



ESA-MOST Dragon Cooperation

中国科技部-欧洲空间局“龙计划”合作

2017 DRAGON 4 SYMPOSIUM

2017年“龙计划”四期学术研讨会

**Synergistic monitoring of ocean winds,
waves and storm surges from multi-sensors
(ID. 32249)**

26-30 June 2017 | Copenhagen, Denmark

2017年6月26-30日, 丹麦 哥本哈根

FRI. 30 JUNE 2017

DRAGON 4 ID. 32249 PROJECT

SUMMARY

List Pls :

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Dr. Alexis Mouche,
Dr. Ole Andersen,*

*Prof. Jingsong Yang
Prof. Biao Zhang
Dr. He Wang*



LI of European: Bertrand Chapron



LI of Chinese: Jingsong Yang

Sub-projects and themes:

Id. 32249_1

Algorithm for advanced wind and wave products from multi-sensors

Id. 32249_2

Global climate on wind and wave from long term multi-sensor data

Id. 32249_3

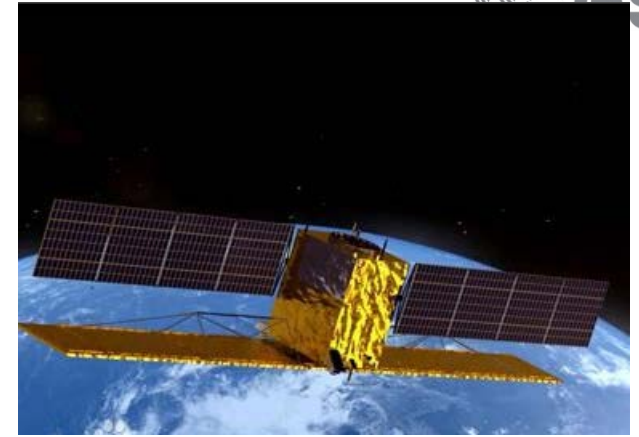
Extreme ocean event monitoring from multi-sensors

Summary EO data exploitation – cumulative stats all subprojects

ESA & ESA TPM DATA	Nos. scenes or inform if by FTP	SENTINELS 1, 2 & 3 DATA	Nos. scenes	CHINESE EO DATA	Nos. scenes
ERS SAR		Sentinel 1-A/B SAR	1000+	HJ-A/B	23
ASAR	1000+	Sentinel 2-A/B MSI		GF-1	300+
MERIS		Sentinel 3-A OLCI		GF-3	1000+
AATSR		Sentinel 3-A SLSTR		HY-A	
SMOS	1000+	Sentinel 3-A SLAR		FY-1	
etc.		Etc.		Etc.	
TOTAL	2000+	TOTAL	1000+	TOTAL	1300+

GF-3 SAR

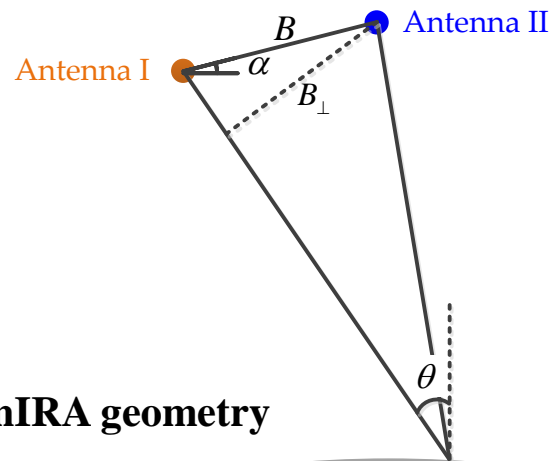
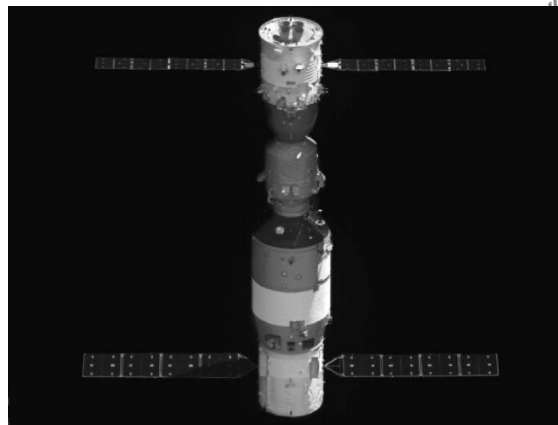
GF-3 (GF stands for GaoFen, which means High Resolution in Chinese) is the China's first **C band** multi-polarization high resolution microwave remote sensing satellite. It was successfully launched on **Aug. 10, 2016** in Taiyuan satellite launch center. The synthetic aperture radar (SAR) on board GF-3 works at incidence angles ranging from **20 to 50 degree** with several polarization modes including single-polarization, dual-polarization and quad-polarization. GF-3 SAR is also the world's most imaging mode SAR satellite, with **12 imaging modes** consisting of some traditional ones like stripmap and scanSAR modes and some new ones like spotlight, wave and global modes.



TG-2 InIRA

TG-2 (Tiangong-2) is a Chinese space laboratory which was launched on **15 September 2016** from Jiuquan Satellite Launch Centre. The onboard **Interferometric Imaging Radar Altimeter (InIRA)** is a new generation radar altimeter developed by China, which combines the functions of interferometric radar altimeter and Synthetic Aperture Radar (**SAR**).

