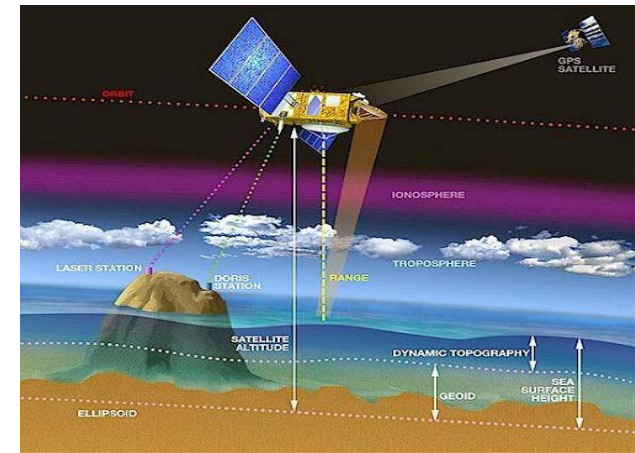


# Validation of SARAL/AltiKa geo-physical products using in-situ and satellite observations

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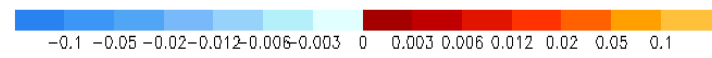
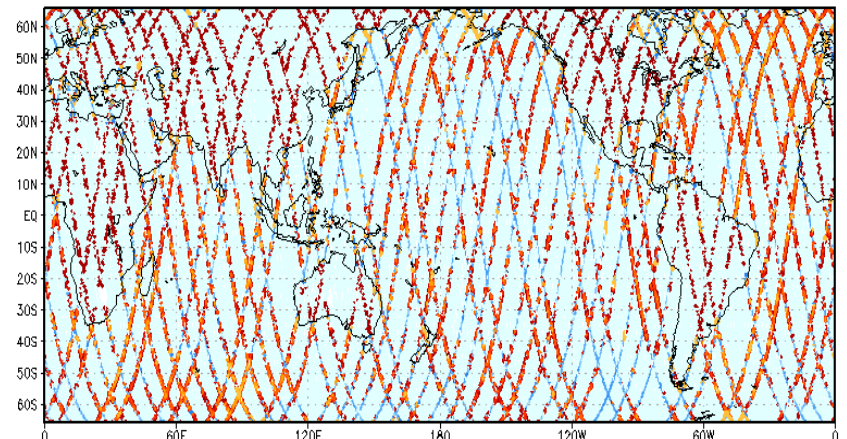
**Contributors OSD: Raj Kumar and Rashmi Sharma**  
**Contributors CVD: A.K Shukla, K.N babu, S. V. V Arun Kumar**



**Validation at operational phase**



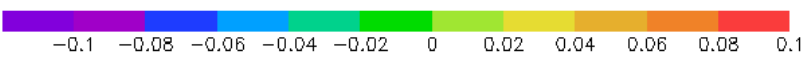
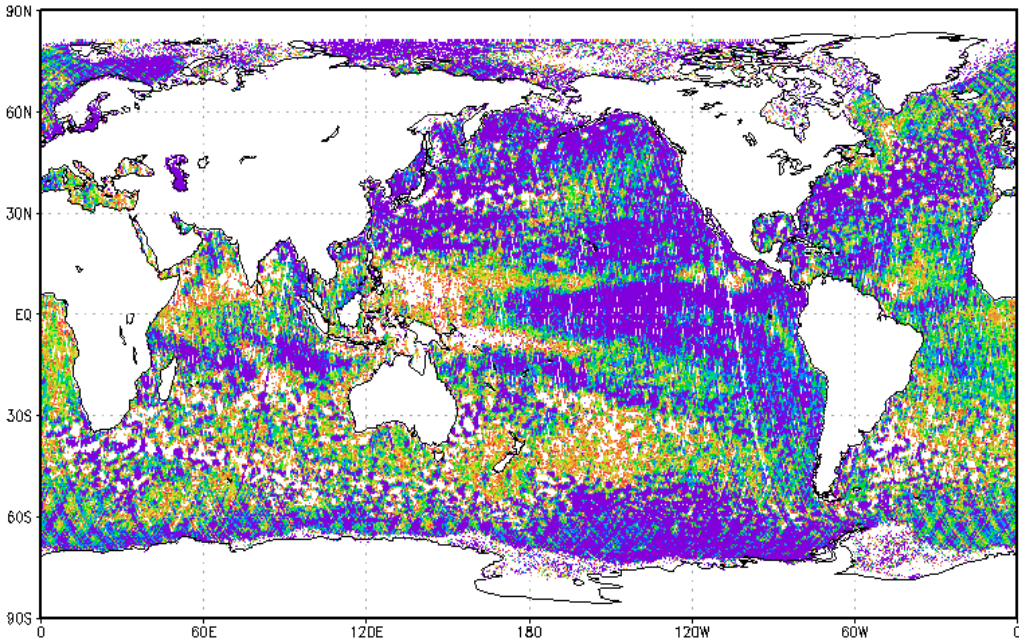
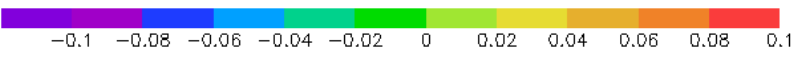
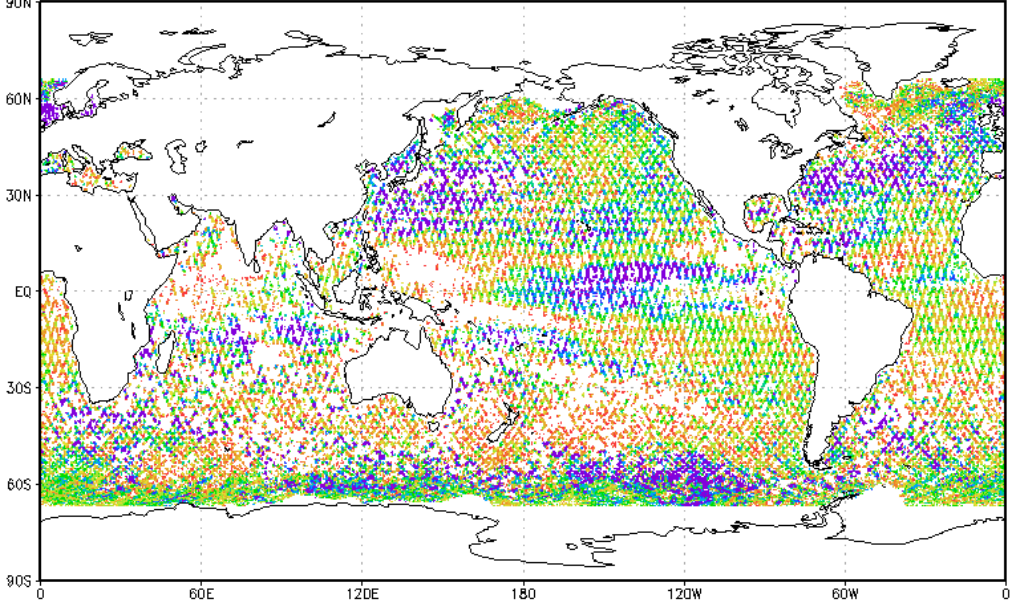
Jason-2 SLA



