0.96	1.24
Correlation	0.870	0.930	0.952	0.920
Wind Direction (deg.), U > 3 m/s				
Number of data	17,104	3,205	2,413	17,243
Bias	-0.2	-1.9	2.7	-1.0
Rms difference	24.7	19.7	16.1	20.0
Correlation	0.969	0.979	0.985	0.979

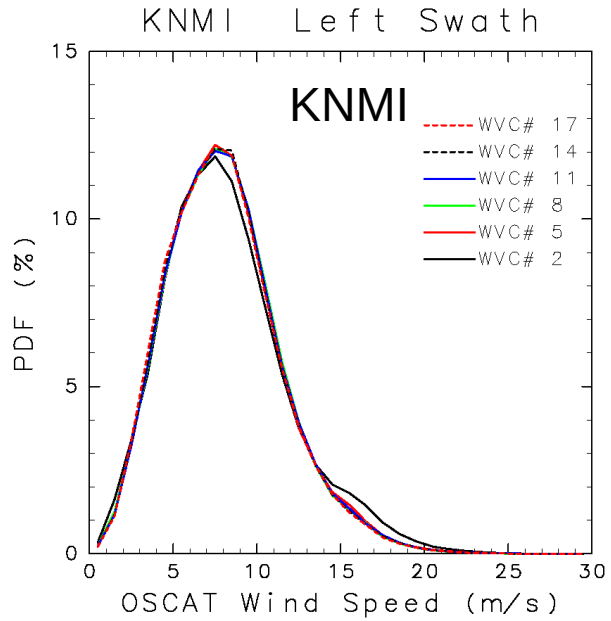
Global Wind Speed Histograms

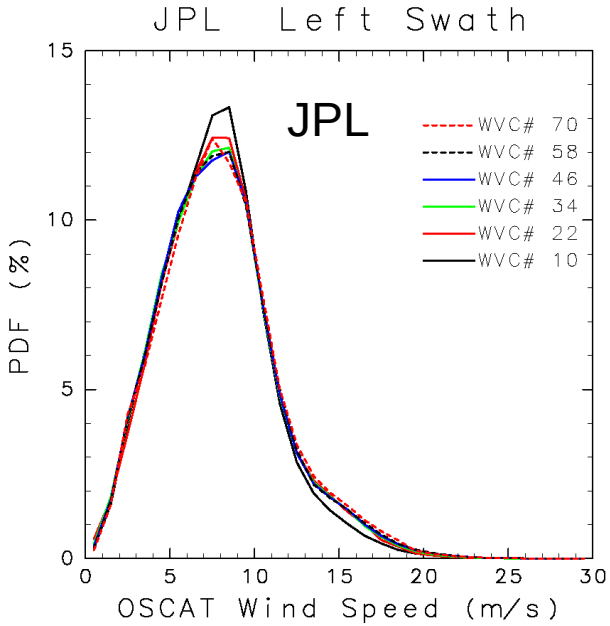






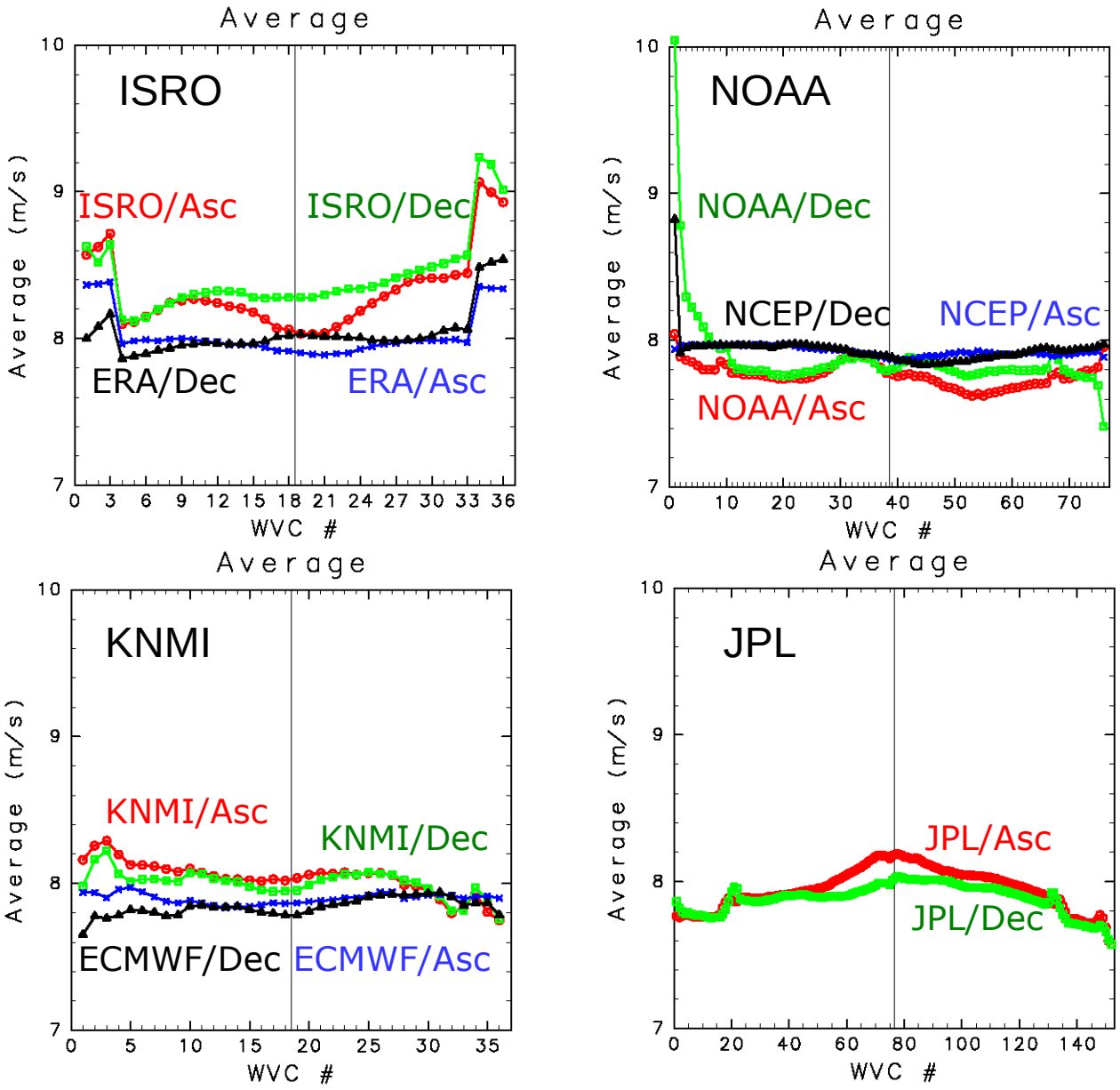
Collocated with ISRO WVCs



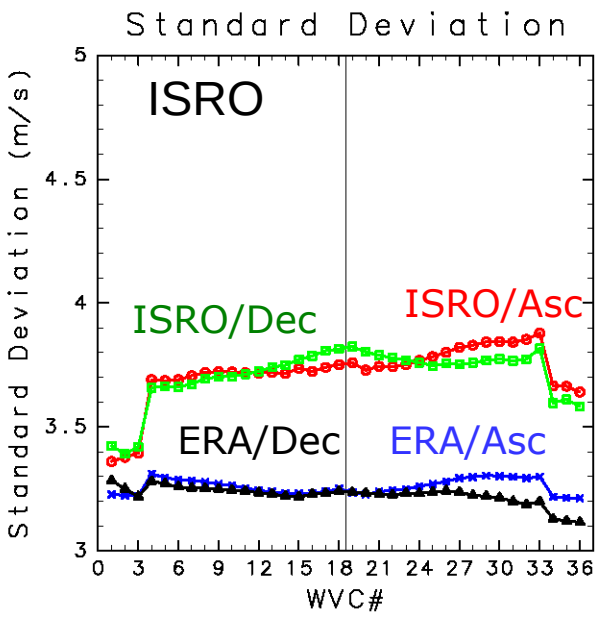


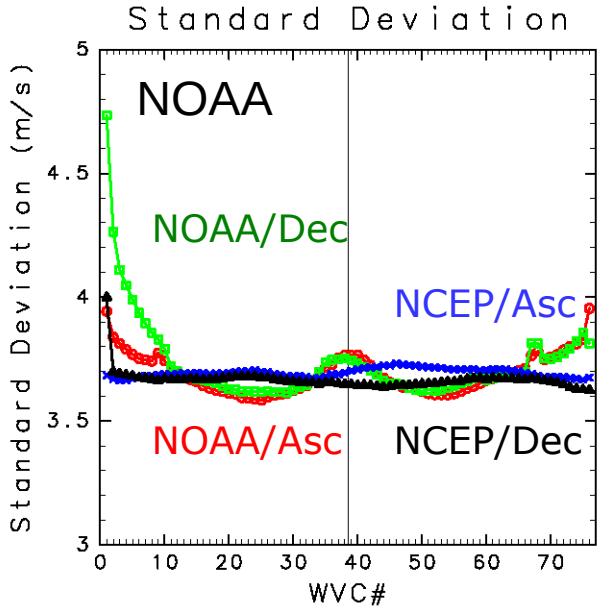
60ºS – 60ºN
Bin size = 1 m/s

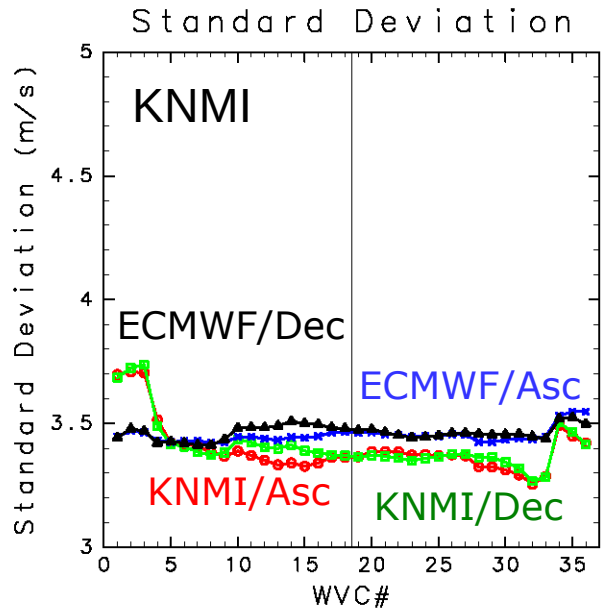
Global Mean Wind Speed

