

# Evaluation of HY-2A Scatterometer Wind Product- Preliminary analysis

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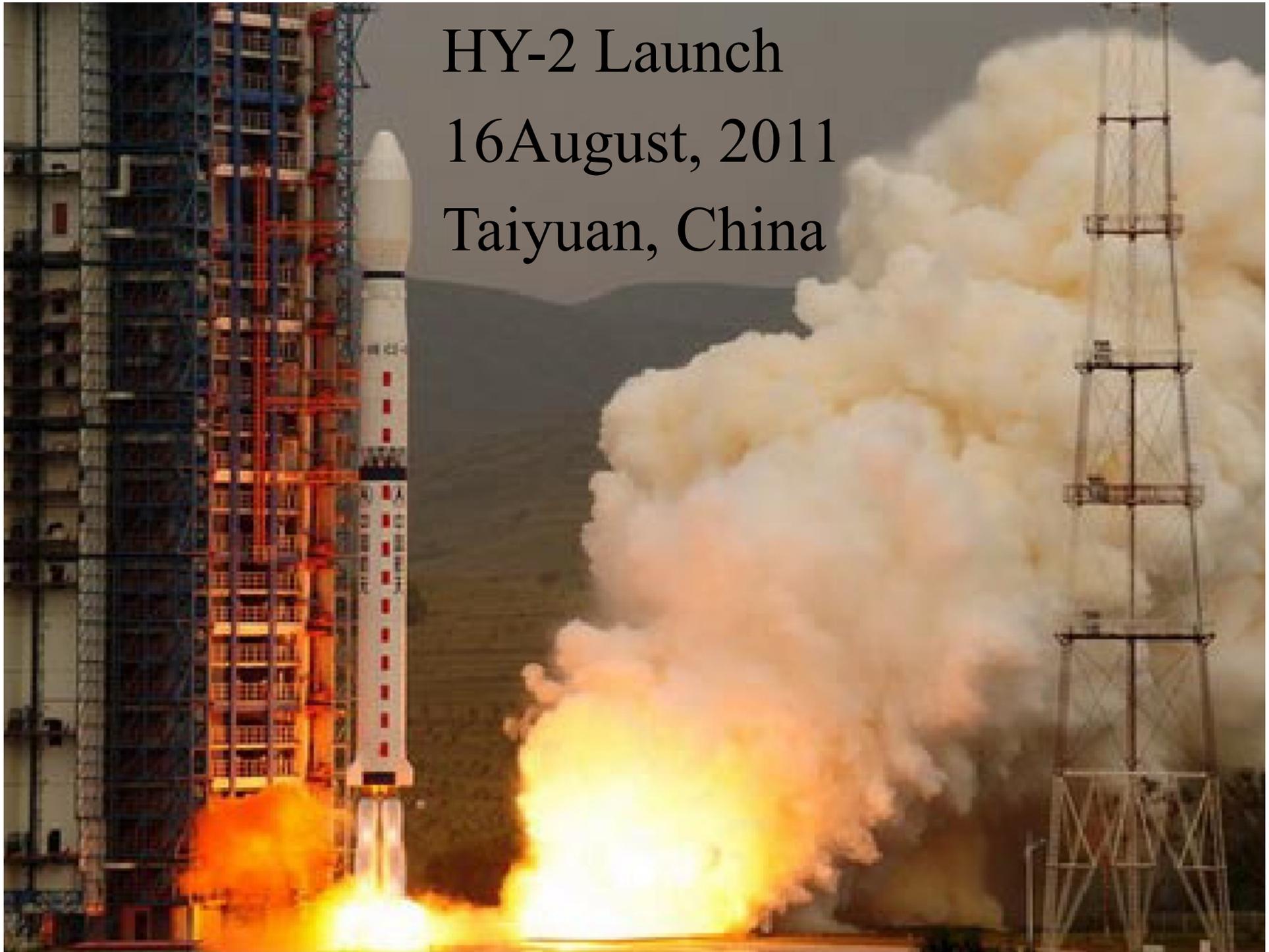
# Outline

- An introduction to Chinese scatterometer missions
- Introduction to HY-2A scatterometer
- Retrieval algorithms
- HY-2A winds evaluation with NDBC buoy observations
- Summary

# An Introduction to Chinese scatterometer missions

- Ocean satellite series (HY-2, ocean dynamic environment missions)
  - Ku-band rotating pencil beam
  - HY-2A, launched in August, 2011
  - HY-2B, approved, 2014
  - HY-2C, approved, 2017
- Meteorological satellite series (FY-3, polar orbit meteorological satellite)
  - Dual frequency (C/Ku) rotating fan beam
  - Approved, 2017
- Chinese-French Oceanography Satellite (CFOSAT)
  - Ku-band rotating fan-beam,
  - Scheduled 2014