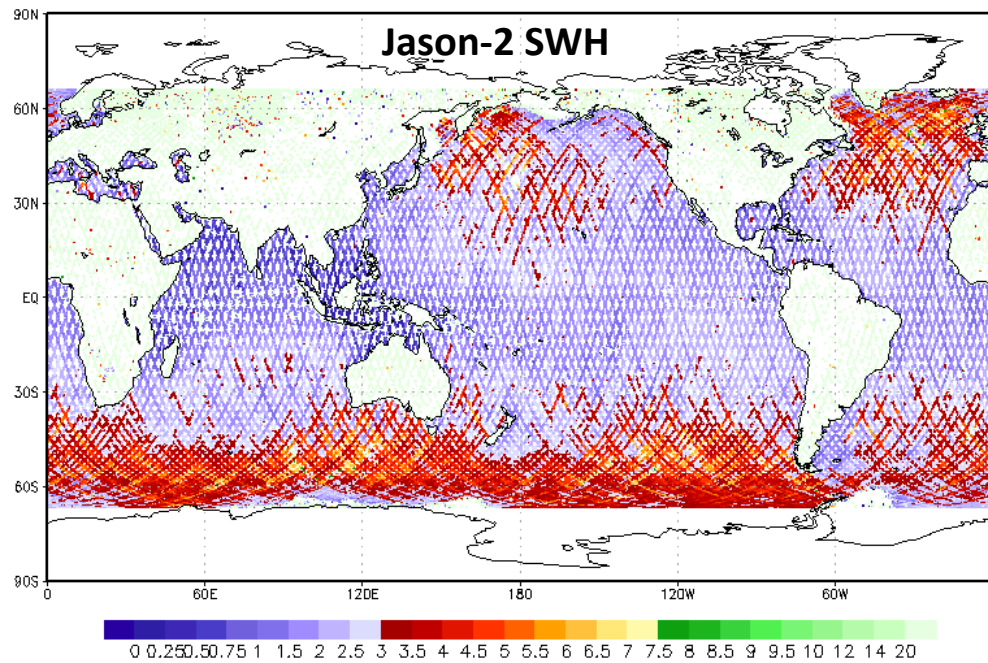
Bias in Global Sea Level Anomaly



SARAL/AltiKa SLA

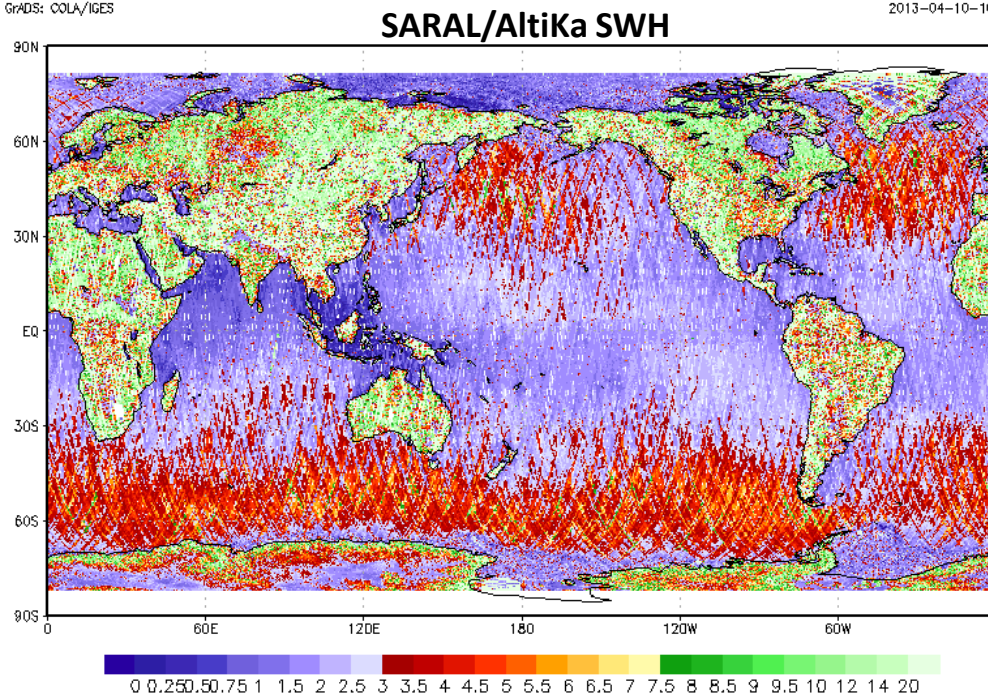






GrADS: COLA/IGES

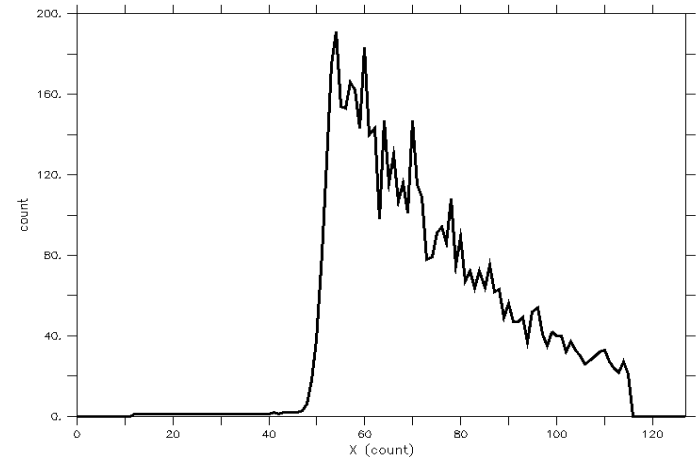
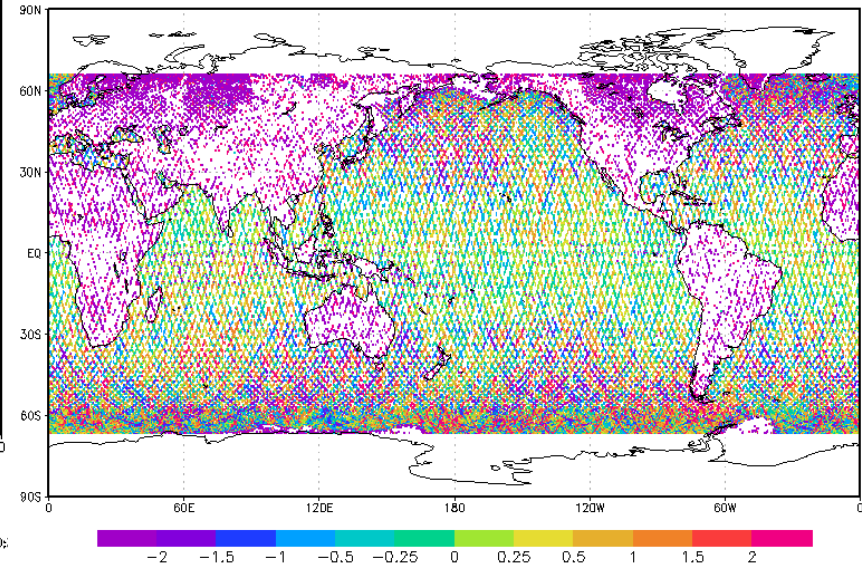
2013-04-10-10:



GrADS: COLA/IGES

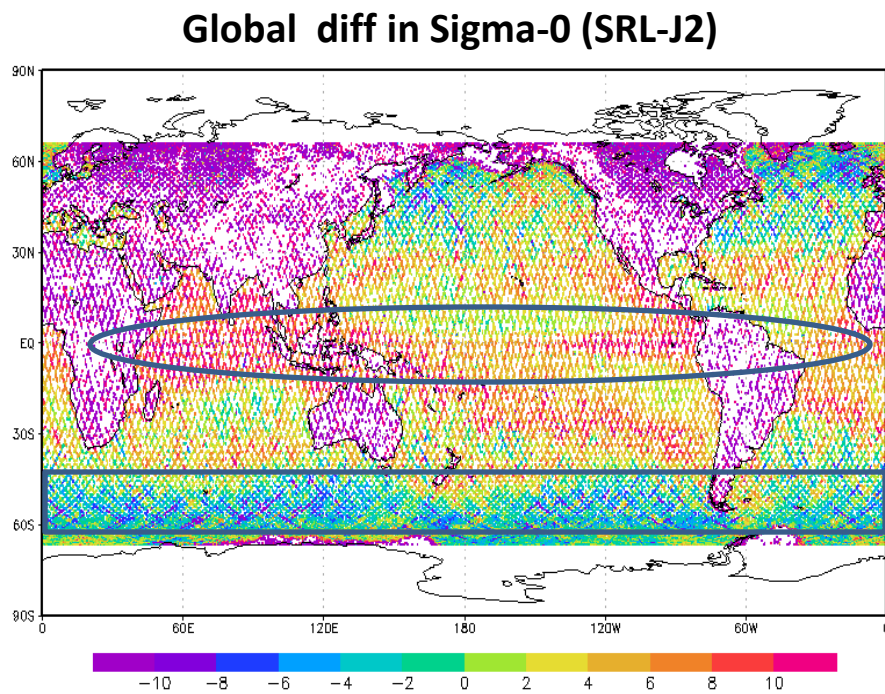
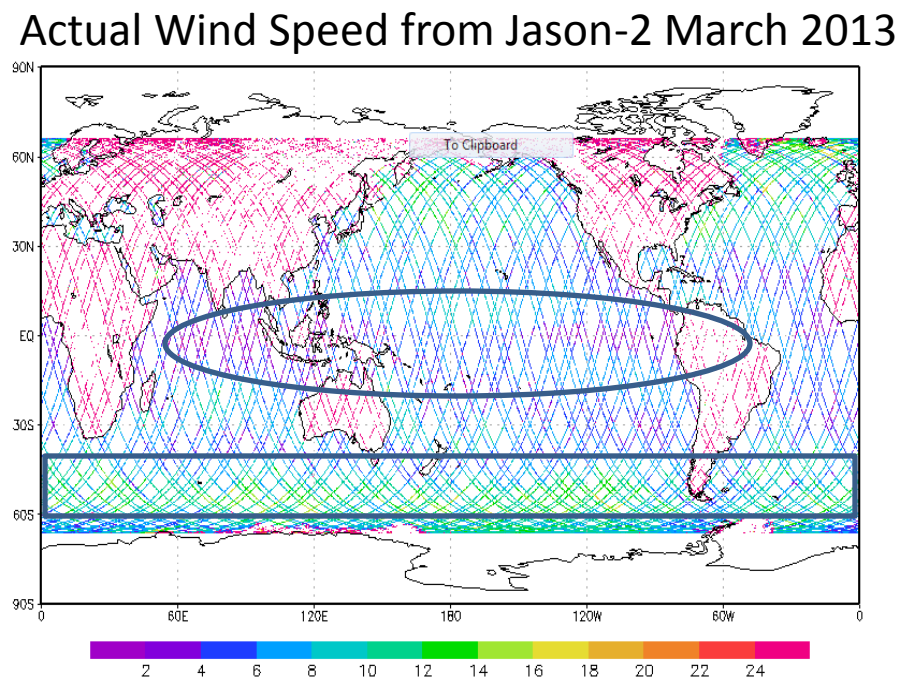
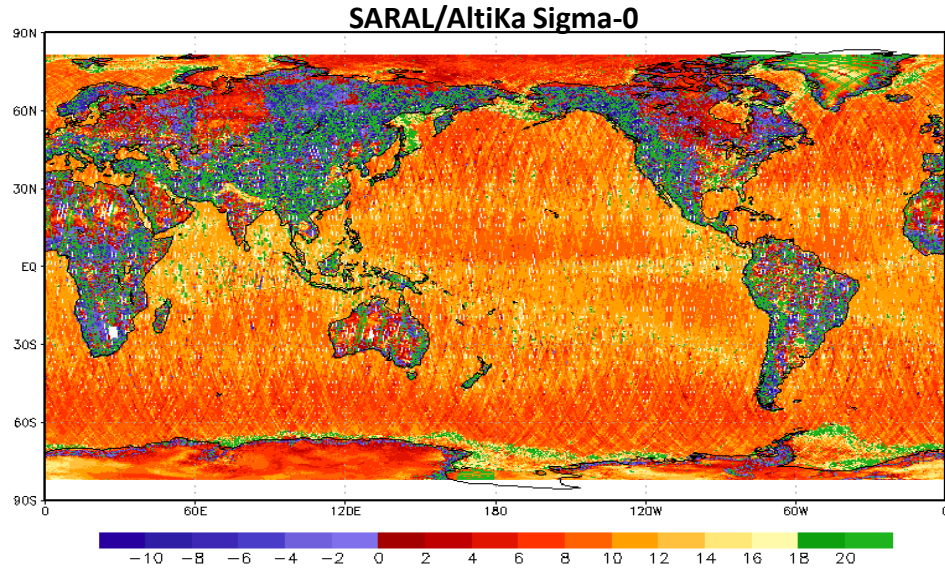
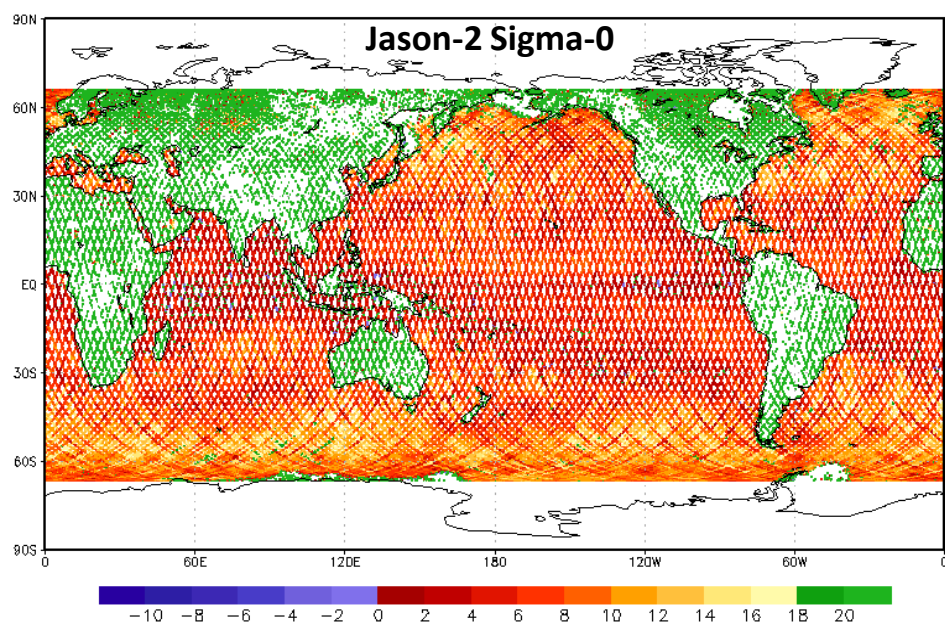
2013-04-10-10:39

### Global Bias in SWH (SRL-J2)



### Typical SARAL/ALTIKA Waveform

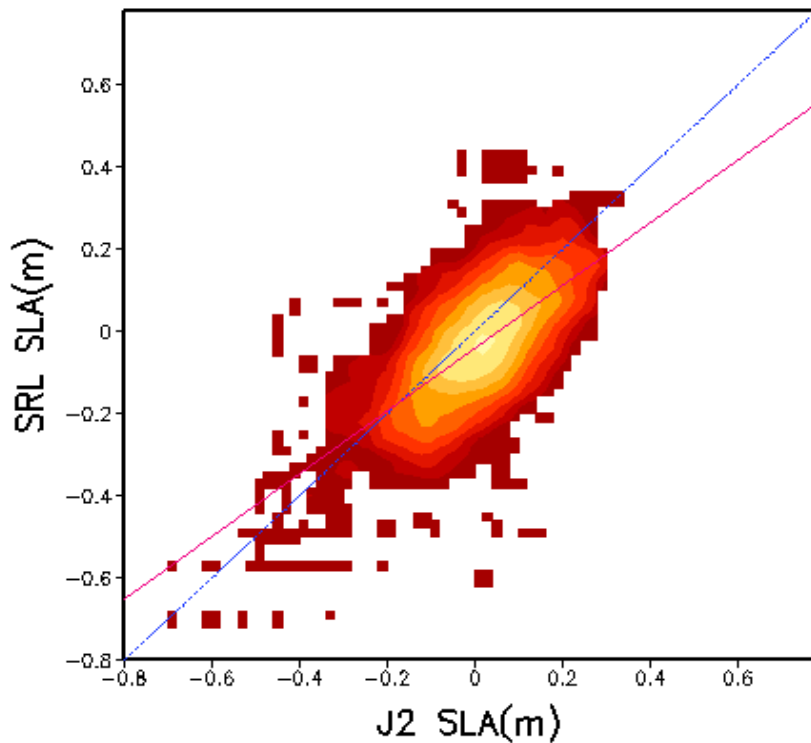




- At low wind the Ku band Sigma 0 is low (negative) while Ka band is having much signal strength at low wind.
- But at high winds ku-band sigma0 slightly more than ka band sigma0 but both are of the same order