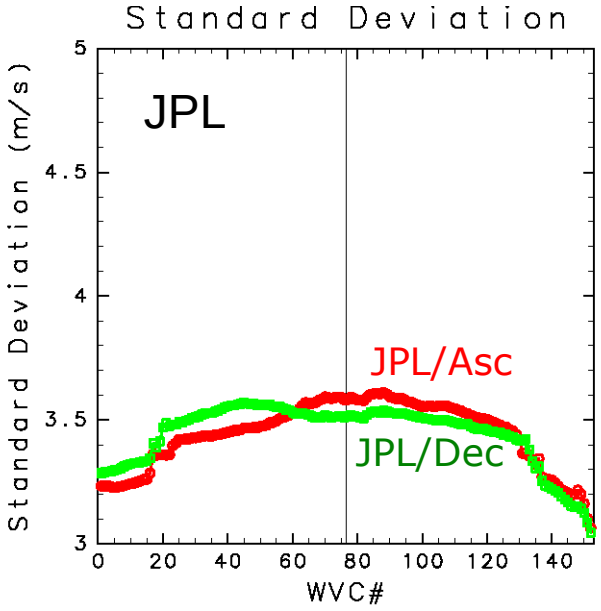


Standard Deviation of Wind Speed



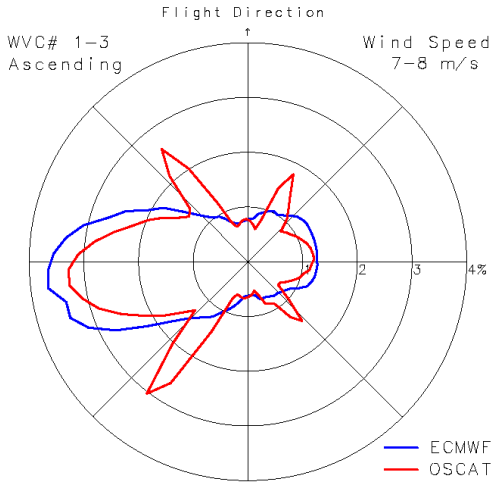




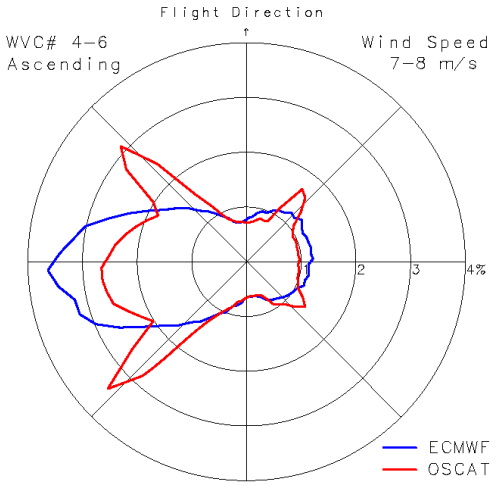


ISRO Wind Direction Histograms

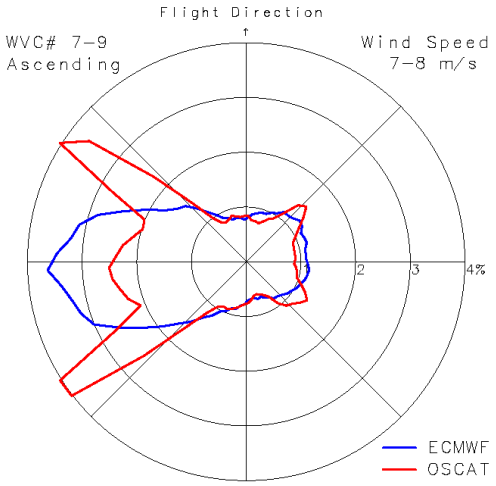
WVC# 1-3



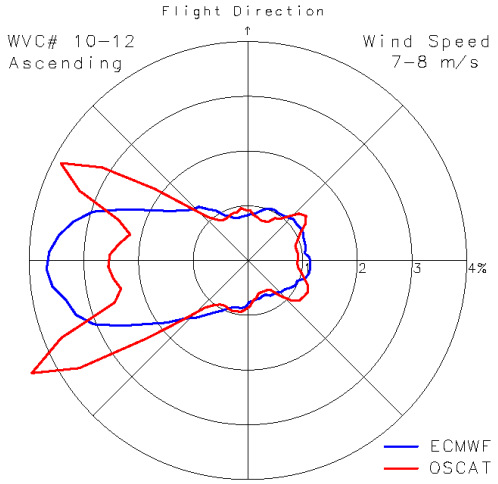
WVC# 4-6



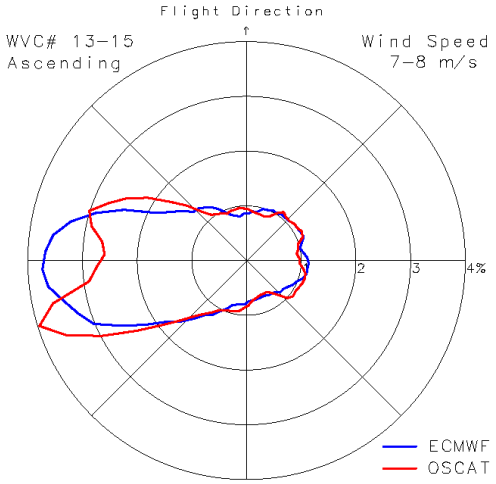
WVC# 7-9



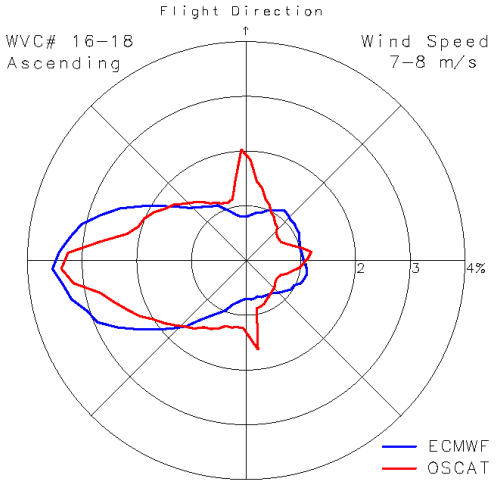
WVC# 10-12



WVC# 13-15



WVC# 16-18

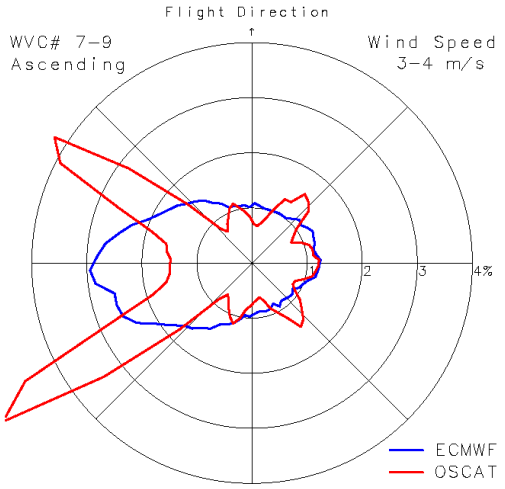


ERA-int
ISRO

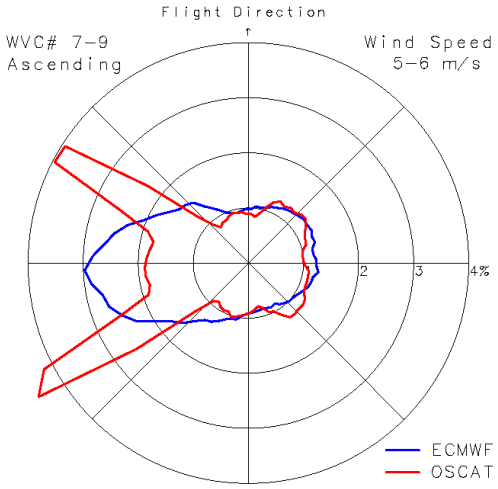
Left Swath, Wind Speed Range: 7-9 m/s, Ascending Paths

