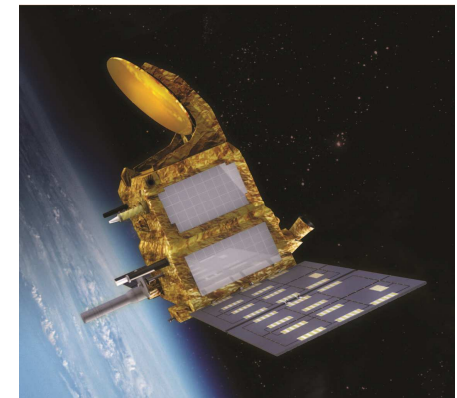
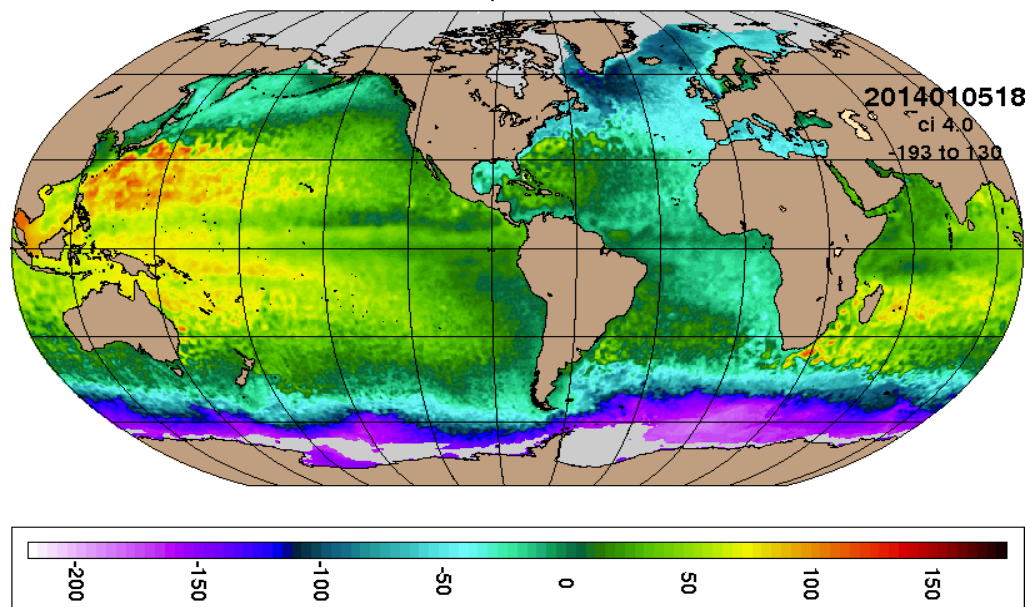


# Impact of AltiKa Observations on Operational Models

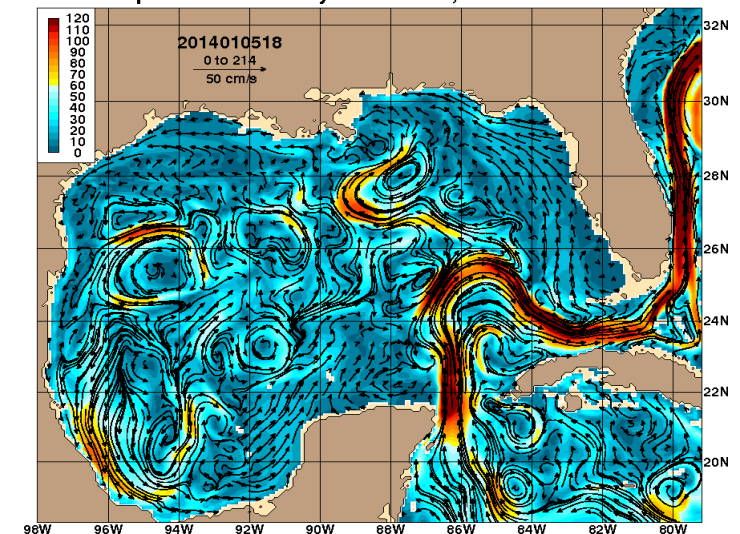
James Richman and Gregg Jacobs  
Oceanography Division  
Naval Research Laboratory



SSH Jan 02, 2014 00Z 91.1



Speed/currents layer 1 Jan 02, 2014 00Z 91.1



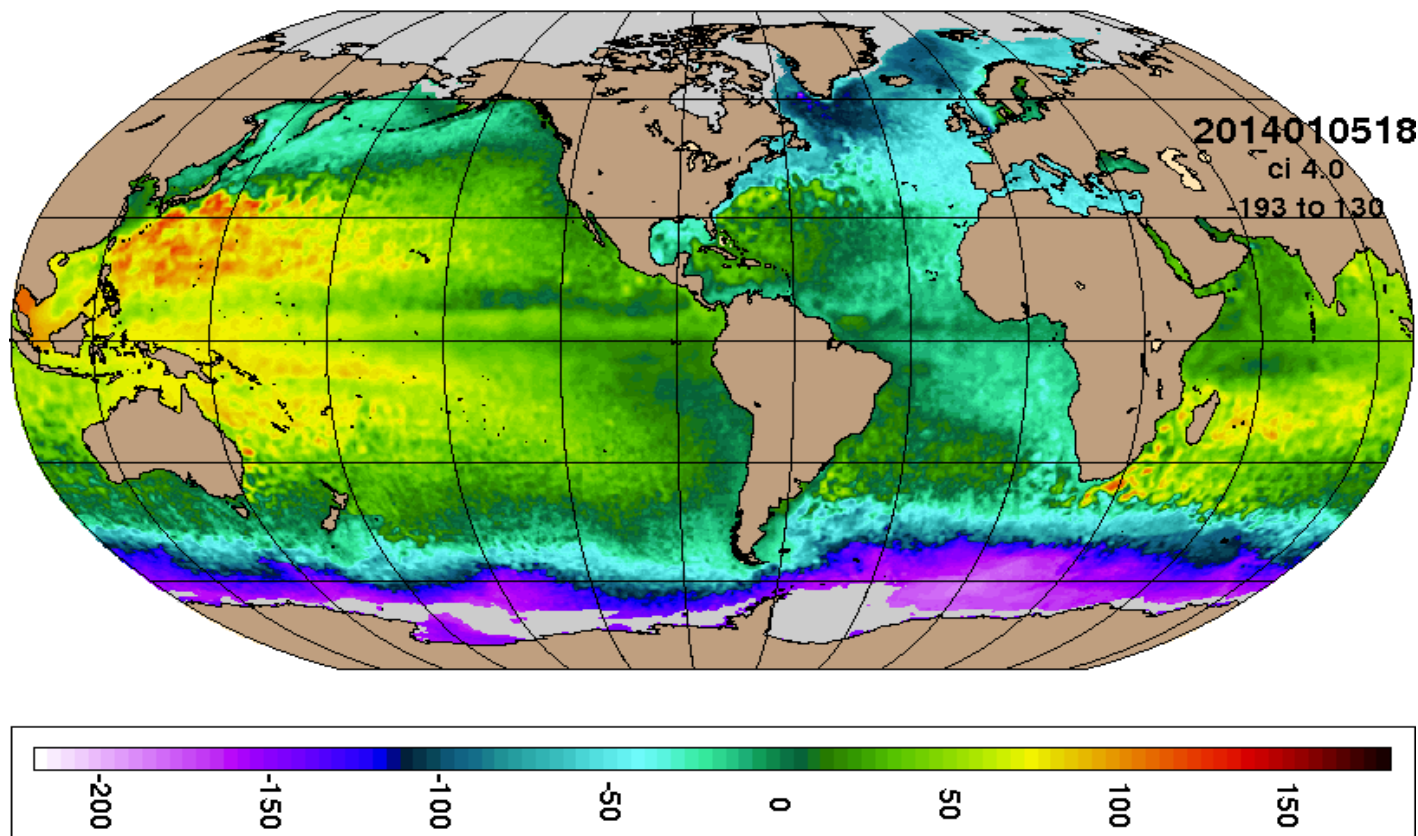
1/12.5 Operational Global Ocean Forecast System using  
Global HYbrid Ocean Coordinate Model (HYCOM)  
assimilating SSH, SST and in situ T,S profiles

