

# Validation of Geo-physical products from SARAL/AltiKa

By

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**2<sup>nd</sup> ISRO-CNES Science Meeting For SARAL/AltiKa, 15<sup>th</sup> -17<sup>th</sup> March, 2011**

# ✓ Measurable from SARAL/AltiKa

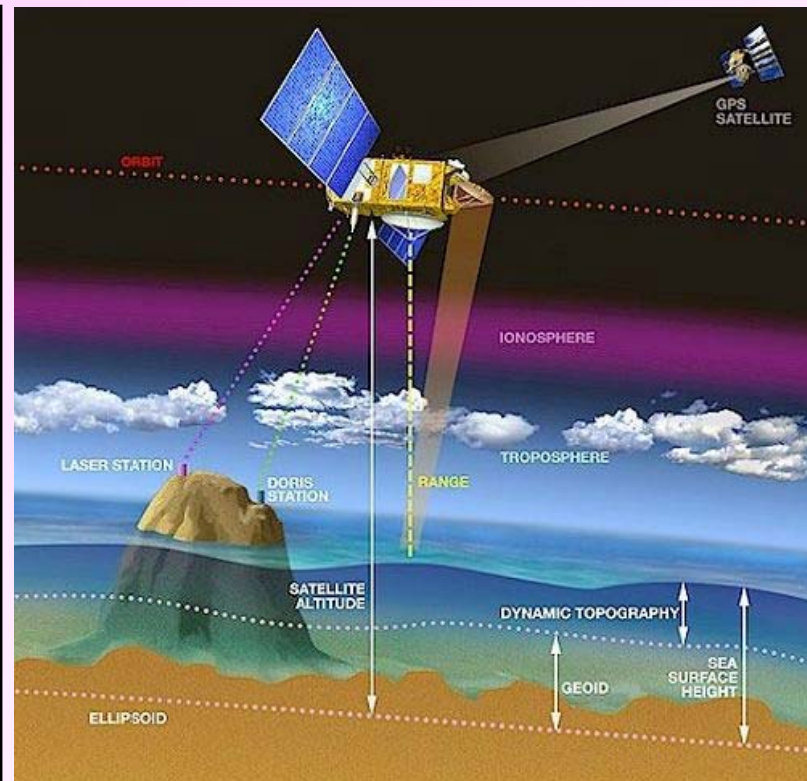
## Direct Measurement:

Altitude or range from two way pulse delay – Used for Sea Surface Height (SSH) determination

## Retrieved Parameters:

Significant Wave Height (SWH)  
Determined from leading edge of Wave Form

Returned power – Used for wind speed determination

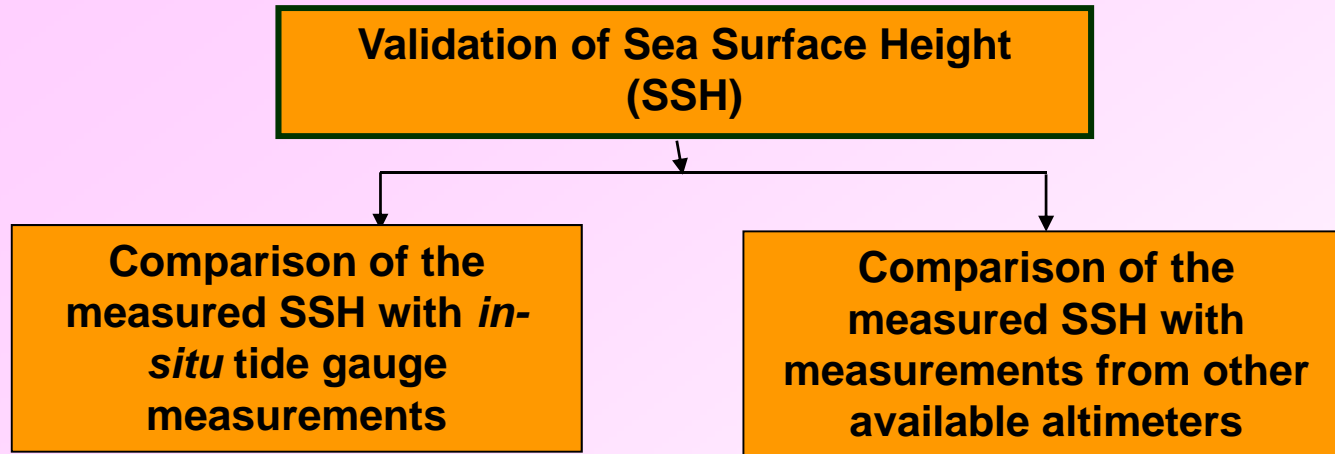


## Expected Errors

Parameters	OGDR	IGDR	GDR	Mission Goal
SSH (cm)	30.5	5.3	4.6	2.8
SWH (m)	0.5	0.4	0.4	0.25
Wind Speed (m / s)	2	1.7	1.7	1