Wind Speed Dependence of Wind Direction Histograms (Mid Cells, ISRO)

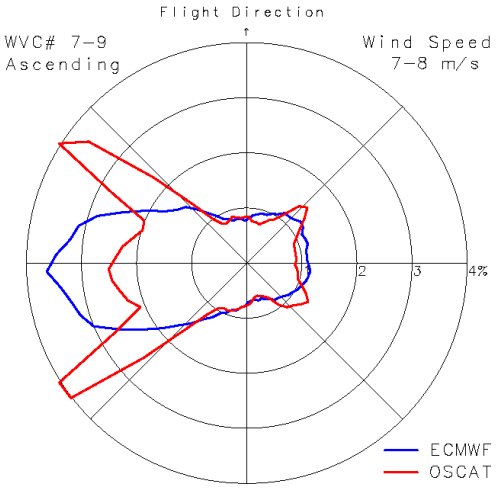
3-5 m/s



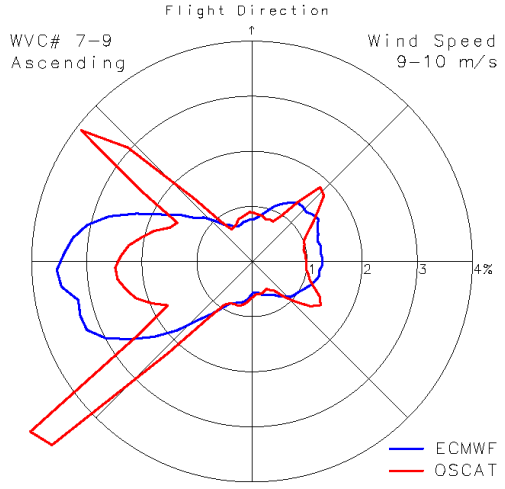
5-7 m/s



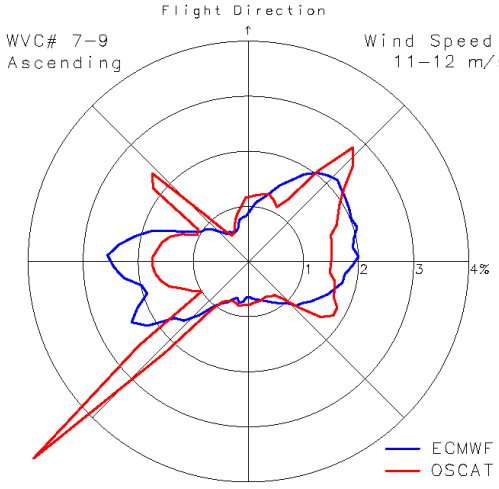
7-9 m/s



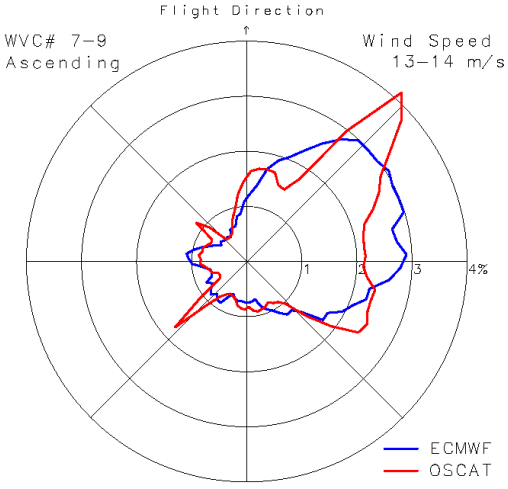
9-11 m/s



11-13 m/s



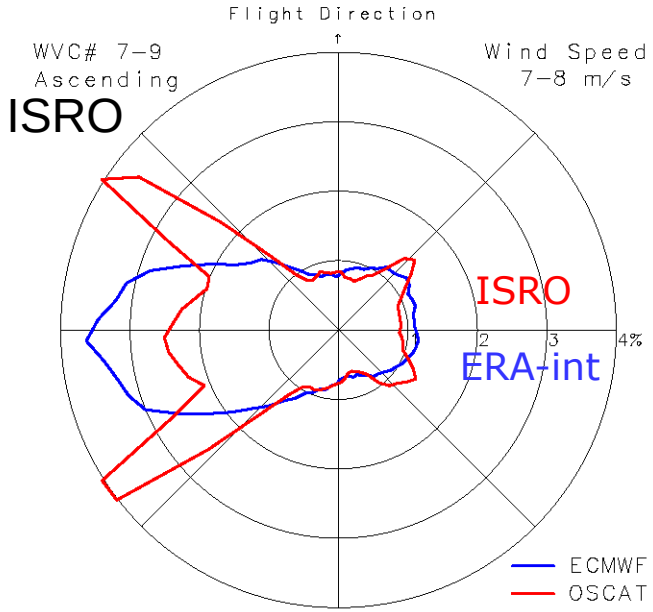
13-15 m/s

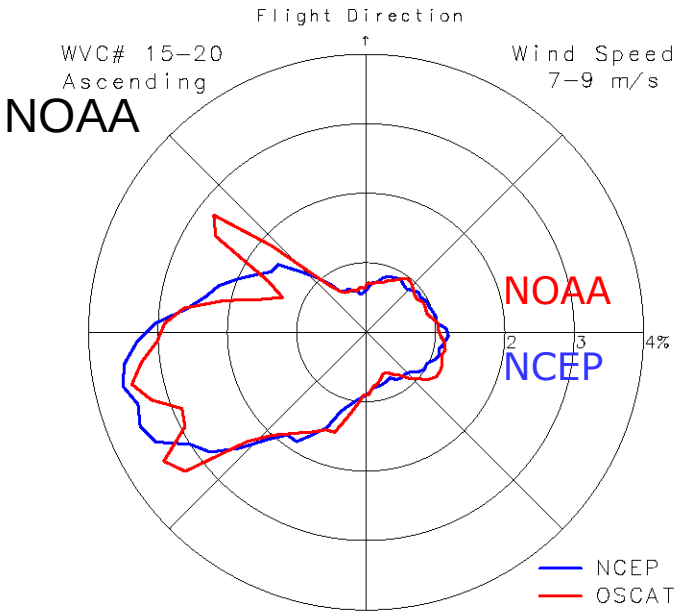


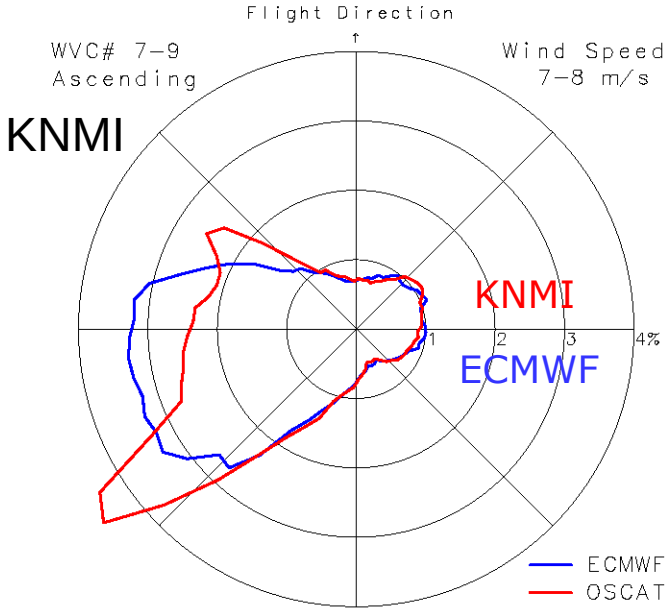
ERA-int
ISRO

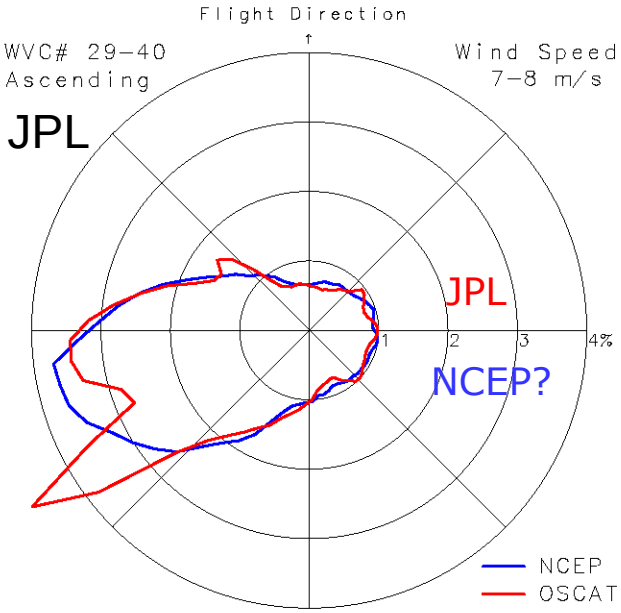
WVC#: 7-9 (Left Mid Swath)

