Near Real Time Processing and Products Splinter

- Results in processing
- Applications
- Recommendations
- Future directions

Results in processing

- CryoSat2 (Griffen)
- ASAR (Aouf)
- Jason-2 processing in operations (Figa-Saldana)
- SARAL & Altika in coastal prediction for waves and circulation (Jean-Michel Lefevre)
- Jason-2 GPS based OGDR Products (Andres)
- Matchups with in situ data (CTS, glider, XBT, …) in RADS

Applications

- Ssalto / DUACS inclusion of new data sets, new extensions to products, new products
- ECMWF wave forecasting, Jason-1G under assimilation testing (Abdalla)
- MFWAM wave forecasting, using wave spectra from ASAR L2 (Aouf)
- Circulation in Atlantic Bight through 4DVar assimilating Jason-1, Jason-2, ENVISAT (Zavala-Garay)
- Tsunami detection (Hamlington)
- Advances toward coupled air / ocean models for tropical cyclone forecasting using altimeter observations (Yablonsky)
- Impact demonstration on eddies relative to HF radar and ocean color (Griffin)
- Reservoir and Lake monitoring (Birkett)
- Marine debris from Japan Tsumani (Maxamenko)

JASON-2 GPS BASED OGDR PRODUCTS

Location 48

Y. Andrés, O. Thépaut, P.L. Righetti, J. Figa Saldaña and H. Bonekamp
EUMETSAT, Darmstadt, Germany

EUMETSAT POD environment designed for METOP and instantiated experimentally for Jason-2

Benefiting from operational GRAS GSN data

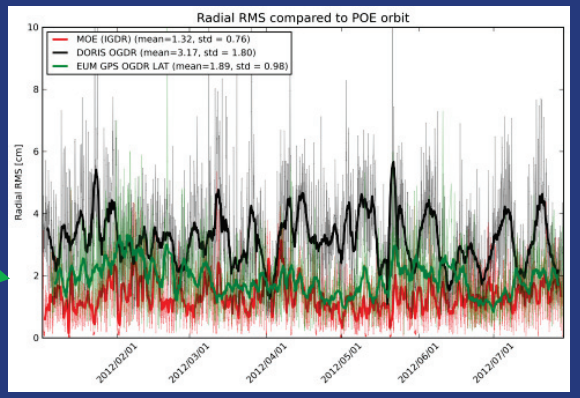
NRT monitoring and validation of the OGDR orbit computed on-board by DORIS/DIODE

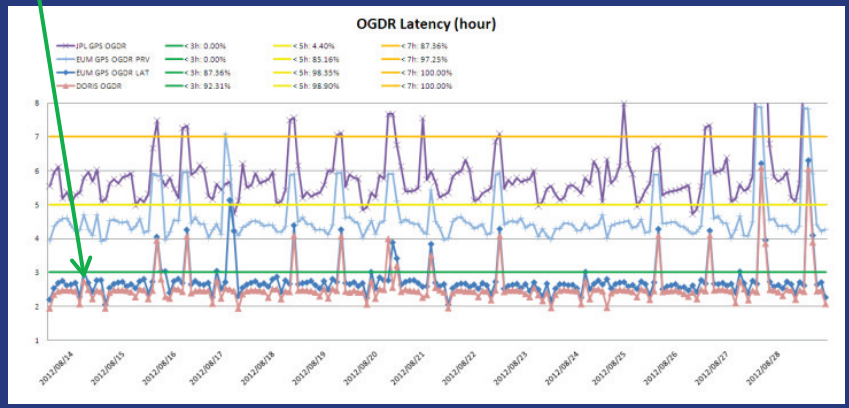
Interest as an operational product?

