Coastal Scatterometer Winds Working Group

IOVWST Meeting 2015
Portland, Oregon, USA

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if you want to be added to our email list,
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The Coastal Working Group currently has 3 sub-groups.
2 groups are developing parallel SCIENCE and APPLICATIONS examples.

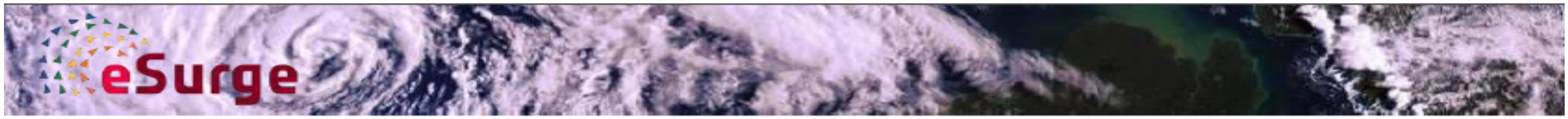
Each example indicates a need for higher Spatial and/or Temporal resolution of scat winds.

1) Strong winds within a few km of the coast
Steve Morey, Dmitry Dukhovskoy

* science questions:
  - How do wave-current-wind interactions affect storm surge? (S, T)
  - In landfalling storms, why does the wind field within ~25 km of coast sometimes increase and sometimes decrease? (S, T)

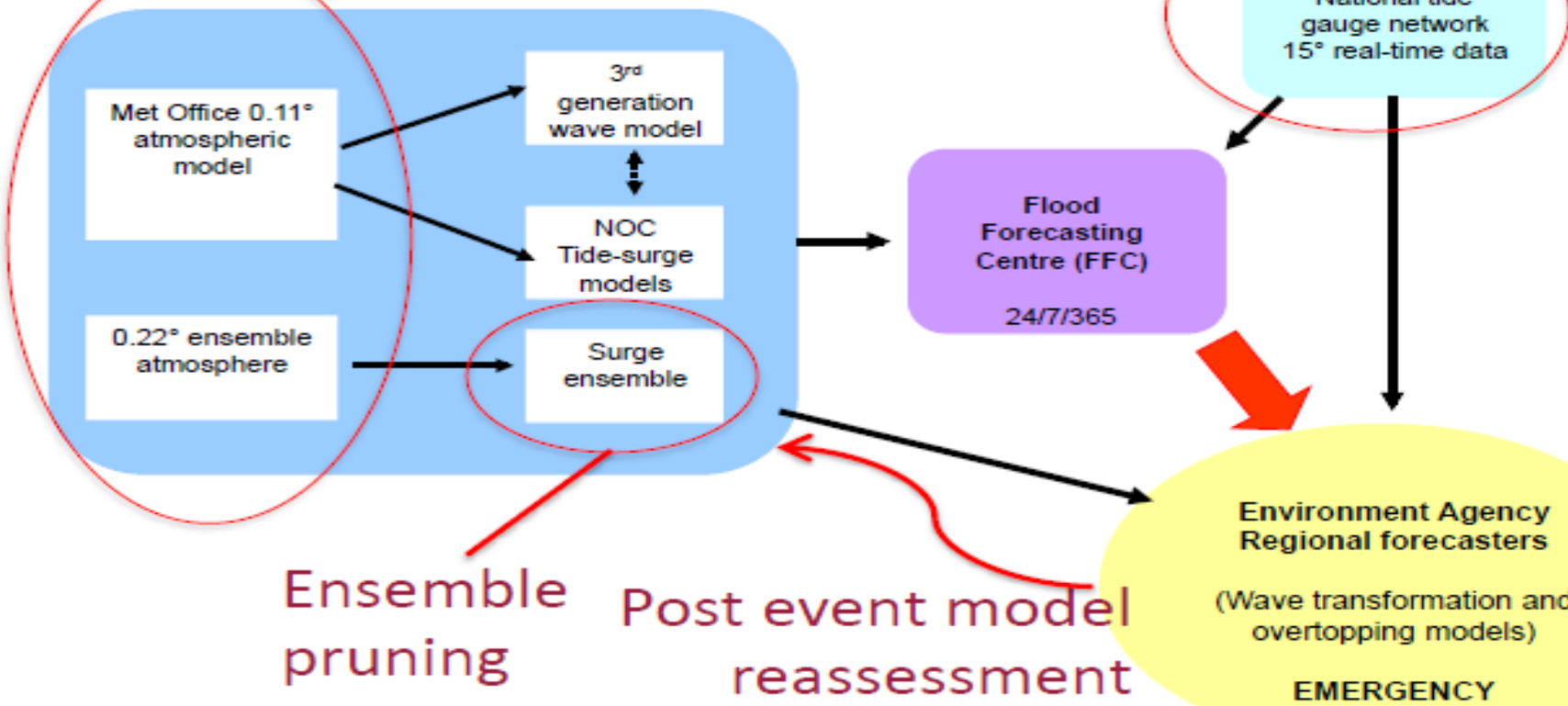
* applications:
  - Coastal flooding forecasts & timing of peak storm surge relative to high tide (T)
    [regional models need scat winds every ~90 min to avoid bias?]
  - Search and rescue (S, T)
  - Siting wind farms (S)
  - Oil spill trajectories/persistence (S, T)