Histograms of Wind Direction





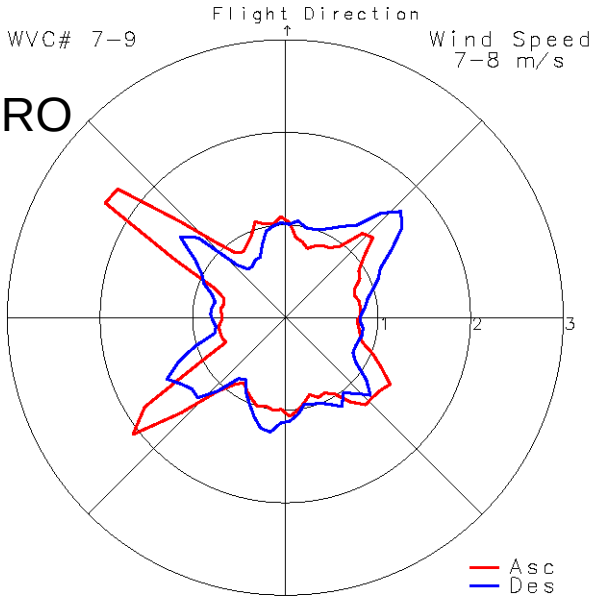


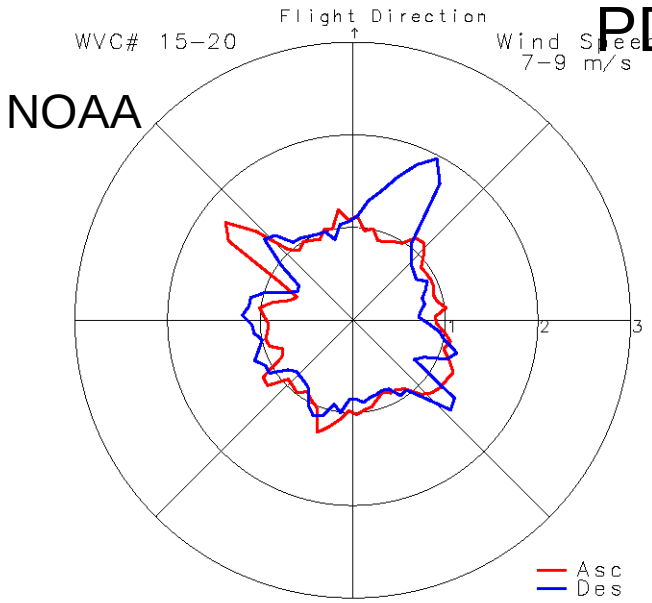


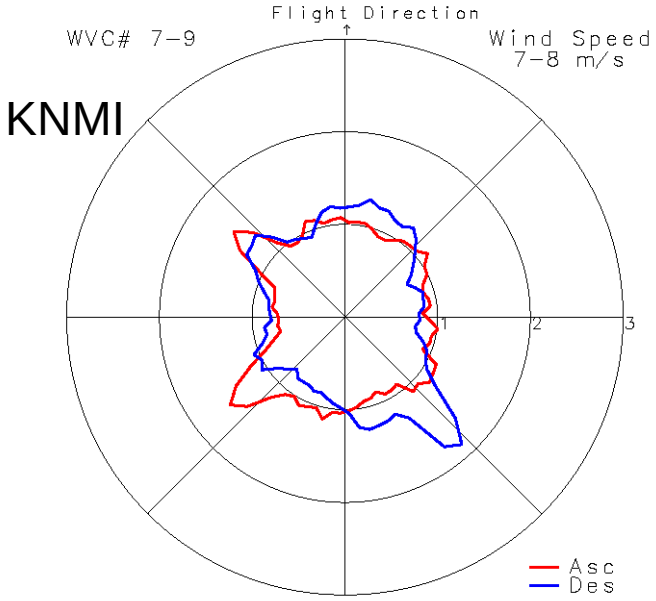
Ascending paths
Left swath
Mid cell
Wind speed
= 7-9 m/s
Bin size = 5 deg.

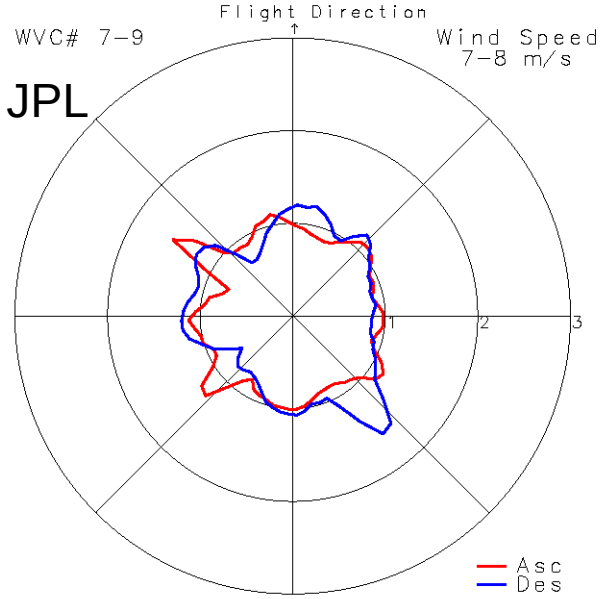
Normalized Histograms of Wind Direction

PDF_{OSCAT}/PDF_{NWP}





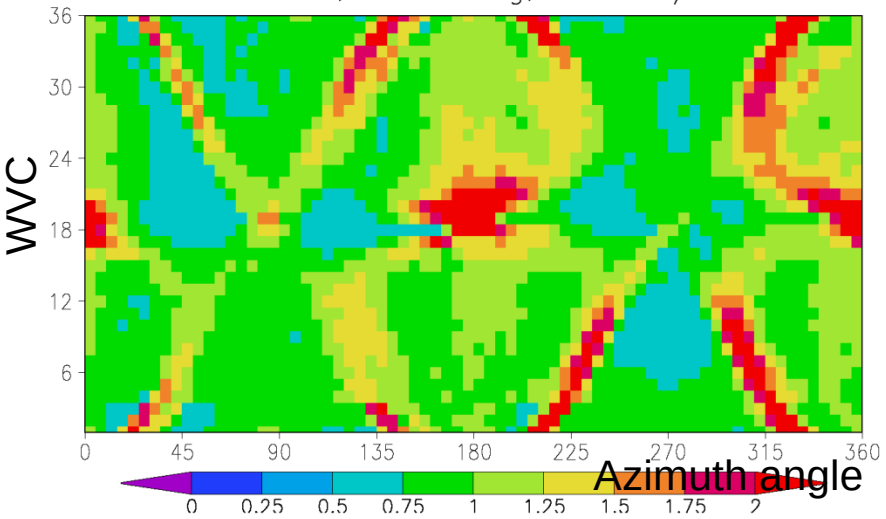




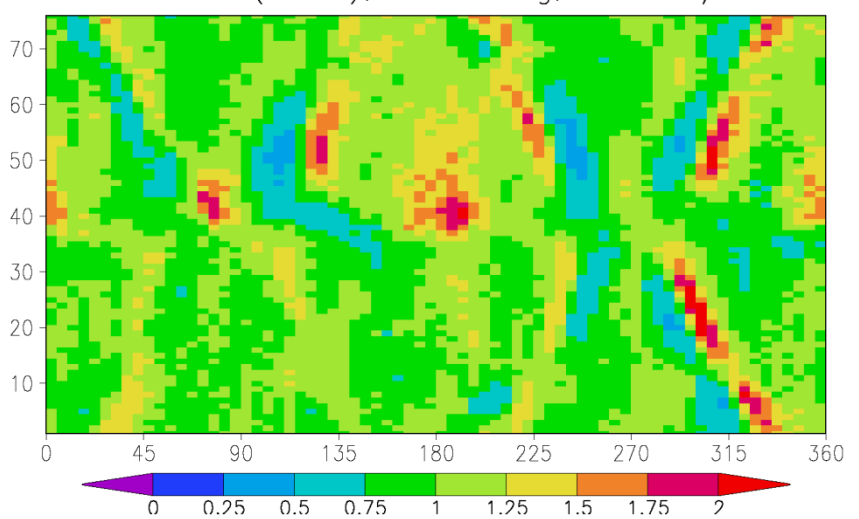
Left swath
Mid cell
Wind speed
= 7-9 m/s
Bin size = 5 deg.