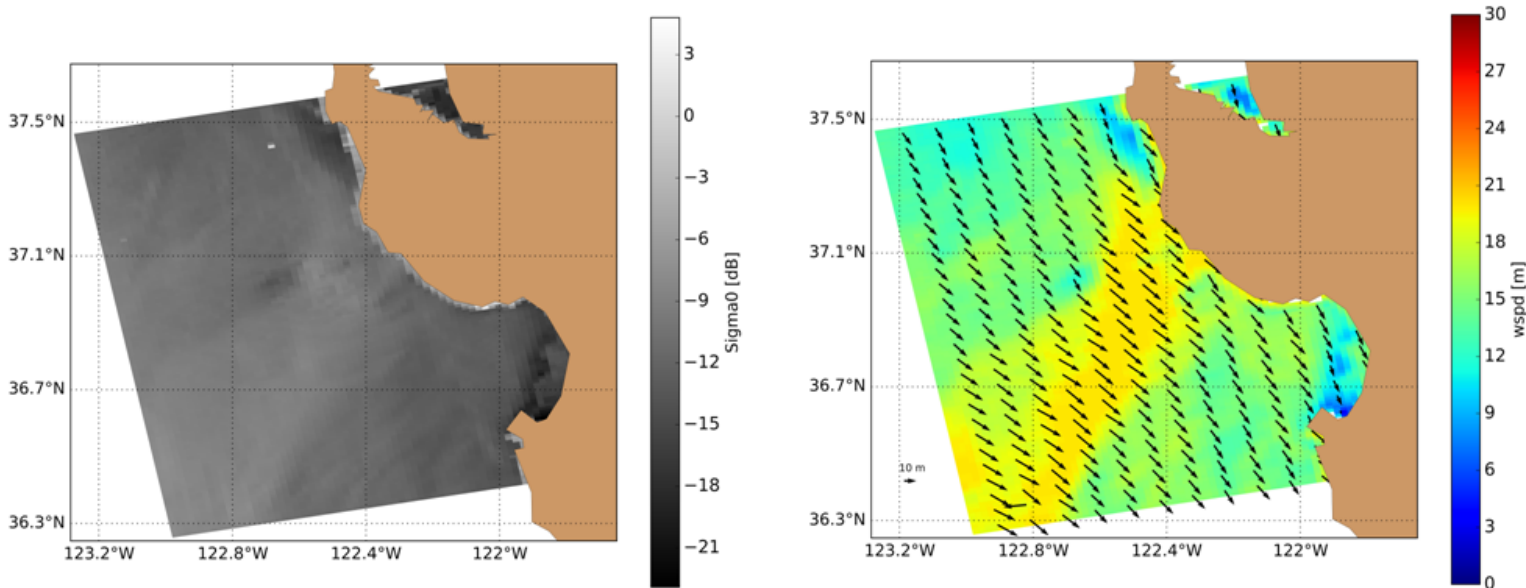
The dominate scattering mechanism for sea surface is quasi-specular scattering due to the small incidence angle range (**3-8deg**).



TG2 InIRA geometry

GF-3 SAR wind retrieval algorithm development

高分三号卫星标准条带模式海面风场专题图



传感器：GF-3/SAR

观测模式：标准条带

观测时间：2017 年 02 月 02 日 02:05:57 UTC

海面雷达后向散射系数（左）、海面风场反演产品（右）

制作单位：国家海洋局第二海洋研究所



术研讨会

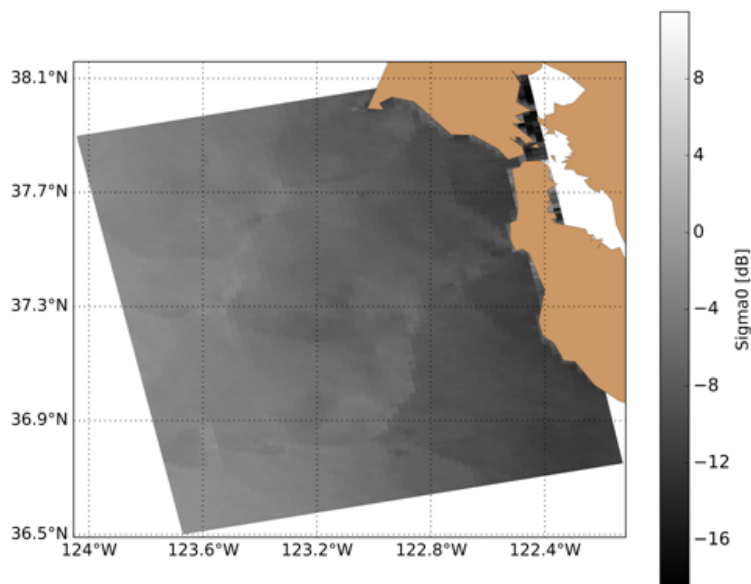
2017 DR

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GF-3 SAR wave retrieval algorithm development