Multi-mission tool suitable for current and future altimetry missions (JA3, JACS, S3)

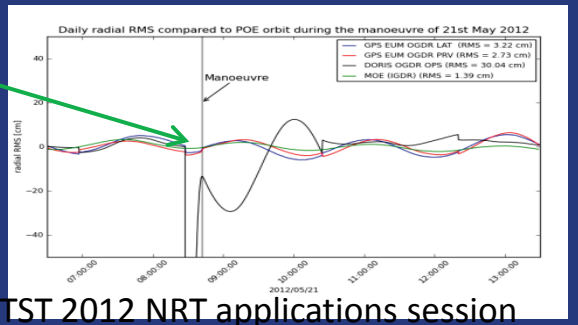
NRT accuracy

On time





Robust to exceptional events (manoeuvre or DORIS OBS update)



Status on DUACS NRT system: **the constellation**

•We lost the optimal sampling for NRT applications provided by the tandem phase J1+J2

•Cryosat-2 mitigate the lost of Envisat (Integration just in time!) but with a very high probability to come back to the 2 satellites (J2+C2) situation

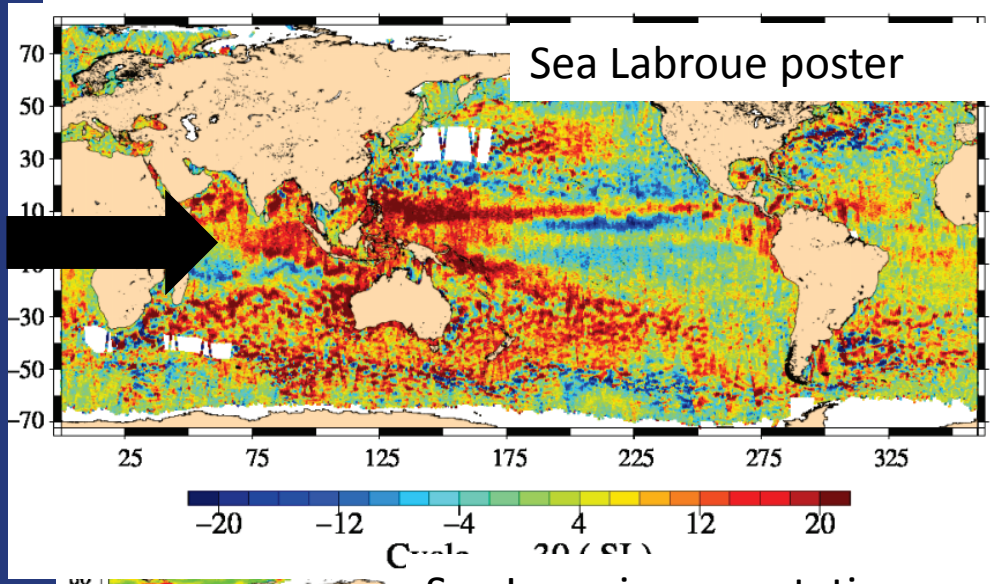
⇒Operational altimetry is very fragile

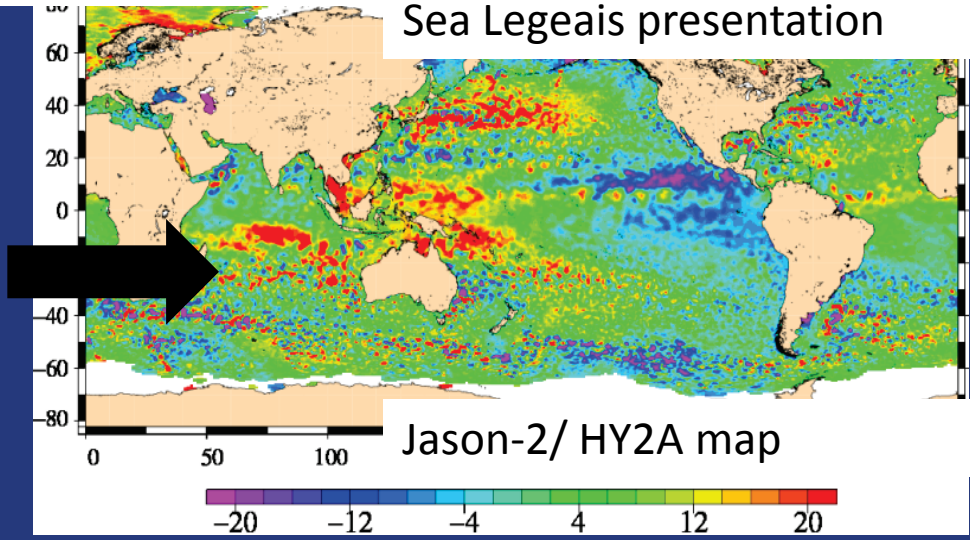
•**AltiKa** : This mission MUST be successful (launch, operations, data quality)