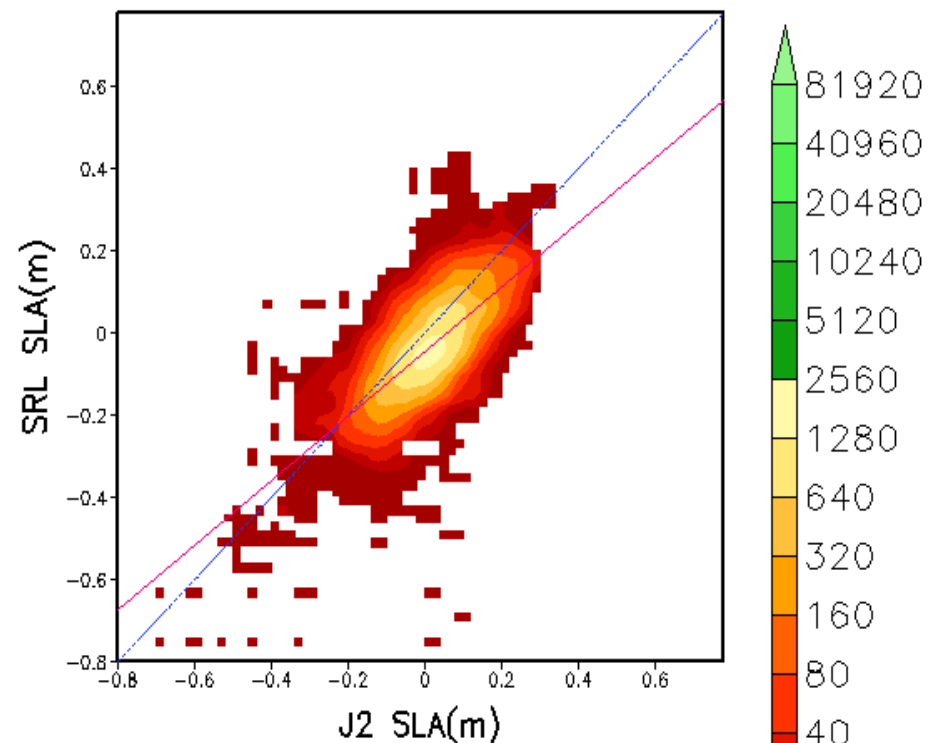
# Inter-comparison of the SARAL/AltiKa geo-physical products with Jason-2 at OGDR and IGDR Level

## Sea Level Anomaly



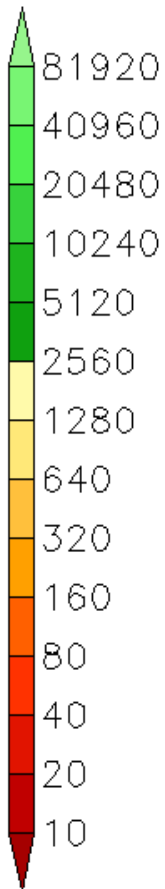
Regression Line:  $y = 0.7622061 * x + -3.9389066E-02$   
 $r = 0.6782337$  Total Points = 113197  
 Bias =  $-4.3311704E-02$  SD =  $8.6037919E-02$   
 rms difference =  $9.6327111E-02$

**OGDR**

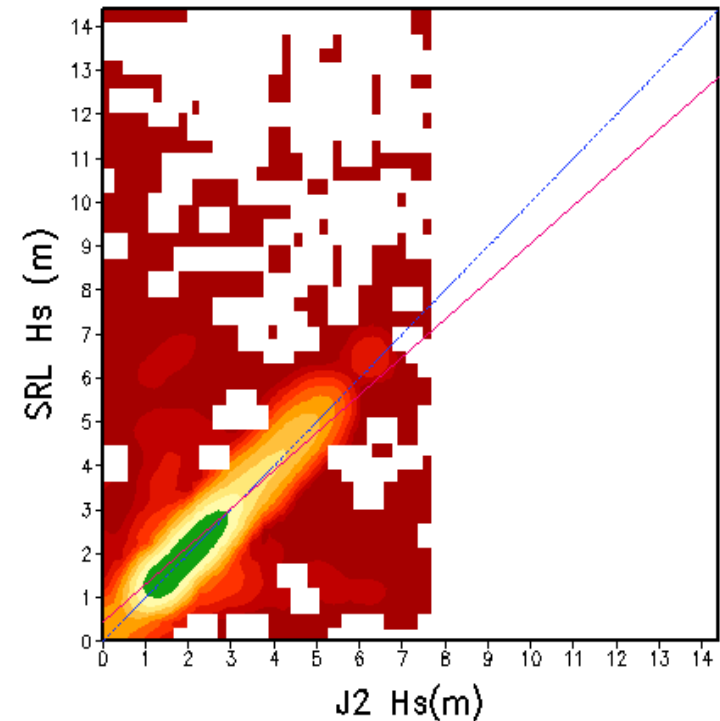


Regression Line:  $y = 0.7840610 * x + -4.3083679E-02$   
 $r = 0.7104383$  Total Points = 119165  
 Bias =  $-4.6440657E-02$  SD =  $7.9770008E-02$   
 rms difference =  $9.2328466E-02$