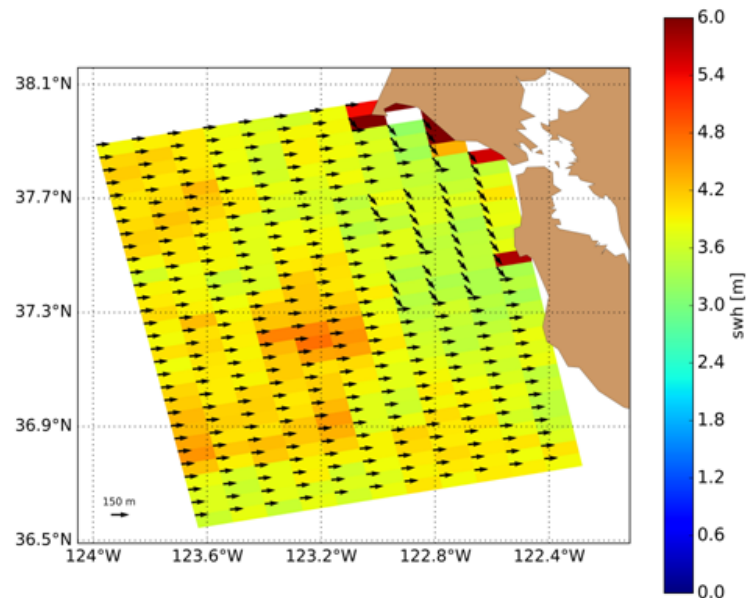
高分三号卫星标准条带模式海面浪场专题图



传感器：GF-3/SAR

观测模式：标准条带

观测时间：2017年01月21日 02:02:39UTC

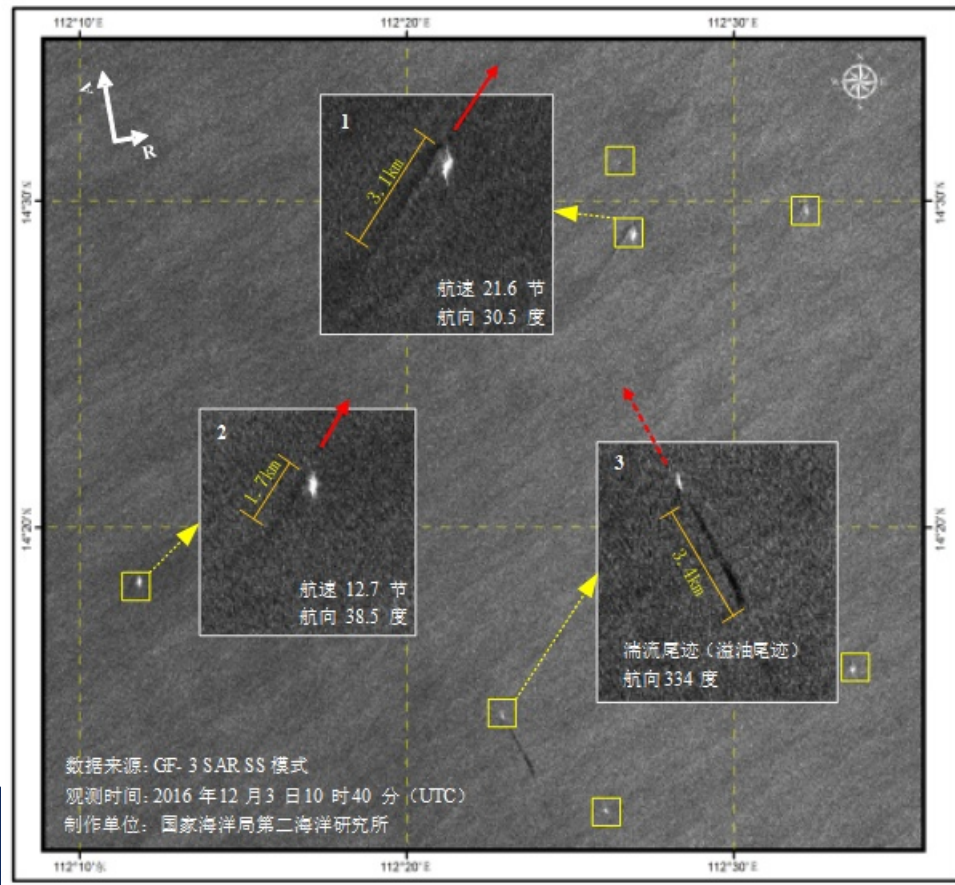
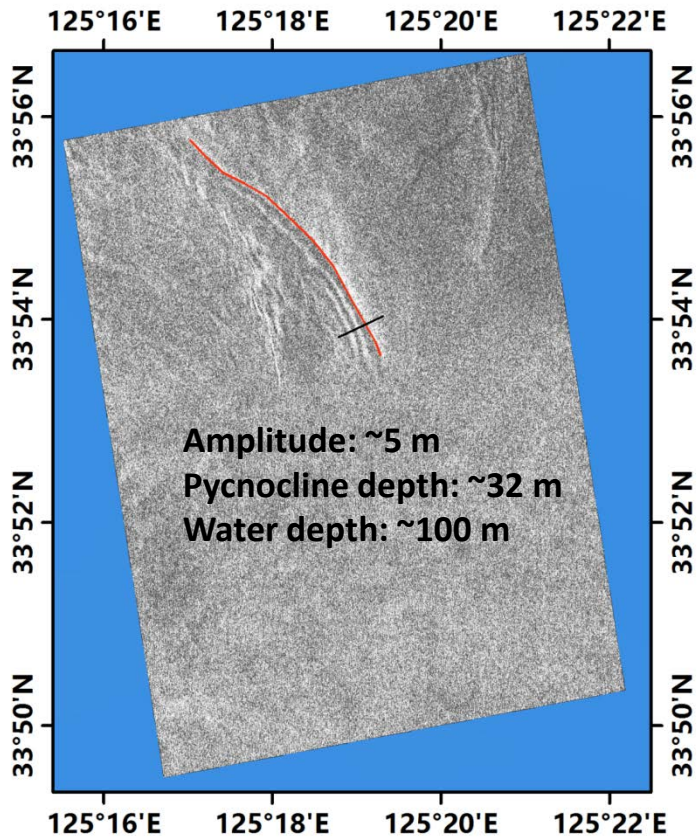


