



Wind Field, Sea State and Currents from SAR in the coastal Zone of Mexico

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**German Aerospace Center
(DLR)**

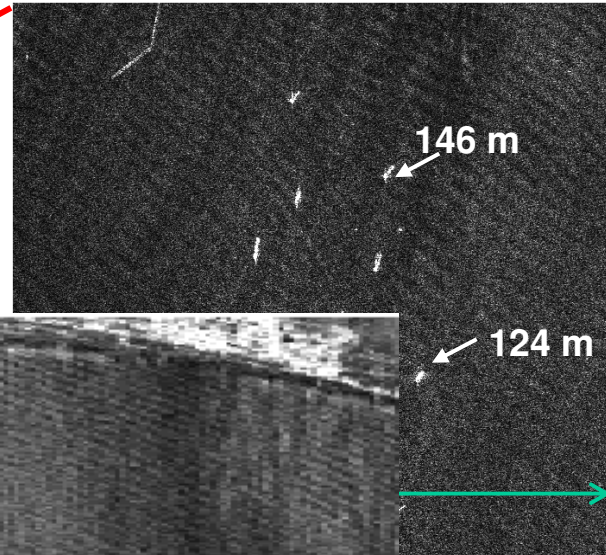
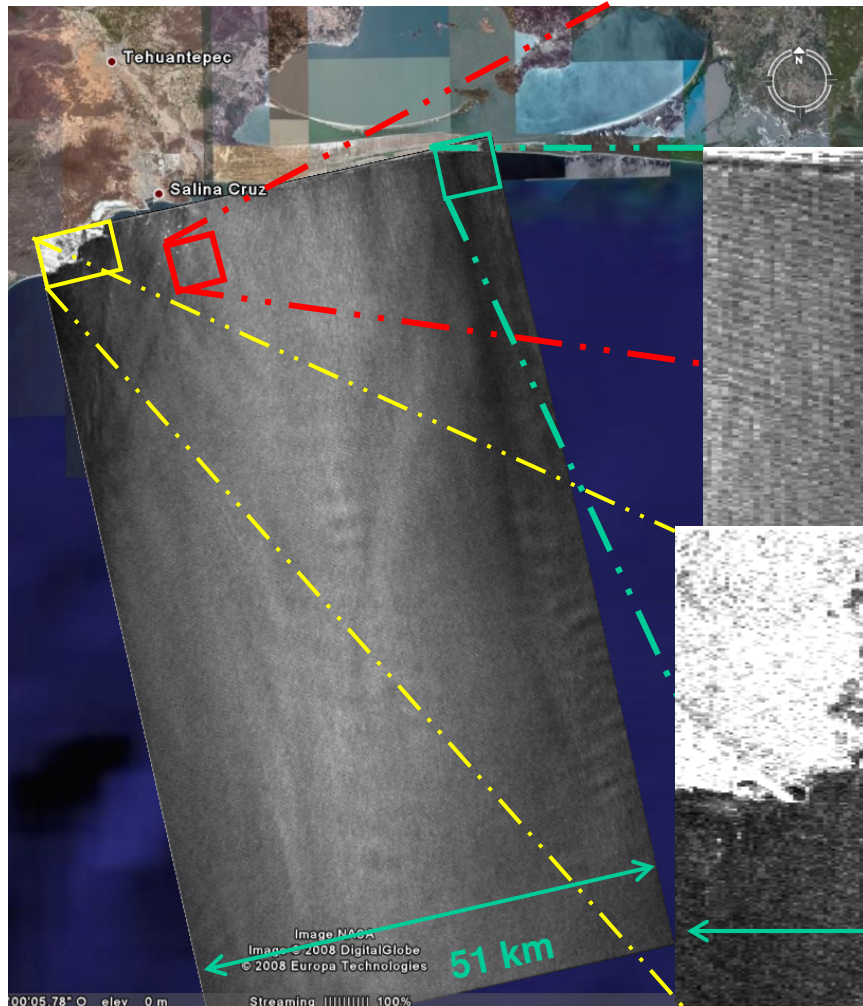
Oberpfaffenhofen 82234

Wessling, Germany



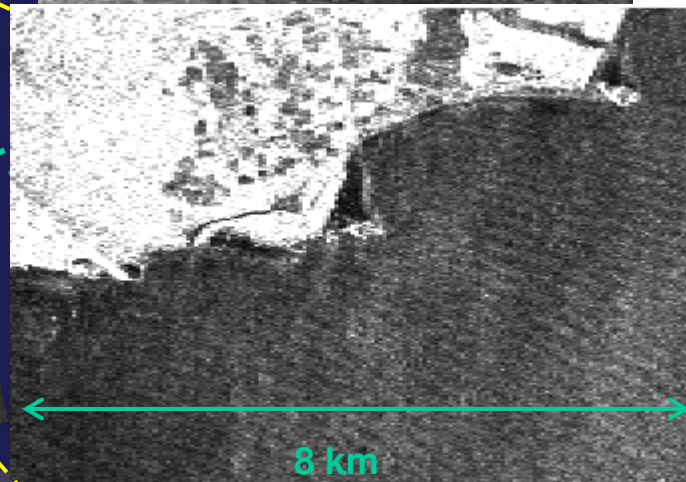
Motivation

ENVISAT Image Mode scene acquired over the Gulf of Tehuantepec on Mar. 12, 2008, 04:40 UTC.



Ship Detection

Ocean Waves



Coastal Area Mapping



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Overview

- Introduction
- High Resolution Wind Field Retrieval
- Near Coast Ocean Wave Fields
- Morphodynamical changes in Coastal Areas
- Oil Spill Monitoring

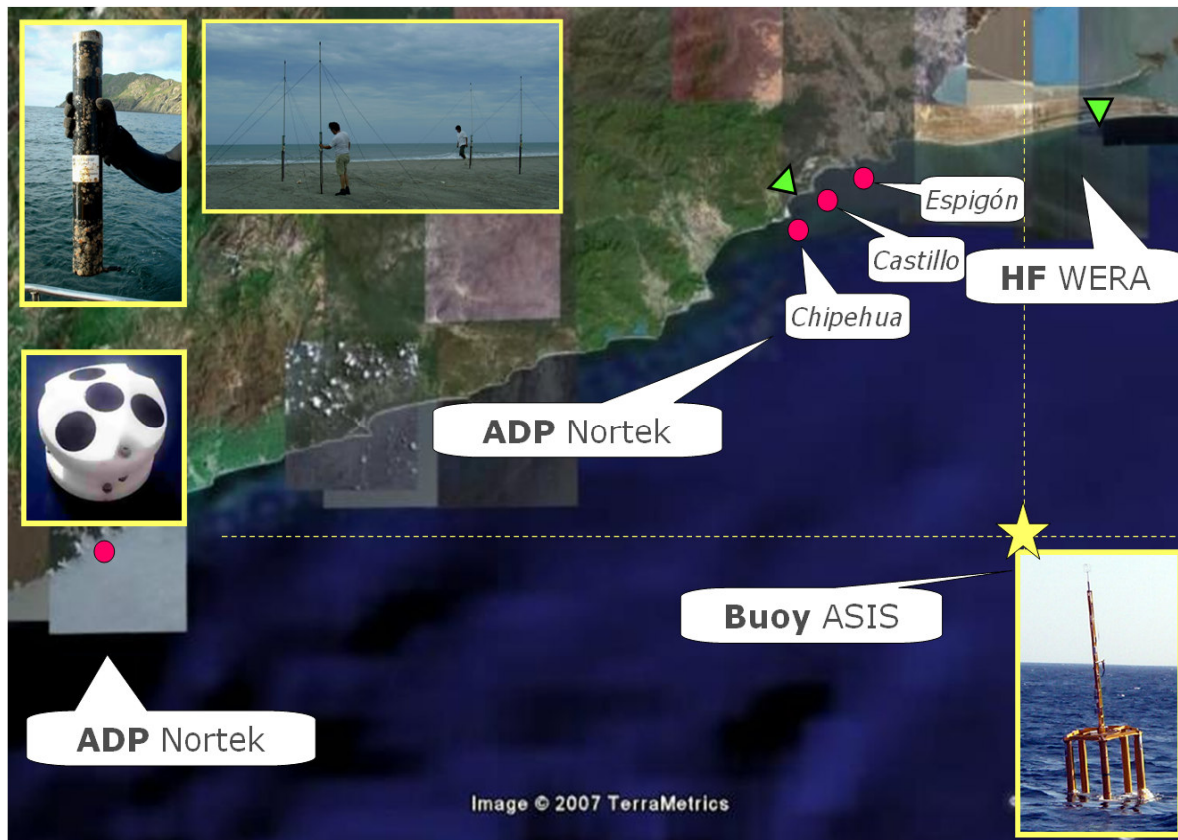


The Radar Oceanography Group at the IMF

- ...develops algorithms for the retrieval of sea state parameters from SAR data, e.g., wind fields, ocean waves.
- validates these procedures with in Situ data.
- uses the derived wind and swell fields as well as numeric models, for the improvement of the forecast.
- provides maps of extreme events and climatologies.
- uses the results in applications like offshore wind energy, ship route optimization and coastal monitoring.

Joint Research Activities

Synergy of ocean remote sensing information in oceanic and coastal waters.