# Navy Global Ocean Forecast System (GOFs)



NRL is developing and improving the US Navy Real-Time Ocean Forecast model. The model makes 7 day forecasts every day using the HYbrid Coordinate Ocean Model (HYCOM) and the Navy Coupled Ocean Data Assimilation (NCODA) 3DVar system. Altimetric SSH is a critical input to this system. NRL has a quality control system which monitors the input data. AltiKa has been added to this system.

**SSH Jan 02, 2014 00Z 91.1**



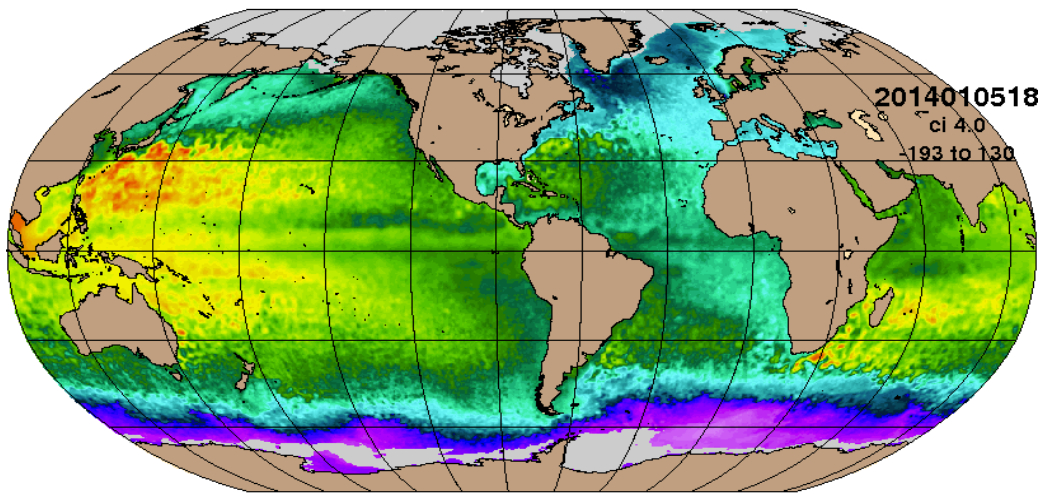
# Monitoring AltiKa is part of the QC for the Global Ocean Forecast System



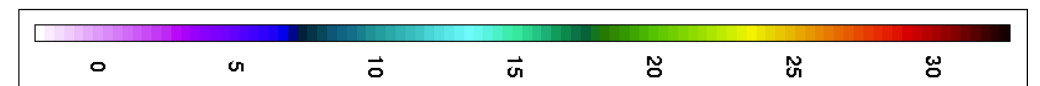
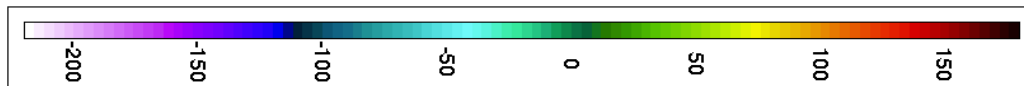
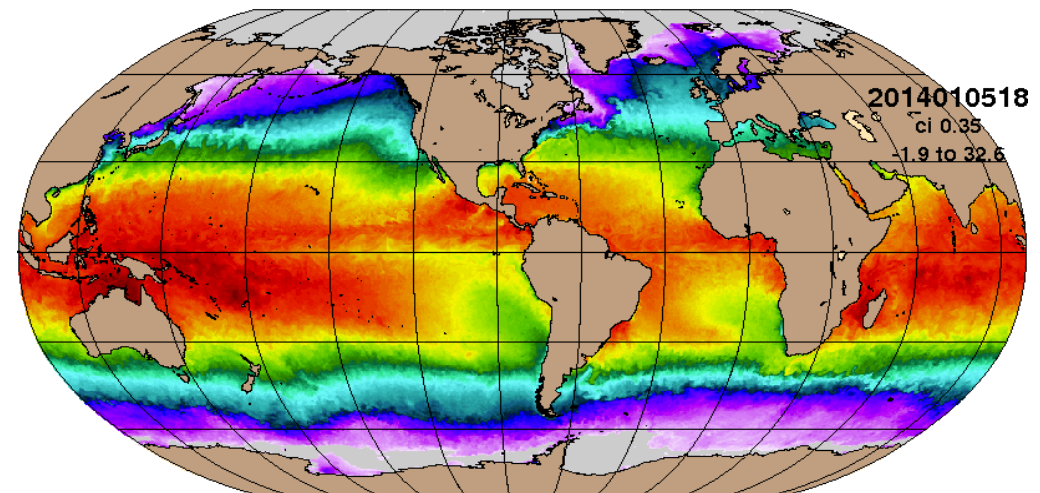
AltiKa is performing as well as Jason-2 providing SSHA to the real-time forecast model. The addition of a second altimeter has a significant impact on the forecast skill of the model.