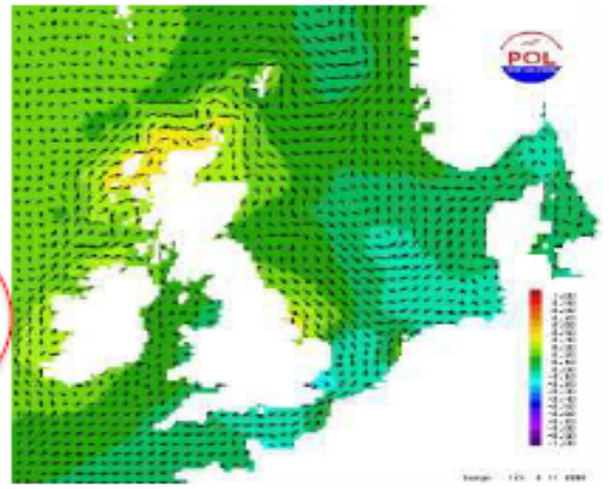
The eSurge programme incorporated scat winds and altimetry into storm surge forecasts.



Better input data (esp. wind fields)

Replace in-situ data where infrastructure is lacking





Operational demonstration service: eSurge live (linked with GDACs)

Building a database of storm surge cases

eSurge is the Storm Surge Demonstration Project
http://www.storm-surge.info/

Funded by the ESA Data User Element Programme

Koninklijk Nederlands Meteorologisch Instituut
Ministerie van Infrastructuur en Milieu

DMI Vejr, klima og hav

CGI

CMRC

National Oceanography Centre
NATURAL ENVIRONMENT RESEARCH COUNCIL

esa

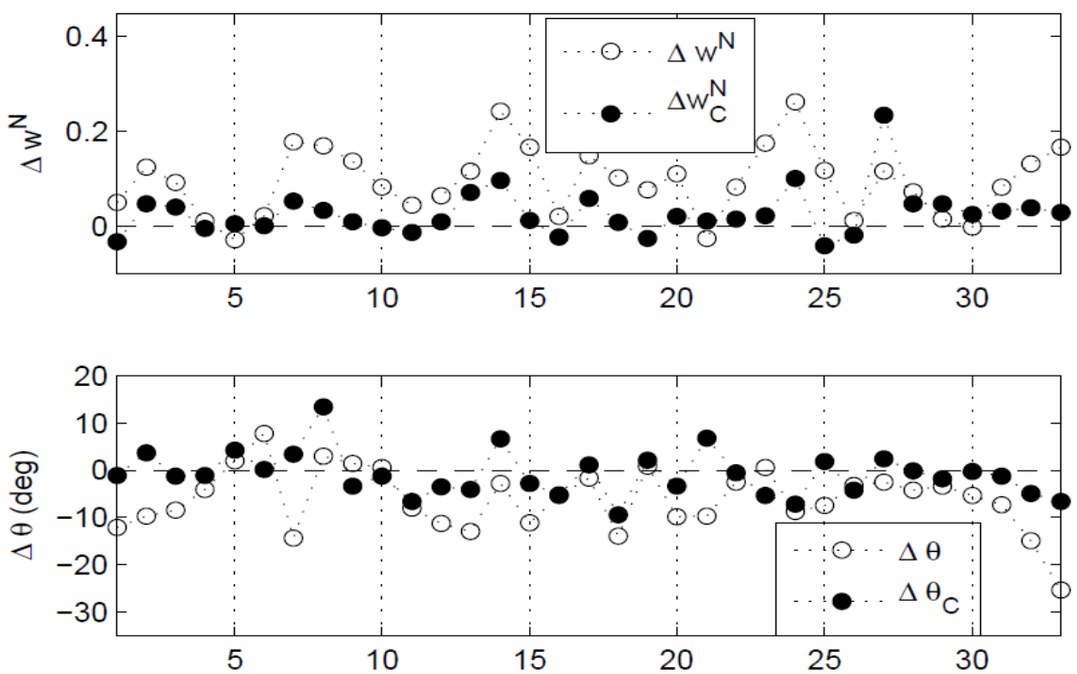
Stefano Zecchetto uses scat winds to improve storm surge forecasts for Venice.