Normalized Histograms of Wind Direction

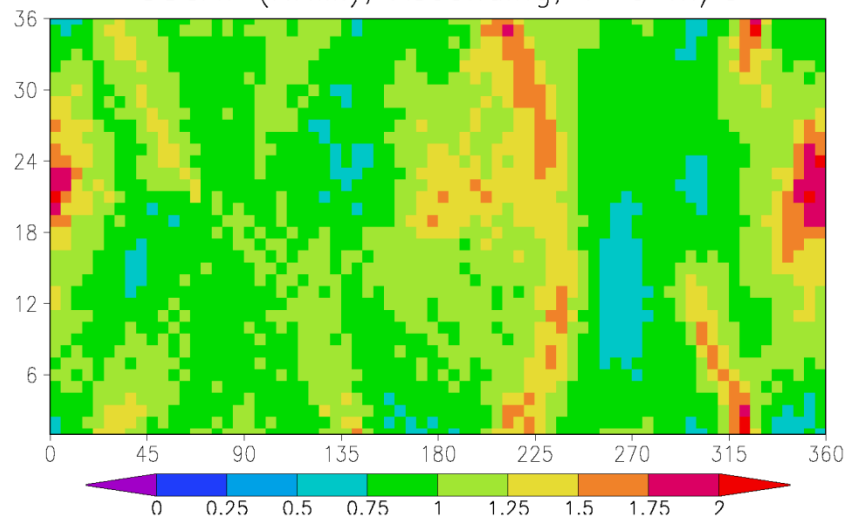
ISRO



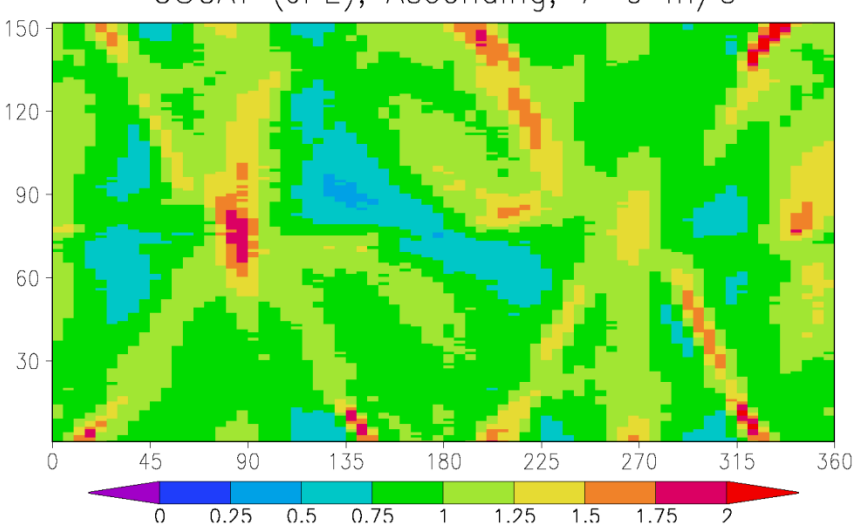
NOAA



KNMI



JPL

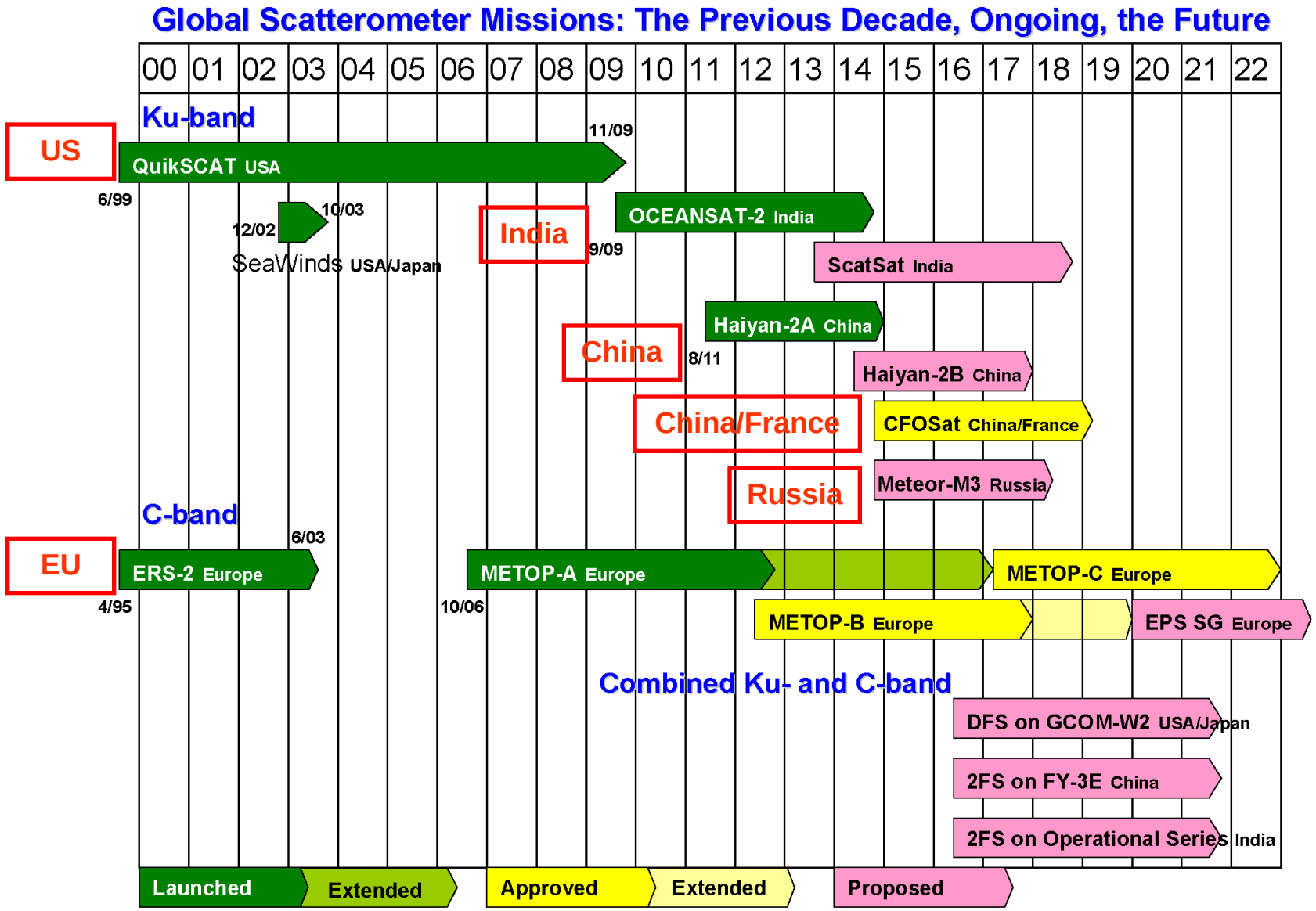


Ascending paths, Wind speed = 7-9 m/s, Bin size = 5 deg.

Summary

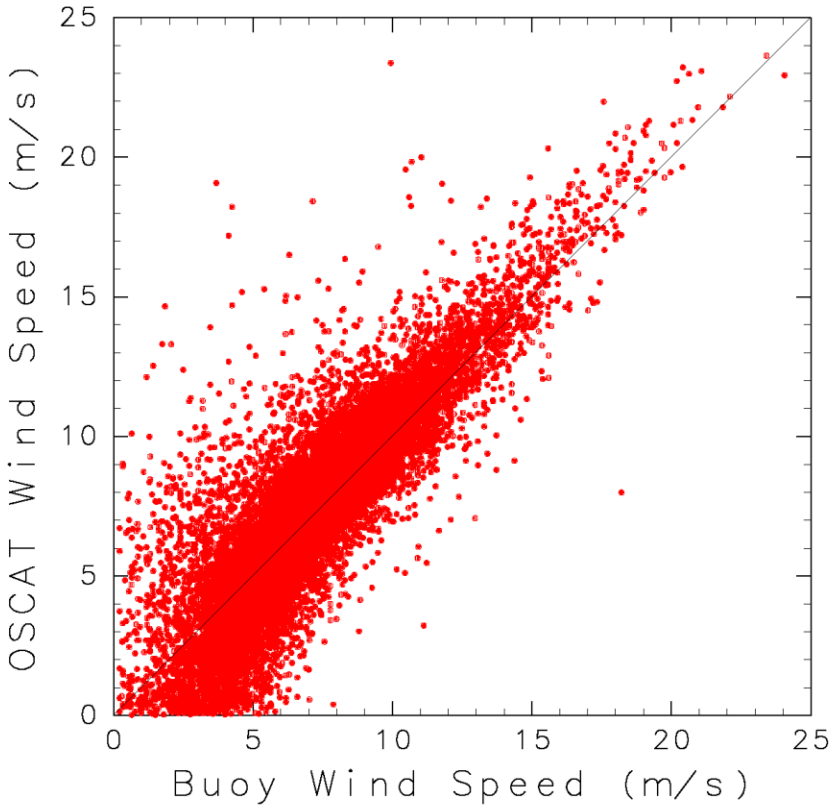
- Wind speeds and directions in the NOAA, KNMI, and JPL OSCAT wind products agree very well with buoy observations, while the ISRO product underestimates the wind speed at low wind speed.
- Global wind speed histograms of the NOAA, KNMI, and JPL products exhibit consistent feature over the cross-track WVC location, although the histograms also show slight differences with each other. Histograms of the ISRO programs exhibit excess of very low wind speed data.
- Although all the products show similar directivity relative to the antenna beams, the amplitudes of modulation for the NOAA, KNMI, and JPL products are less than that for the ISRO product.