The same system can be used retrospectively to compare the performance of AltiKa and Jason-2 over the first year of AltiKa. This comparison is based upon the operational GDRs for both altimeters.

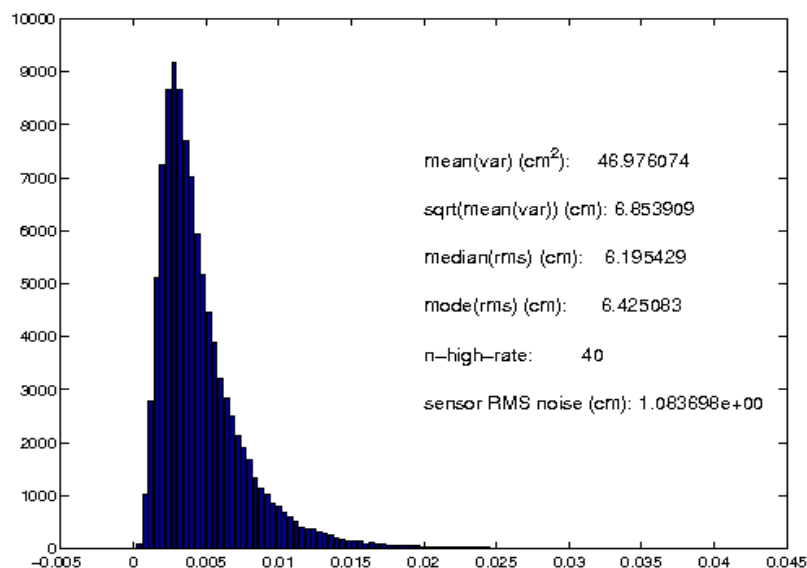
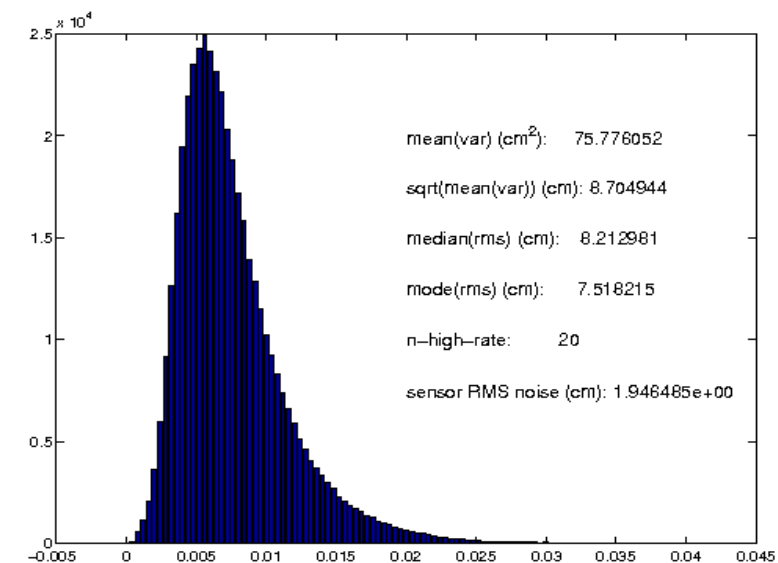
SSH Jan 02, 2014 00Z 91.1