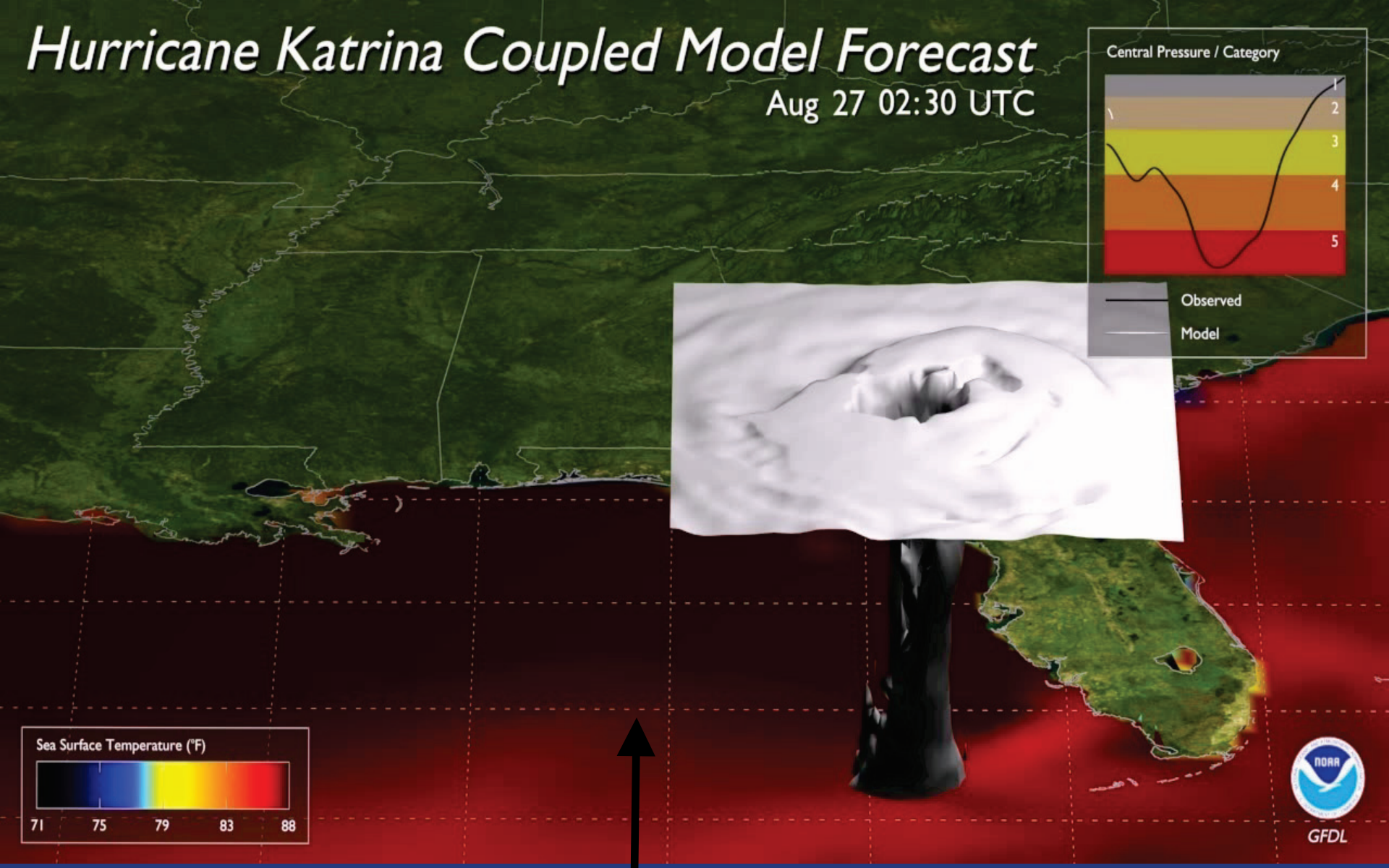
•**HY2A**: Encouraging results. HY2 is a valuable asset that would become critical for DUACS if another altimeter mission dies