The Data User Element (DUE) program of the European Space Agency (ESA) funded the **eSurge-Venice** project, aimed to demonstrate the improvement of the storm surge forecasting through the use of Earth Observation (EO) data and specifically focused on the Gulf of Venice (northern Adriatic Sea). **eSurge-Venice** had the following objectives:

- *Select a number of Storm Surge Events and provide the EO, in situ and model data;*
- *Provide a demonstration NRT service of EO data in support of operational and experimental forecasting and warning services;*
- *Run a number of re-analysis cases to demonstrate the usefulness of EO data.*

Scatterometer data were used to reduce the wind speed and direction biases between the modelled and observed wind fields, a technique called *wind bias mitigation*.

The figure shows the results of the method over a number of storm surge events (x-axis): the relative wind speed bias (top) and the wind direction bias (bottom) between the model and the scatterometer, before (open circles) and after (solid circles) mitigation. Overall, the relative wind speed bias is reduced from 10% to 2%, and the wind direction bias from -5 to -2 degrees. The *wind bias mitigation* brings improvements in the storm surge hindcast.

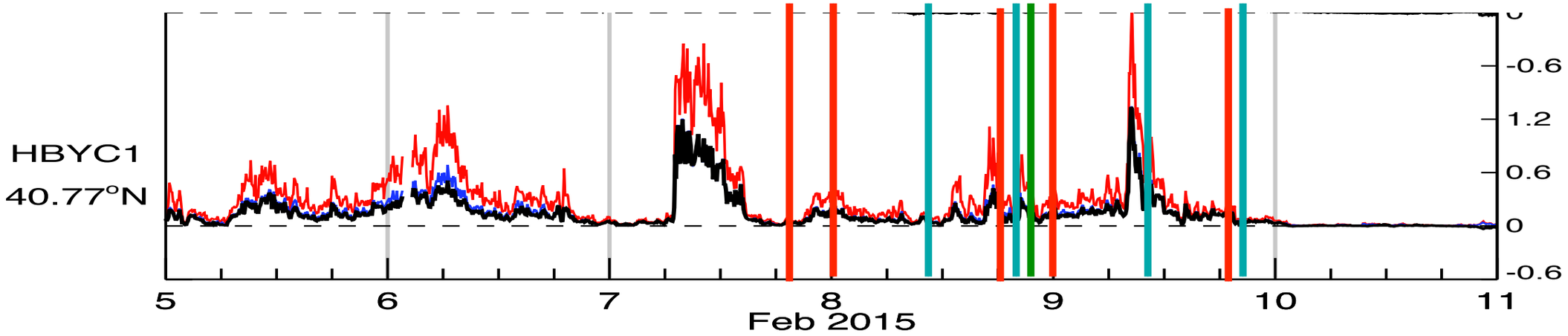


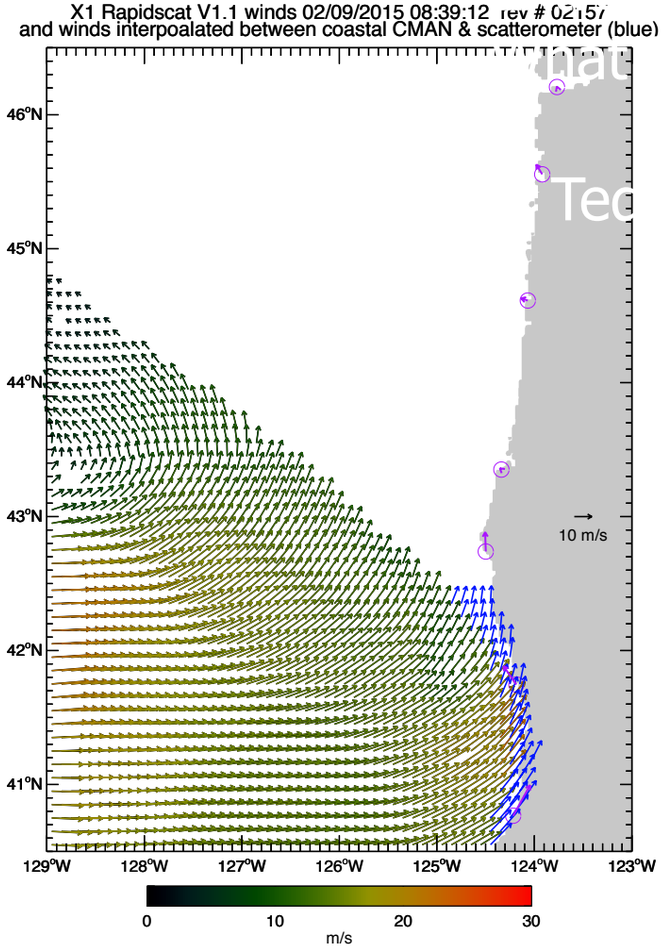
Ted Strub studies what aspects of coastal storms are (not) resolved by existing scat data.

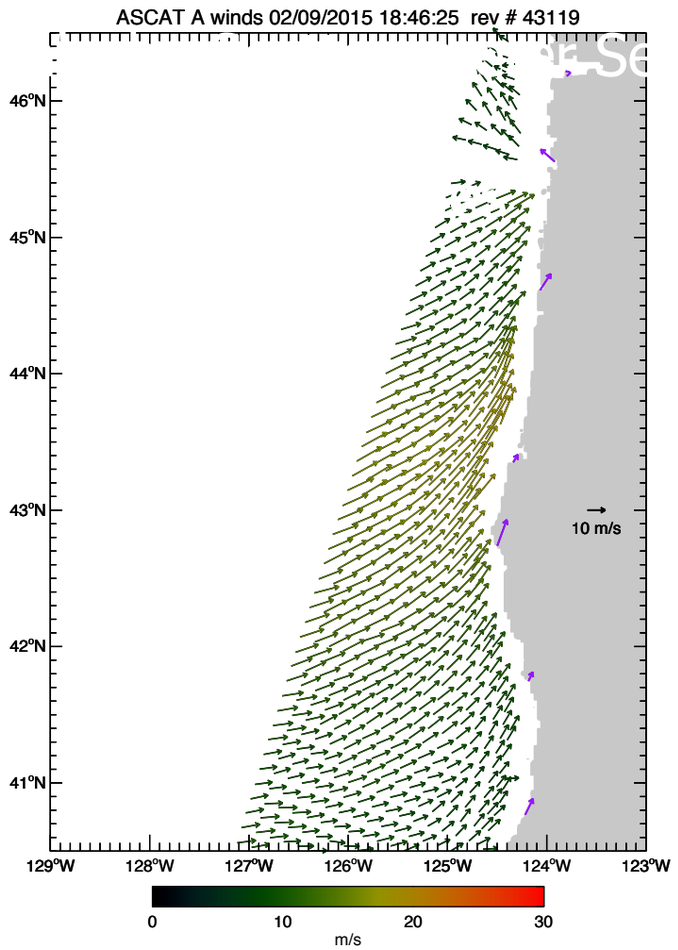
(POSTER)