# AltiKa Validation Requirements

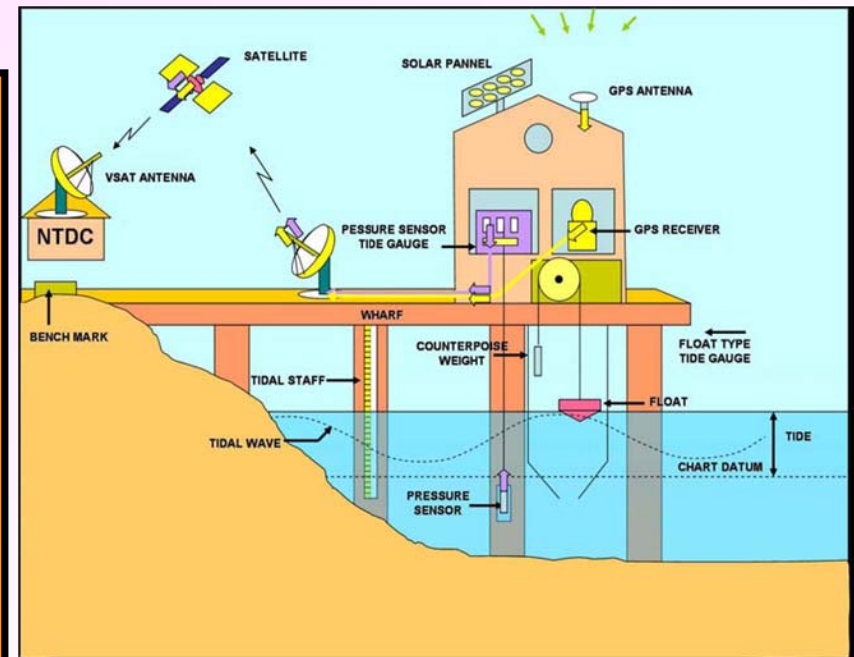
It aims to assure that the accuracies of the derived products are well within the mission requirement. (2 -3 cm of SSH, 0.3 m in SWH, 1.7 m /s in Wind speed)



## Methodology

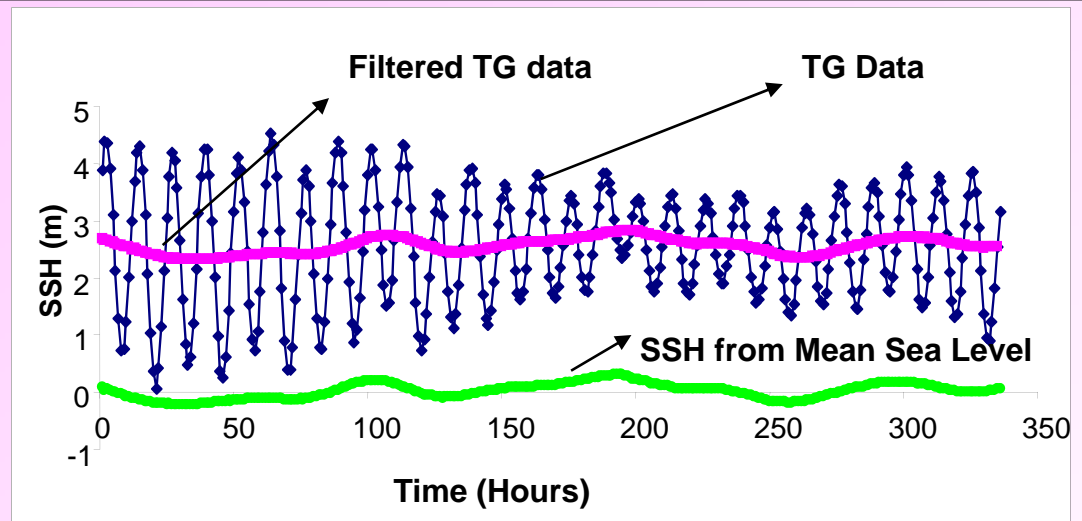
✓ In-situ tide gauge SSH measurement over global oceans at various location either coincident with altimeter overpasses (direct measurements) or at nearest vicinity (indirect measurements) are selected based on EnviSAT-RA2 ground tracks, and differences in geoids of pass and site.

✓ Tide gauge data is processed firstly using Doodson X0 filter for damping out the main tidal frequencies.



### Doodson Filter:

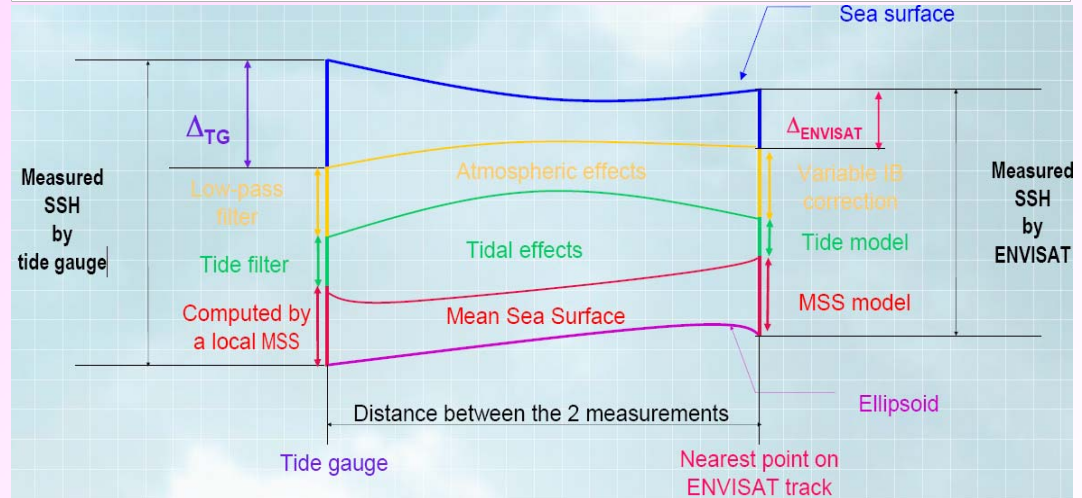
It takes hourly values, 19 values either side of the central one. A weighted average is taken with the following weights:  
(10100101102011021120  
2112011020110100101)/30.