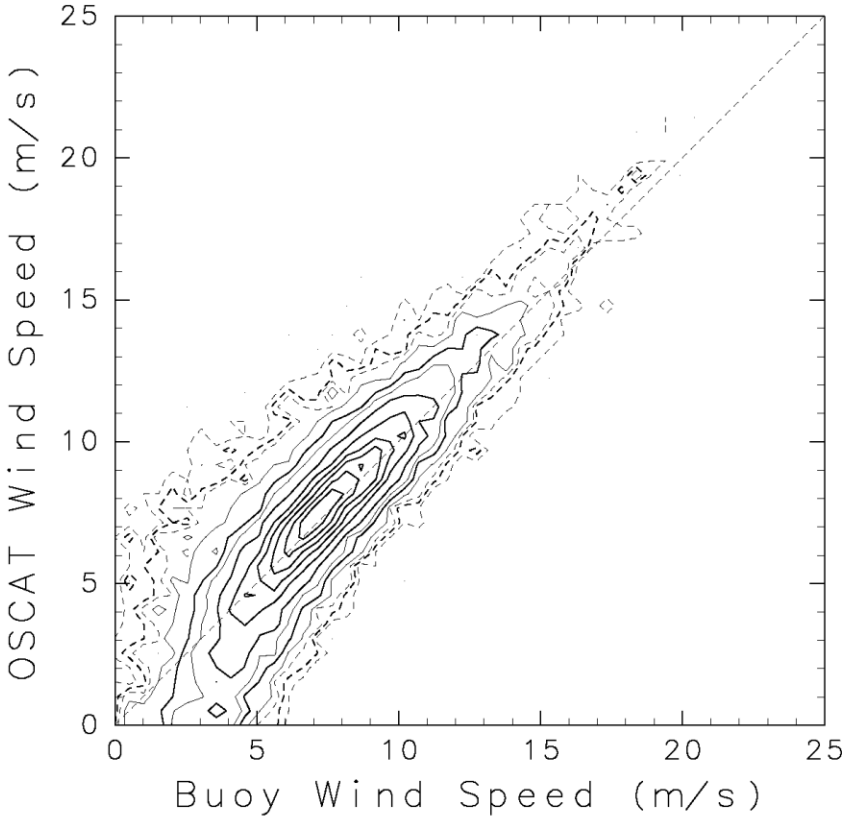
Spaceborne Scatterometer Missions



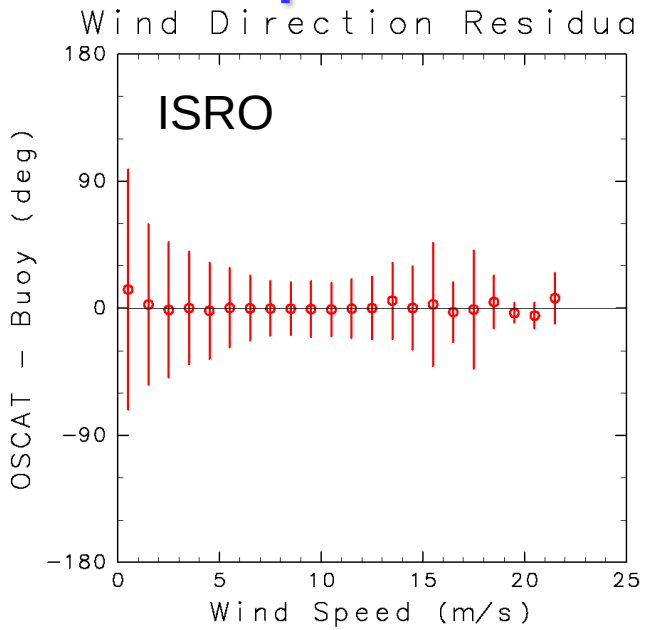
Comparison of OSCAT Wind Speed with Buoy Data

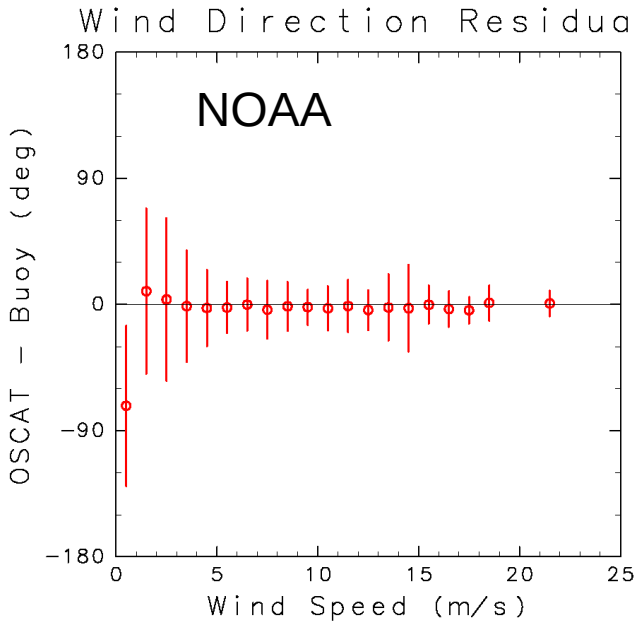
Ver. 1.3

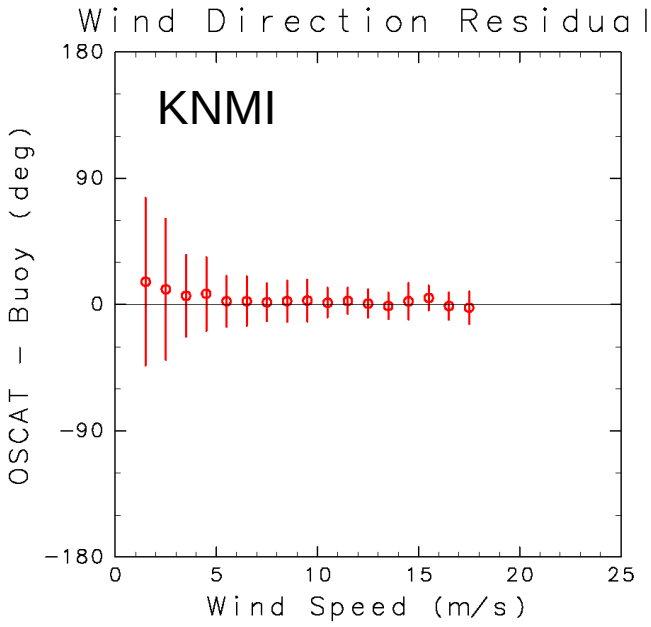


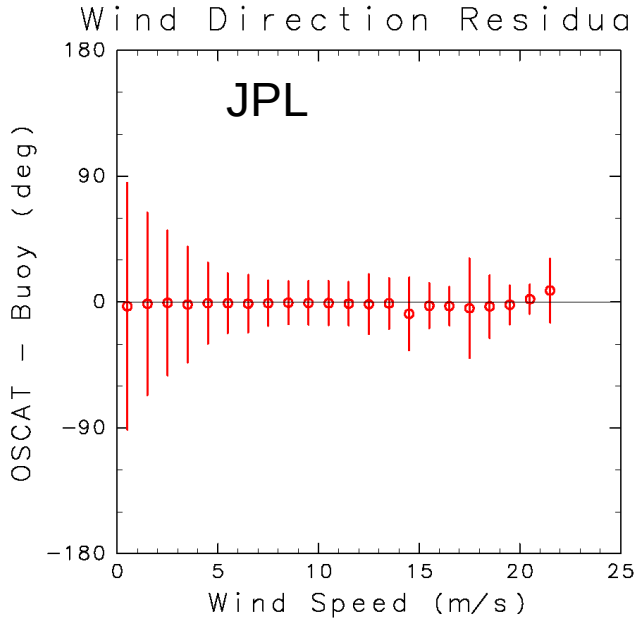


Comparisons of Wind Direction (2)