Partners:

- German Aerospace Center (DLR)
- Centro de Investigación Científica y de Educación Superior de Ensenada (CICESE) (Dr. P. Ocampo Torres)

Proposal submitted to the German Aerospace Agency

Monitoring of Sea State Wind Fields and Currents in the Coastal Area of Mexico (MMC)

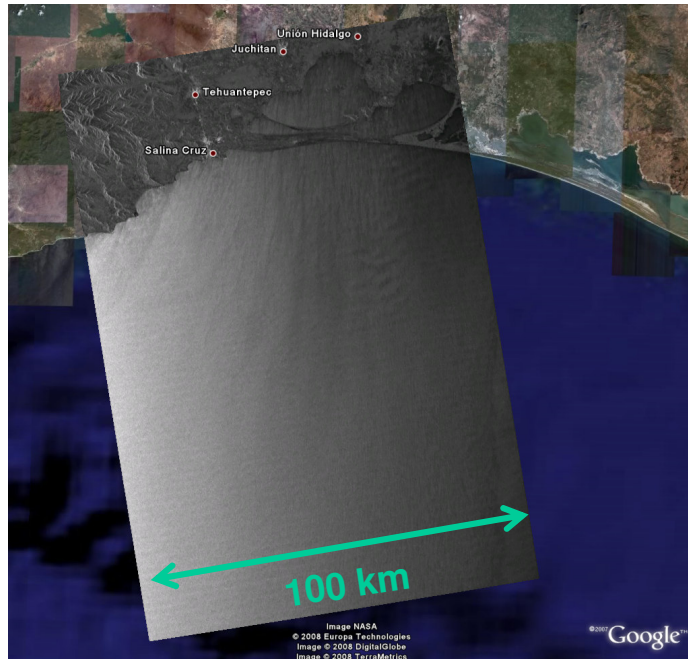
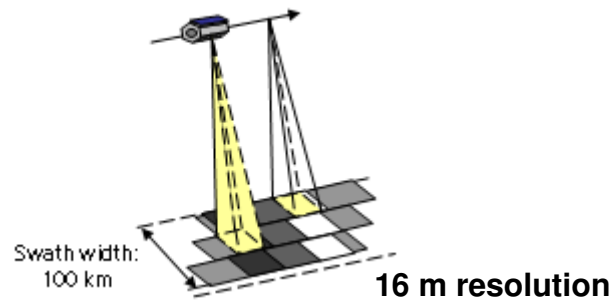


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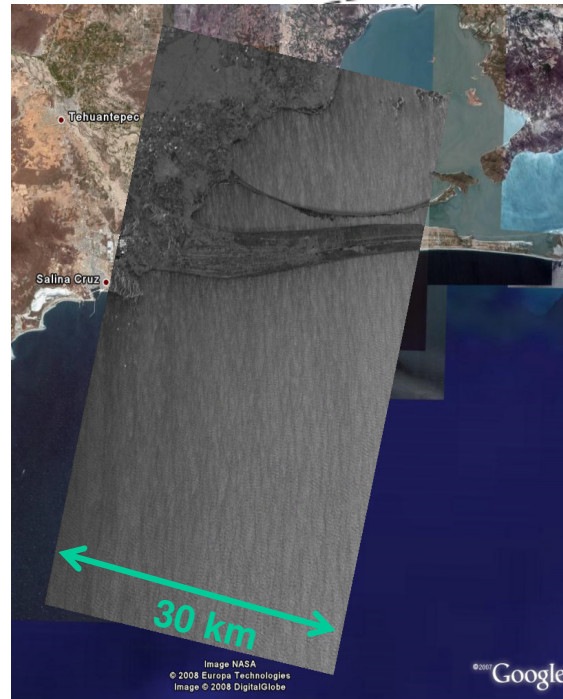
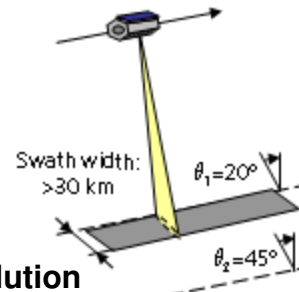
TerraSAR-X Imaging Modes for Coastal Monitoring

ScanSAR



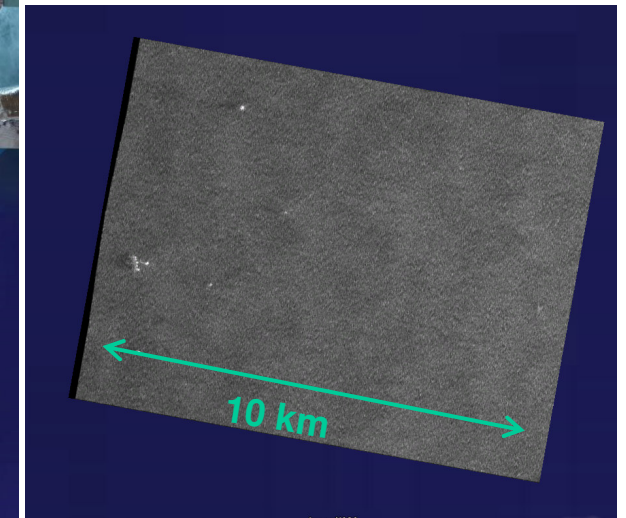
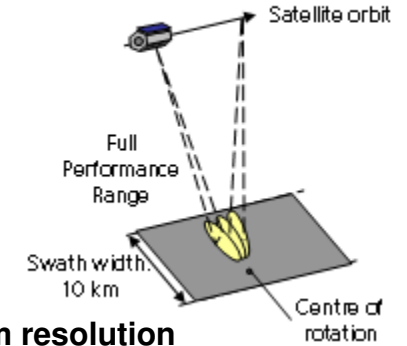
Gulf of Tehuantepec
Mar. 21 2008 19:29 UTC.

StripMap



Gulf of Tehuantepec
Mar. 20 2008 12:19 UTC.

Sliding Spotlight



Bay of Campeche
Mar. 26 2008 12:10 UTC.

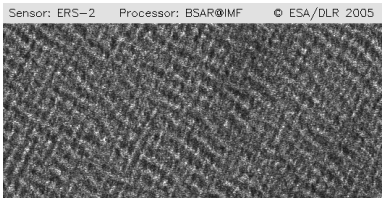


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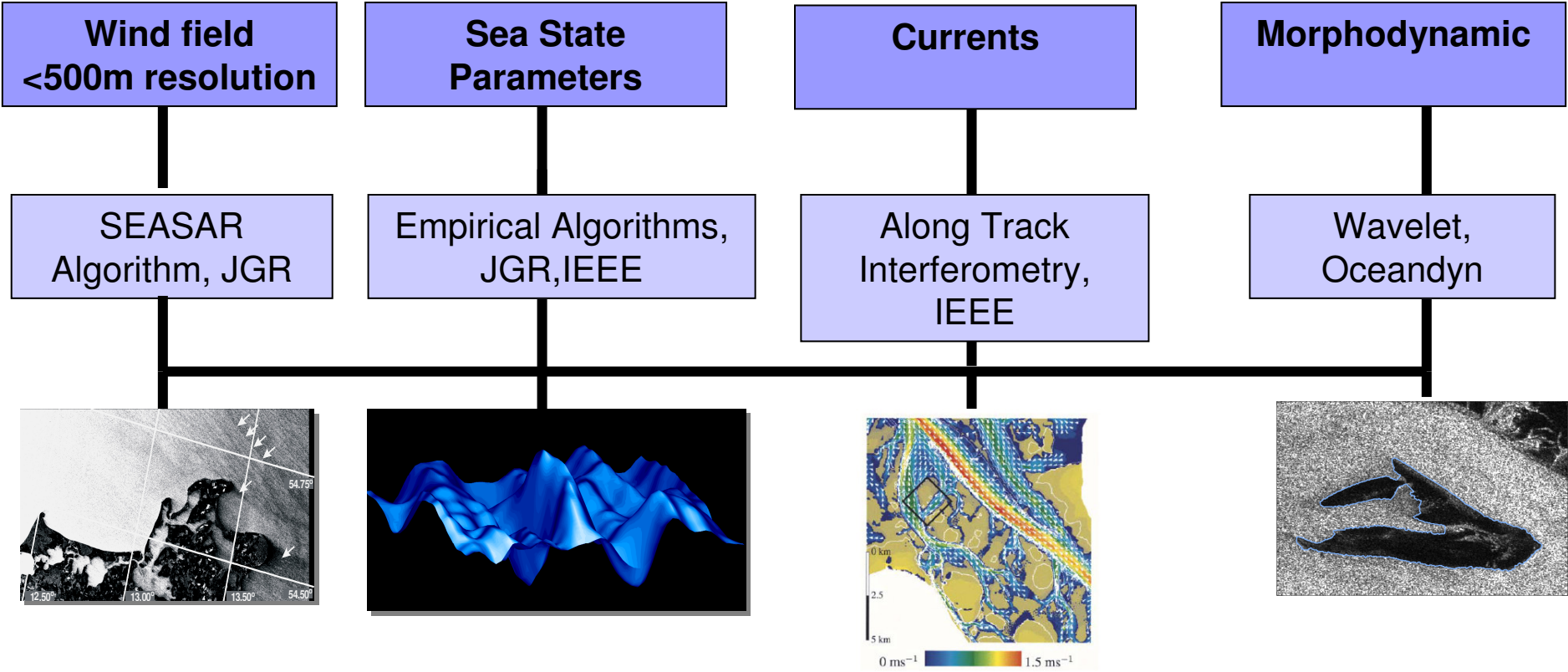
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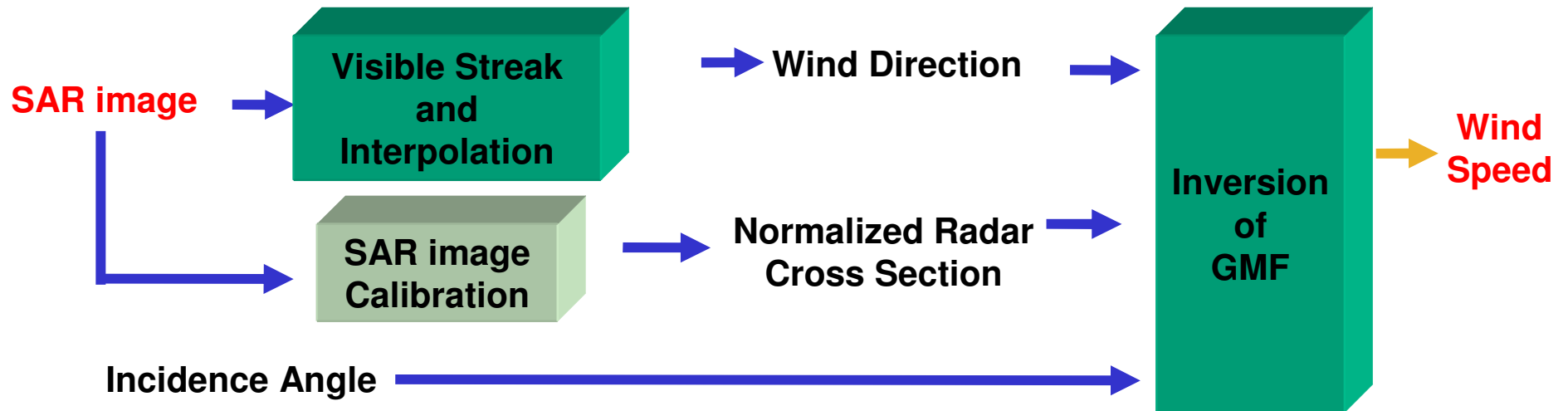
Algorithms to derive marine Parameters