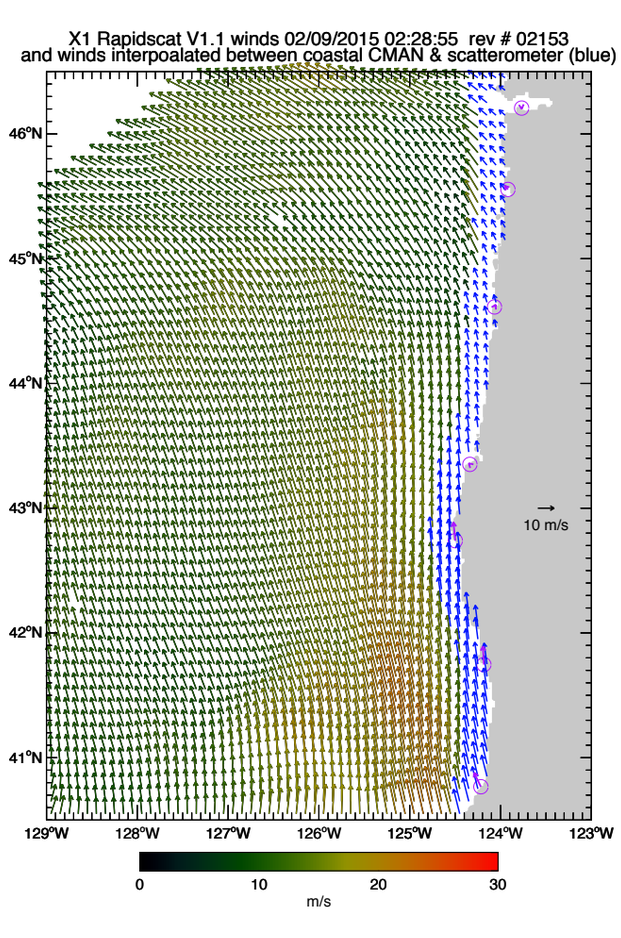
Extreme Coastal Wind Events: What the Scatterometer Does (Not) See

P. Ted Strub and Corinne James
CEOAS – Oregon State University









2) Atmosphere-ocean coupling within ~50 km of the coast

Larry O'Neill, Melanie Fewings

* science questions:

- Does SST-wind coupling in coastal upwelling regions enhance or suppress upwelling and relaxation events? (S, T)
- In wind features tied to orography, how does the SST-wind coupling differ from the 1-way coupling assumed in the open ocean? (S, T)
- Does SST-wind-current coupling at submesoscale features like fronts and filaments lead to enhanced upwelling on small scales? (S, T) *[models are ahead of observations]*
- In productive island wakes, is upwelling due more to wind wake or oceanic wake? (S, T)

* applications:

- Fish catch enhanced at fronts (S)
- Hypoxia and fish die-offs in upwelling systems (S, T)
- Nutrient supply to fisheries via submesoscale features (S, T)

Talks in this session:

Fabien Desbiolles - Impact of fine-scale wind stress curl on coastal upwelling (Benguela)

other possibilities:

Polar lows (not coastal)

Sea ice

A 3rd sub-group pursues the production and use of coastal scat products with global coverage.

3) Methods for improving Scat resolution near coast

Julia Figa-Saldaña, Bryan Stiles

* Methods for producing "coastal" products from existing missions:
  - Coastal ASCAT (Eumetsat/OSI-SAF) (S)
  - NOAA coastal products (S)
  - Stiles et al. QuikSCAT/OSCAT/ASCAT product in progress (S)