•**Sentinel-3 is needed !**

Cryosat-2 SLA Cycle 30 (May 2012) (cm)

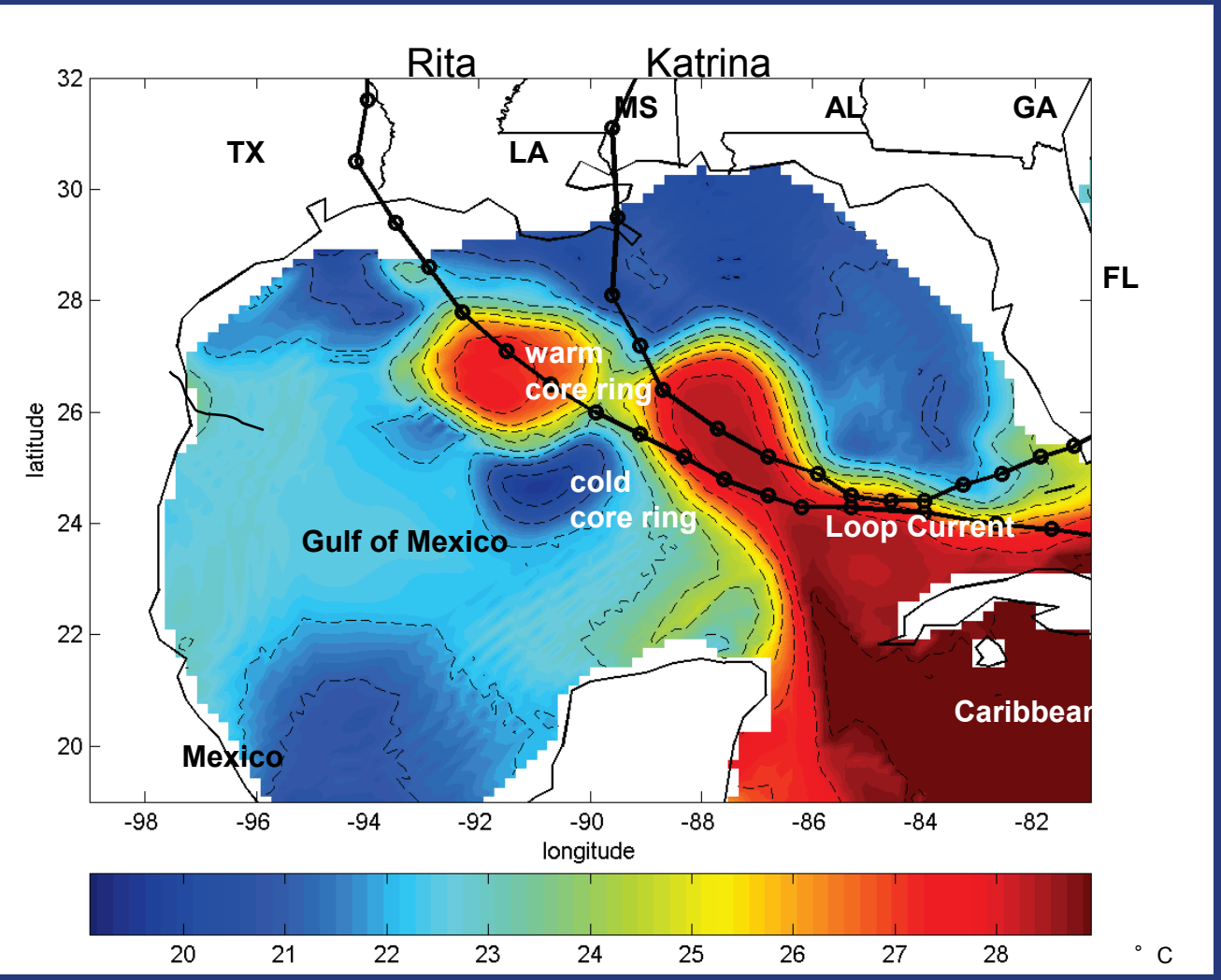






Why is the cold wake "not as cold" here?