### Methodology Contd.....

✓ Removal of the mean from filtered data to compute the SSH from Mean Sea level (MSS)

✓ Comparison between AltiKa SSH and TG SSH



For Direct Measurements

Sea Level<sub>Altimeter</sub> vs. Sea Level<sub>Tide Gauge</sub>

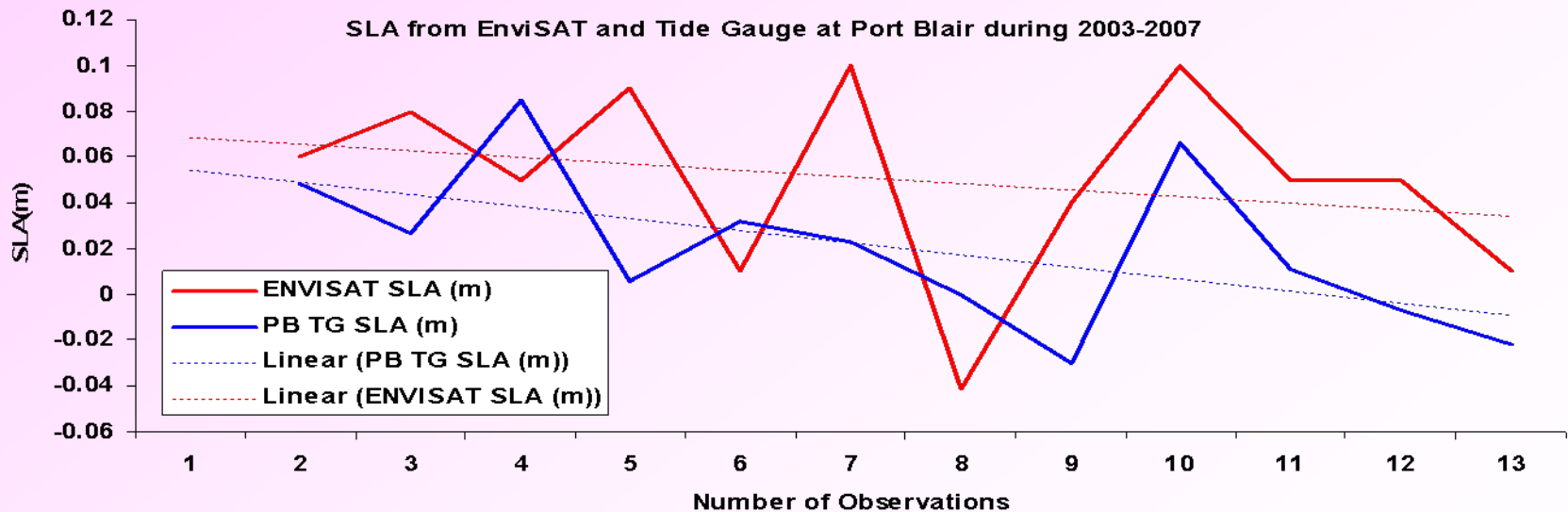
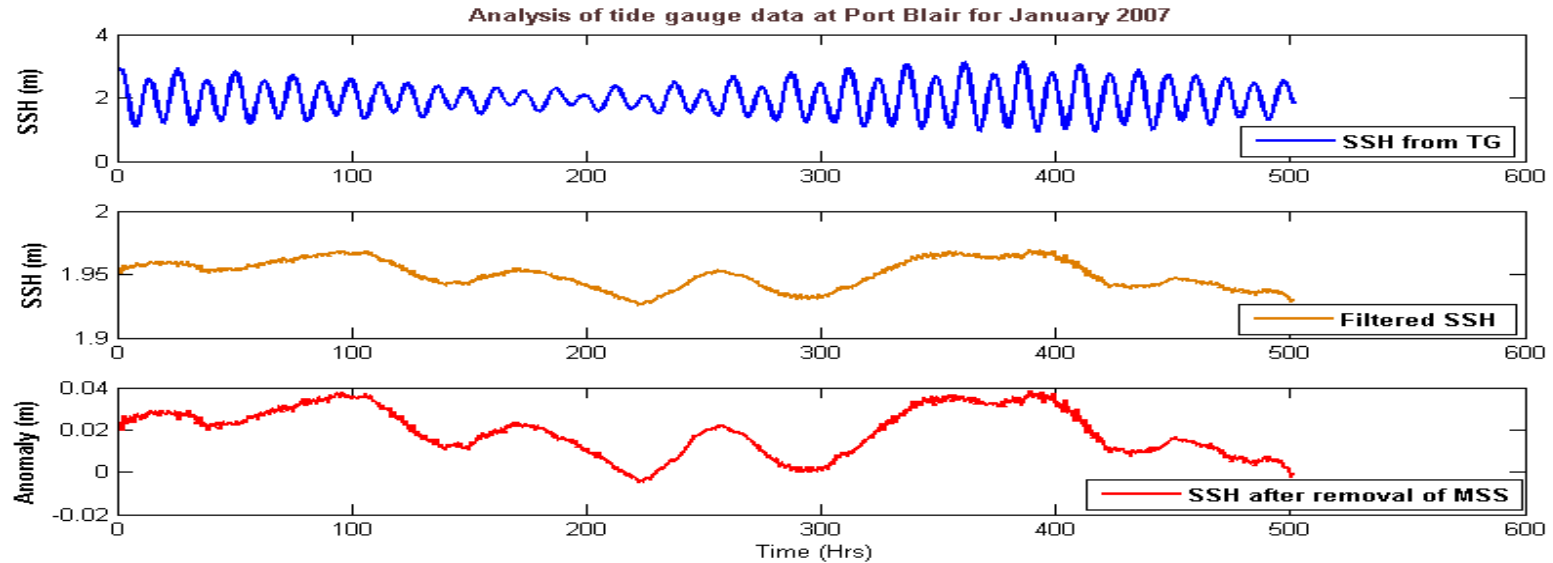
For Indirect Measurements