SST Jan 02, 2014 00Z 91.1



# Precision Monitoring

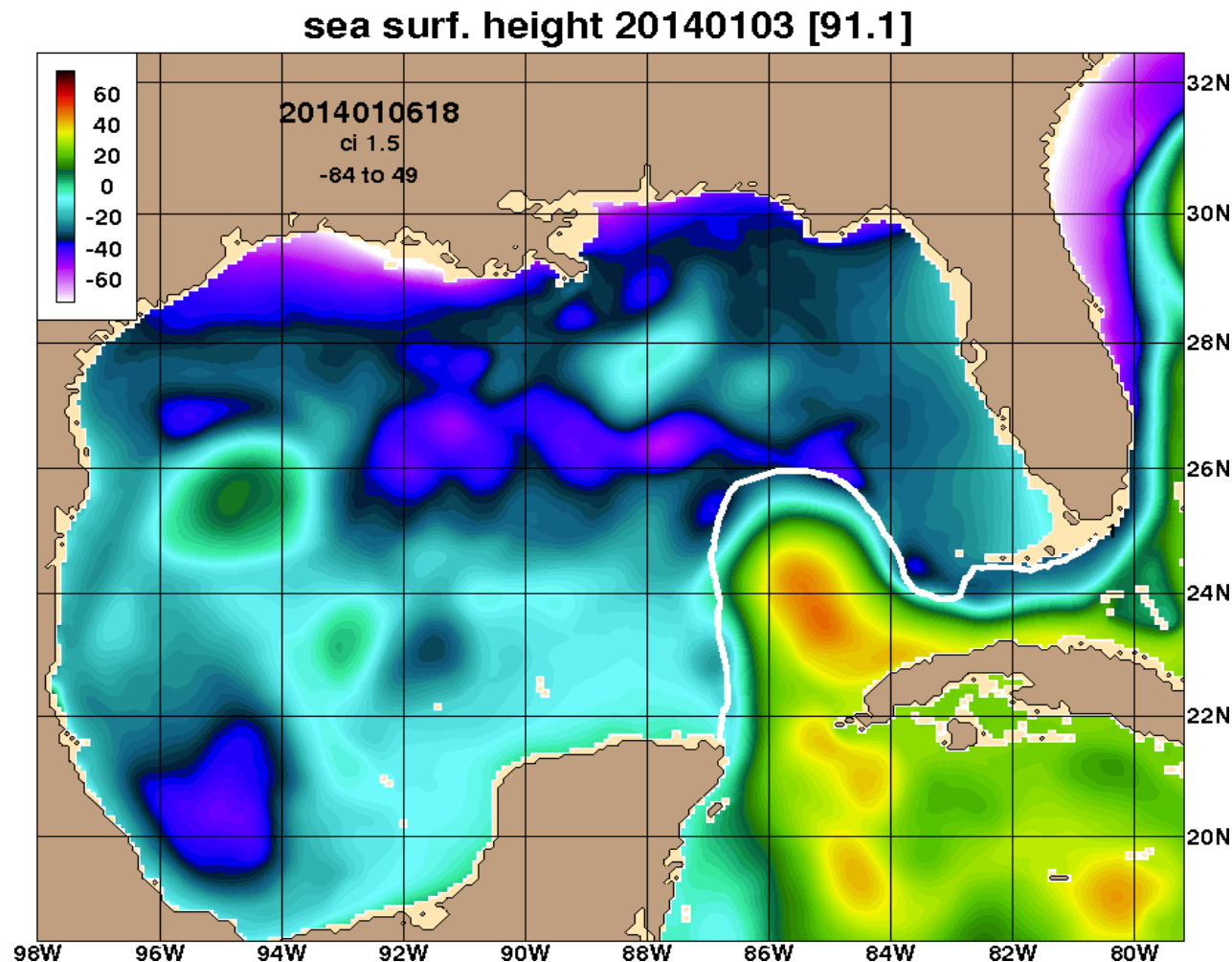


- Sensor performance is monitored in the Altimeter Processing System (ALPS)
- Sensor noise is estimated from the variance about a linear fit of the 20 or 40 hz data over 1 second

Jason-2 has <2 cm RMS noise over the year

AltiKa has ~1 cm RMS noise over the year

# Impact of AltiKa Data on Ocean Models

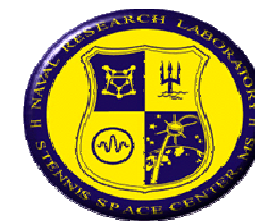


ALPS is used to prepare the altimeter data for assimilation into ocean models.

A set of twin experiments are performed where all data are assimilated in the control

One experiment assimilates AltiKa data only and another experiment assimilates Jason-2 data only

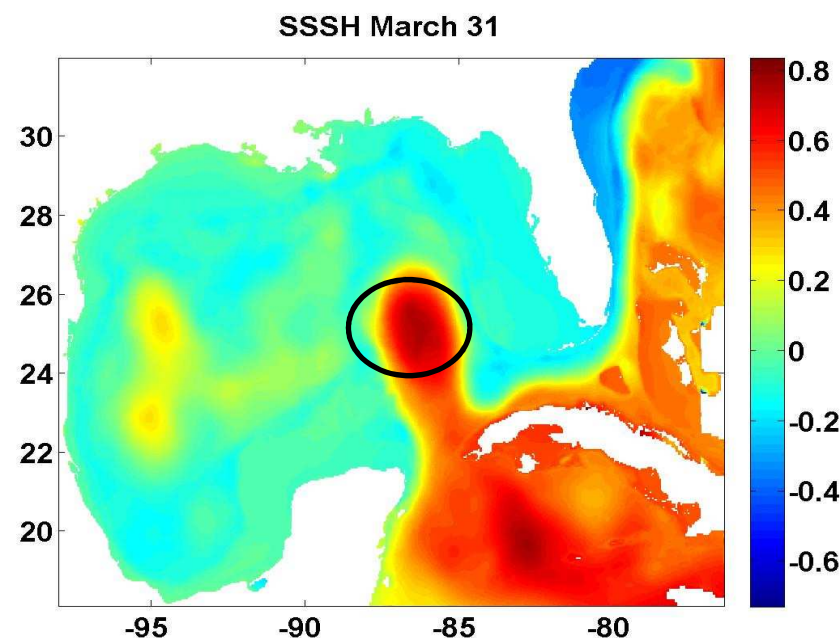
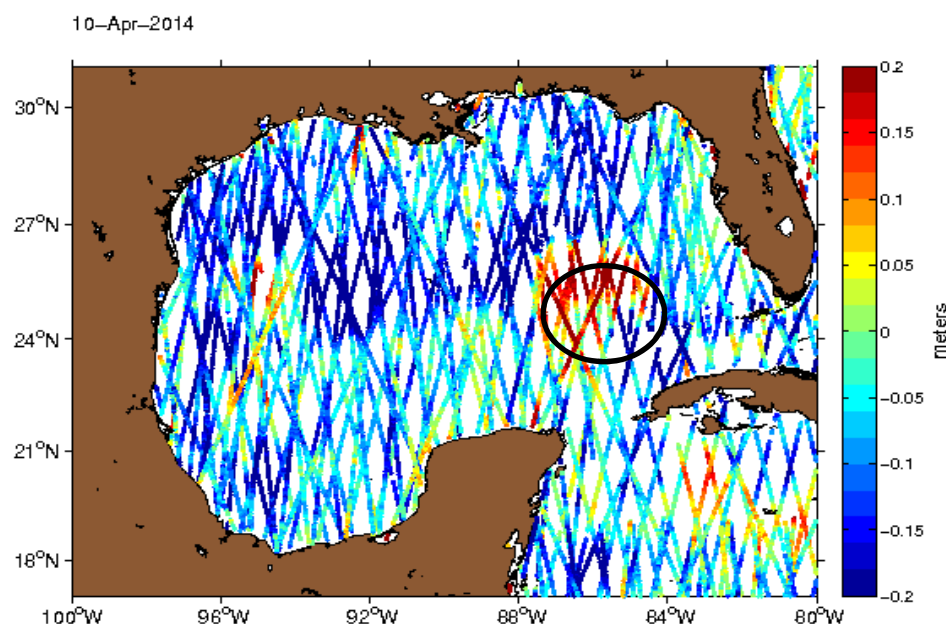
Impact of AltiKa assessed by root mean square differences between the control and experiments with denied data