Approximate Locations of Oceanic Features During Hurricanes Katrina and Rita (2005)



Subsurface (75-m) ocean temperature during Katrina & Rita

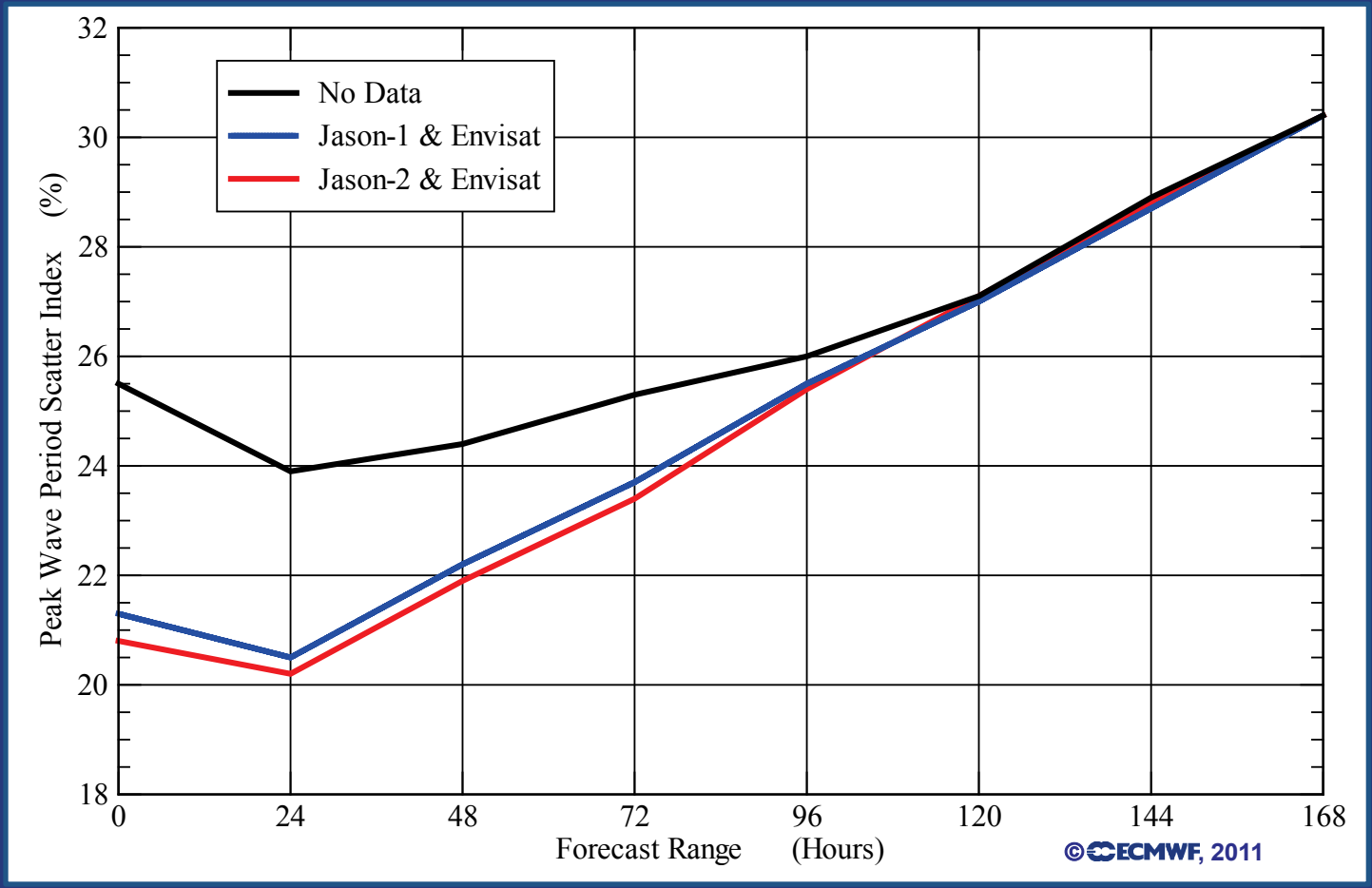
Warm Loop Current water and a warm core ring extend far into the Gulf of Mexico from the Caribbean…

Directly under Rita's & Katrina's track…

But… how do we know the locations of (& how do we assimilate) these features in real-time?