**IGDR**

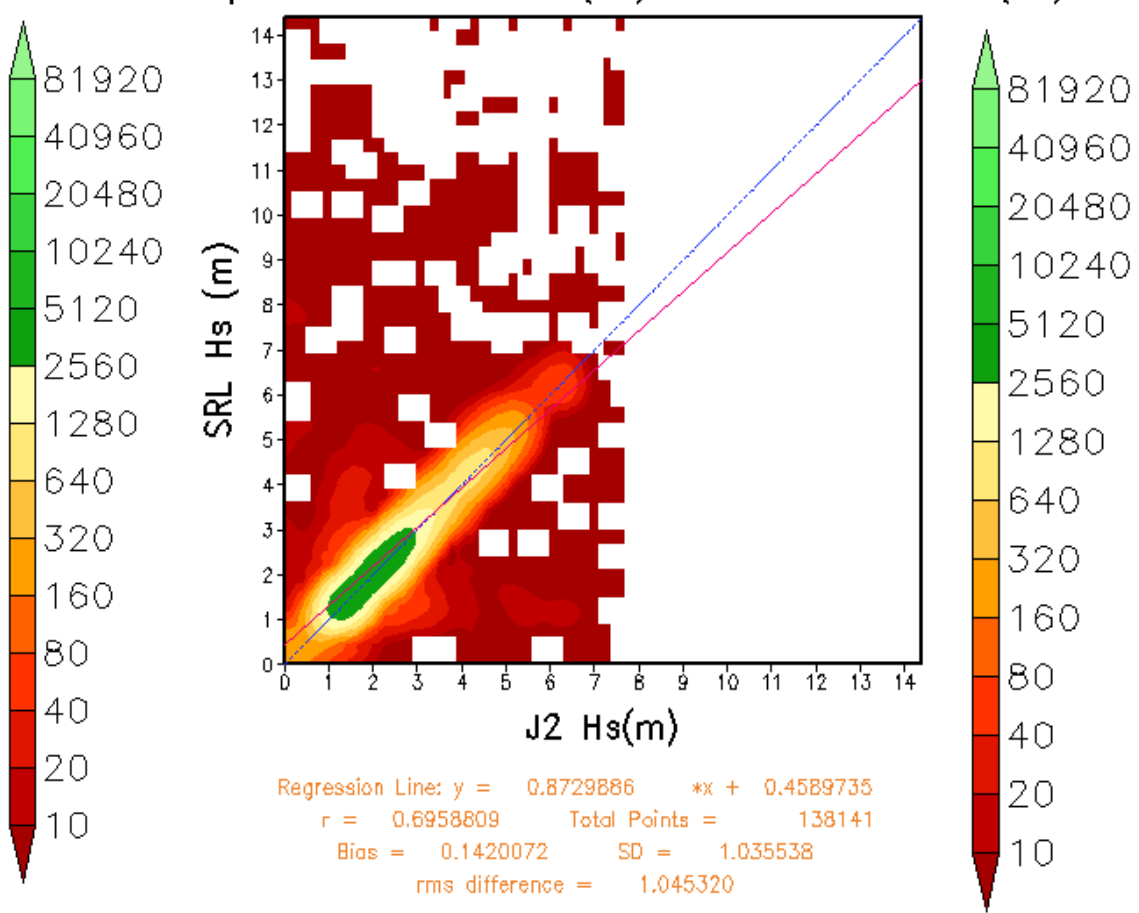


# Significant Wave Height



Regression Line:  $y = 0.8599057 * x + 0.4834622$   
 $r = 0.6704084$  Total Points = 132318  
Bias = 0.1431673 SD = 1.057953  
rms difference = 1.067604

**OGDR**

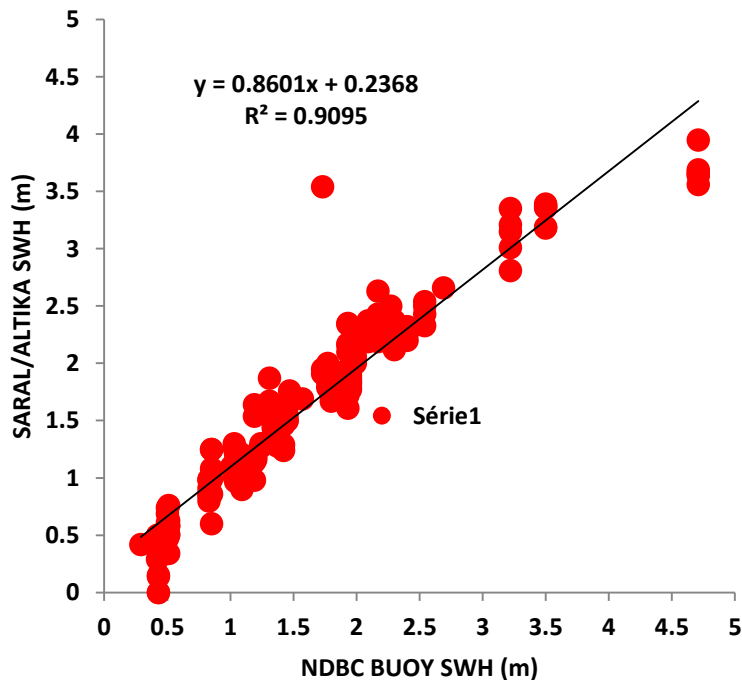


Regression Line:  $y = 0.8729886 * x + 0.4589735$   
 $r = 0.6958809$  Total Points = 138141  
Bias = 0.1420072 SD = 1.035538  
rms difference = 1.045320

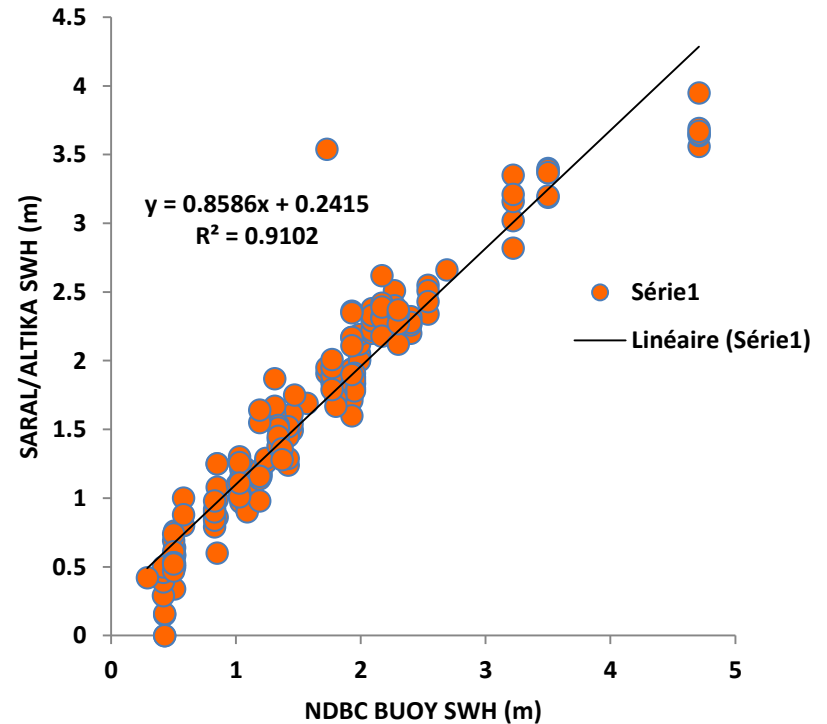
**IGDR**

# Validation of the SARAL/AltiKa geo-physical products with NDBC Buoy at OGDR and IGDR Level

Validation of AltiKa SWH (OGDR) using NDBC Buoys collocated within 70 km and 30 mins



Validation of AltiKa SWH (IGDR) using NDBC Buoys collocated within 70 km and 30 mins





# Assessing impact of assimilating SARAL/AltiKa SWH in numerical model

**Study Area:** Indian Ocean region 60°-90°E longitudes and -11° to 22° N latitudes. Spatial resolution 0.5° x 0.5°. The model output is at every 6 hours.

**Forcing Wind :** The 6-hour analysis and forecast wind field from NCMRWF at a 0.25° X 0.25°

**Boundary Condition :** From the WAM model (-70° to 70° N and 0° to 160° E)

**Method:** The SWAN model run in f/c mode operationally using NCMRWF wind forcing to produce three type of forecast.

1. Forecast without assimilation
2. Forecasts with assimilation of SARAL/AltiKa SWH

**Before going to the forecast cycle, spin up was given from 01 Jan to 12<sup>th</sup> March 2013.**

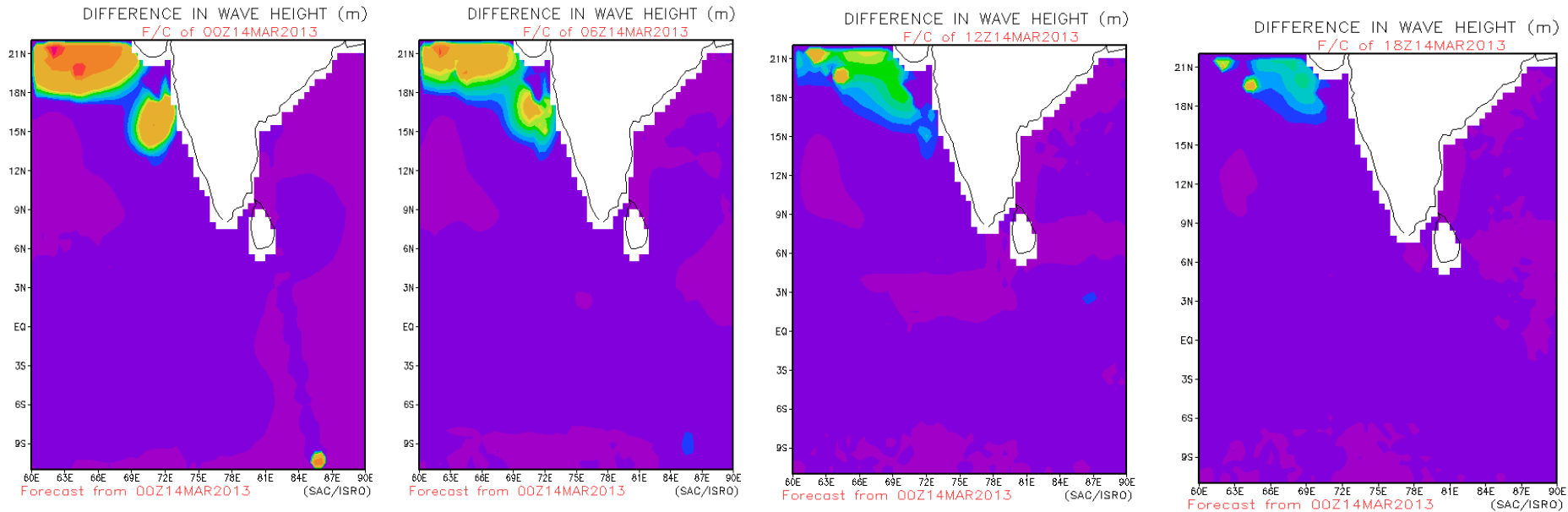
**Assimilation Technique: Optimum Interpolation**