海面雷达后向散射系数（左）、海面浪场反演产品（右）

制作单位：国家海洋局第二海洋研究所

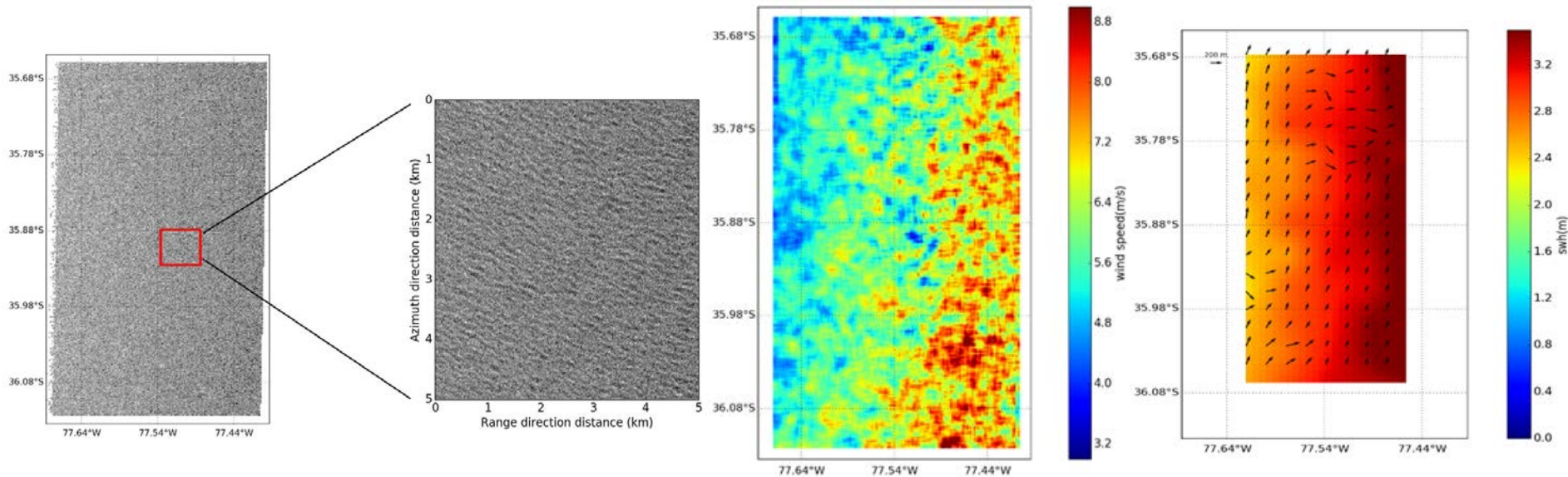


GF-3 SAR internal wave retrieval and ship detection algorithm development



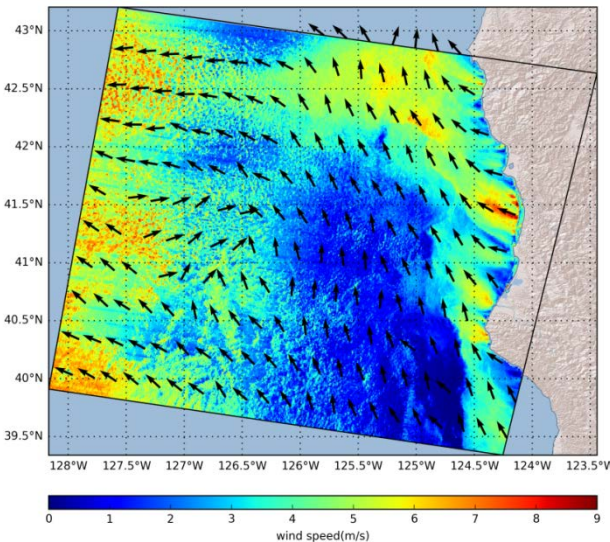
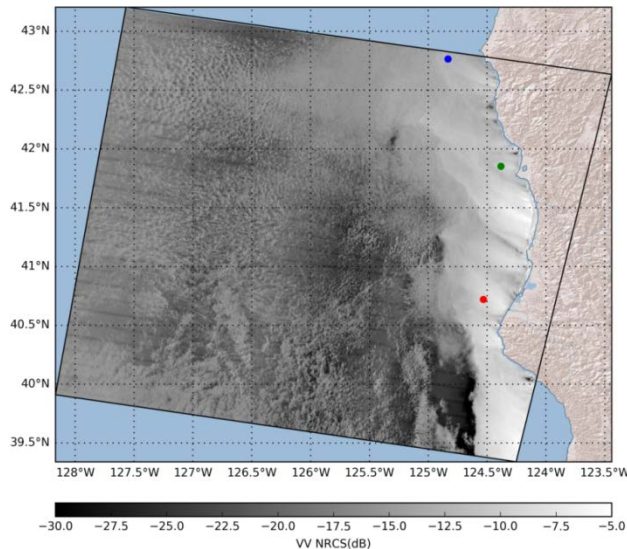
Results summary id. 32249_1