# Gulf of Mexico Nowcast

**Altimeter Data Available  
between 3/6 – 4/10/2014**

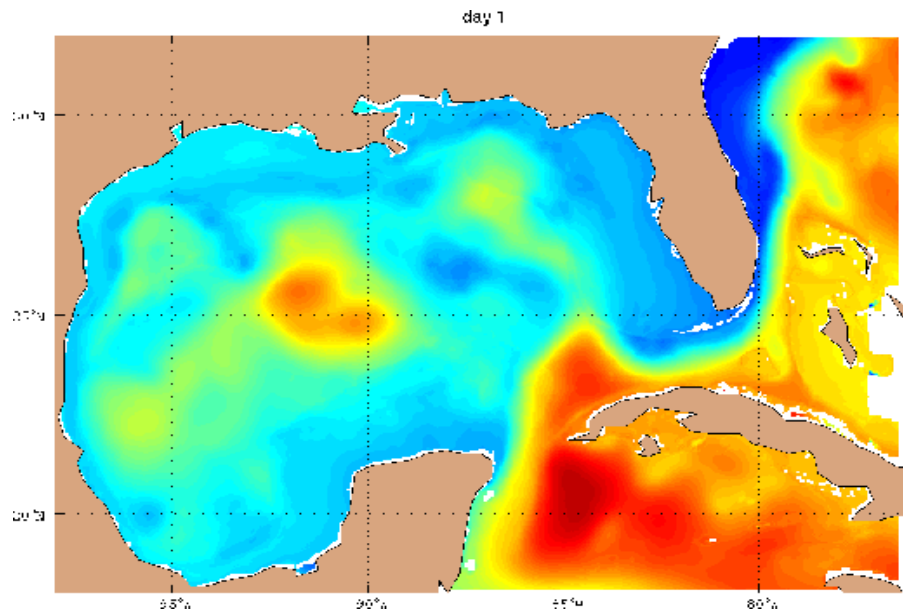
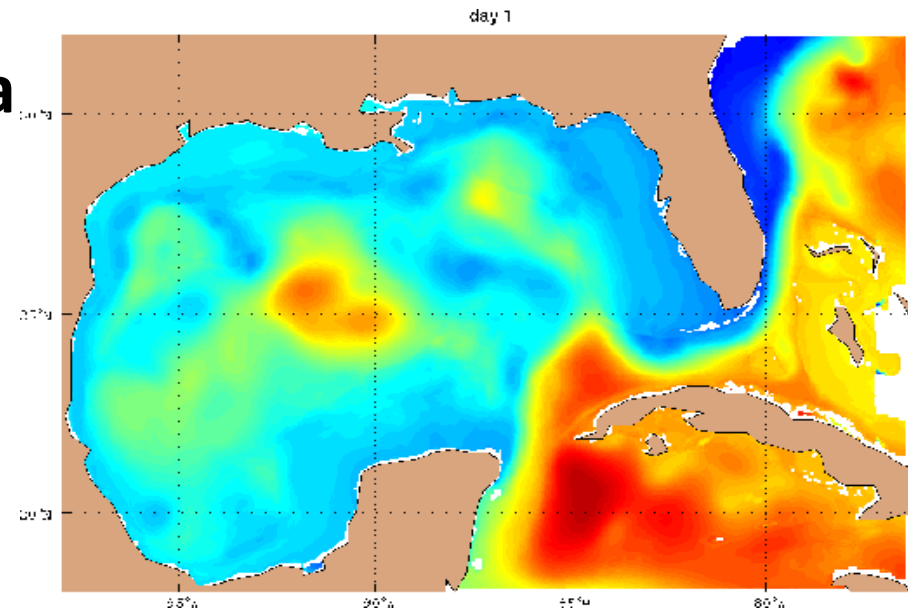
**Steric Sea Surface Height from  
regional HYCOM assimilating all  
altimeter data**



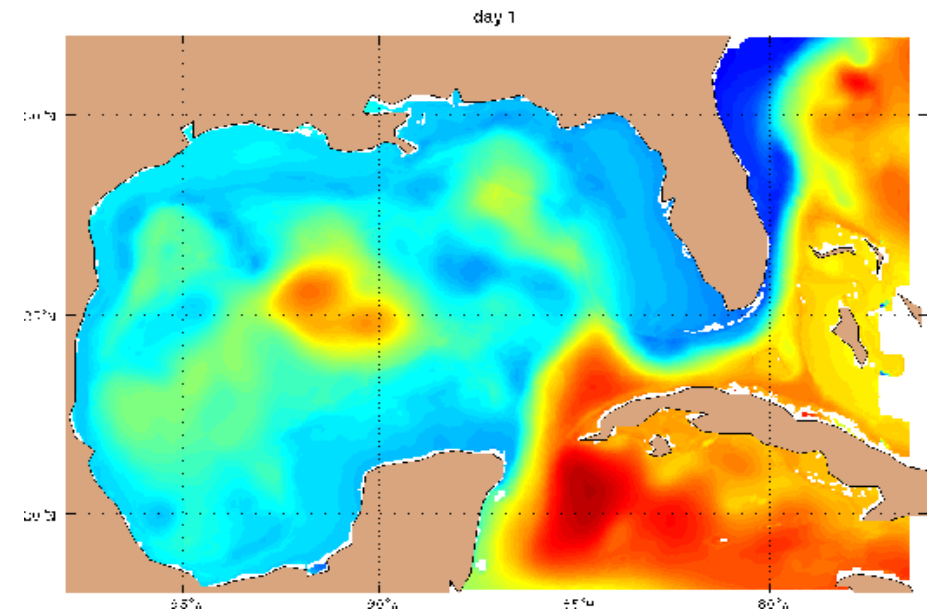
Wide spacing of Jason-2 tracks allows features to fall between tracks  
Thus, sensor performance is only part of the altimeter impact