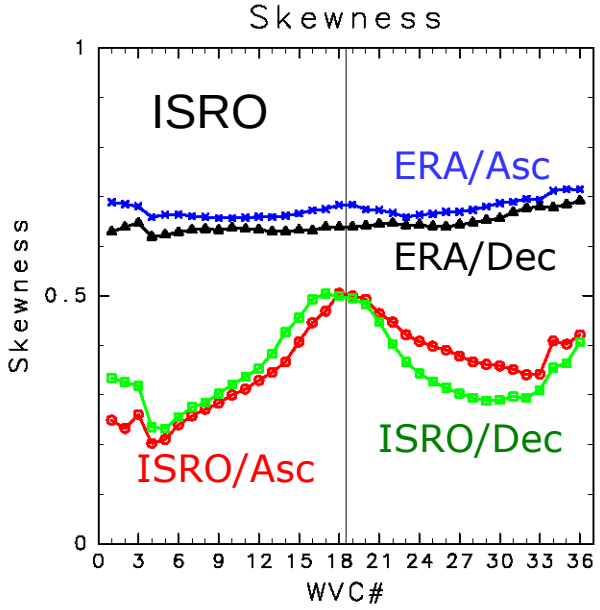


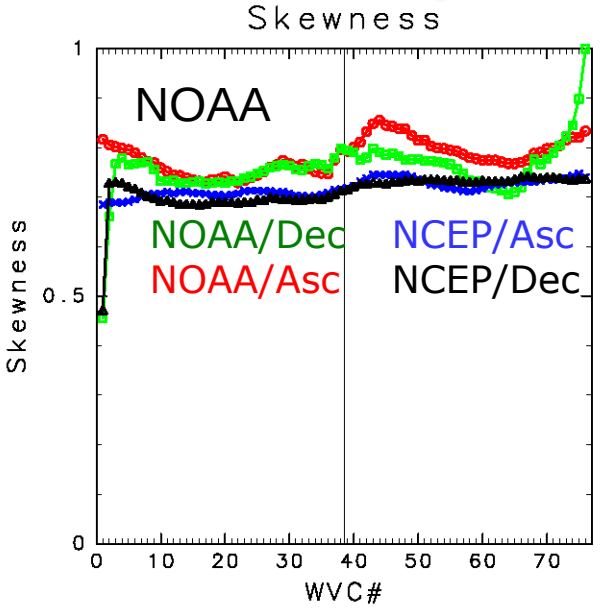


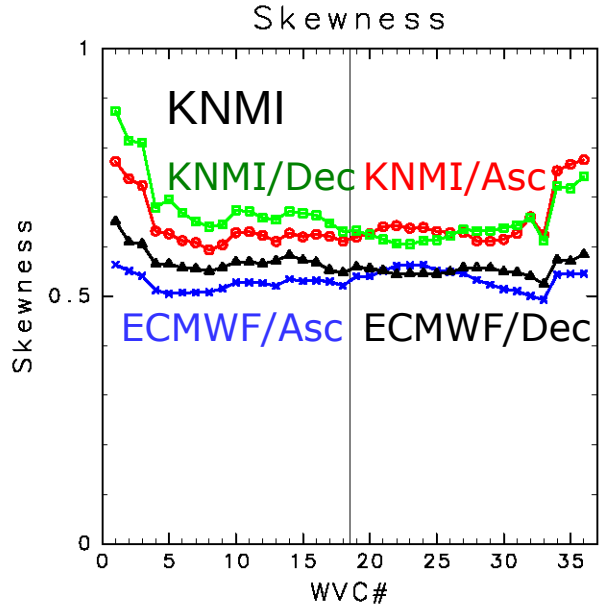


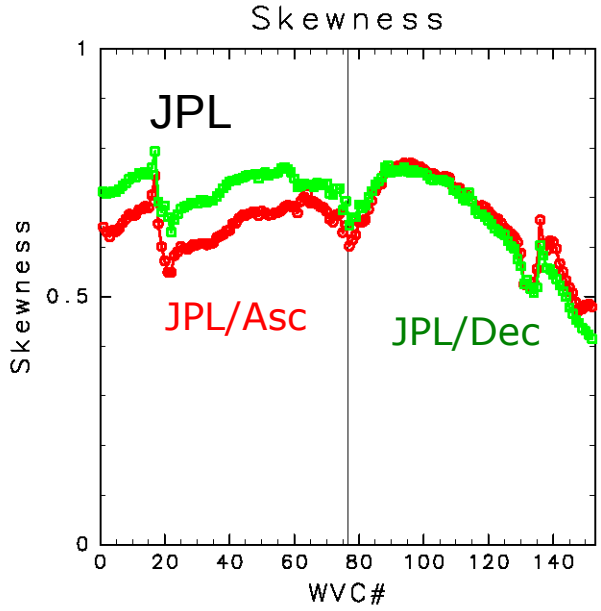


Skewness of Wind Speed

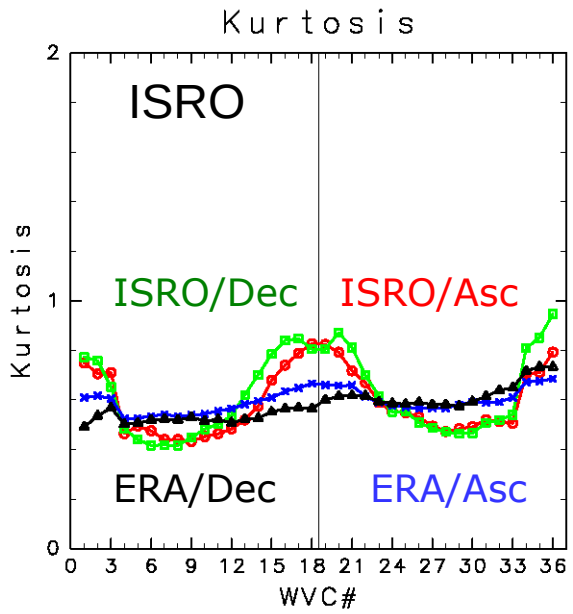


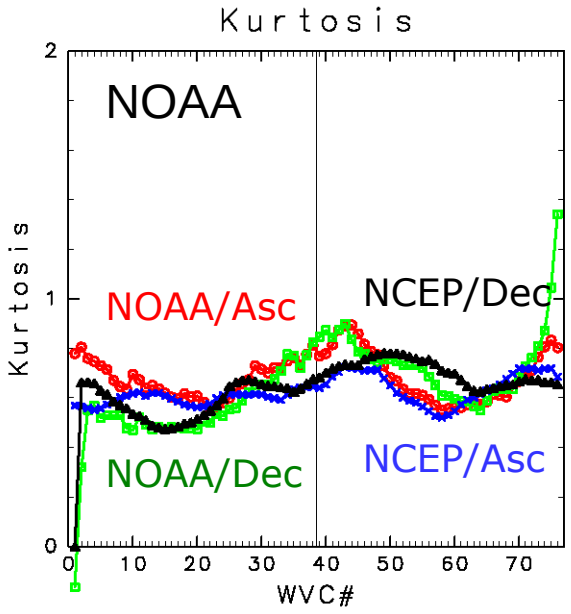


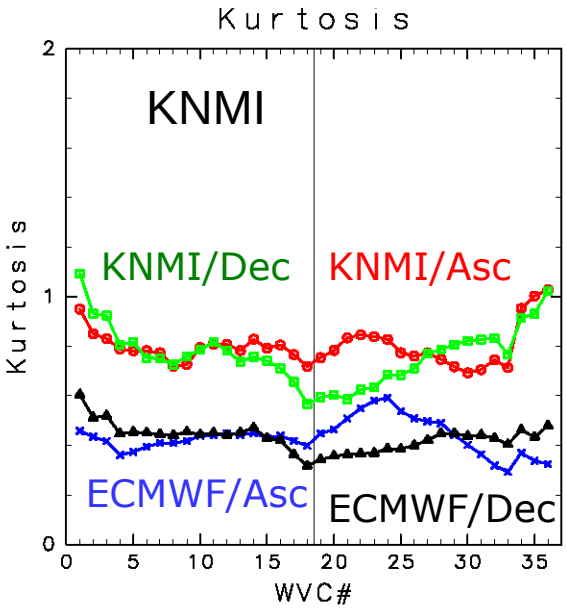


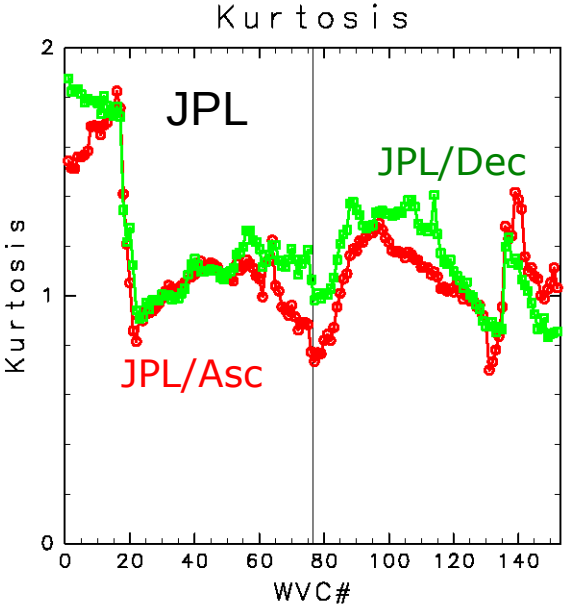


Kurtosis of Wind Speed





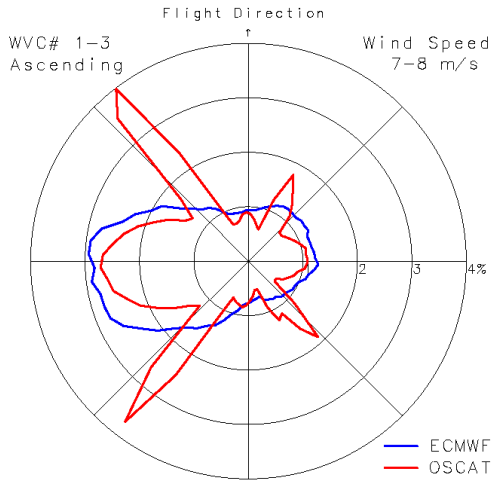




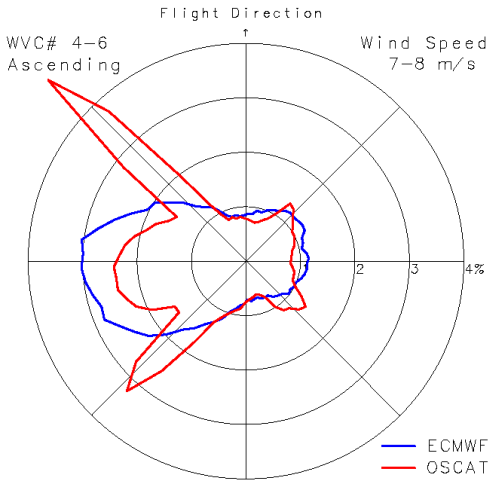
OSCAT Wind Direction Histograms