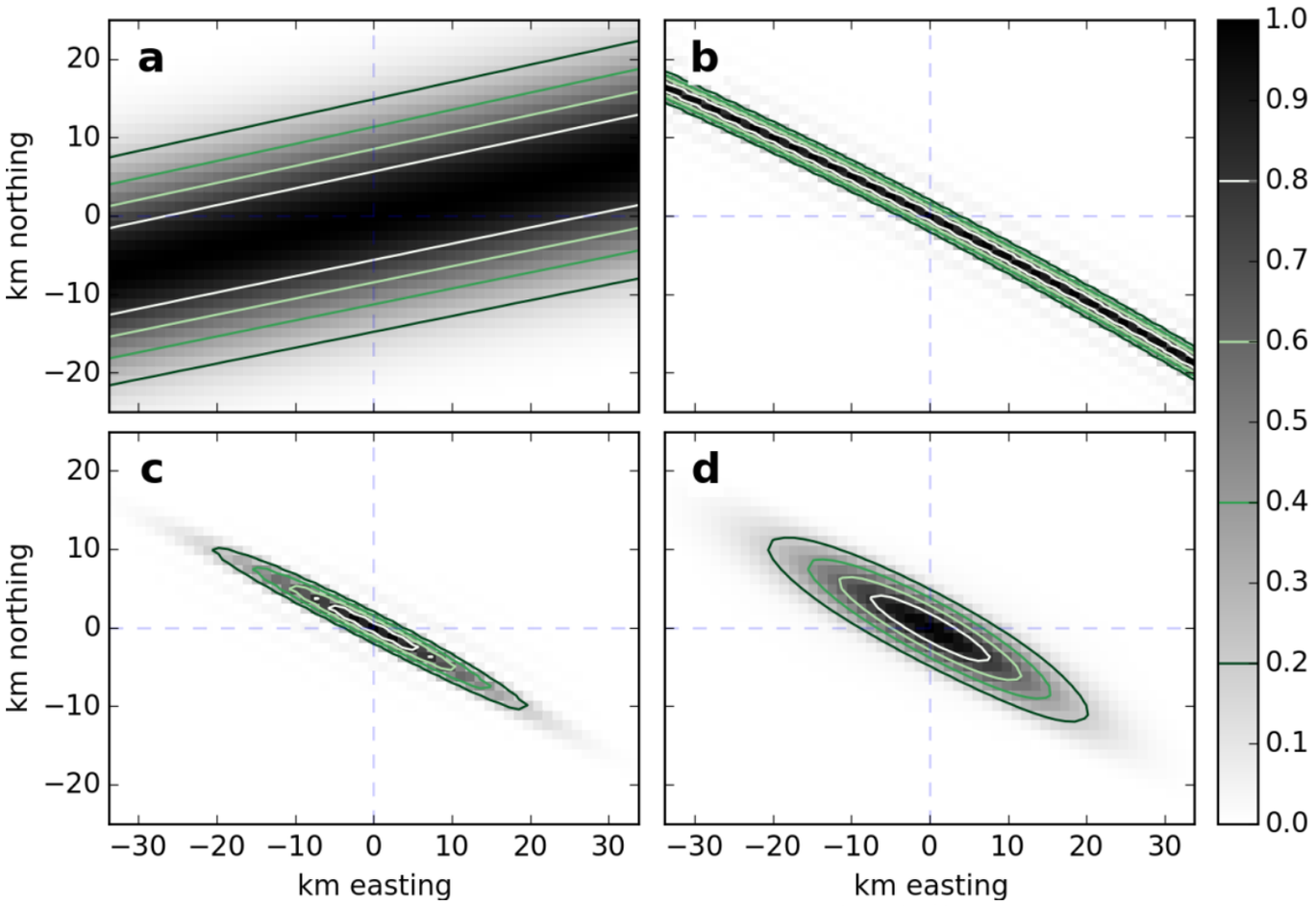
* How should "coastal" products be validated?
  Need global product so many users can validate it regionally against buoys, land winds, etc.