**Number of passes per day**

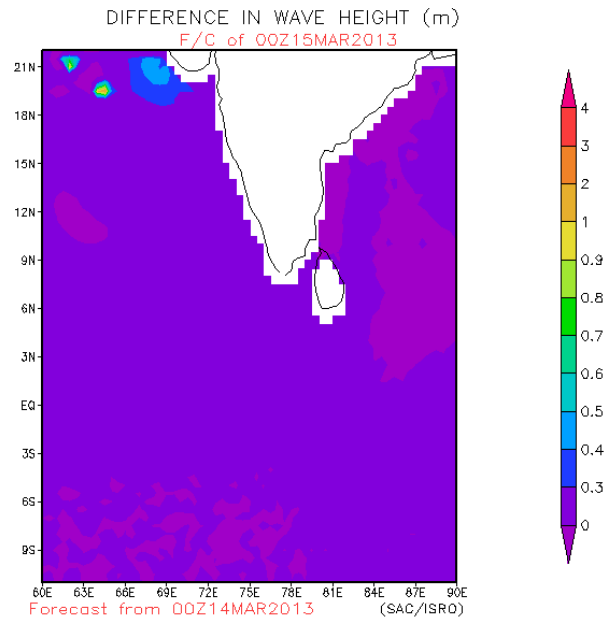
SARAL has maximum two to three tracks i.e. at 00UTC, 06 UTC and 18 UTC. However on 13<sup>th</sup> March when SARAL/Altika data started flowing in the number of tracks over study area was only one.



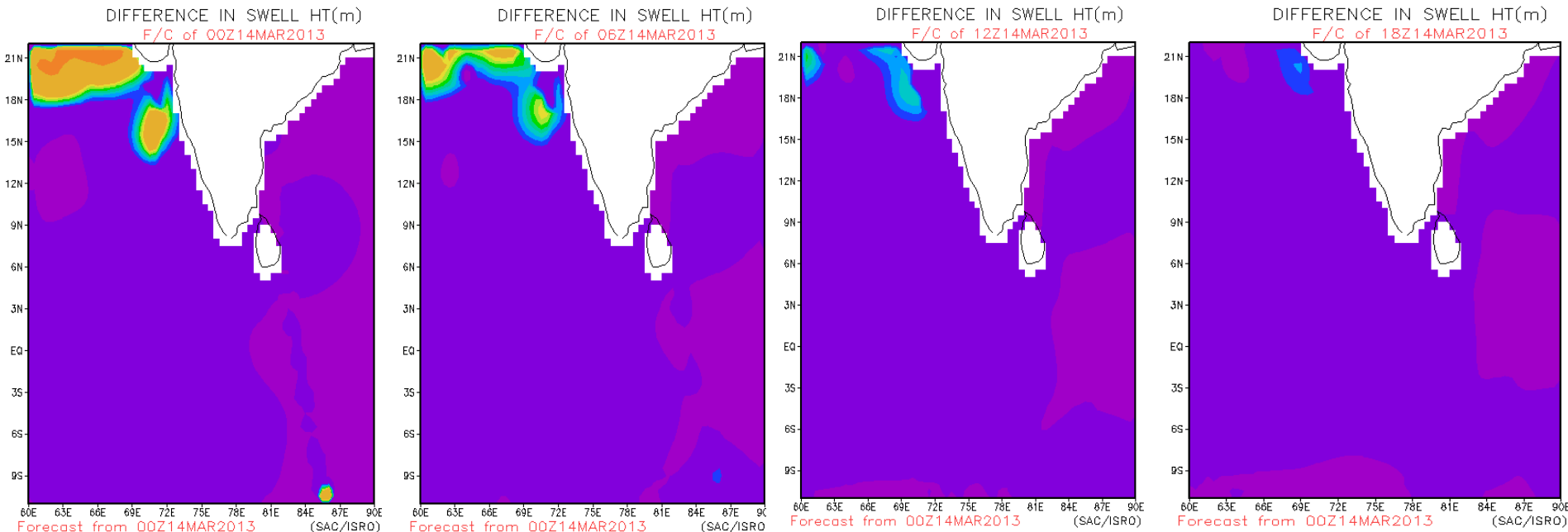
# Impact of SWH assimilation in wave height forecast of SWAN from 00 UTC of 14<sup>th</sup> March 2012



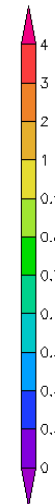
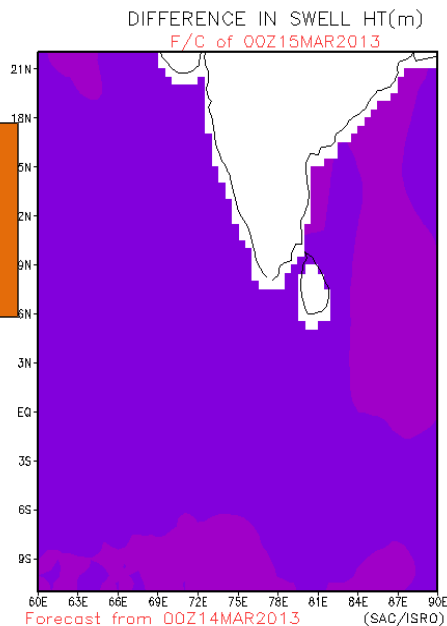
**Plots showing difference between assimilated wave field and wave field without assimilation**