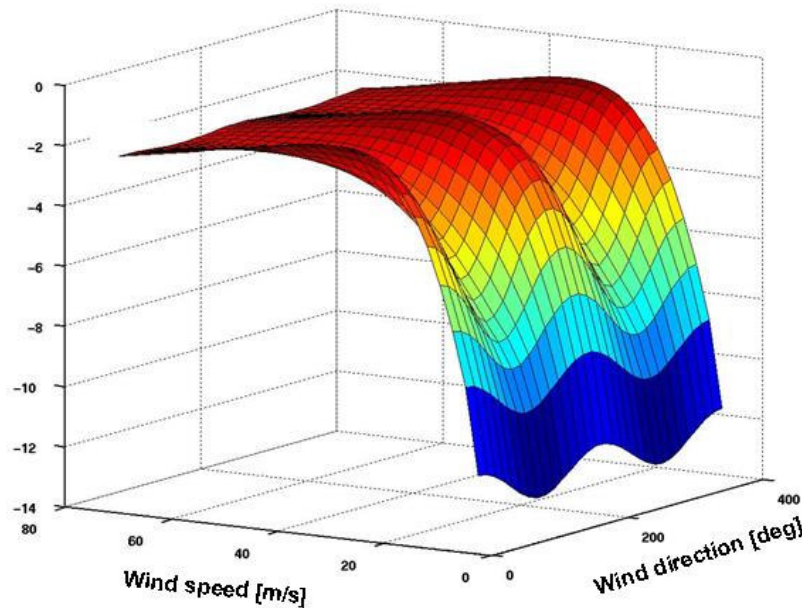
One Million ERS Wave Mode SAR images



SAR Wind Field Retrieval



**CMOD 5
GMF**



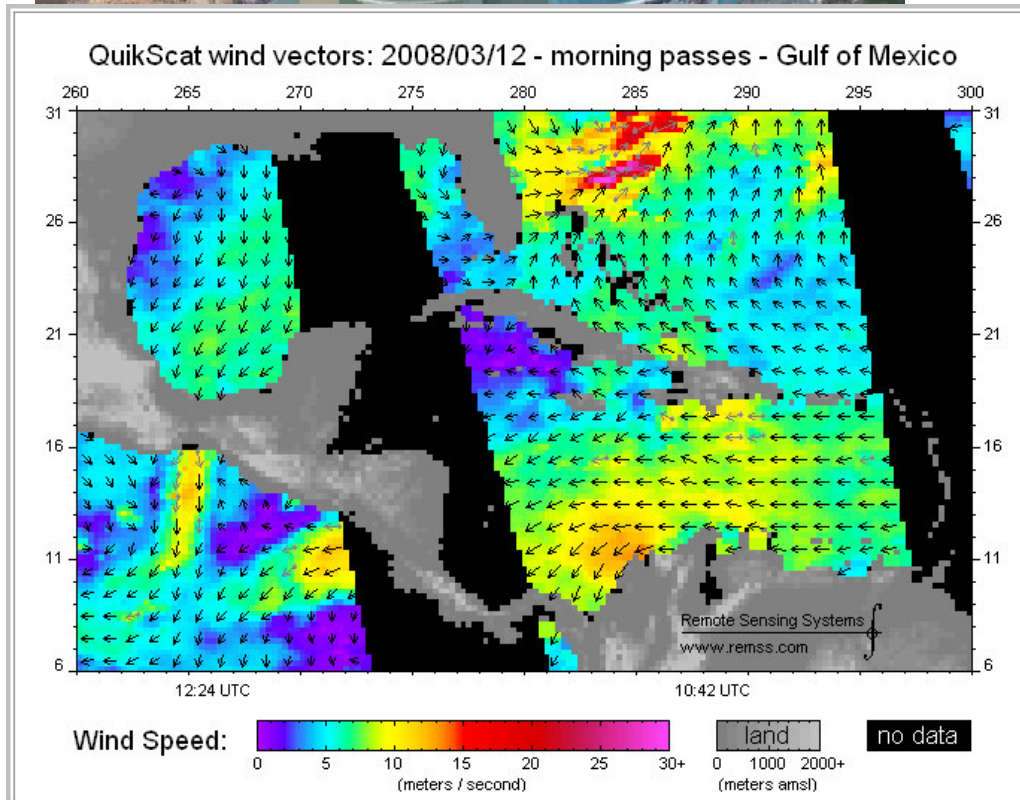
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SAR Wind Field Retrieval

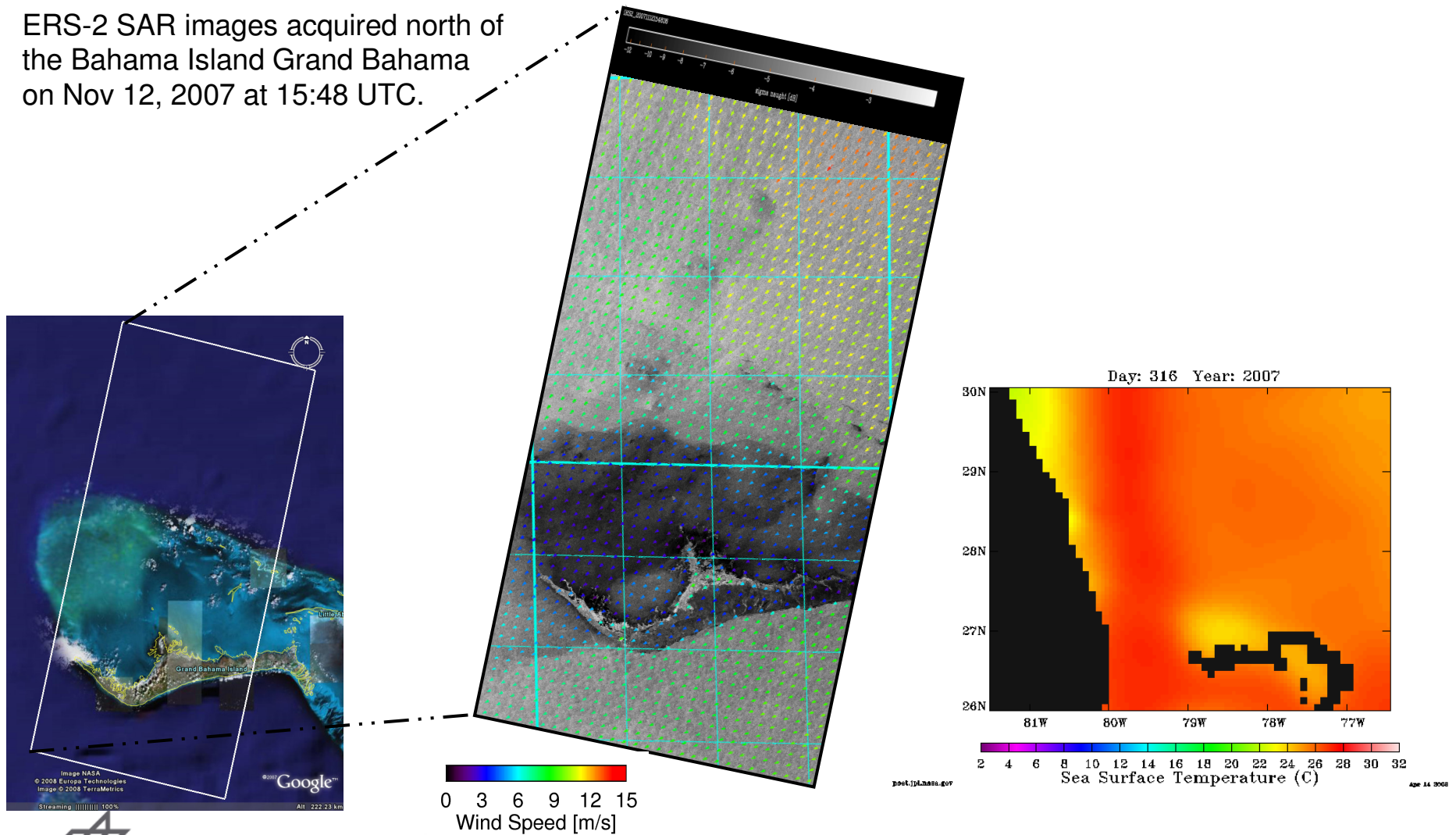
ENVISAT Image Mode acquired over the Gulf of Tehuantepec on Mar. 12, 2008 ,04:40 UTC.