Old Version

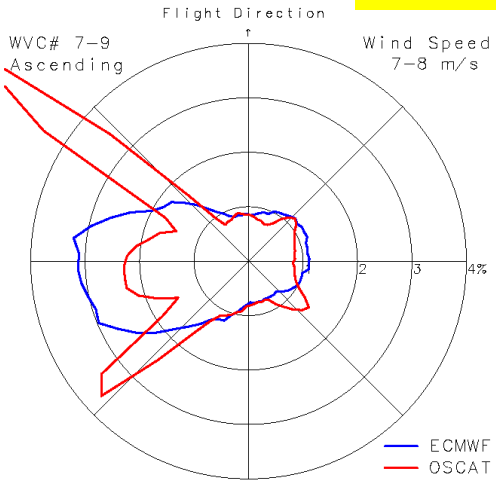
WVC# 1-3



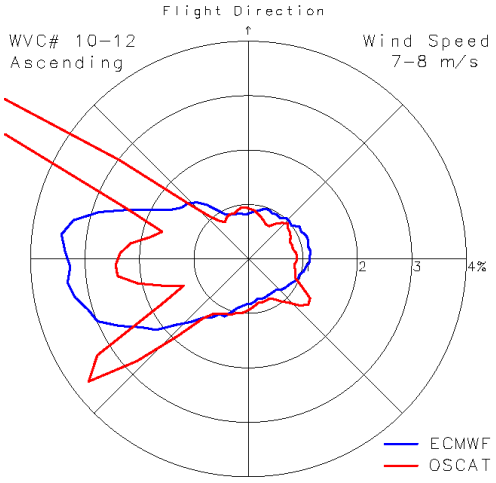
WVC# 4-6



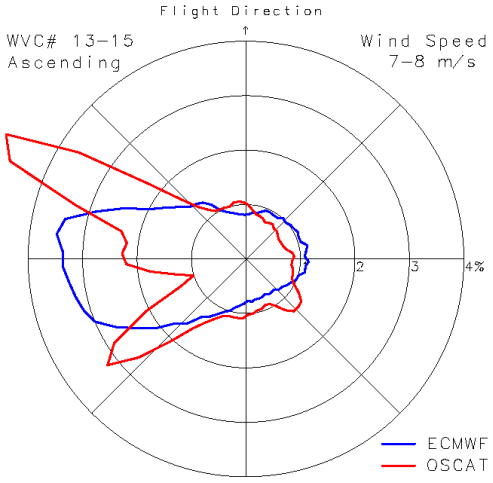
WVC# 7-9



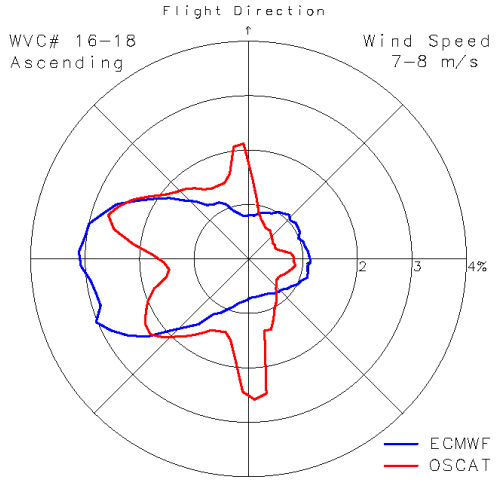
WVC# 10-12



WVC# 13-15



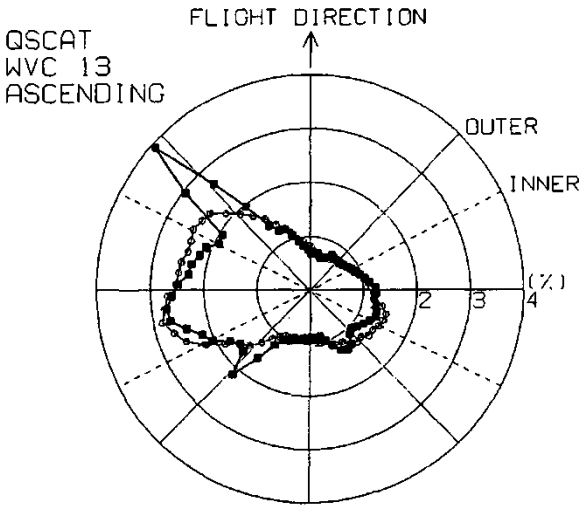
WVC# 16-18

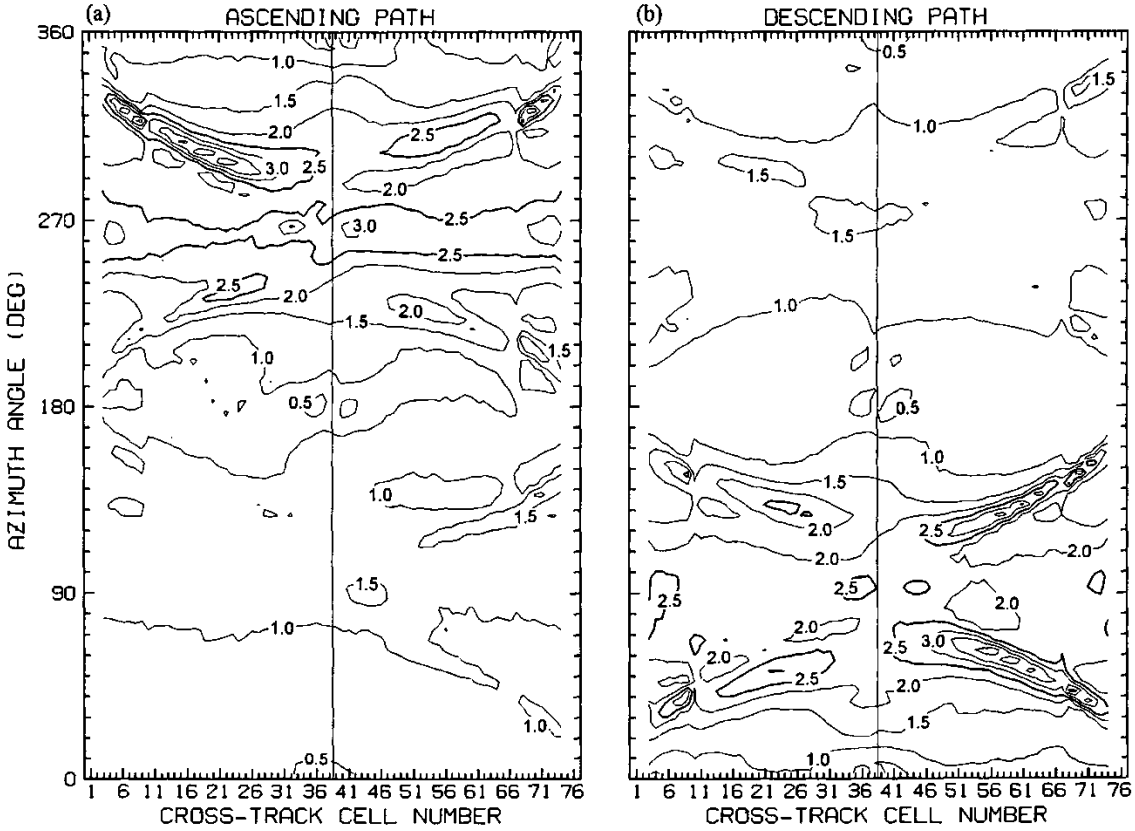


ECMWF
OSCAT

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

Histograms of QSCAT Wind Directions





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