HY-2 Launch  
16 August, 2011  
Taiyuan, China



# HY-2A Scatterometer

## Orbit

sun-synchronous

descending local time : 6:00 am

repeat cycle: 14 days

## Key parameters

pencil-beam, similar to Seawinds/QSCAT

Ku band, 13.256 GHz

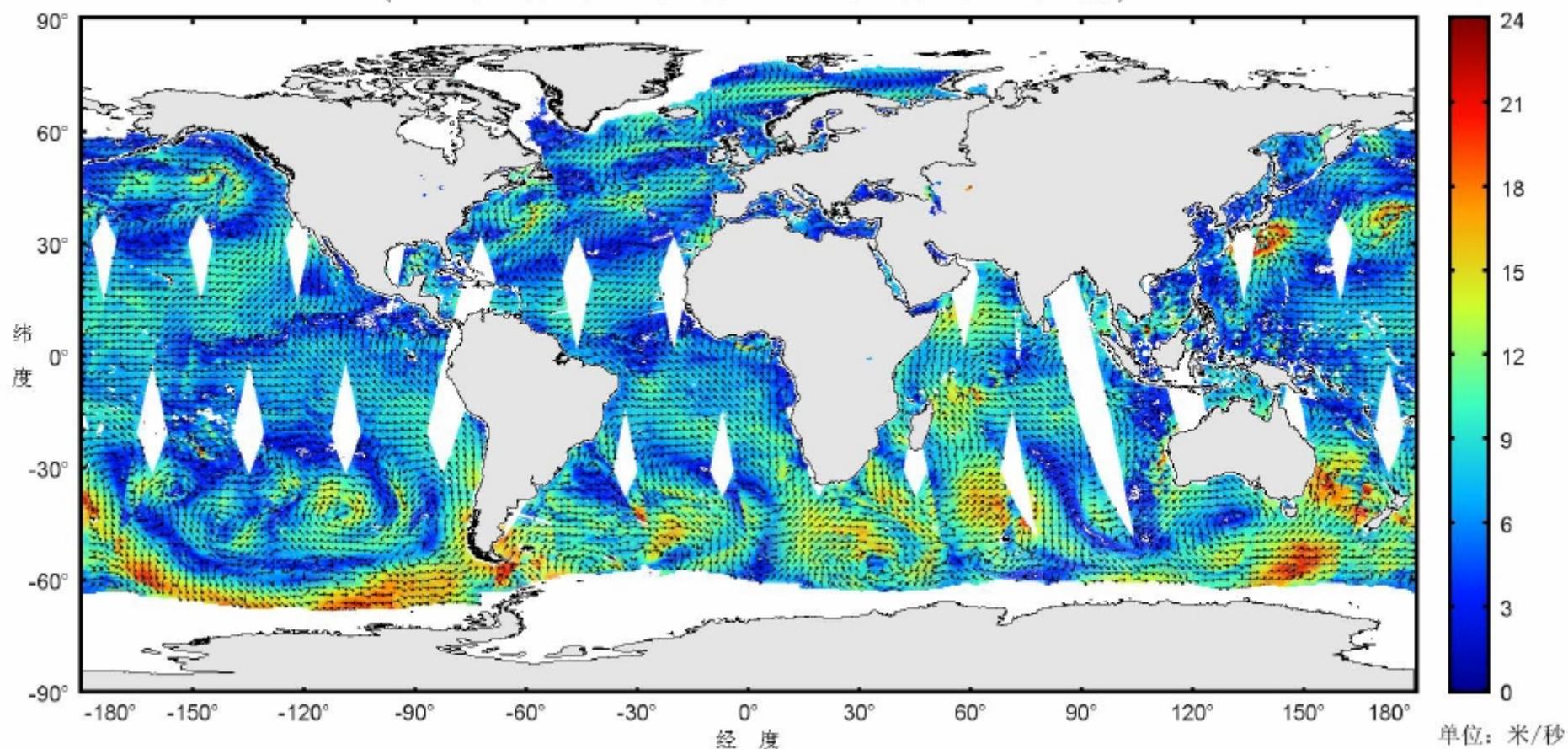
polarization: HH (inner), VV(outer)

incidence angle: 41.36 (inner), 48.44 (outer)