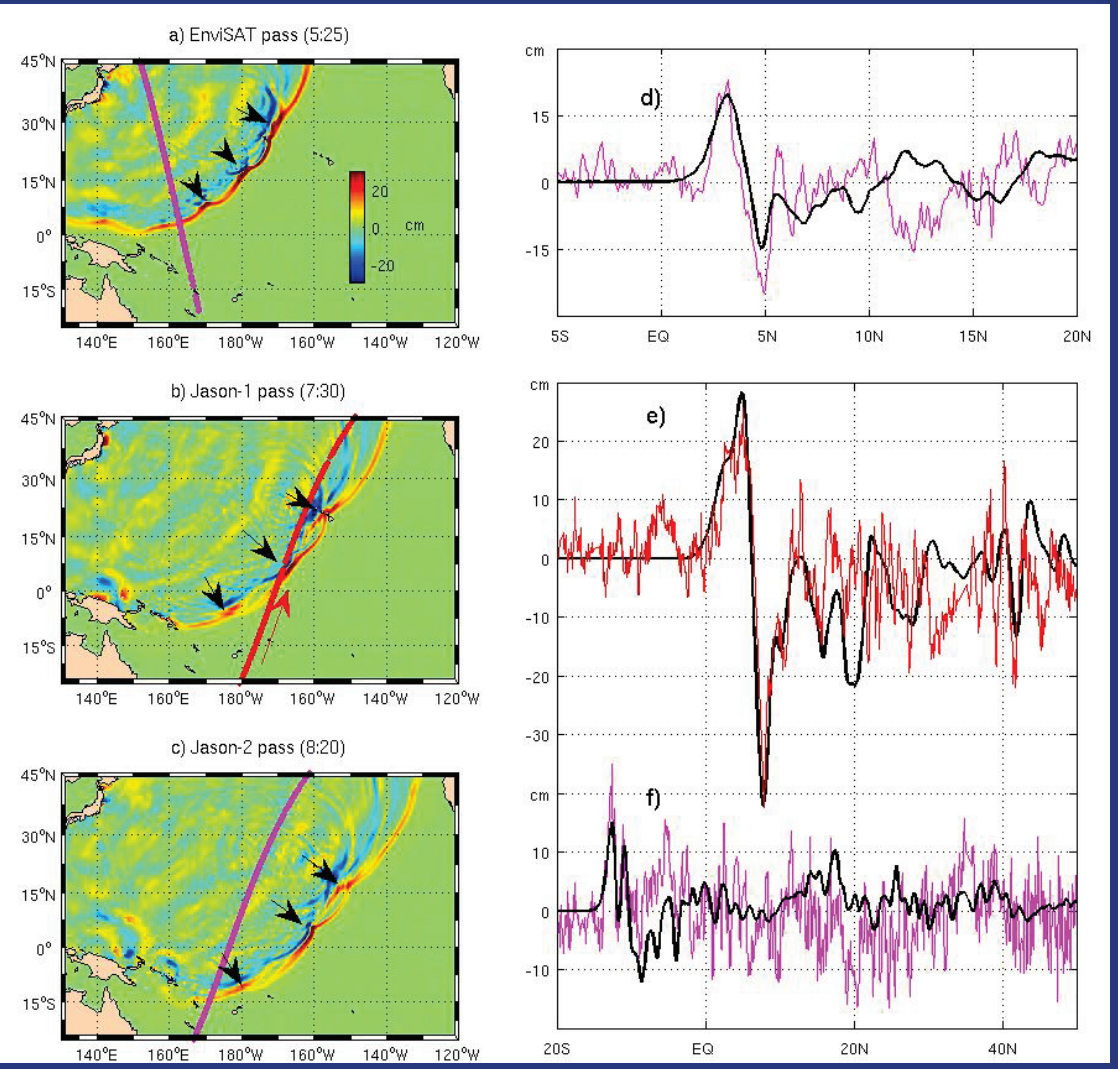
Impact of Jason-1/2 SWH assimilation on the model peak wave period forecast errors