Sea Level<sub>Altimeter</sub> vs. Sea Level<sub>Tide Gauge</sub>

with geoid considerations

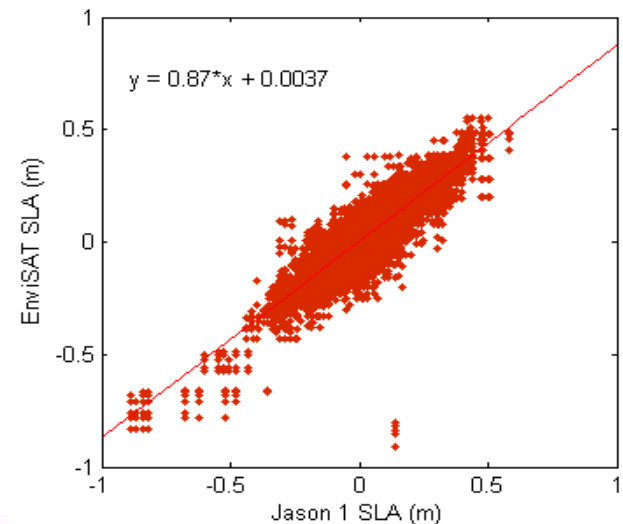
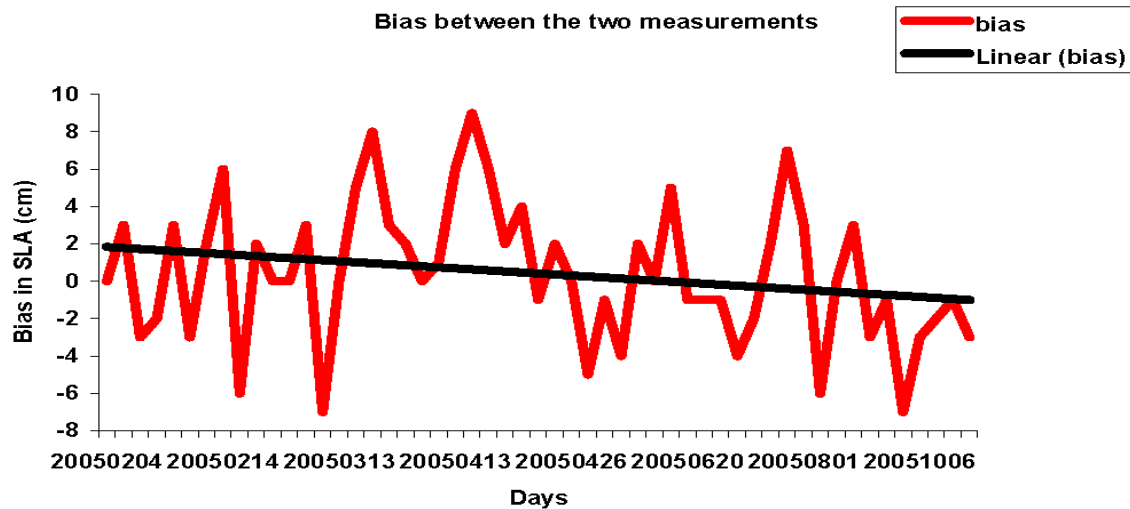
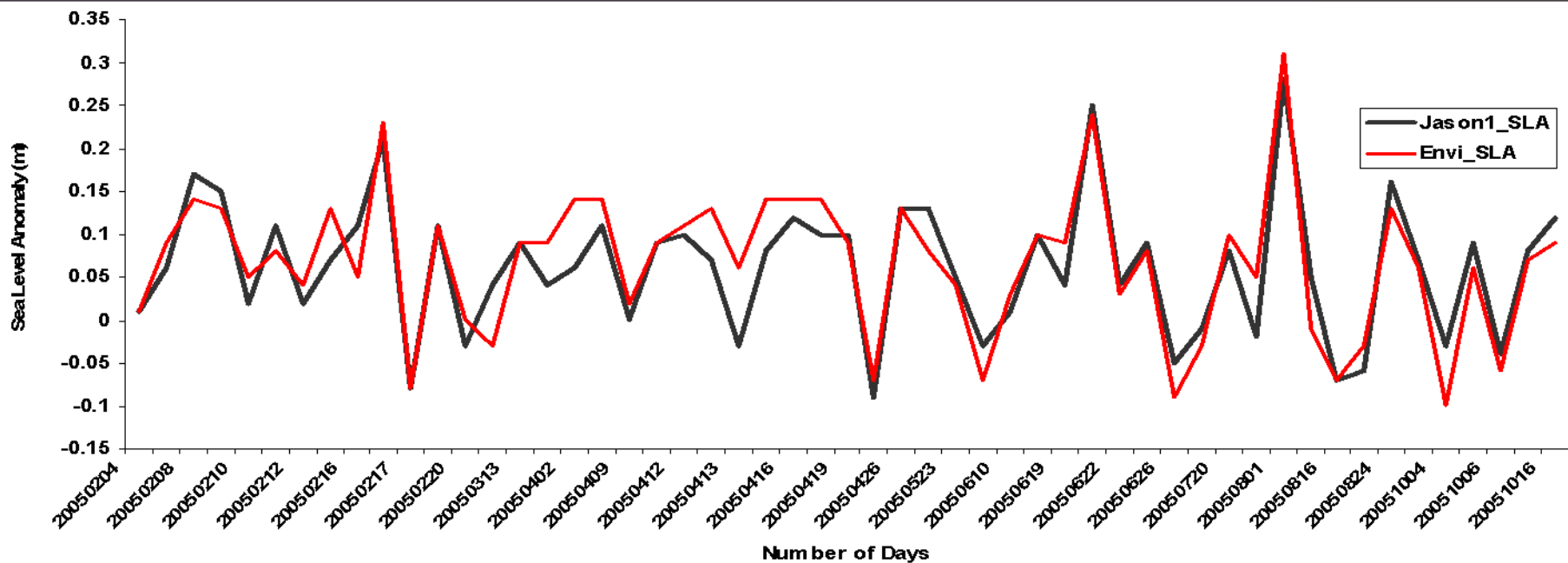
## Data Used and Results