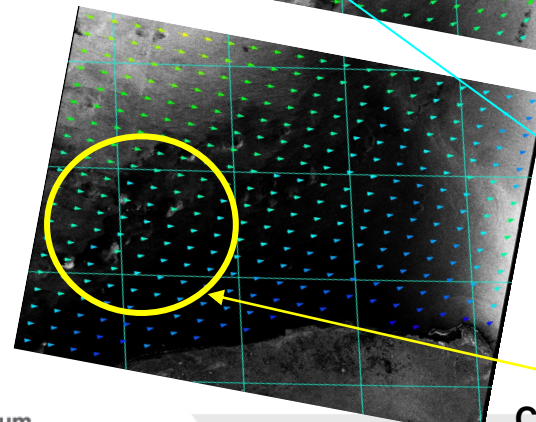
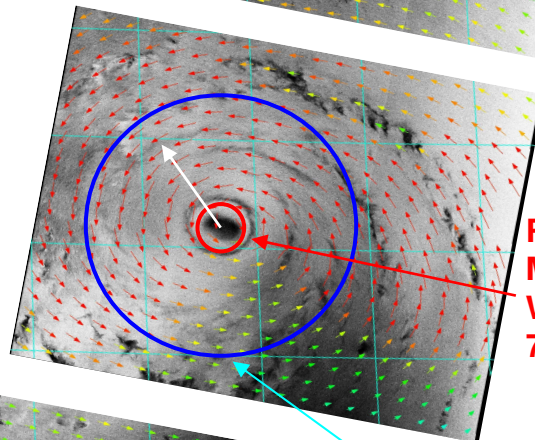
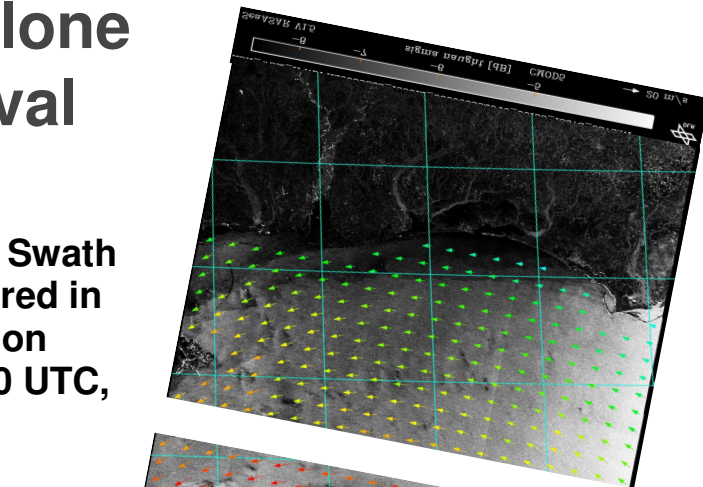
ERS-2 SAR Image Downlinked at the Receiving Station in Chetumal

ERS-2 SAR images acquired north of the Bahama Island Grand Bahama on Nov 12, 2007 at 15:48 UTC.



Tropical Cyclone Wind Retrieval

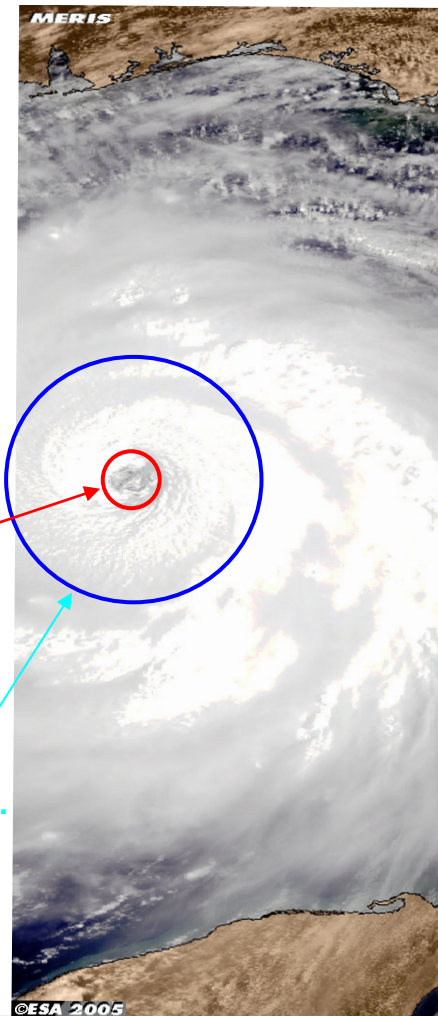
Three ASAR Wide Swath Images were acquired in the Gulf of Mexico on Aug. 28, 2005 15:50 UTC,



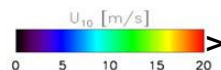
Radius of
Maximum
Wind.
70 m/s

Radius of
Hurricane
force Wind .
33 m/s

Strong
Convective
Cell



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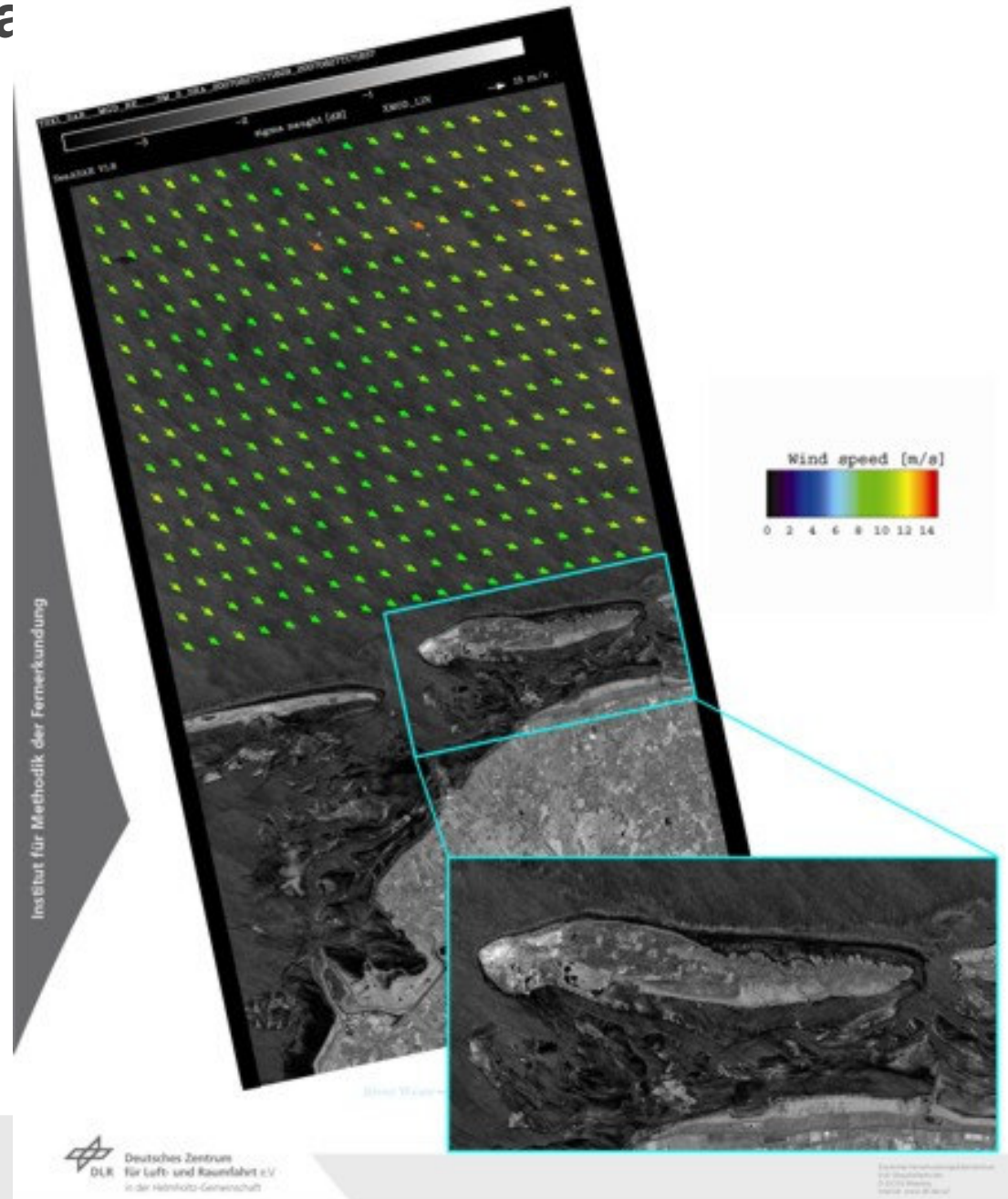
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TSX Wind Field Retrieval