# Impact of Altimeter Data on model performance

**Control**  
**Assimilating All**  
**Altimeter Data**



**Assimilating AltiKa Data Only**

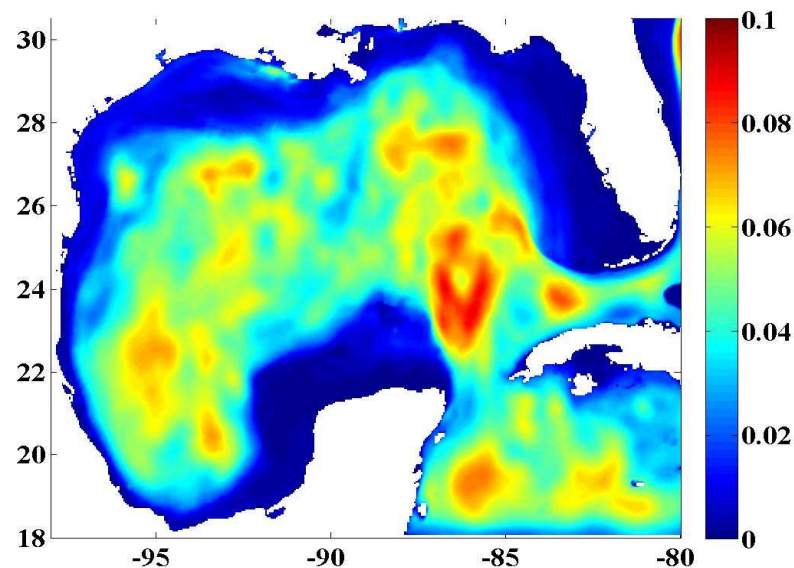


**Assimilating Jason2 Data Only**

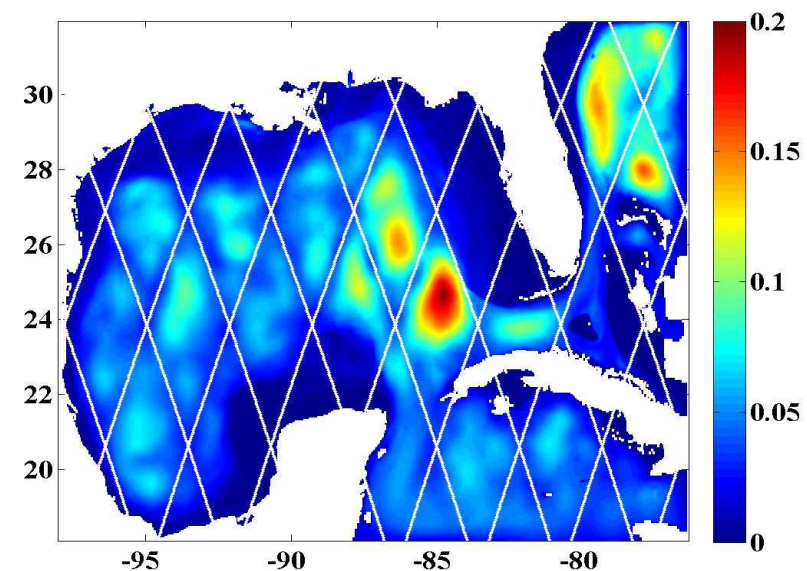
# Steric SSH Root Mean Square Error for Sept 2013 thru April 2014 between model assimilating only one altimeter and all altimeter data



AltiKa Only



Jason 2 Only

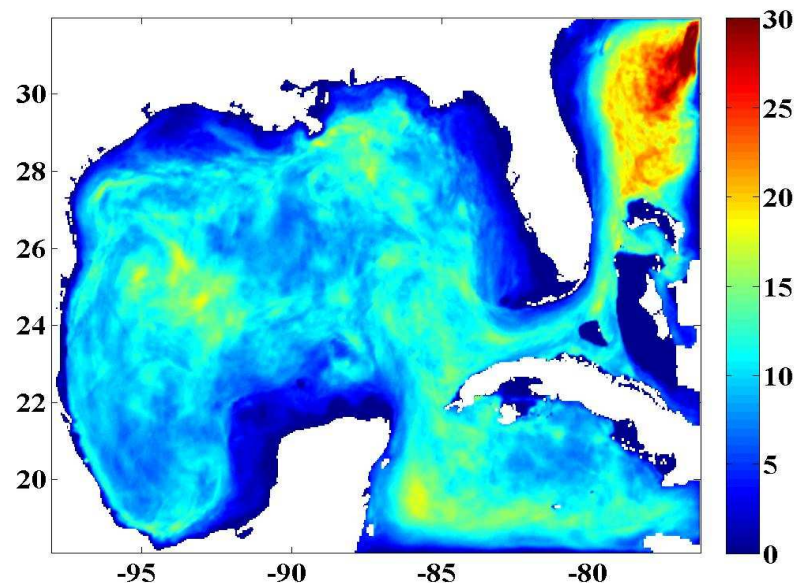


RMSE for the AltiKa only nowcast is  $\sim 1/2$  the MSE for the Jason 2 only nowcast  
For the Jason 2 only nowcast the RMSE is large between the altimeter tracks  
Orbital sampling may be responsible for much of the difference

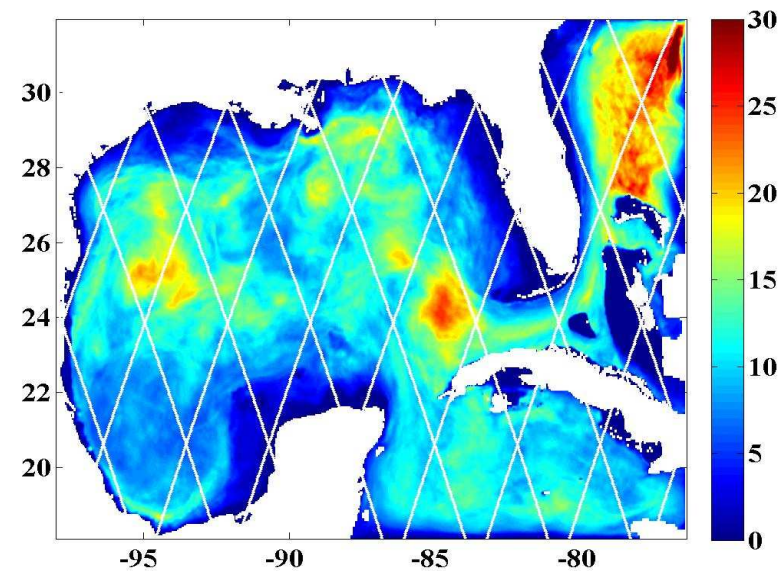
# Mixed Layer Depth Root Mean Square Error for Sept 2013 thru April 2014 between model assimilating only one altimeter and all altimeter data