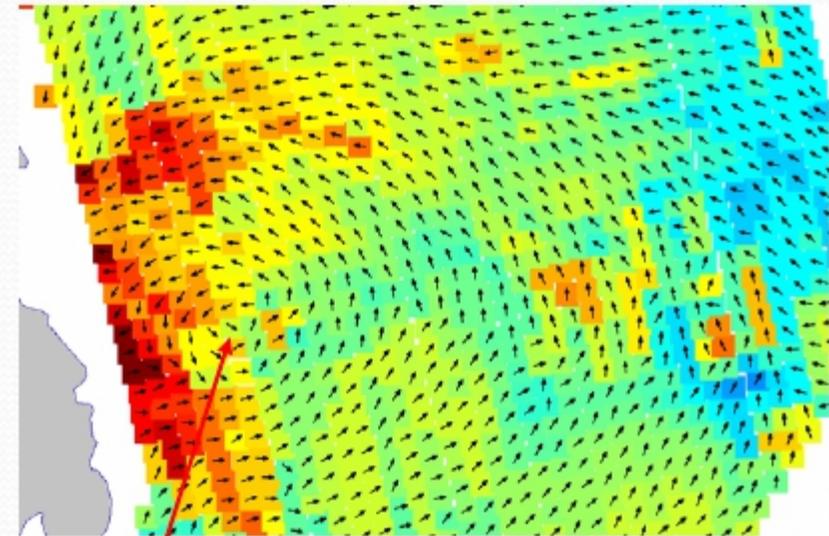
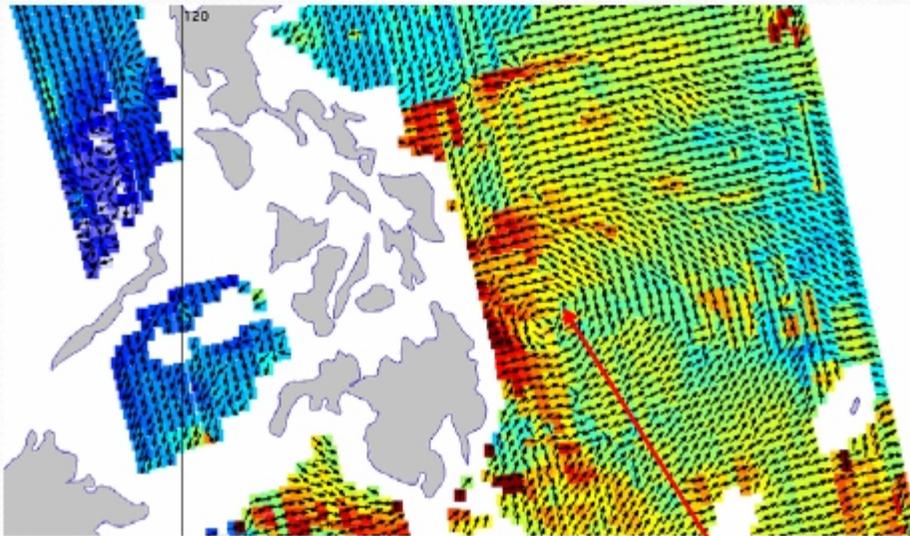
swath width: 1350km (inner), 1700km (outer)

# Daily coverage (June 5, 2012 )

海洋二号卫星微波散射计海面风场  
(2012年06月05日00时25分—2012年06月05日22时34分)



# Tropical Cyclone example



Typhoon Banyan  
(Oct. 11, 2011)  
HY-2A captures  
the spiral wind  
structure.

# HY-2A Scatterometer Data

L2B ocean surface winds are retrieved by NSCAT-2 GMF using maximum likelihood estimator.

The ambiguity removal algorithm for L2B product is based on median filter technique with initialization by NCEP winds.