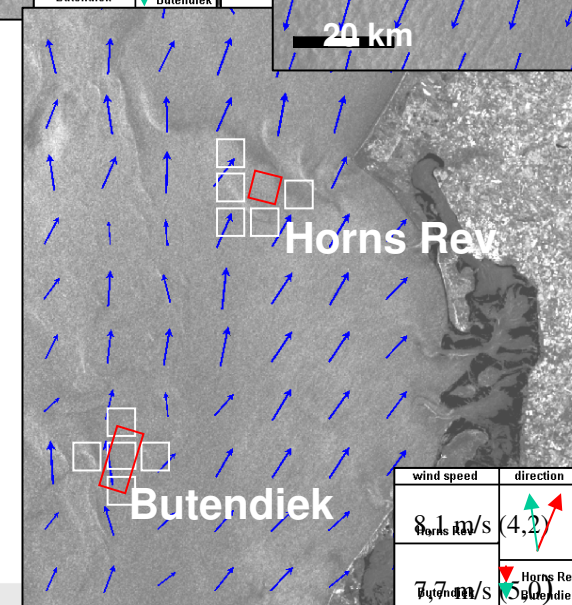
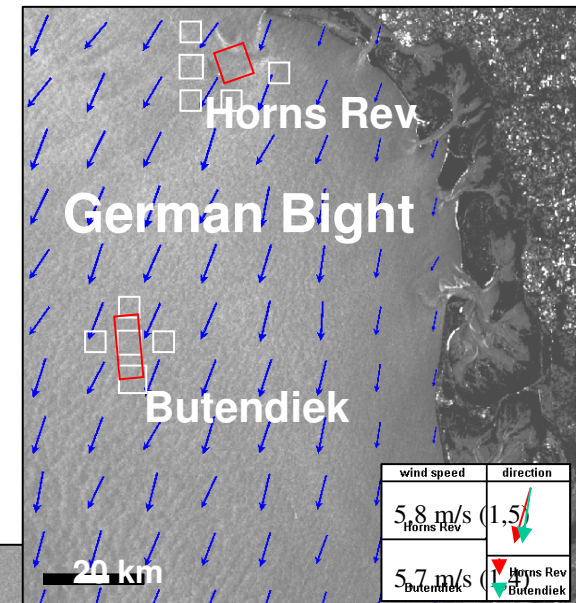
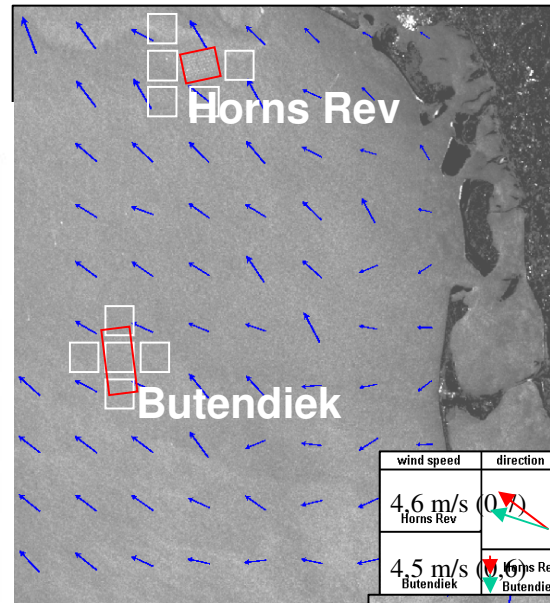
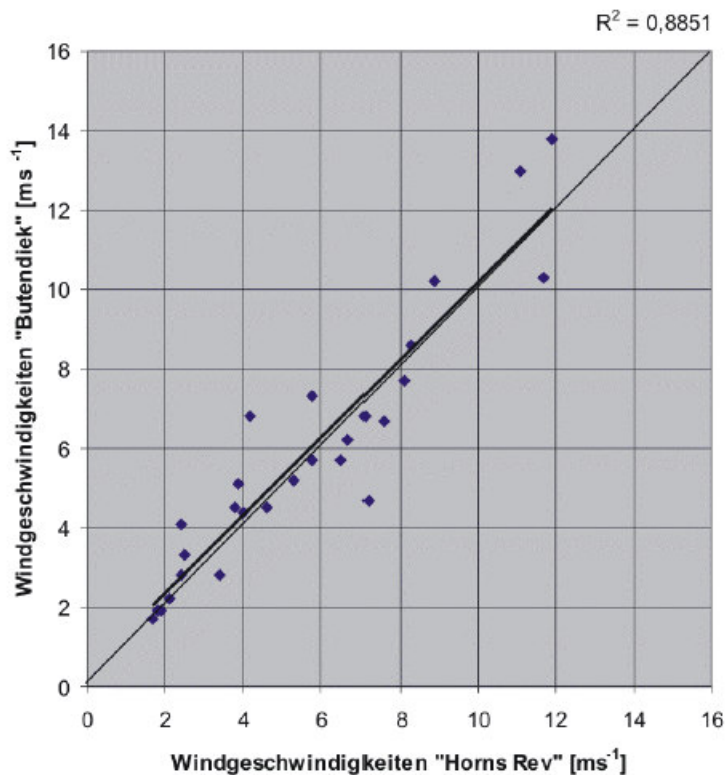
30 km x 100 km
TSX VV Stripmap image

The superimposed wind field
was derived from the NRCS
using the new XMOD GMF





Optimal Siting of Offshore Wind Farms Using SAR Data

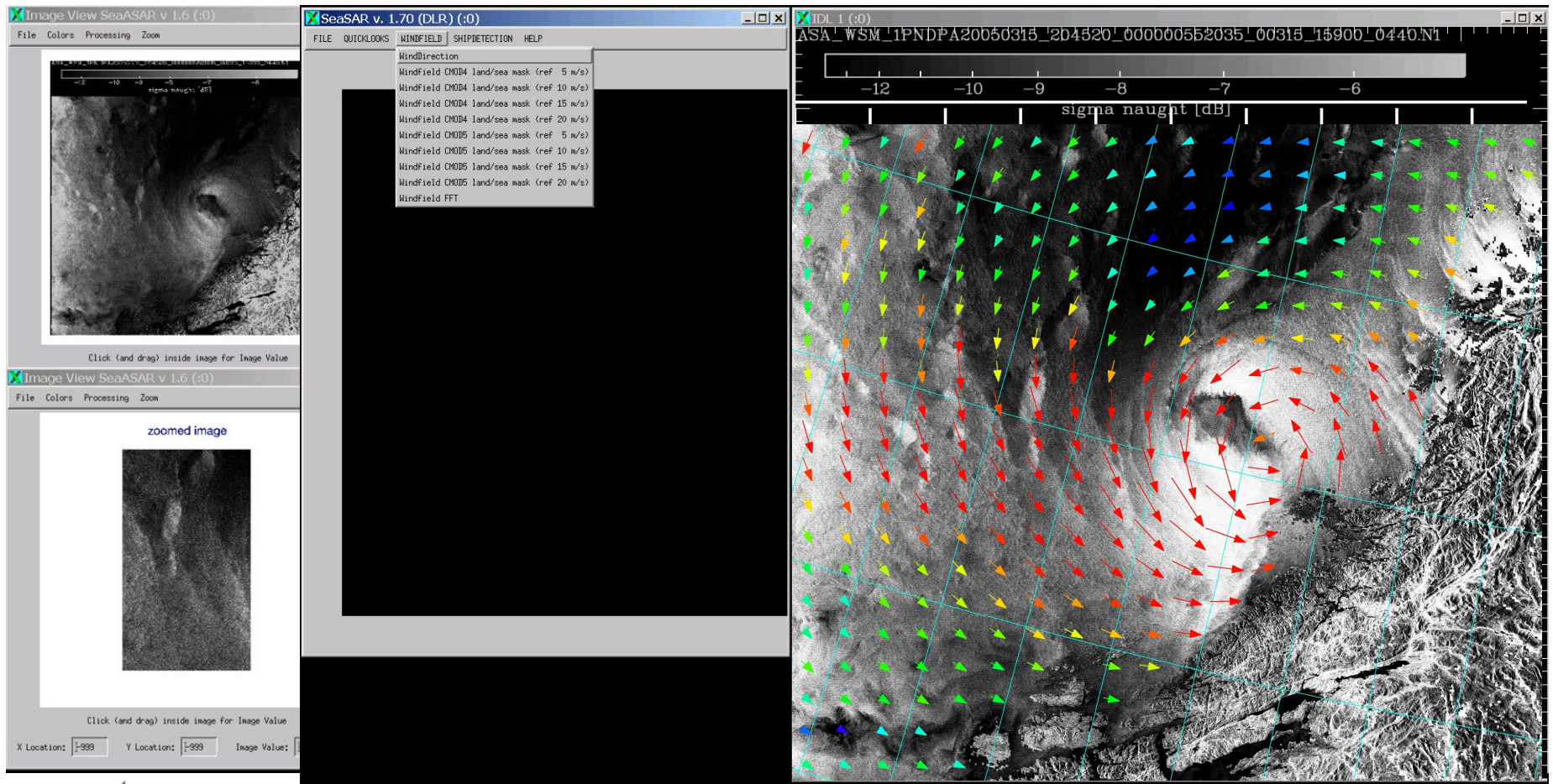


Schneiderhan, T., Lehner, S., Schulz-St., Horstmann, J.,
*Comparison of two offshore wind park sites using SAR wind
 Measurement techniques*, Metereological Applications, Vol 12,
 Cambridge University Press, 2005