AltiKa Only



Jason 2 Only

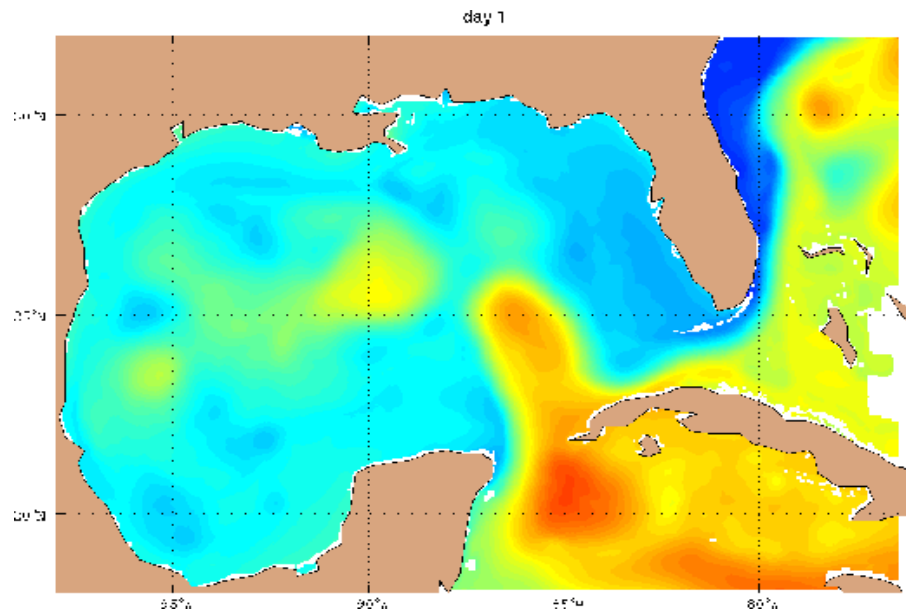
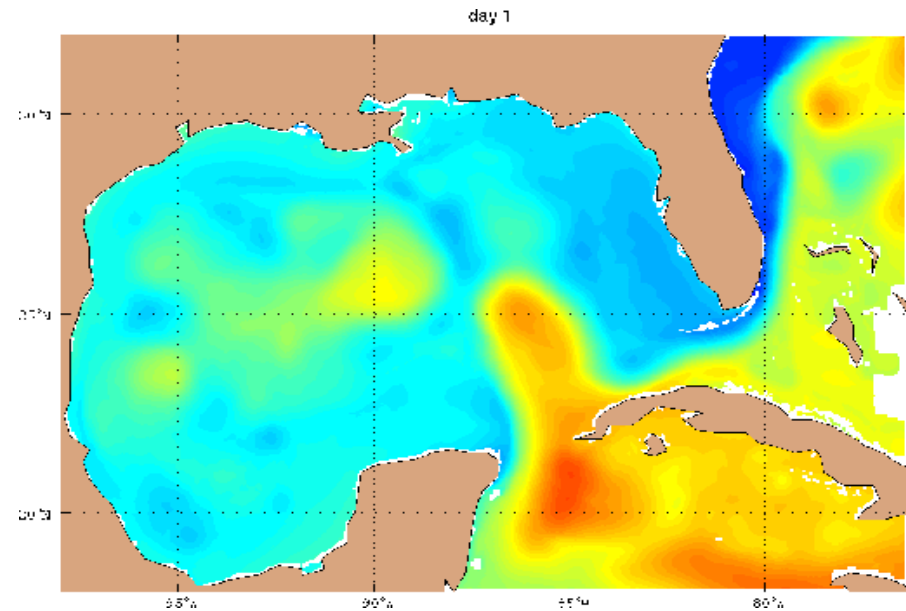


Mixed Layer Depth RMSE is much smaller for AltiKa only compared to Jason-2 only  
consistent with the better description of the Loop Current and shed eddies

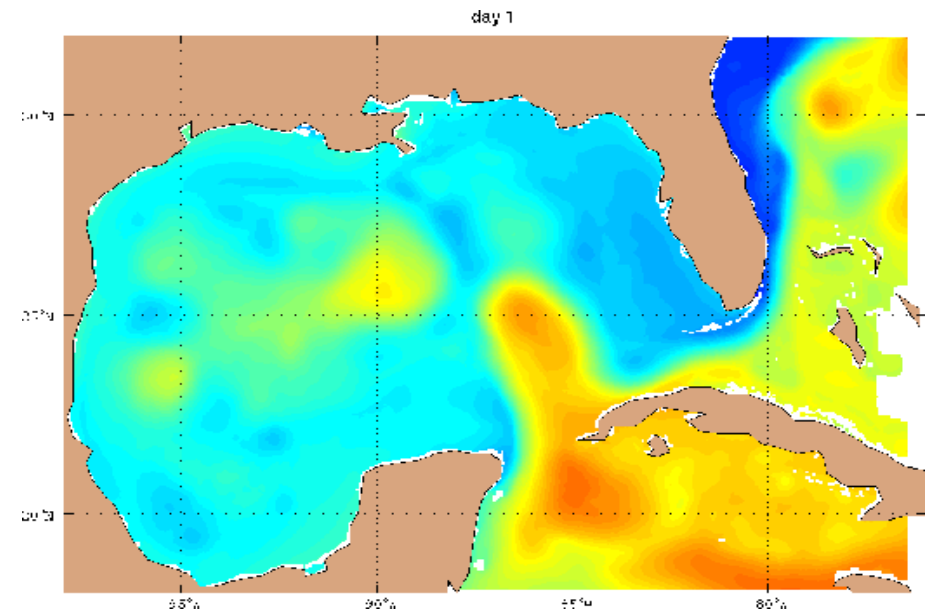
# Impact of Altimeter Data on model performance replacing Altika with Envisat Same Orbit but more noise