1. Tide Gauge data from Survey of India (SOI) at seven stations (2003-2007)
2. Envisat radar altimeter data for the coincident period of time



# Inter-sensor comparison of altimeters

Data Used and Results: EnviSAT and Jason 1 data for the entire year of 2005



**Validation of SARAL AltiKa retrieved parameters (SWH and Wind Speed)**

**Removal of data out of range**

**Statistical comparison with observations**

**In-situ buoy**

**High resolution numerical model simulations**

**Other satellite observations**

**Data From:**

**In-situ:** Wind and SWH from NDBC, TRITON RAMA and TAO Buoys

**Numerical Model:** High resolution Wave model (WAM) and Atmospheric Model from NCEP

**Satellite:** Jason -2 and EnviSAT RA 2 data

**Methodology for Satellite Altimeter Validation**

**With in-situ observations:**

Collocation of the hourly buoy measurements (NDBC, TRITON, TAO, RAMA) of SWH and Wind Speed with the EnviSAT RA passes (spatial distance of 20 Km, temporal window of 30 min)

Comparison of the altimeter measured wind and SWH with the in-situ buoy data.

**With Numerical Models:**

Collocated SWH and Wind speed from high resolution wave model and atmospheric model is compared with EnviSAT RA data

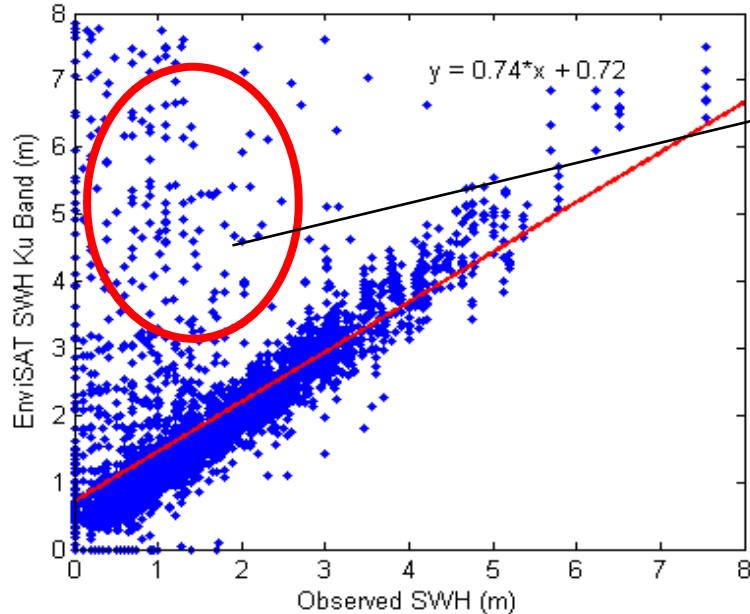
**With other satellite altimeters:**

Collocated measurements from other satellites like Jason-1 and 2 and EnviSAT is used for inter-comparison