SEASAR v. 1.7 Software Tool

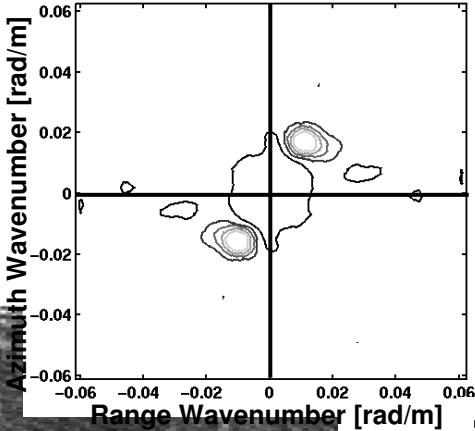
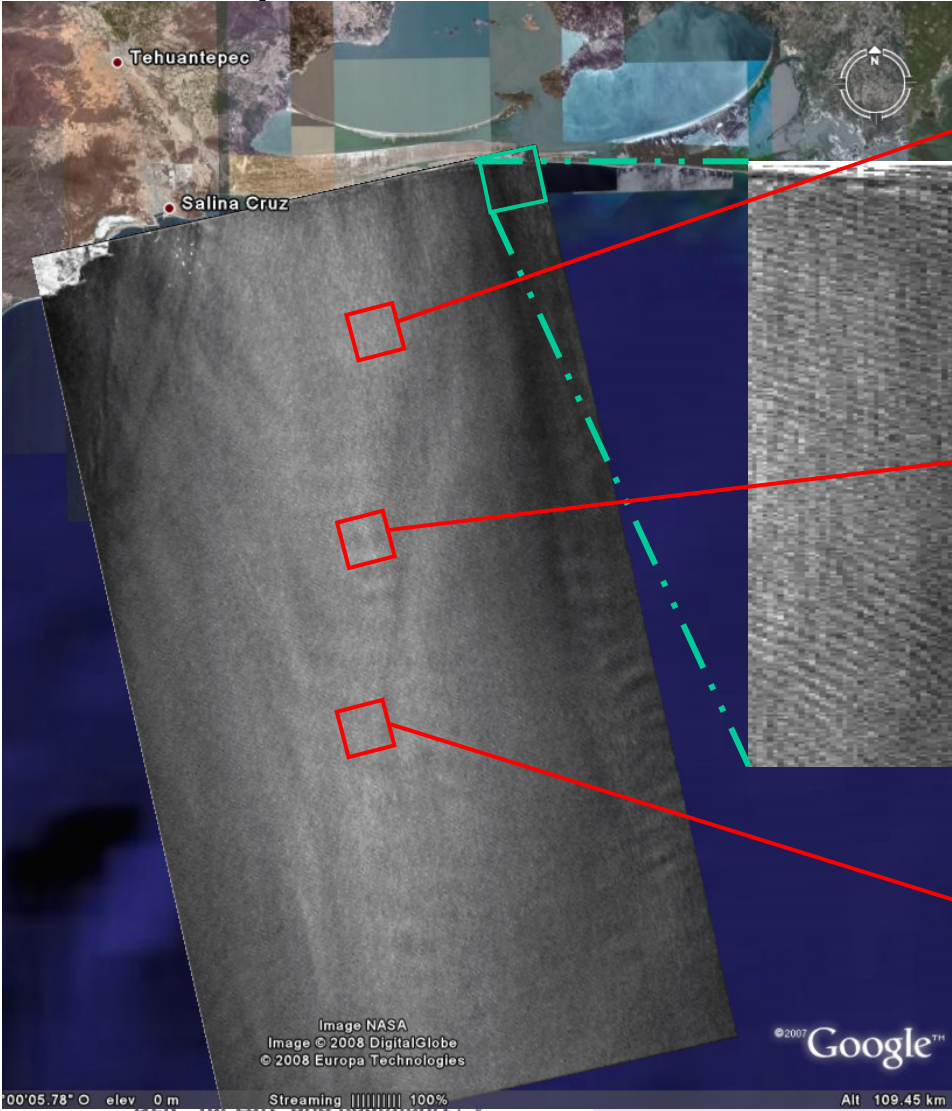
(Implementation in c++ with IDL front-end)



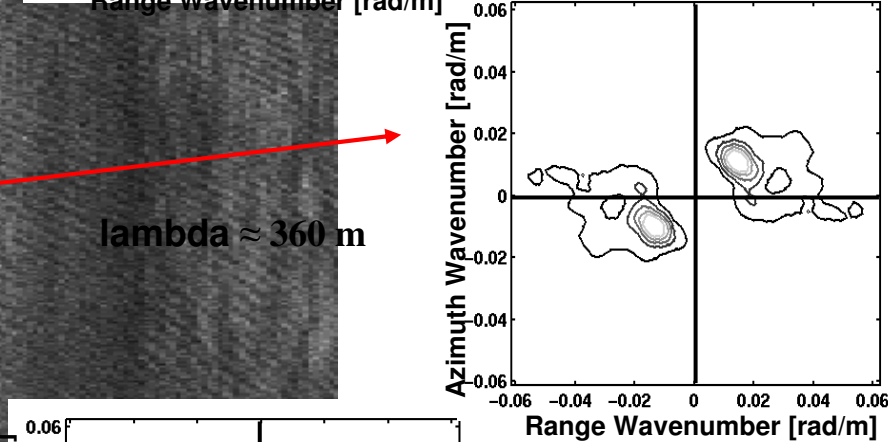


Sea State

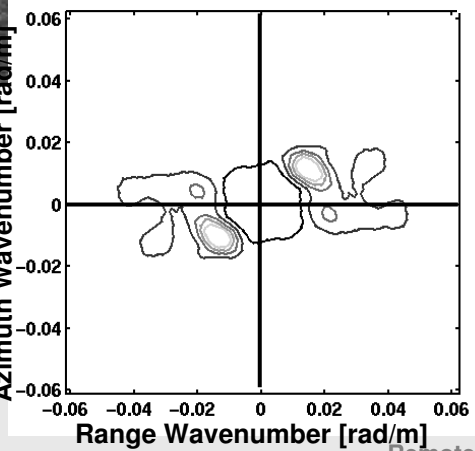
ENVISAT Image Mode acquired over the Gulf of Tehuantepec on March 12, 2008, 04:40 UTC.



$\lambda \approx 330$ m



$\lambda \approx 360$ m

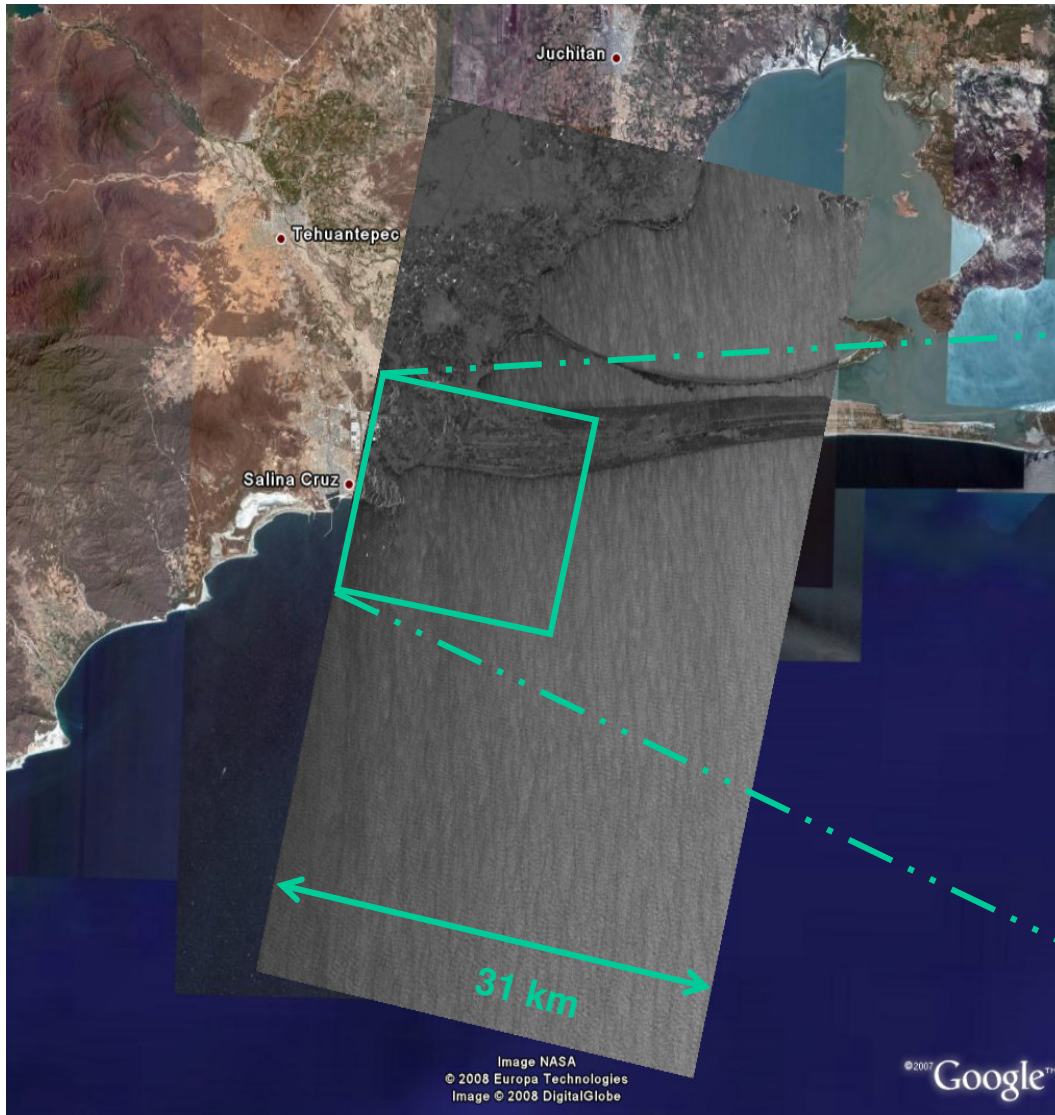


$\lambda \approx 370$ m

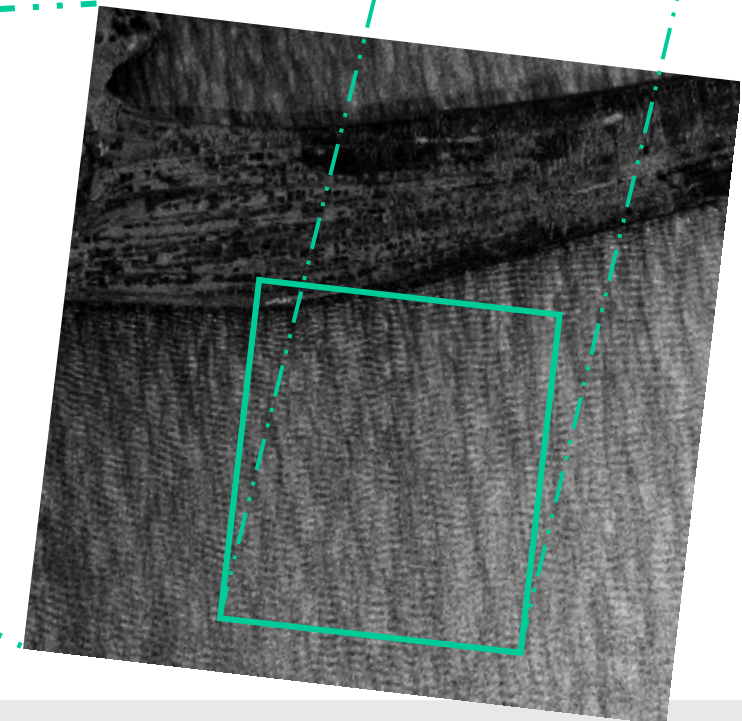
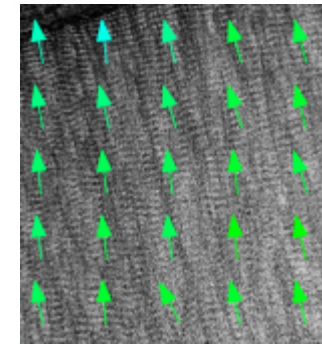


Sea State

TerraSAR-X Stripmap Mode image acquired over the Gulf of Tehuantepec on March 20, 2008 at 04:40 UTC.