**Control**  
**Assimilating All Altimeter Data**



**Assimilating Envisat Data Only**

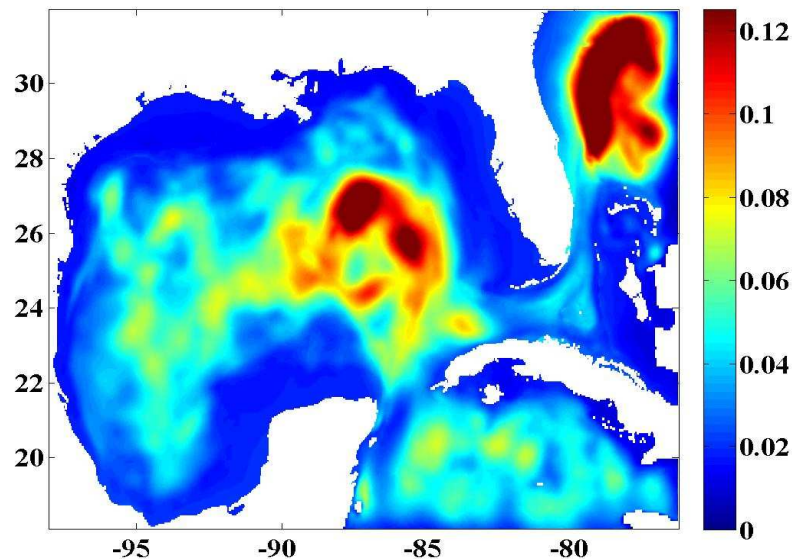


**Assimilating Jason2 Data Only**

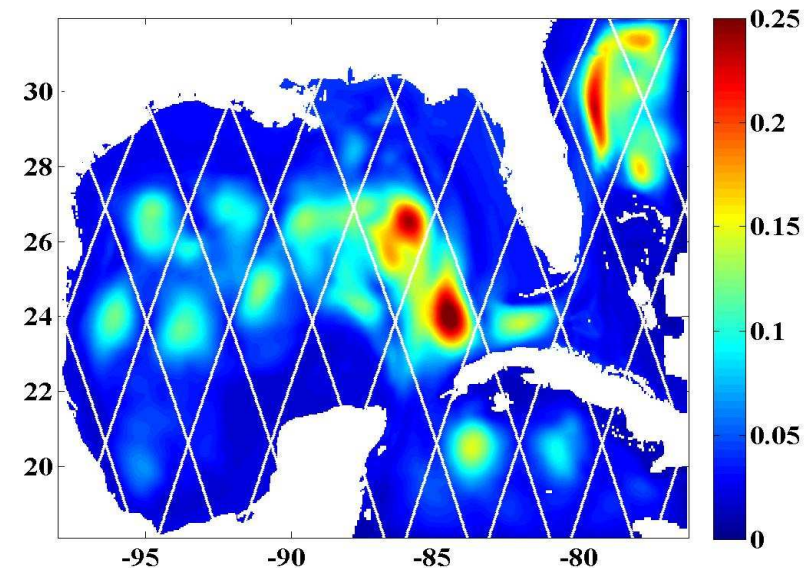
# SSH Root Mean Square Error for April thru Sept 2009 between model assimilating only one altimeter and all altimeter data



Envisat Only



Jason 2 Only

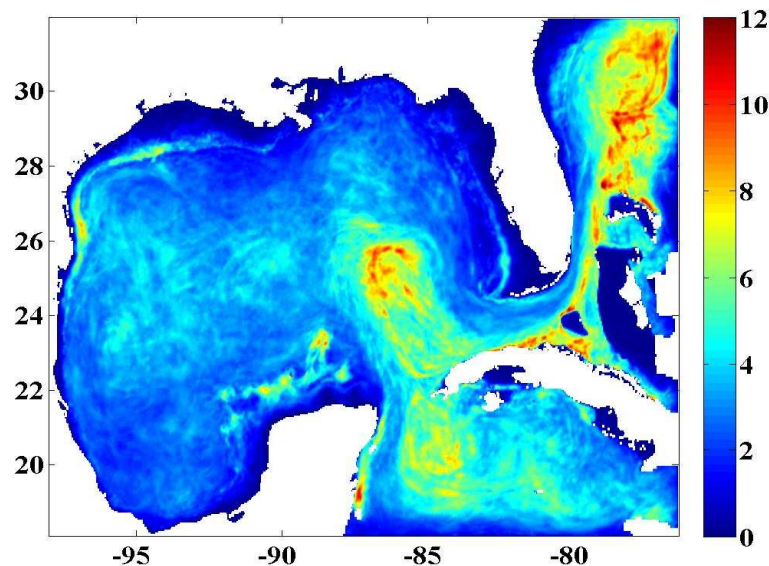


Similar to the Altika experiments, the RMSE for the Envisat only nowcast is  $\sim 1/2$  the RMSE for the Jason 2 only nowcast, but larger than the Altika only nowcast  
For the Jason 2 only nowcast the RMSE is large between the altimeter tracks

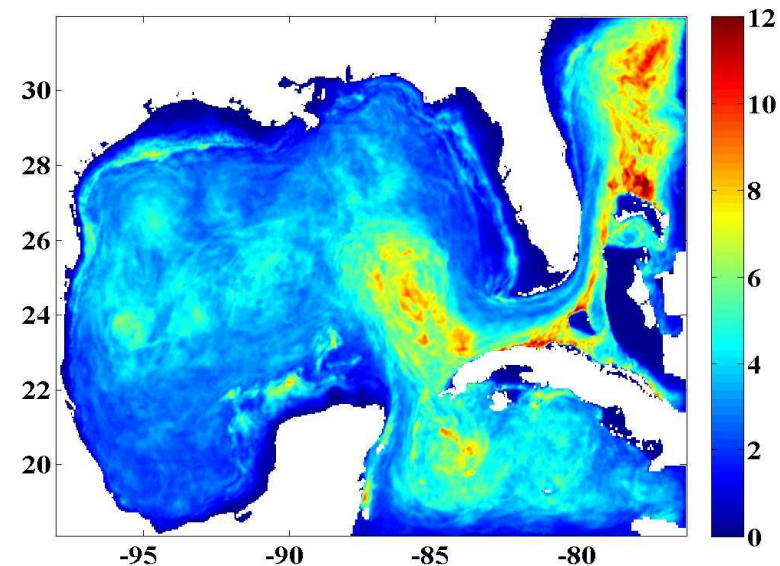
# Mixed Layer Depth Root Mean Square Error for April thru Sept 2009 between model assimilating only one altimeter and all altimeter data



Envisat Only



Jason 2 Only



Mixed Layer Depth RMSE is similar for Envisat only compared to Jason-2 only  
However, the result may be misleading since the MLD is very shallow during the  
summertime

# Monitoring AltiKa is part of the QC for the Global Ocean Forecast System



Using the realtime monitoring system, the first year of AltiKa can be compared to Jason-2 for the same time period.

AltiKa performance is comparable to Jason-2

AltiKa has lower sensor noise

Jason-2 has a slightly lower crossover difference

AltiKa has a greater impact than Jason-2 providing SSHA to the realtime forecast model. The impact is mostly due to the closer track spacing of AltiKa, since an experiment replacing AltiKa with Envisat gives similar results