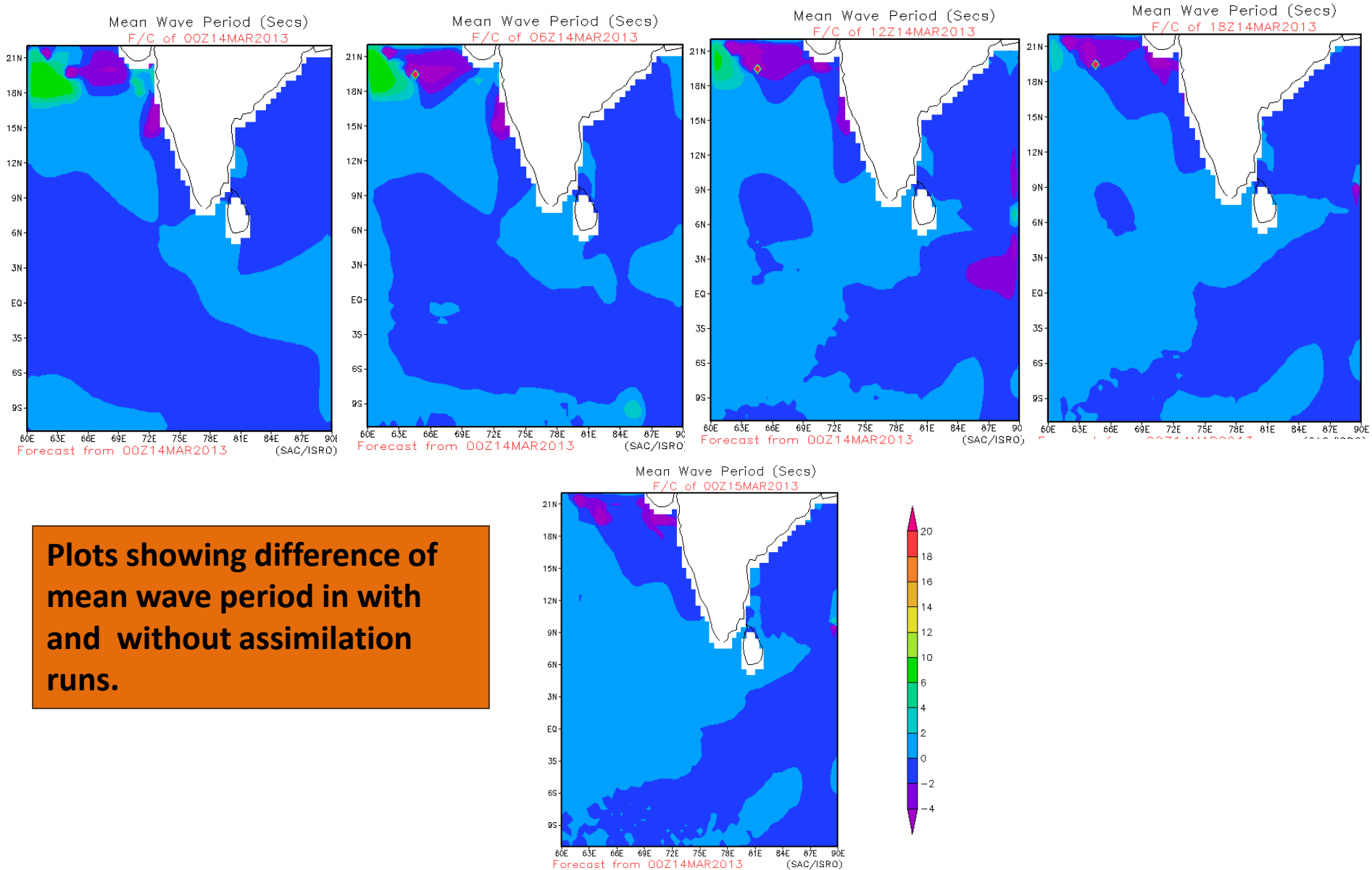
# Impact of SWH assimilation in swell height forecast of SWAN from 00 UTC of 14<sup>th</sup> March 2012



Plots showing difference of swell field in with and without assimilation runs.



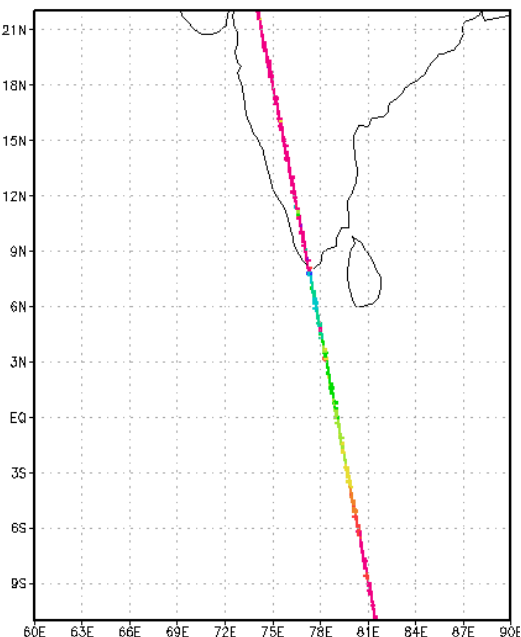
# Impact of SWH assimilation in wave period forecast of SWAN from 00 UTC of 14<sup>th</sup> March 2012



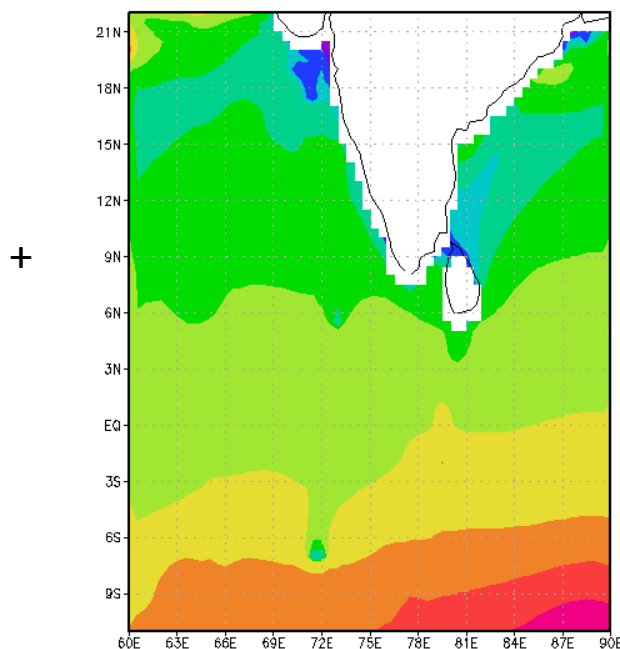
Plots showing difference of mean wave period in with and without assimilation runs.



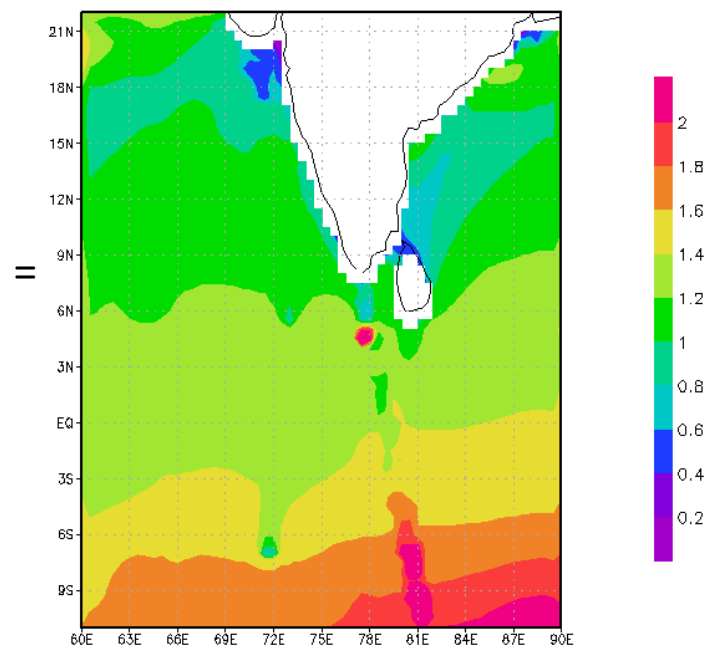
# Over all impact of the AltiKa SWH assimilation on the analysis field is very significant.