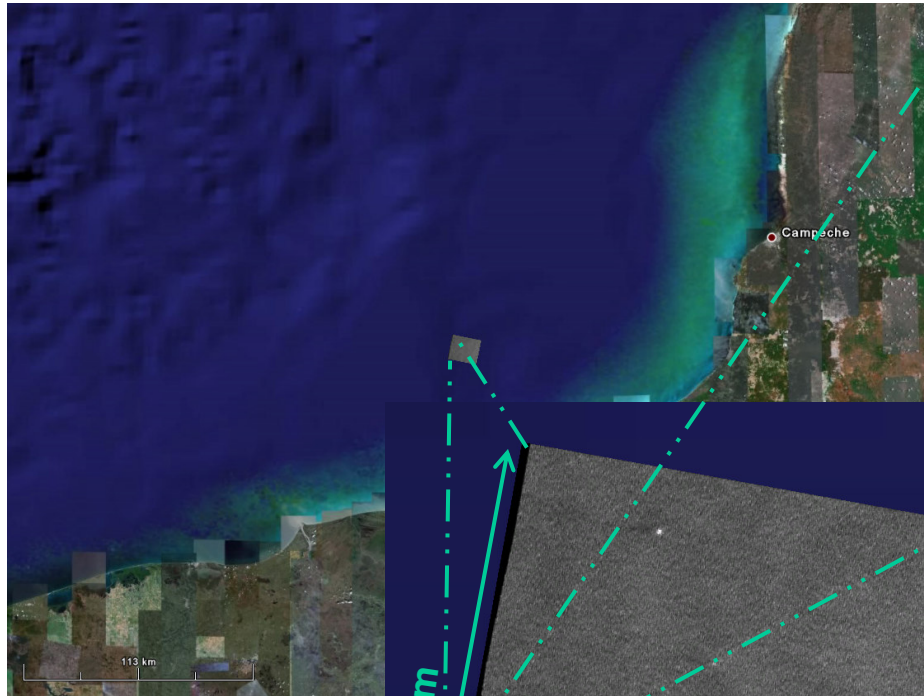
30 120 210 300
Wave Length [m]



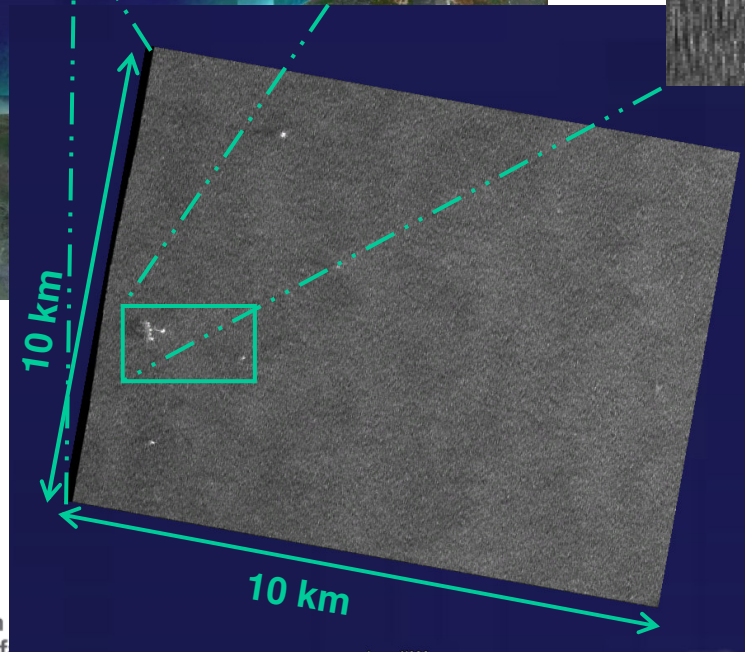


Cantarell Oil Field

TerraSAR-X Spotlight Mode
Mar. 26 2008 04:40 UTC.



**NOHOCH-A
Platform**

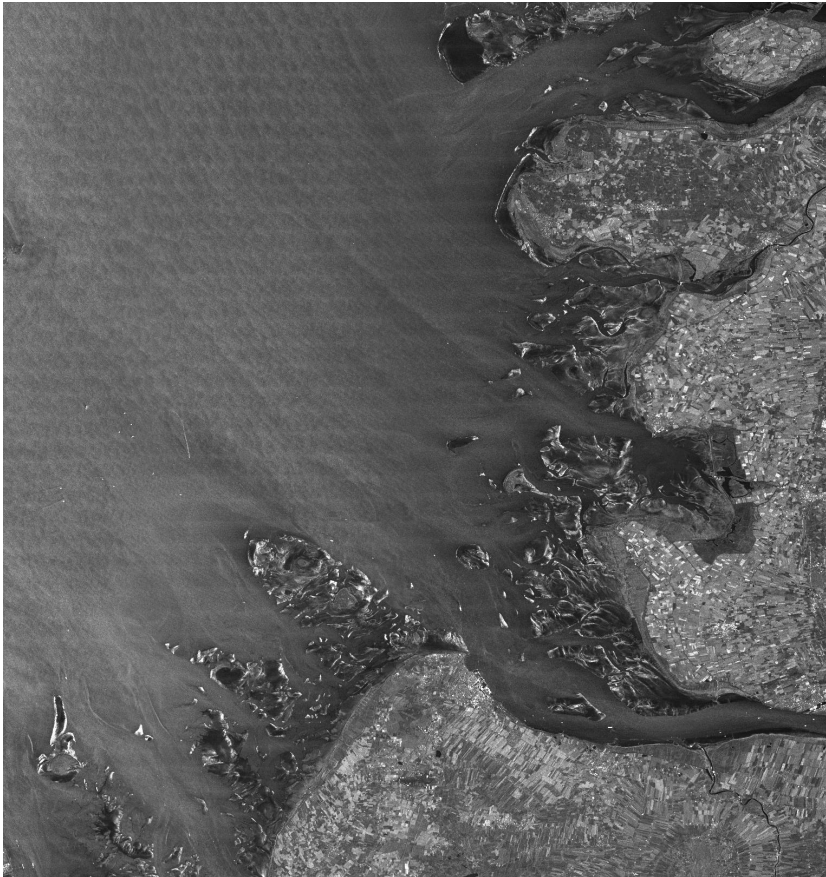


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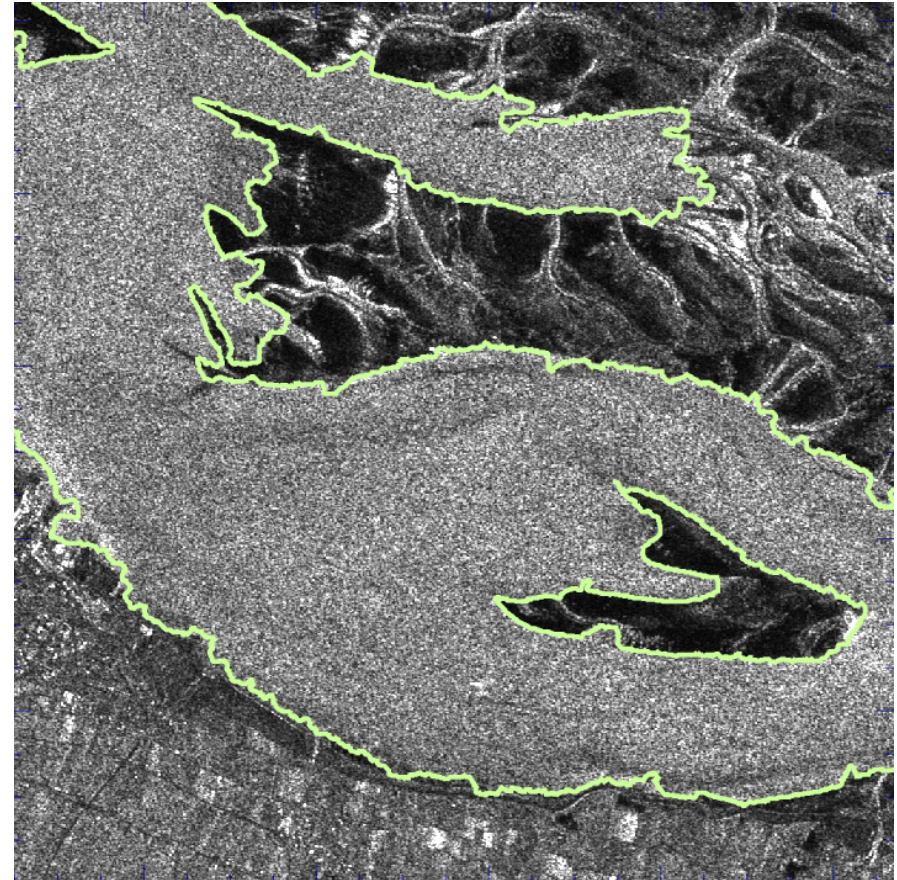