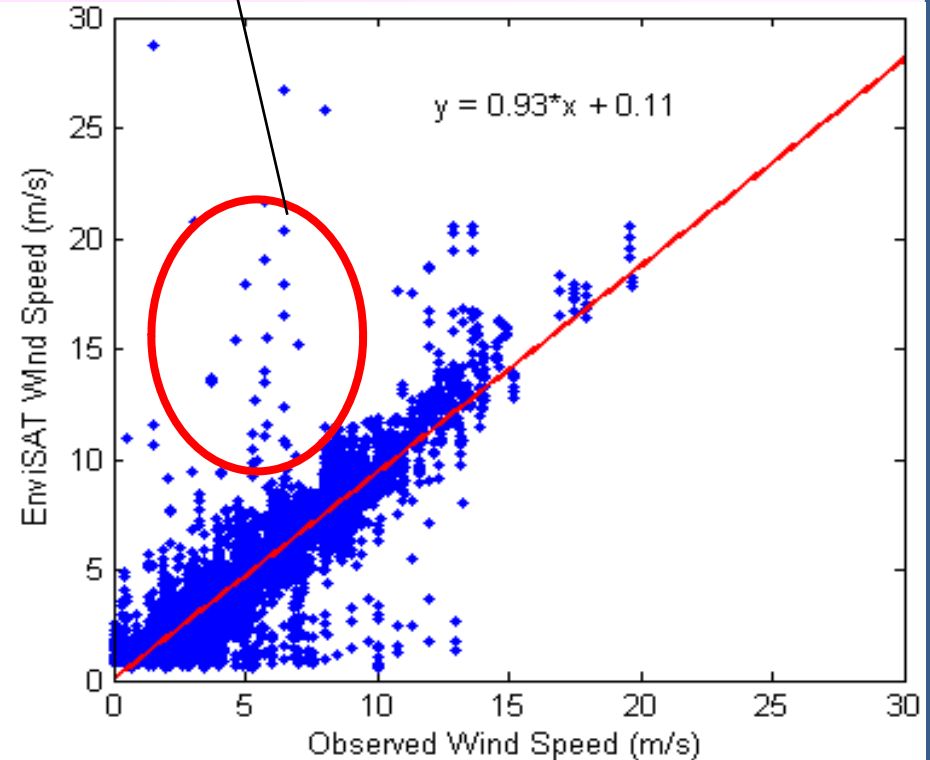
# Validation of wind speed and SWH from EnviSAT radar altimeter using in-situ observations from NDBC Buoys for 2005

## EnviSAT vs. NDBC (SWH)



Out lying points due to land ocean contaminations.

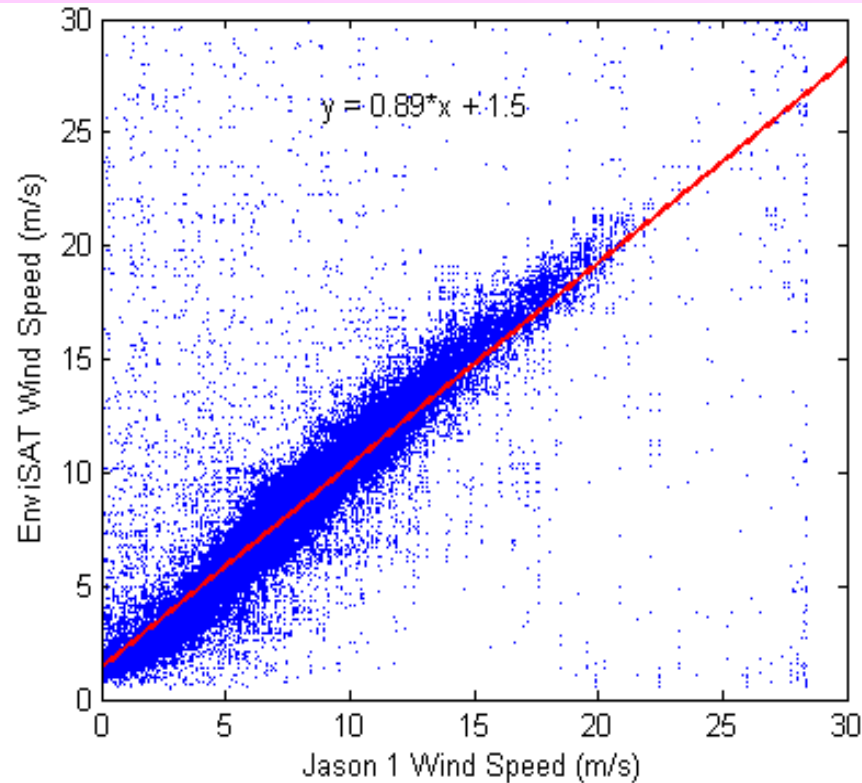
## EnviSAT vs. NDBC (Wind Speed)