The SARAL/AltiKa Track  
00UTC of 23/03/13

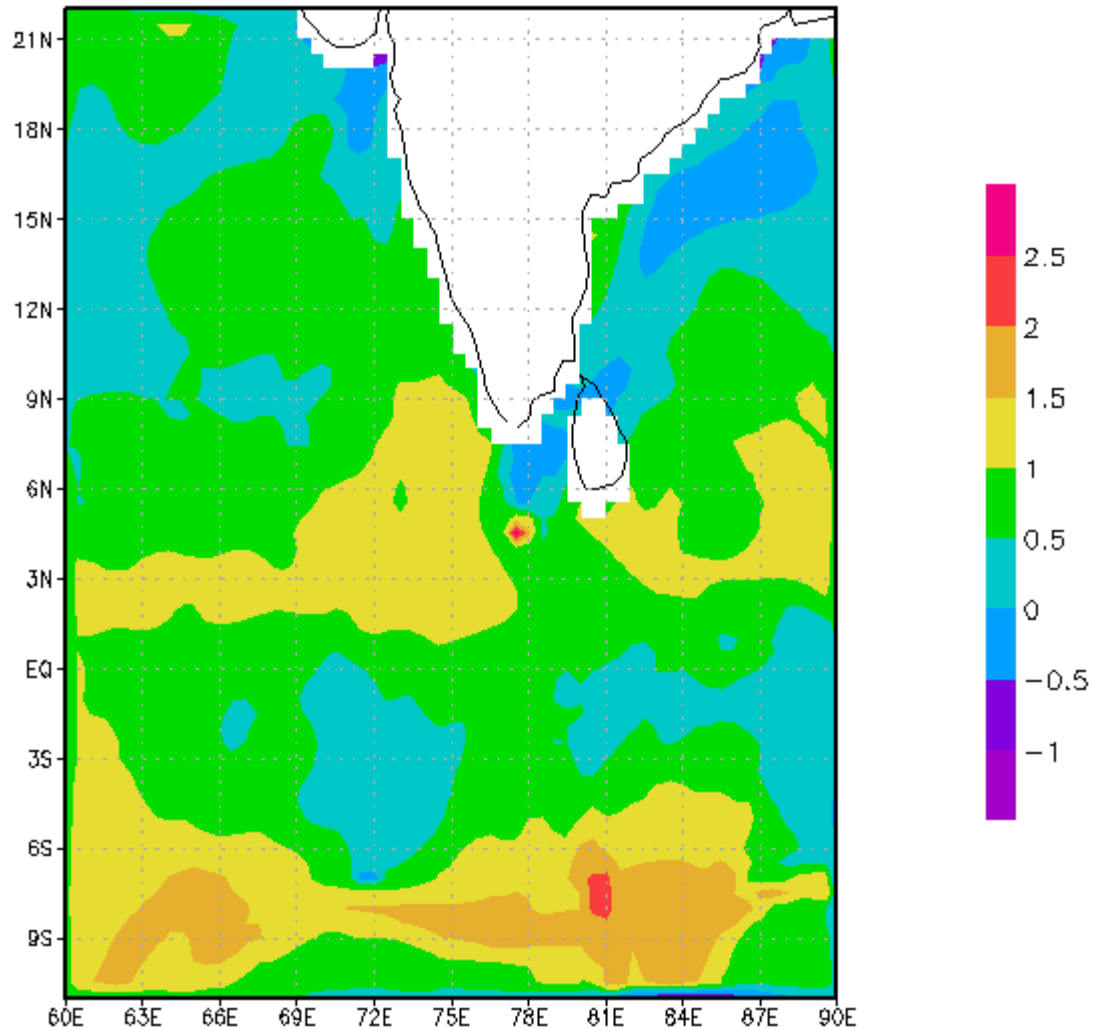


The SWAN Model Background  
00UTC of 23/03/13

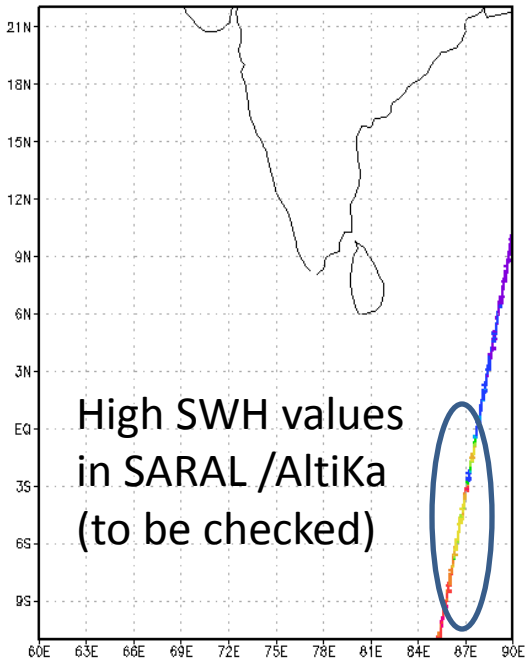


The SWAN Model analyzed field  
00UTC of 23/03/13

# Difference of Assimilated and control run on 00 UTC of Mar 23, 2013 after continuous assimilation from Mar 13-23, 2013.

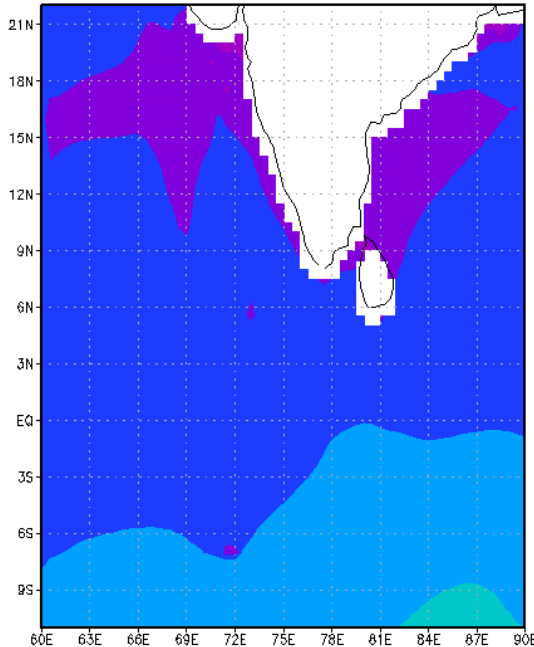


Shows significant impact of the AltiKa SWH assimilation on the analysis field



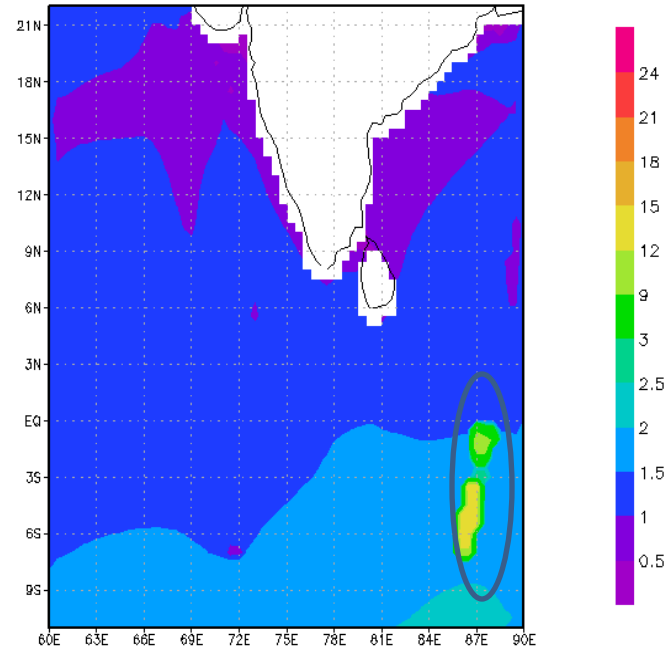
The SARAL/AltiKa Track  
12 UTC of 23/03/13

+

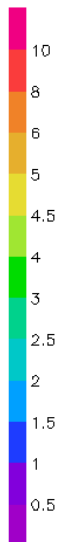
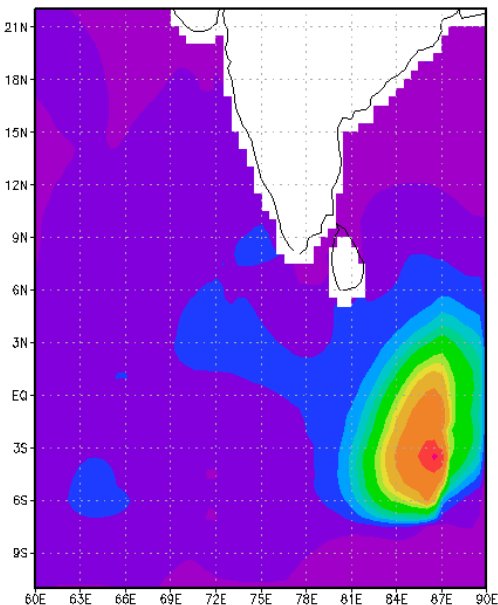


SWAN Model Background  
12UTC of 23/03/13

=



SWAN Model analyzed field  
12UTC of 23/03/13



**Difference of analysis and background field on 00 UTC of 24<sup>th</sup> March 2013 at end of continuous assimilation cycle from 13<sup>th</sup> March -24<sup>th</sup> March, 2013. Large difference due to very high SWH of AltiKa**



Thank you