Topography and Morphodynamics

TSX – SC VV, 22.10.2007



ERS VV, 1994



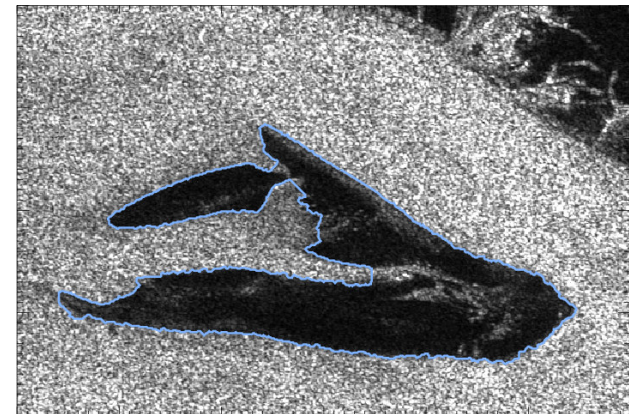
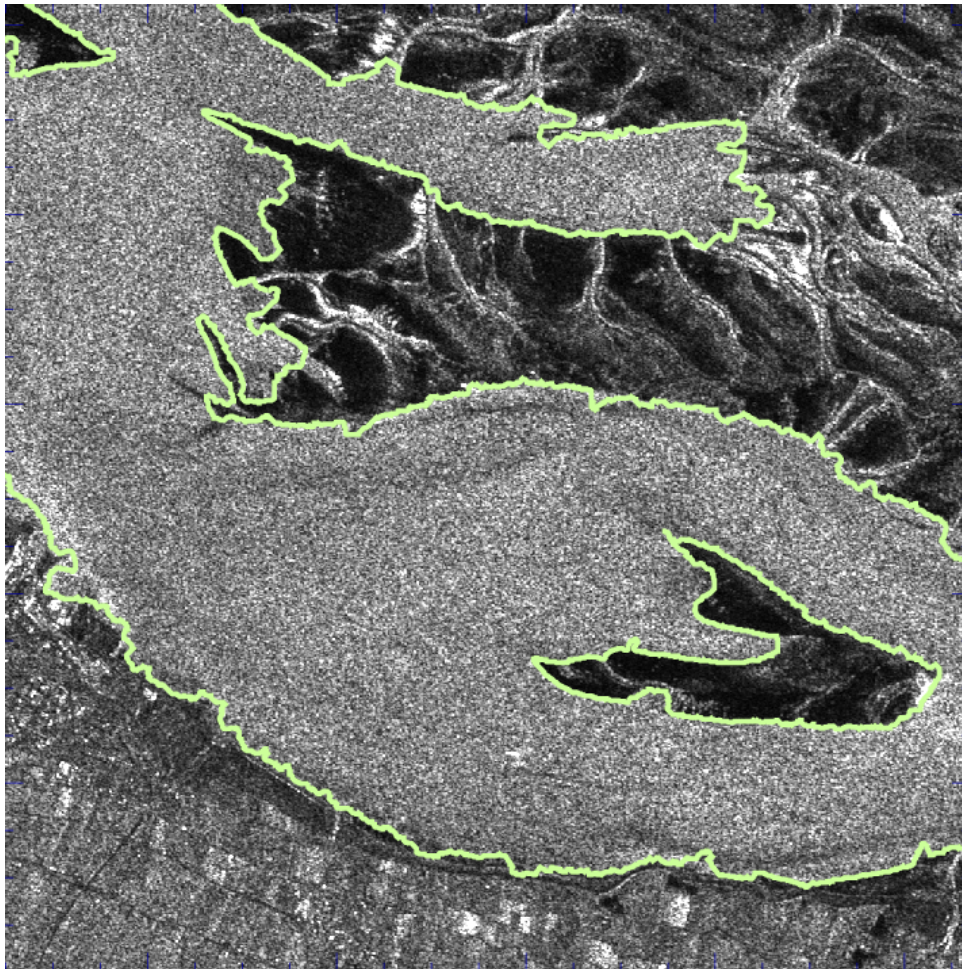
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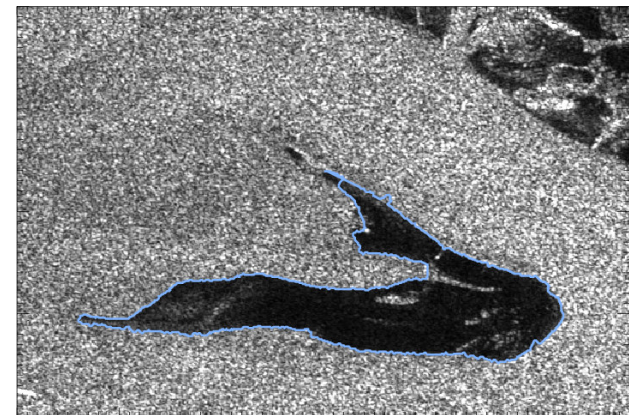


Monitoring of the Morphodynamics

ERS VV, 1994



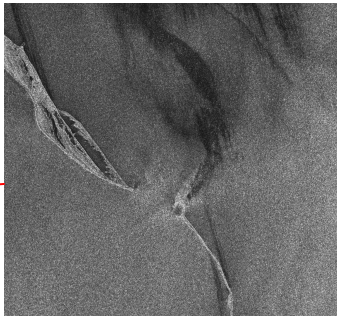
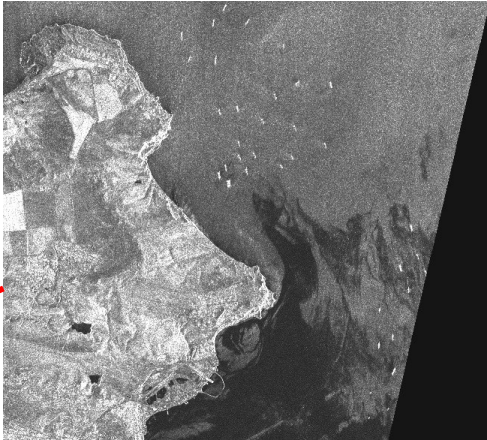
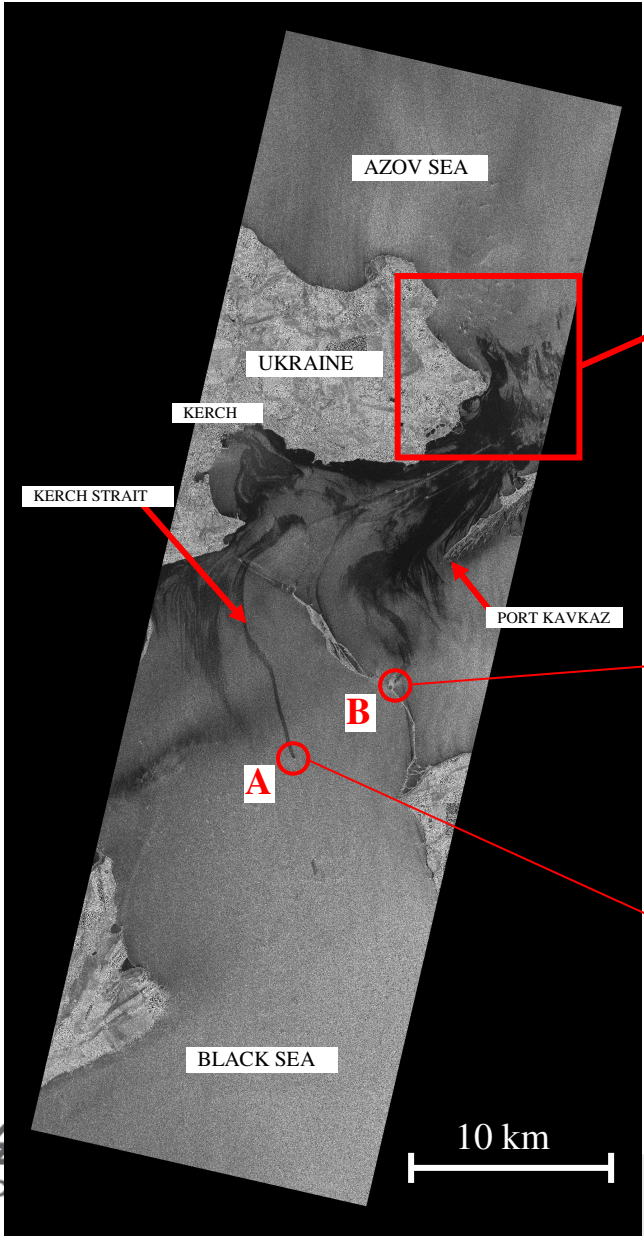
Different Tidal Situations



A.Niedermeier, D. Hoja, S. Lehner, „Topography and Morphodynamic in the German Bight Using SAR and Optical Remote Sensing Data“, *Ocean Dynamics*, 2005



Oil Spill in the Strait of Kerch



VV Pol





Conclusion and Outlook

- TerraSAR-X is a promising instrument for oceanographic applications.
- Still some work to do to adjust the existing C-band algorithms to X-band.
- The Gul of Tehuantepec it is ideally suited for remote sensing experiments, :
 1. Interesting swell conditions
 2. Unique wind conditions
 3. In situ measurements available
 4. Interesting bathymetry



Thank You for Attention !



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