# NDBC buoy Data

Temporal interval : 1hour or 0.5 hour

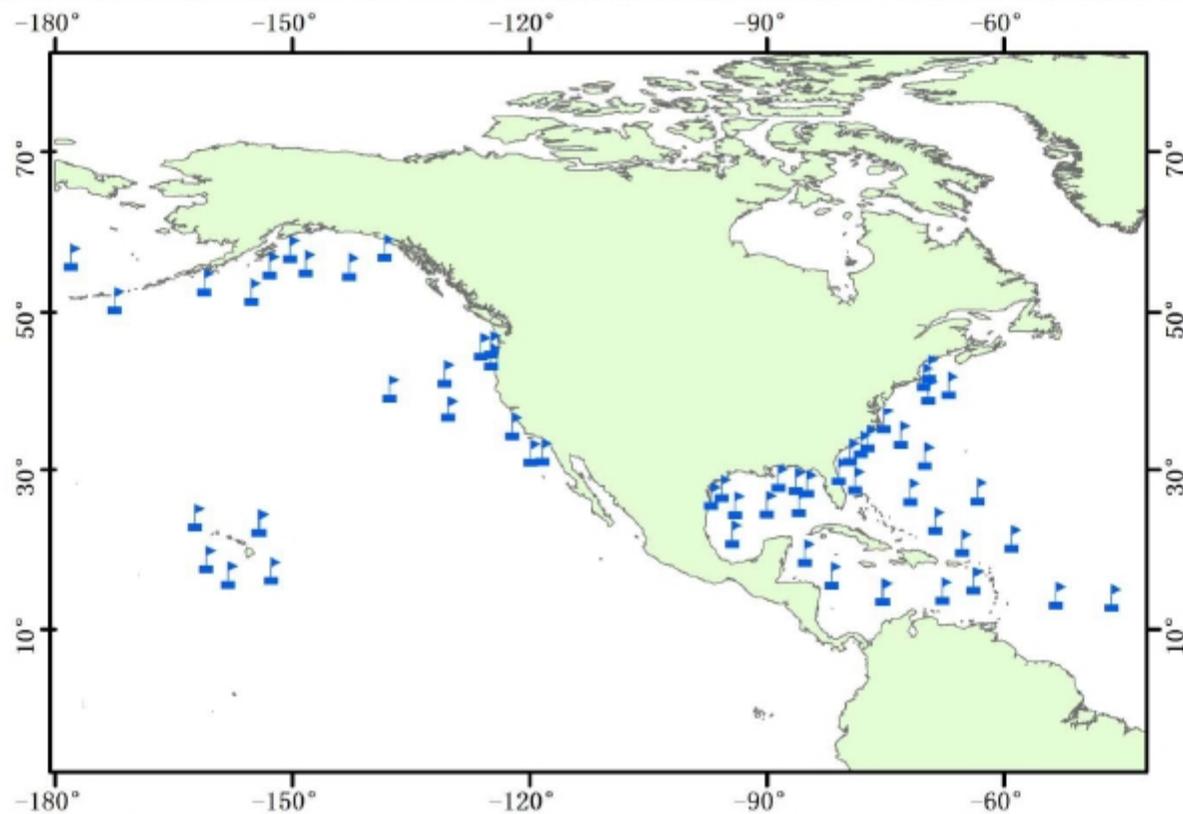
Height of anemometer: 5m or 10m

Equivalent neutral wind speed correction (**Liu and Tang, 1996**). The measurements of air and sea surface temperature, surface pressure, relative humidity were obtained from NCEP FNL (ds083.2) by trilinear interpolation (two space and one time) if data is not available on buoy sites.

Exclusion of lake moored buoys and coastal stations (within 50km off land)

# NDBC buoy site

The number of selected buoy sites is 59.



# Co-location Criteria

Spatial threshold: **25 km**

Temporal threshold: **1 hour**

Linearly interpolated to HY-2A observation time.

If the time difference between two buoys observation is  $>1$  hour (for 1 h sampling interval), or  $>0.5$  hour (for 0.5 h sampling interval), the buoy data is not used.

# Evaluation method

**Wind speed range for evaluation: [2, 24] m/s**

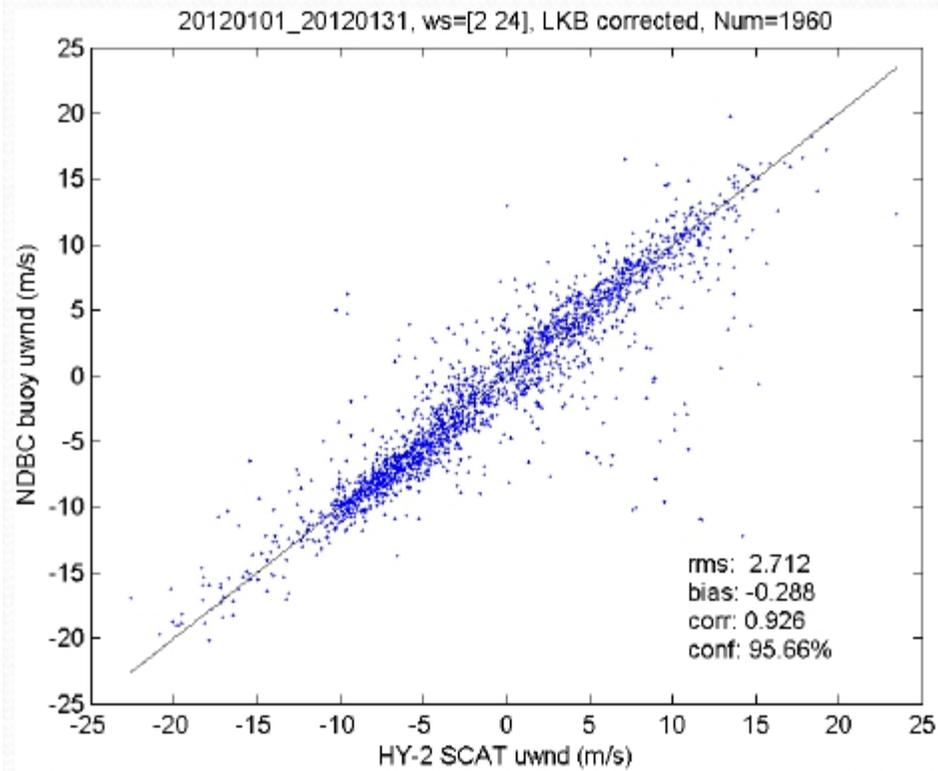
**Two cases for evaluation:**

1. Validation of all colocation data between HY-2A and NDBC buoy.
2. Validation of the colocation data after ambiguity wind removal.