(At all buoys; From 01 Aug. to 21 Sep. 2008)



Merging Tsunamis Confirmed by Altimetry

Tony Song[1], Lee-Lueng Fu[1], Ichiro Fukumori[1], C.K. Shum[2], Yuchan Yi[2], Victor Zlotnicki[1]
[1]Jet Propulsion Laboratory [2]Ohio State University, Columbus



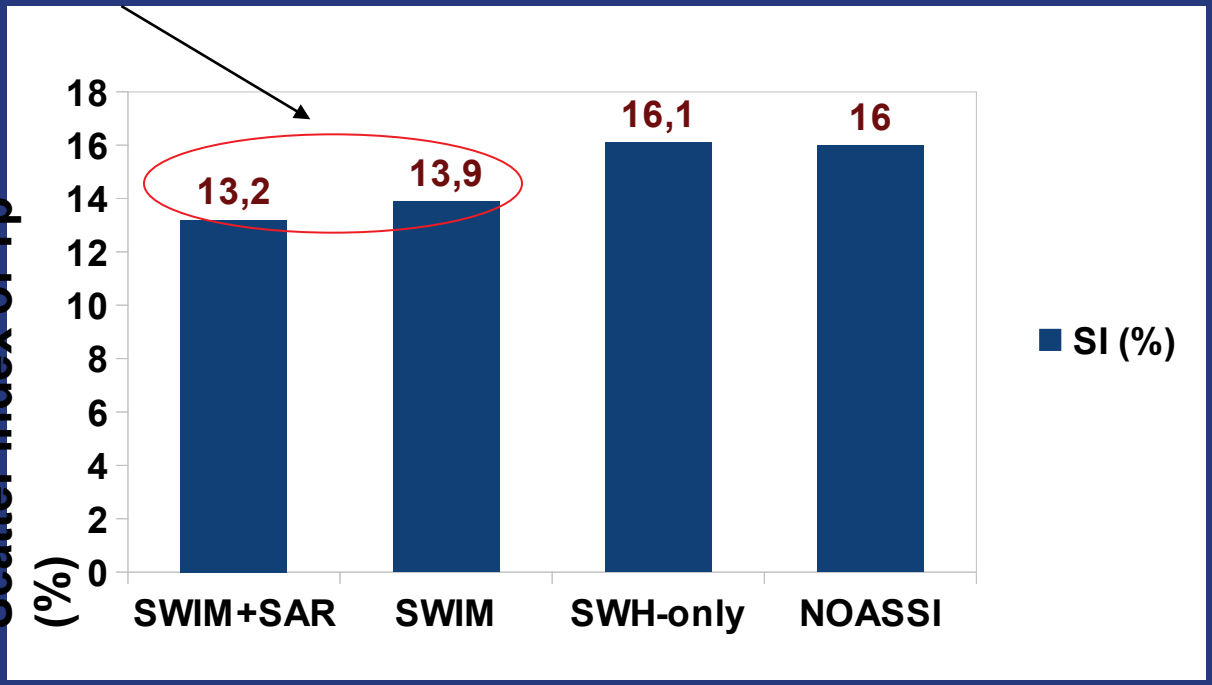
During the 2011 Tohoku-Oki earthquake and tsunami, Satellite Jason-1 was flying over the tropical Pacific and observed one of the mergers (b), while the other satellite, Jason-2, about 1500 km apart, observed the normal tsunami front (a, c).

The tsunami height observed by Jason-1 is about twice as high as that observed by Jason-2 along the same tsunami front, suggesting the amplification of the tsunami height is a result of merging waves.

Red lines are Data and black lines are model simulation**. Details see** Song, et al., *Geophys. Res. Lett*. (*Nature* Highlights on March 8, 2012.)