TG-2 InIRA wind and wave retrieval algorithm development

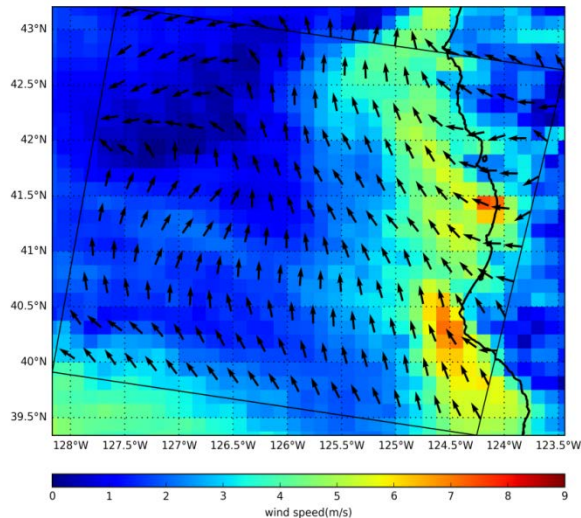


Results summary id. 32249_2

GF-3 wind retrieval **katabatic wind** algorithm development

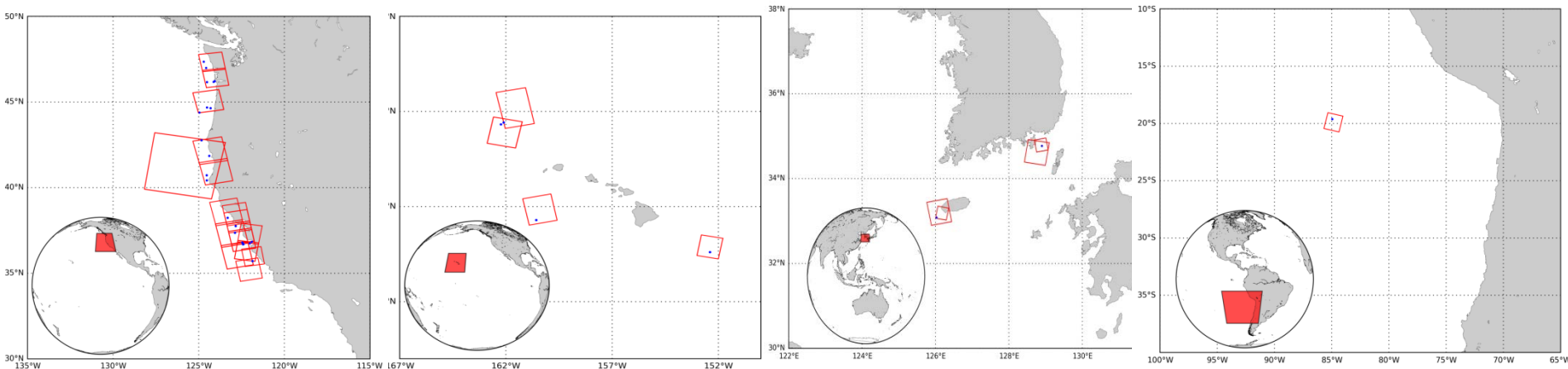


GF-3 wind @ 1 km

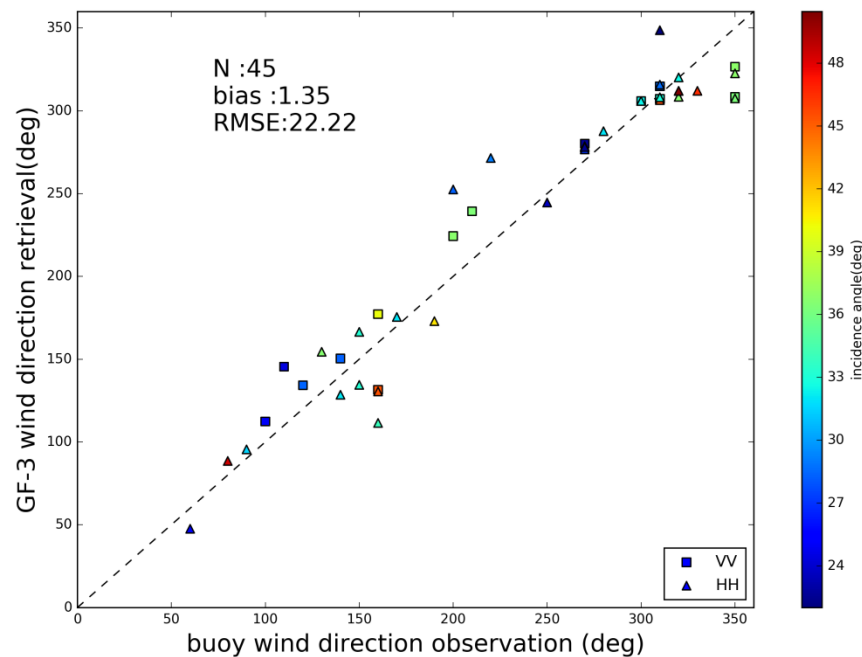
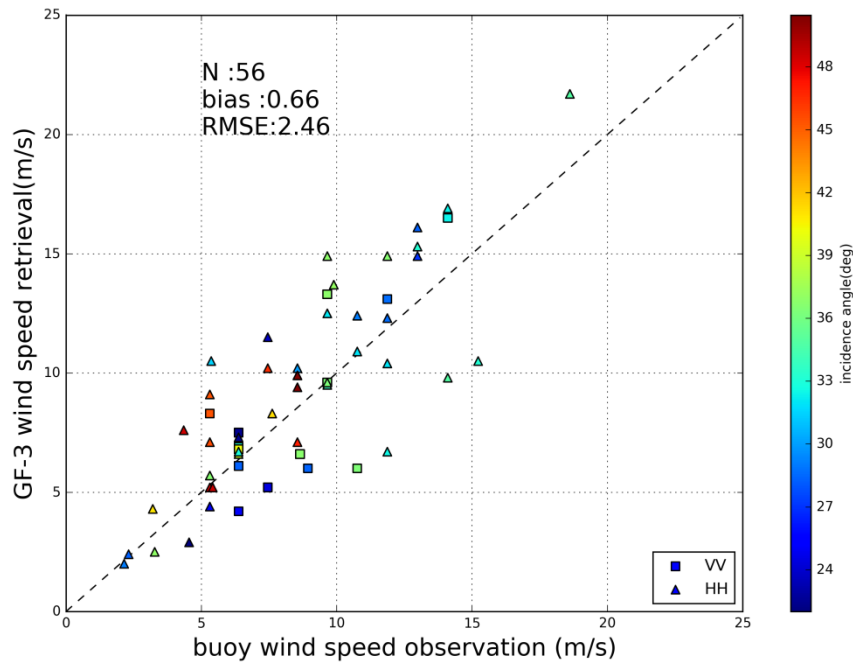