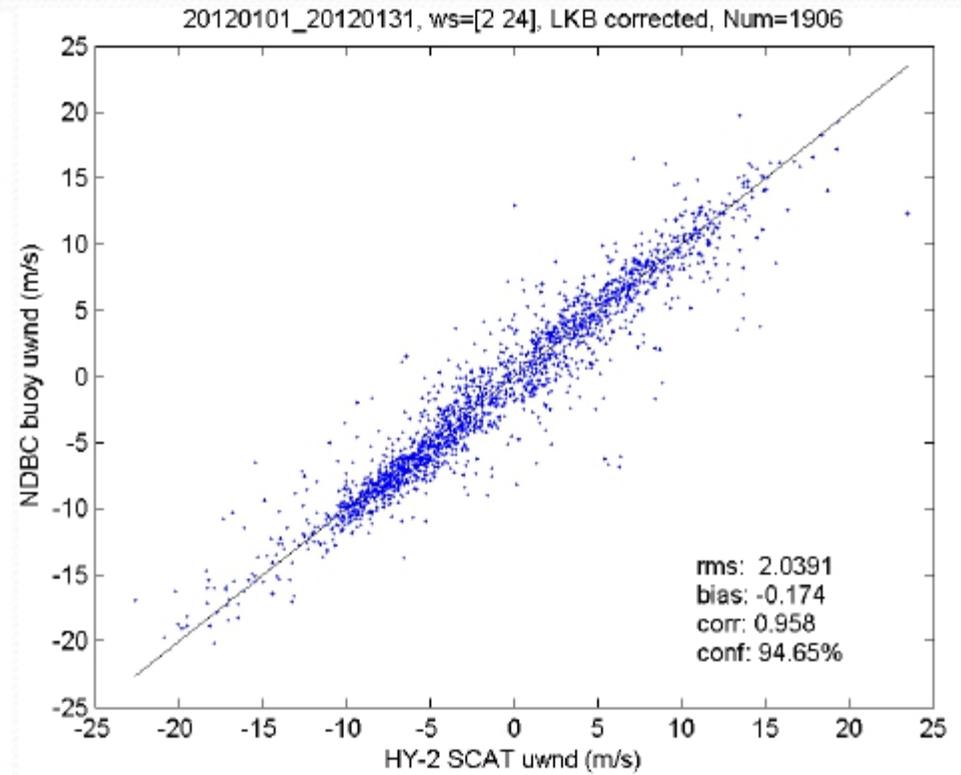
Filtering criteria for ambiguity removal:

$$\text{abs}(\text{direction\_hy2} - \text{direction\_buoy}) > 90^\circ$$

# Zonal wind component

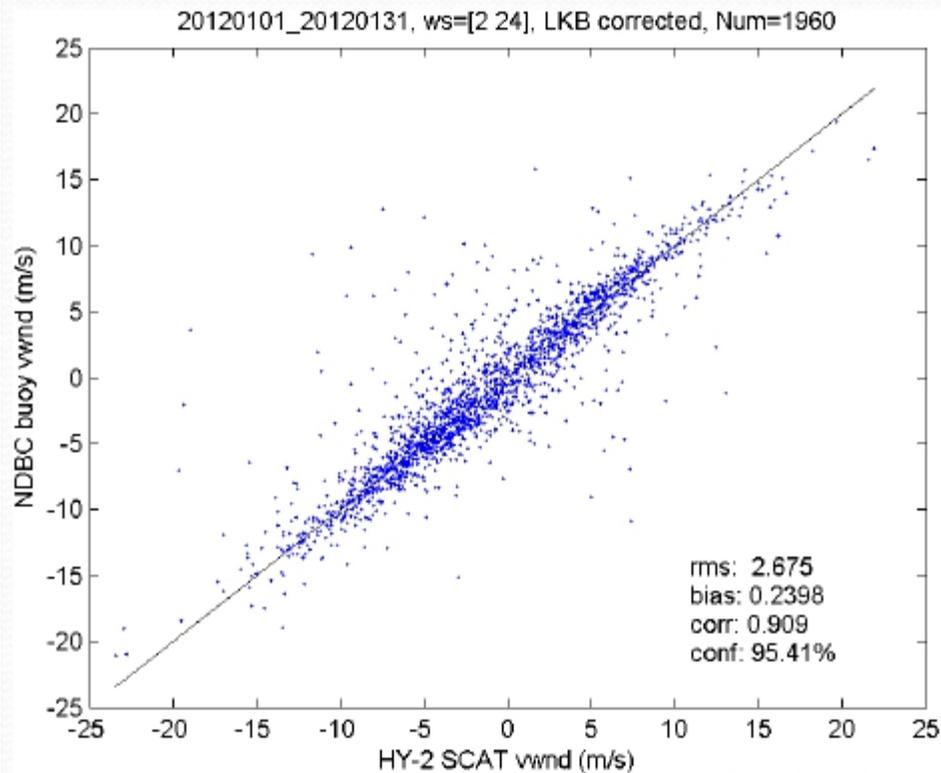


all

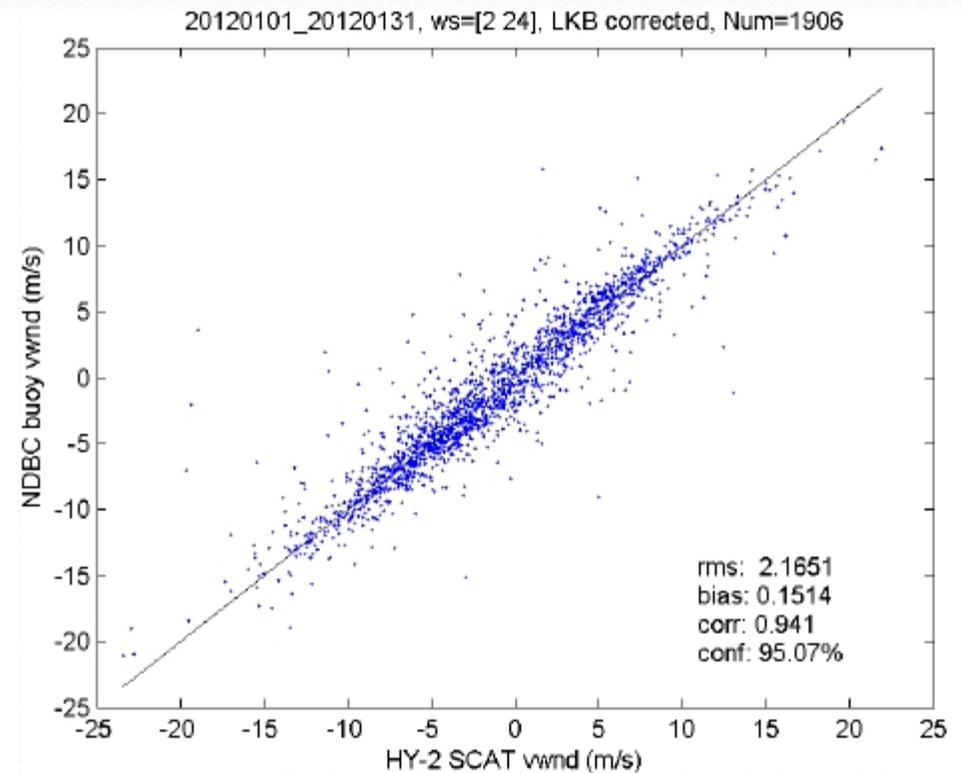