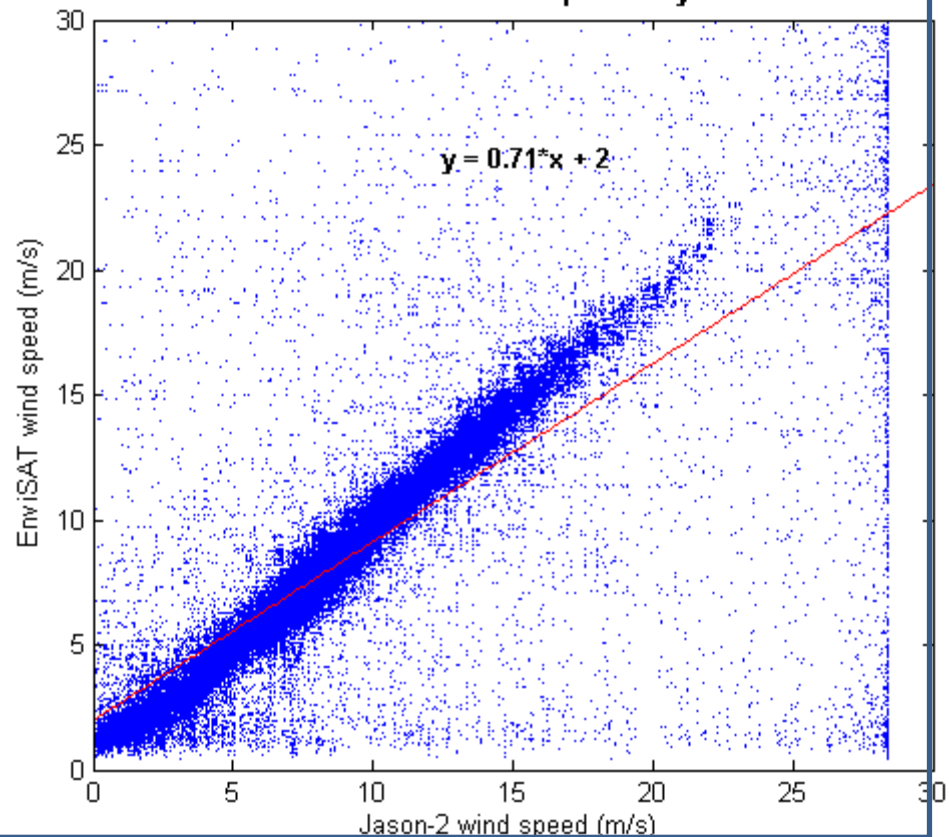


# Validation of Wind Speed from EnviSAT Radar Altimeter using Jason-1 for 2005 and Jason-2 for 2009

## EnviSAT vs. Jason-1 (2005)

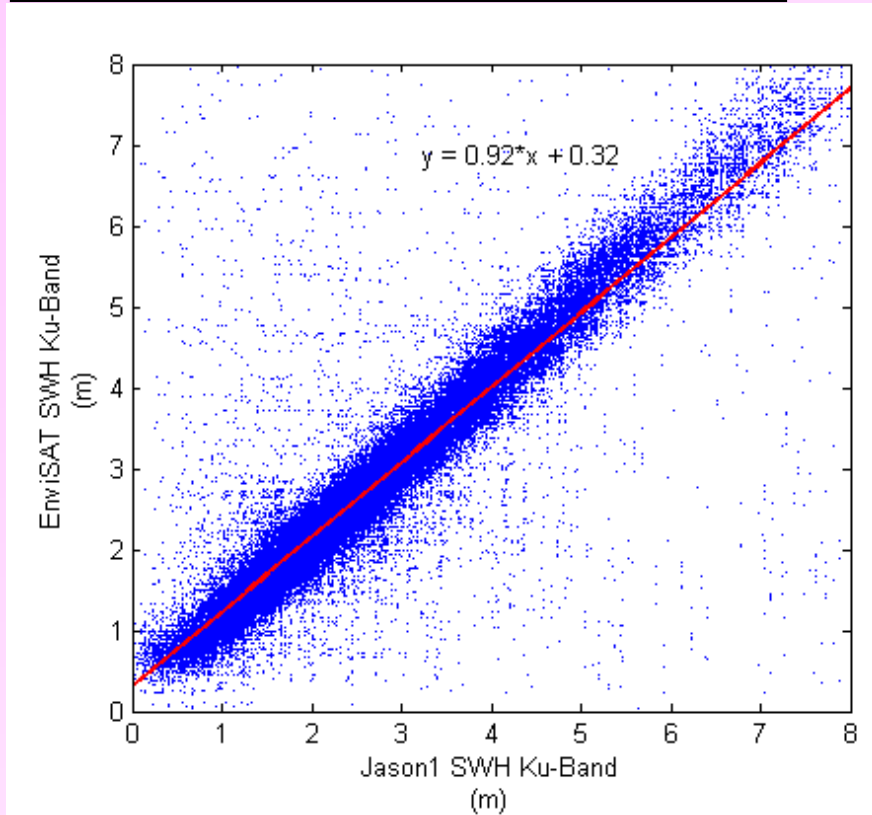


## EnviSAT vs. Jason-2 (2009)

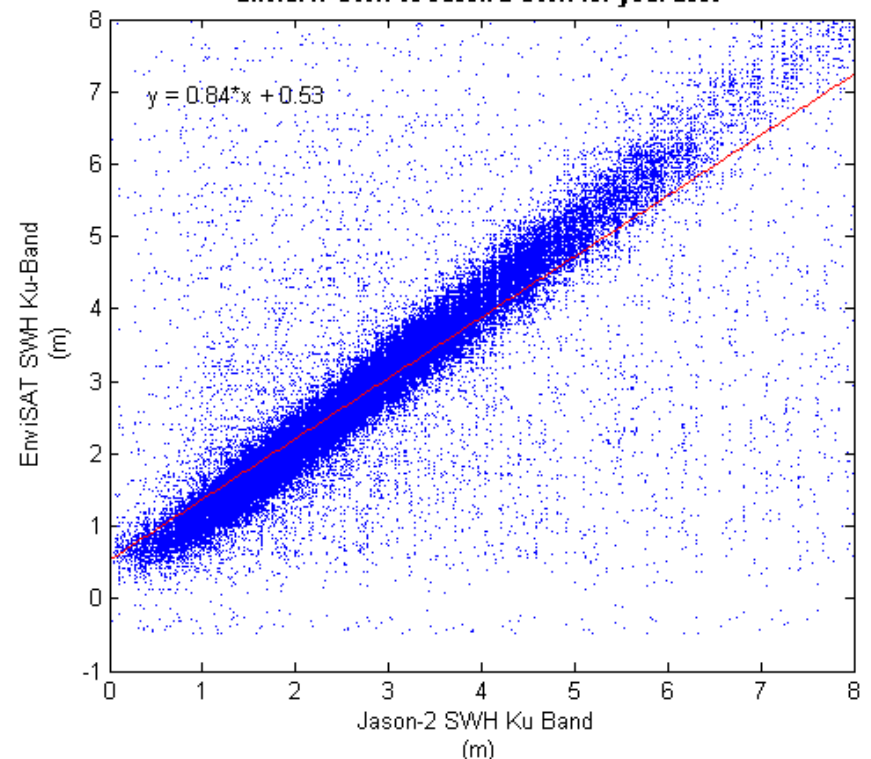


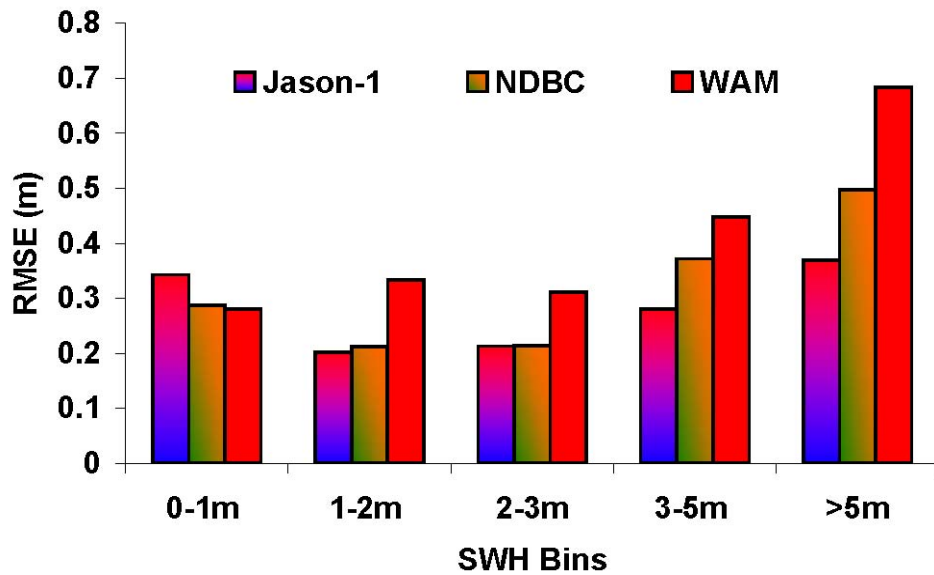
# Validation of SWH from EnviSAT Radar Altimeter using Jason-1 for 2005 