ECMWF wind @ 12.5 km

GF-3 wind retrieval **collocated with NDBC buoys**

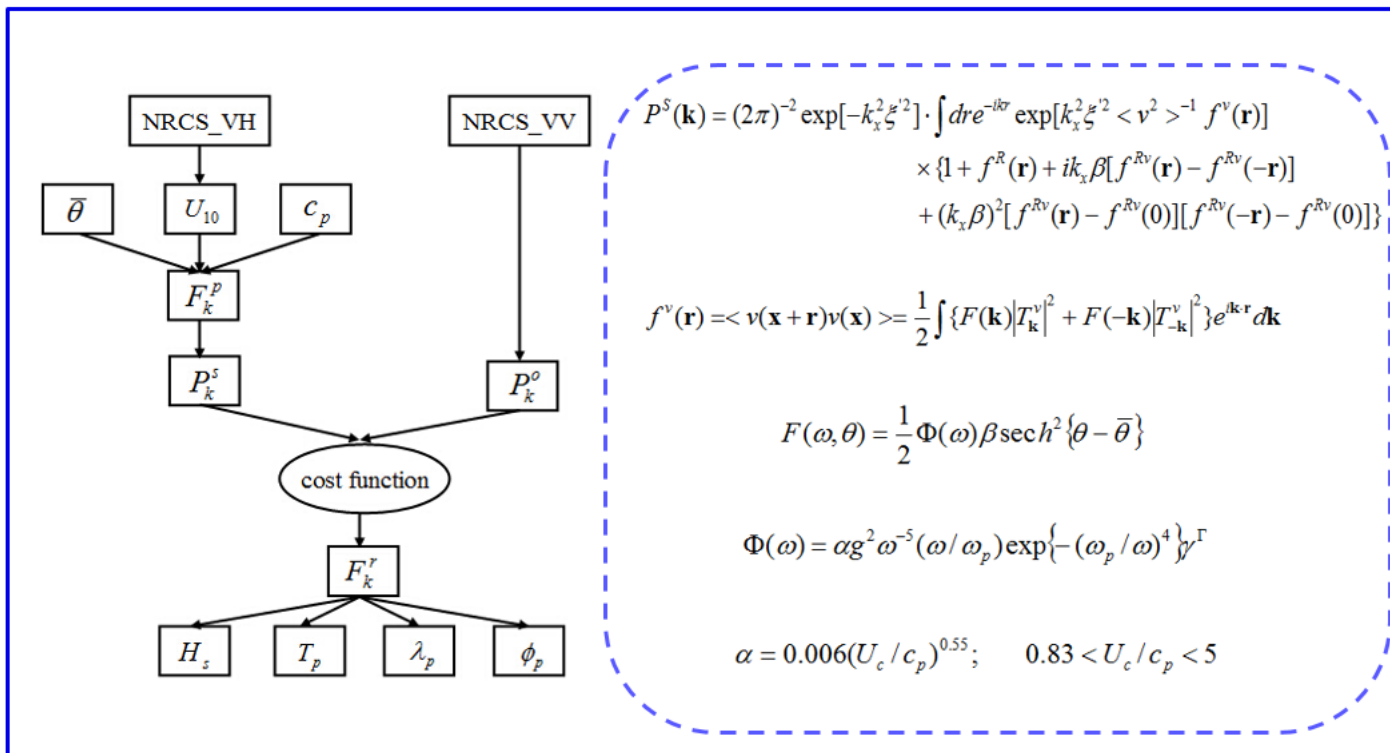


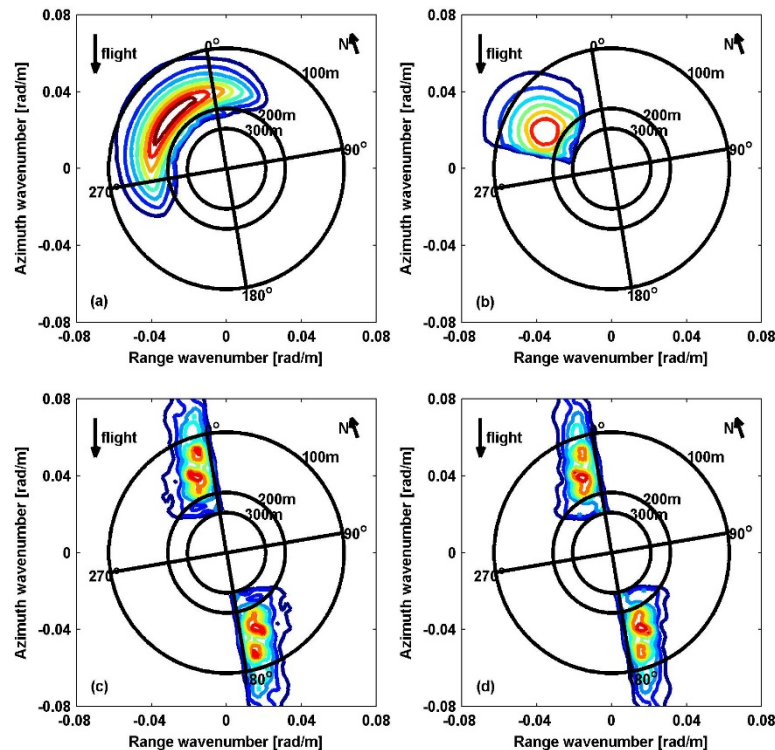
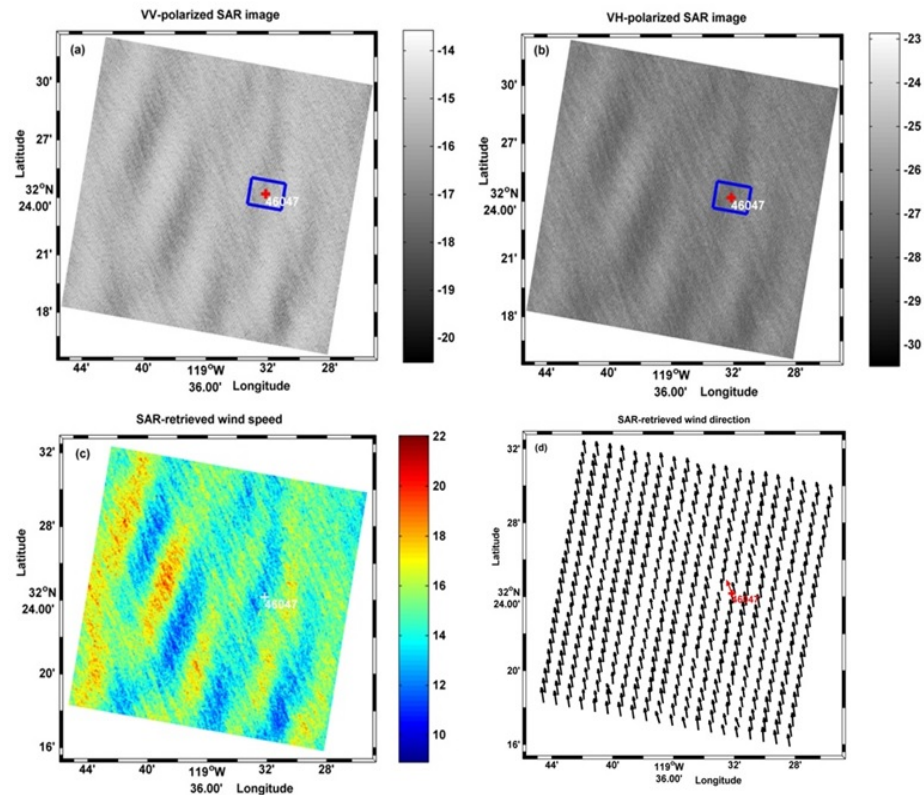
GF-3 wind retrieval validation results