Assimilation of SWIM synthetic wave data : Validation with buoy peak period Tp

impact of using directional wave spectra



SWIM+SAR : MFWAM with assimilation of SWIM and ASAR (ENVISAT)
SWIM : MFWAM with assimilation of synthetic wave spectra and Sig. wave heights
SWH-only : MFWAM with assimilation of Sig. Wave heights only
NOASSI : MFWAM without assimilation

Test run of 1-cycle CFOSAT

Recommendations Jason-CS radiometers

Application of 2 radiometers

- Intercalibration
- NRT calibration of drift through cross-calibration
- Cross calibration could lead to more rapid generation of long term trends
- Onboard calibration is probably more important than accuracy
- An external calibration is needed (hot / cold load) (particularly for larger scale products)
- Redundancy

2 channel vs 3 channel

- 2 frequency acceptable only if it meets requirements for accuracy/precision/drift
- For global products, a well calibrated radiometer becomes more important than for regional products

LRM, SAR, Interleaved

Present baseline is exclusive use of either SAR or LRM

Current baseline does not satisfy requirements for Jason-CS. Can not connect coastal calibration sites to open ocean for calibration / assimilation. Interleaved mode is required.

SSH and SWH must meet accuracy / precision specifications at all points along ground track.

Must not affect data availability / latency.

Recommendations

- Strong support for continued / expanded coverage in NRT
  - Altika, Sentinel 3 (Faugere)
  - CryoSat2, HY-2A (Griffin)
  - Wave spectra CFOSAT
  - Explore alternative solutions (Microsats could provide possibility of greater payoff)

- David Griffin: One satellite altimeter is completely insufficient for operational oceanography, without at least two it is not worth constructing present products

- For hurricane problem, higher spatial resolution may be the higher priority case

- Nick Shay OHC could not produce the product using only one altimeter (John Lillibridge)

- Jean-Michele, for regional applications, coverage is more important

Recommendations

- Review latency vs accuracy strategies of O/I/GDR

- IGDR / OGDR differences become smaller and implies reduction in latency in combination with advancing accuracy and precision
- Orbits are very similar, GPS orbits in NRT could help as a backup
- Remaining large differences:
    - Inverse barometer
    - Calibration of water vapor radiometer jumps need addressing

- Need CryoSat2 latency within 3 hours for many applications, some work under way within ESA to bring CryoSat2 to this point

Near real time products and applications

20 years of progress and success

- Starting with TOPEX/Poseidon Quick Look products
- Jason-2 IGDR less than 24 hours
- Processing of altimeter data in operational centers
- Latency reduced from several days to hours
- Accuracy and precision advanced beyond expectations (orbits)
- Data streams never designed to be NRT are now provided in NRT (Jason-1/2)
- New applications and challenges still exist in this area

Near real time products and applications New challenges

New challenge to quantifying sensitivity

- Now possible with a range of applications in place
- Each has sensitivity to
  - Accuracy and precision
  - Latency
  - Quantity
- What is degradation of applications to these?
- What is the point at which applications are lost?
- What is the breaking point?

Our challenge for next years, quantify requirements relative to the range of NRT applications

Near real-time altimeter SSH in an ocean forecast system for the Mid-Atlantic Bight (MAB) continental shelf (J. Wilkin, Rutgers)

- ROMS model 4D-Var data assimilation of SSH (+ SST & CODAR currents)
- Along-track SSH acquired via RADS

RADS allows regional customization e.g. local tide model
RADS consistent format facilitates inclusion of new platforms into RT model pre-processing

- J-2 only – cautious about adding ENVISAT in case OGDR orbits introduce short wavelengths in data at J-2 cross-overs inconsistent with 4D-Var error assumptions

Before adding CryoSat to RT forecast we would revisit this issue

- To use SSH on broad continental shelf (like MAB) need a good MDT

Because model works with absolute dynamic topography. We made our own MDT based on regional analysis of hydrography and in situ velocity

- Coastal models may apply atmospheric pressure in meteorology forcing in which case OGDR interpretation may require NRT DAC

e.g. model designed to compute storm surge
RADS easily allows option to exclude DAC
Need access to NRT DAC at native resolution for interpolation to arbitrary locations (possibly to integrate with tide gauges)