after ambiguity removal

# Meridional wind component

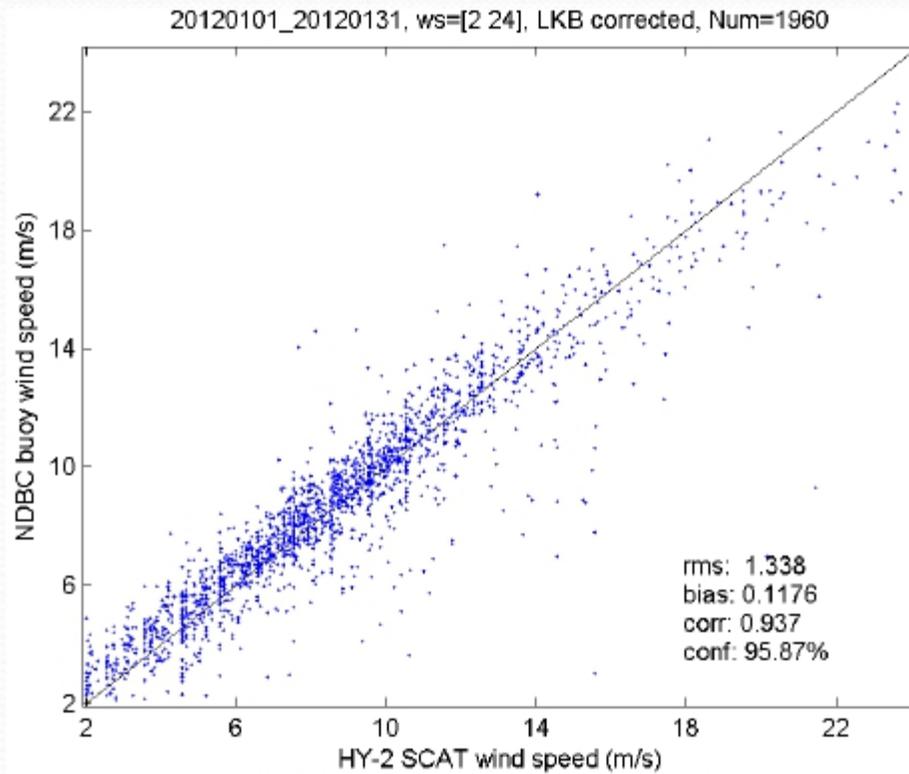


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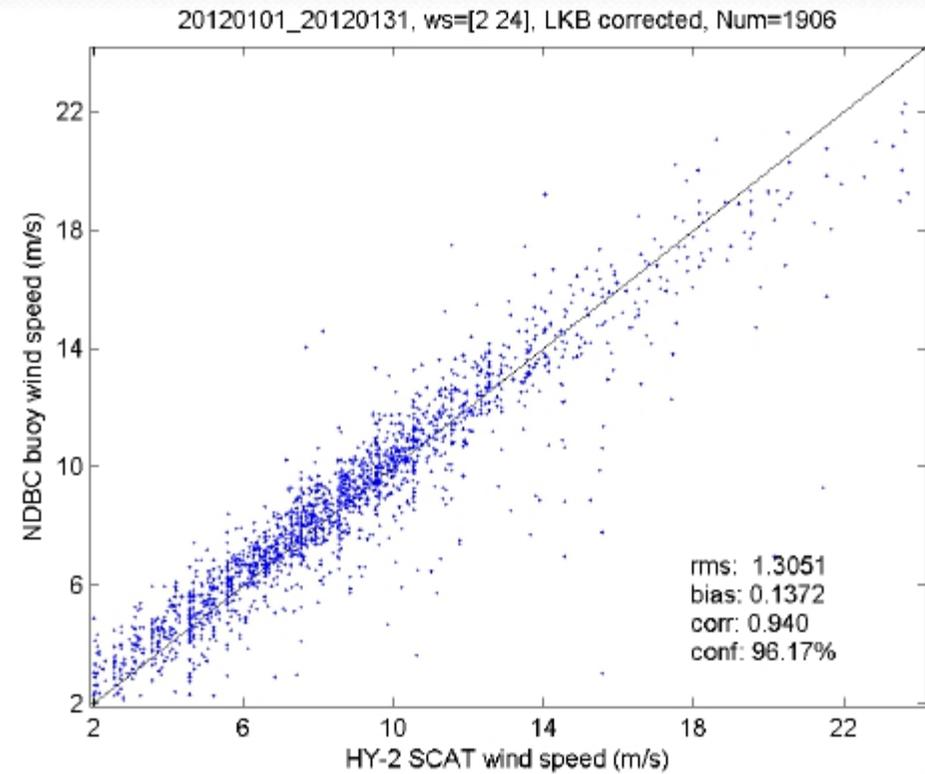