Results summary id. 32249_3

SAR ocean winds and waves synergistic measurements





Radiometer High Winds Measurements

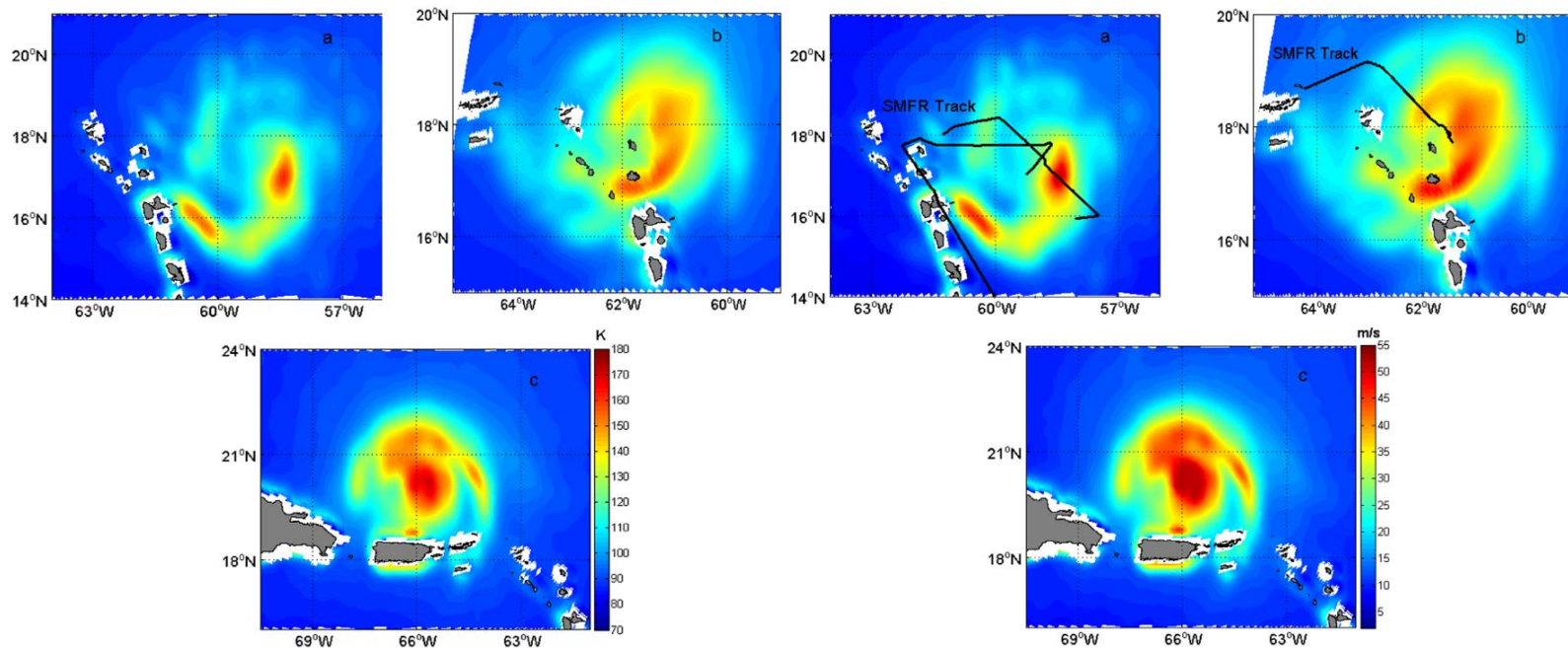
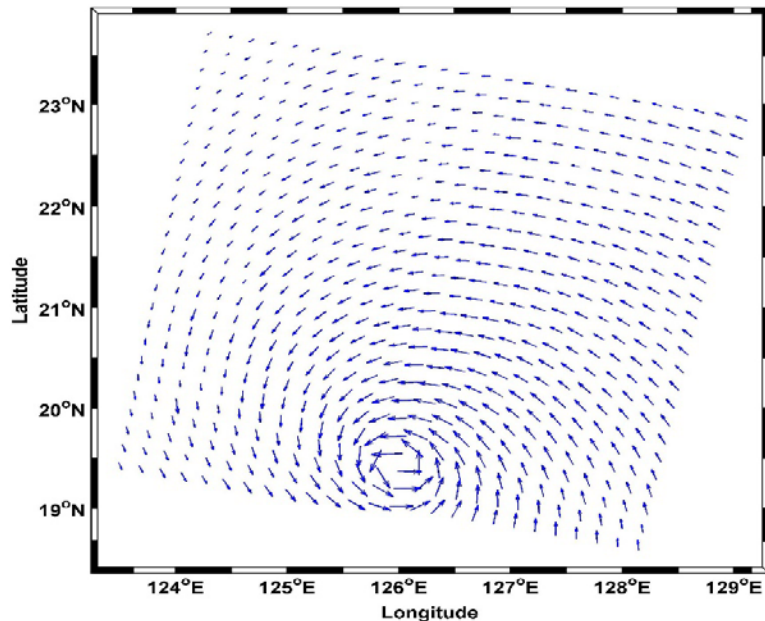