and Jason-2 for 2009

## EnviSAT vs. Jason-1 (2005)

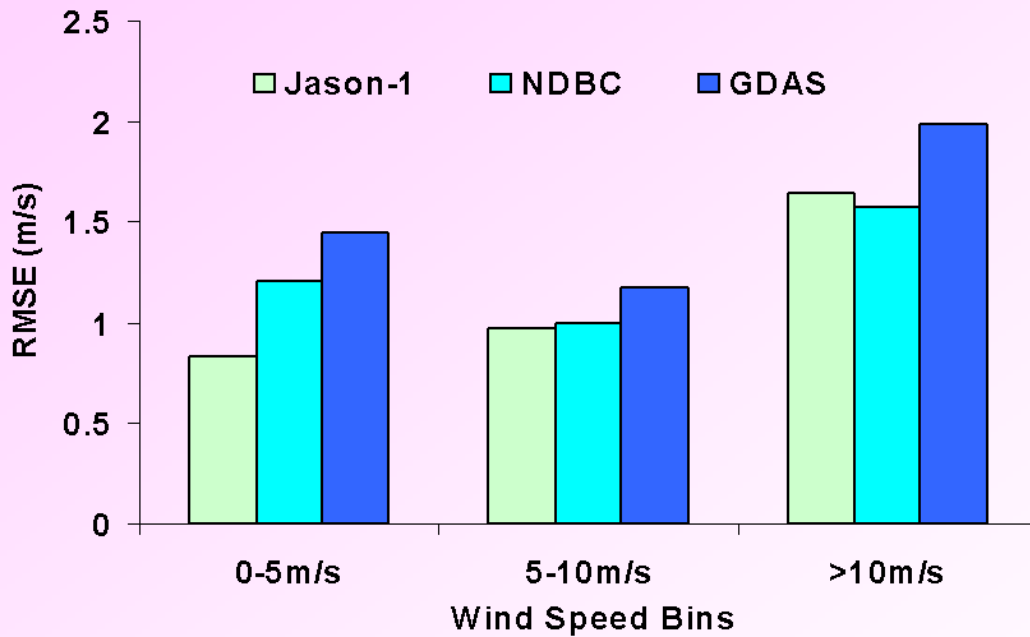


## EnviSAT vs. Jason-2 (2009)





The RMSE of the altimeter wave height when compared with simulated, observed and satellite derived wave height at various ranges



The RMSE of the altimeter wind speed when compared with simulated, observed and satellite derived wind speed at various ranges

**Thanks**