after ambiguity removal

# Wind speed

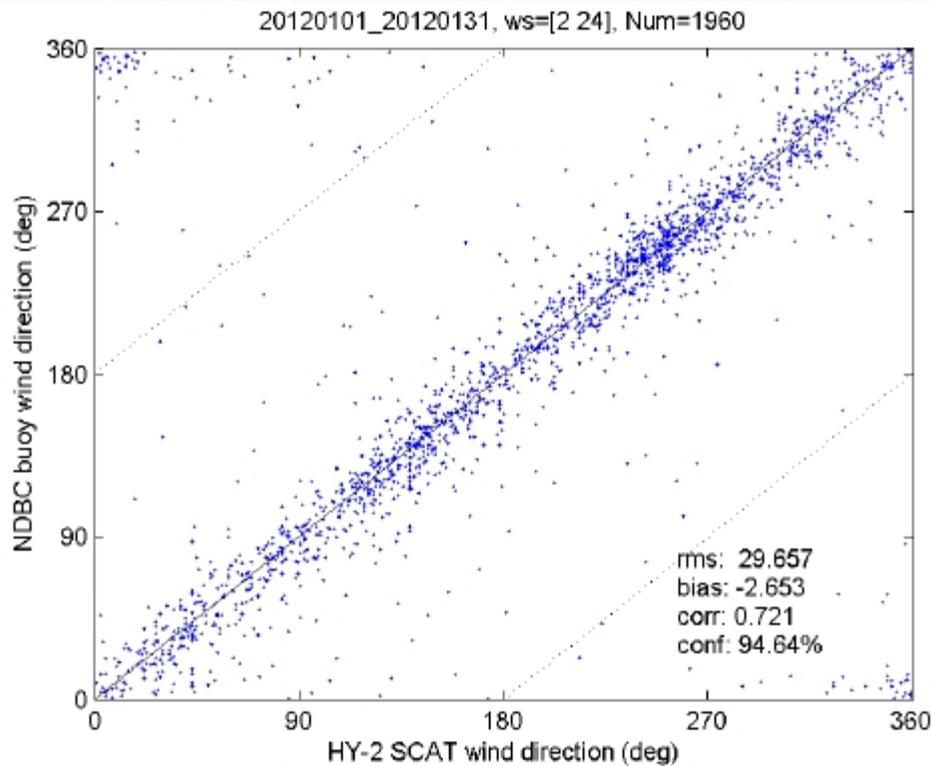


all

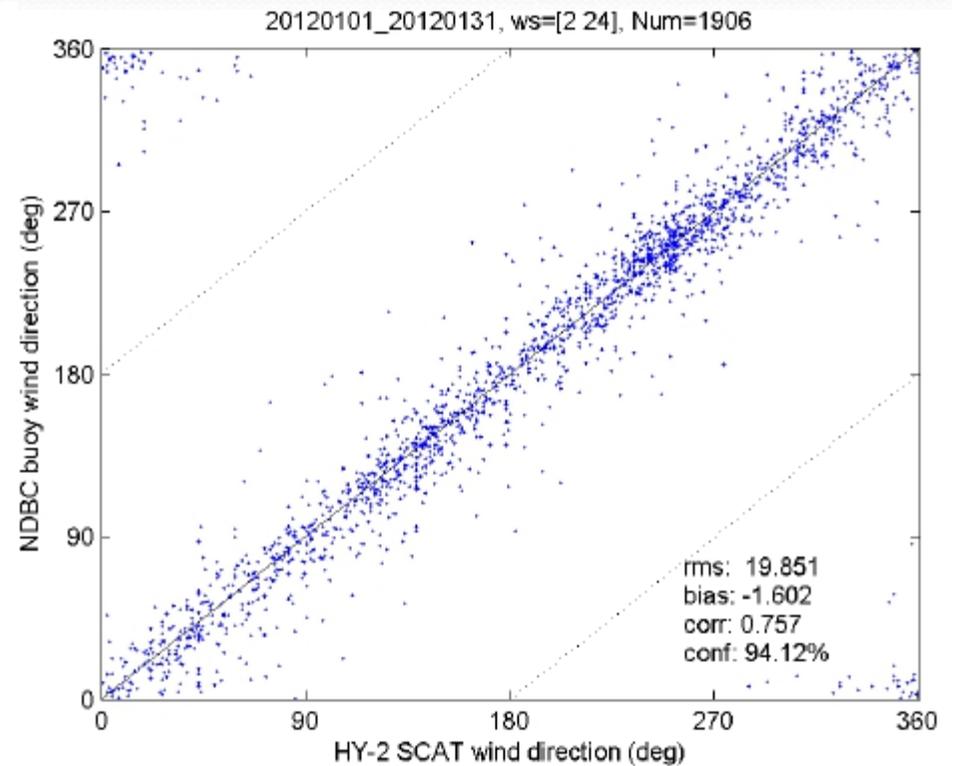


after ambiguity removal

# Wind direction



all



after ambiguity removal

# Validation result of HY-2A (all data)

Timerange (YYYYMM)	Statistical parameter	Windspeed	Winddirection	uwnd	vwnd
201111 No.ofobs.: 2046	RMS	1.373	33.446	3.418	3.054
	Bias	-0.194	-0.614	-0.391	0.191
201201 No.ofobs.: 1960	RMS	1.338	29.657	2.712	2.675
	Bias	0.118	-2.653	-0.288	0.240
201202 No.ofobs.: 2106	RMS	1.257	29.593	2.754	2.617
	Bias	0.005	-1.169	-0.125	0.098
201203 No.ofobs.: 1241	RMS	1.492	35.539	3.423	2.822
	Bias	-0.021	-1.000	-0.458	0.039

# Validation result of HY-2A (after ambiguity removal)

Timerange (YYYYMM)	Statistical parameter	Windspeed	Winddirection	uwnd	vwnd
201111 No.ofobs.: 1973	RMS	1.235	22.415	2.462	2.369
	Bias	-0.144	-0.870	-0.249	0.060
201201 No.ofobs.: 1906	RMS	1.305	19.851	2.039	2.165
	Bias	0.137	-1.602	-0.174	0.151
201202 No.ofobs.: 2043	RMS	1.126	19.524	1.950	1.938
	Bias	0.045	-0.769	-0.074	0.065
201203 No.ofobs.: 1187	RMS	1.368	20.562	1.999	1.979
	Bias	0.063	-0.447	-0.234	0.049

# Summary

4-month HY-2A scatterometer winds are evaluated using NDBC buoy observations.

The overall accuracy is 1.4 m/s and 32° in direction for wind speed range [2 24] m/s.

The wind accuracy after ambiguity removal is Improved (1.3 m/s and 20°). The amount of ambiguity removal data is less than 5% of the total scatterometer winds.