Fig. 5. Wind speed retrieval results from the SSA/SPM model and H13 spectrum, using the AMSR-E observed 6.9-GHz horizontal polarization brightness temperatures (T_B) over Hurricane Earl on (a) August 29, 2010, at 1722 to 1726 UTC; (c) August 30, 2010, at 0534 to 0537 UTC; and (e) August 31, 2010, at 0615 to 0620 UTC. The black solid lines in (a) and (b) represent the SMFR tracks, which were acquired on August 29, 2010, at 1640 to 1750 UTC, and August 30, 2010, at 0500 to 0600 UTC.

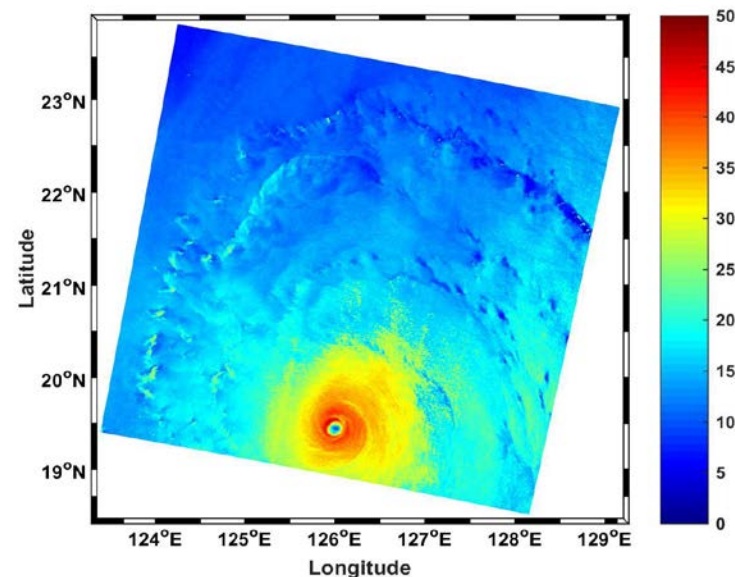
Results summary id. 32249_3

VH-pol SAR wind direction derivation



21:28 UTC 12 Sep 2016

Dual-Pol SAR wind field



maximum wind speed is 47.4 m/s

1: The reasonable typhoon wind fields are obtained via combination of co- and cross-pol SAR measurements .

2: Dual-polarized SAR wind field is a good candidate surface forcing for oceanic numerical model. Synergy of SAR winds and model simulations has potential to better understanding the response of upper ocean to typhoon.

3: High temporal RCM SAR along with scatterometer and radiometer observations will provide a unique opportunity for monitoring typhoon and improving its forecast accuracy.

Young scientists contributions

European YS

Leo Vinour (PhD student) – Air-sea interactions and coupling under extremes : impact on wind-waves coupling

Clement Combot (PhD student) – Hurricane impact on the upper ocean dynamic : Re-stratification of mixed layer depth and seasonal impact

Chinese YS

Lin Ren – algorithm development for GF-3 SAR wind & wave retrieval

Juan Wang - algorithm development for GF-3 SAR internal wave

Peng Chen - algorithm development for GF-3 SAR ship detection

Academic exchanges & joint publications

Academic exchanges & cooperation

Provide update & outcomes on

- Meetings
- Visiting scientists
Bertrand Chapron & Alexis Mouche visited SIO & NOTC in summer of 2016
Yili Zhao, Huimin Li, Chen Wang & Quan Wang in Ifremer for one (two) years visiting
- Workshops organised

Joint publications

List any publications in press or published

He Wang, Jingsong Yang, Weizeng Shao, Alexis Mouche, et al., GF-3 SAR ocean wind retrieval: the first view and preliminary assessment. Remote Sensing. (under review)

Plans for the next 2 years

1. Improve consistent wind and waves algorithm for GF-3, S-1A/B SAR.
2. Joint analysis of hurricanes generated waves from SAR
3. Multi-sensor synergy to improve the upper layer ocean dynamics : wind, waves, current, SST & SSS

10-m Wind Speed for 01-Aug-2015 00:00 UTC [m/s]