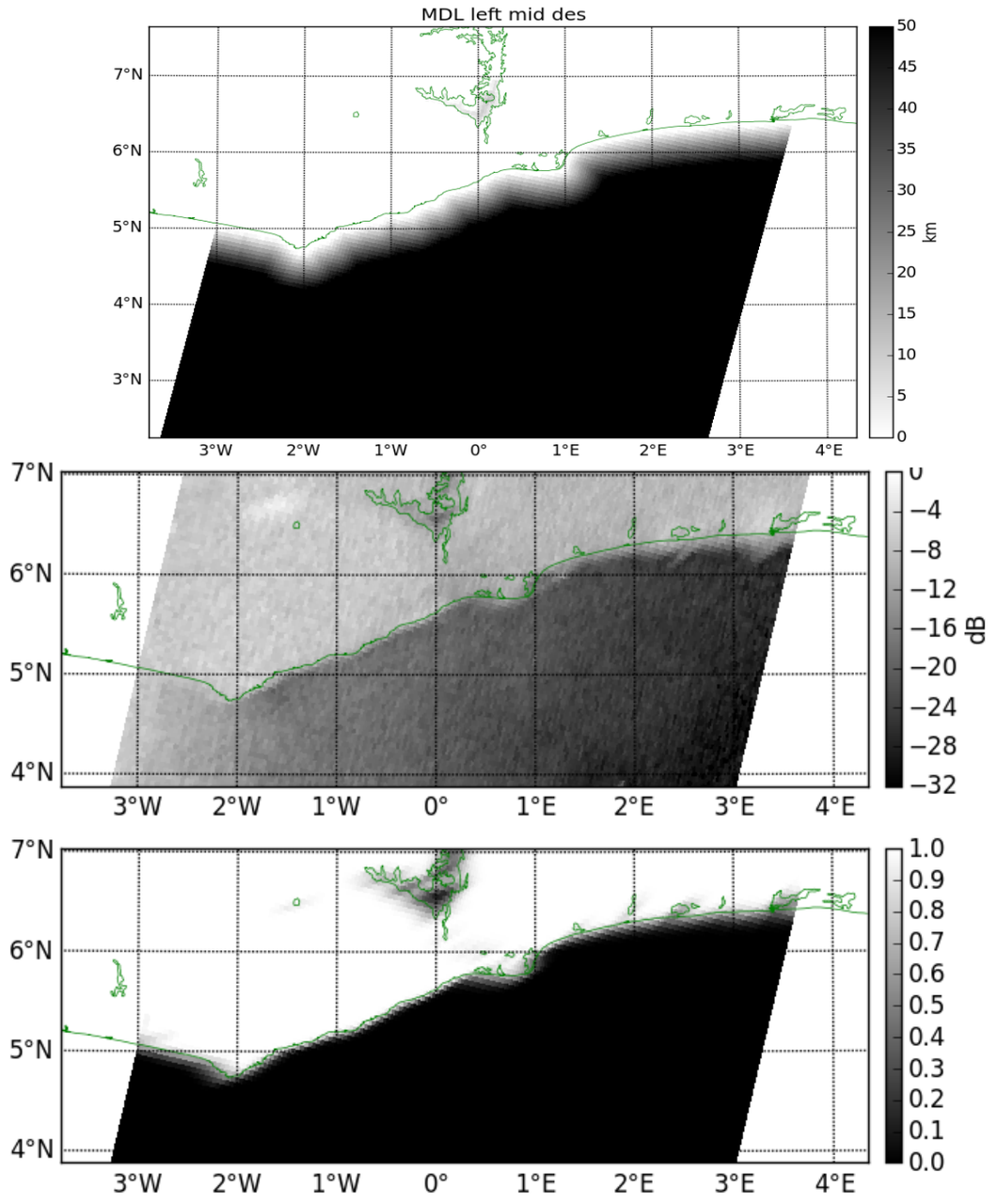
* Future missions:
  - Advocate for little/no on-board aggregation to permit high-resolution reprocessing (S)

Talks in this session:
Ad Stoffelen - Highlights of the ASCAT high-resolution processing workshop
Alex Fore - Bringing winds closer to the coast with QuikSCAT and RapidSCAT

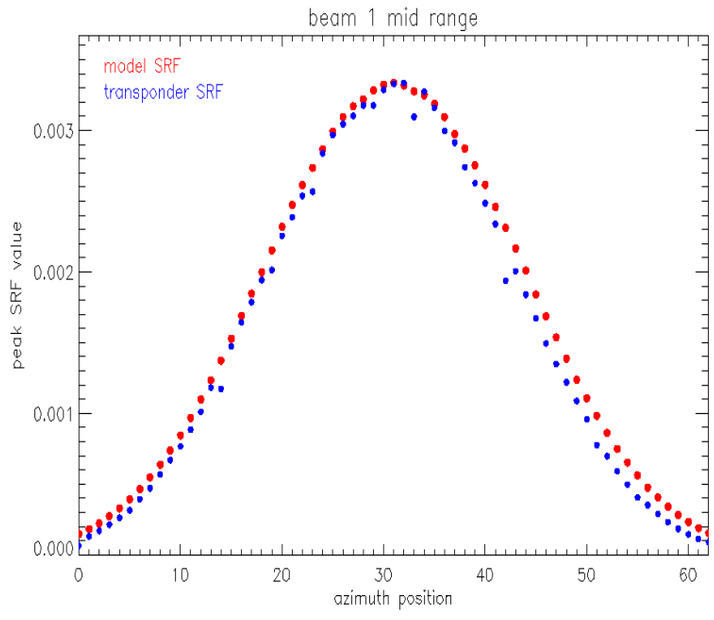
Richard Lindsley, Craig Anderson, David Long, Julia Figa Saldaña, Ad Stoffelen

Progress in the modelling and validation of the ASCAT Spatial Response Function and land flag





Lindsley & Anderson 2015:
A Parameterized ASCAT Measurement Spatial Response Function
(in preparation)

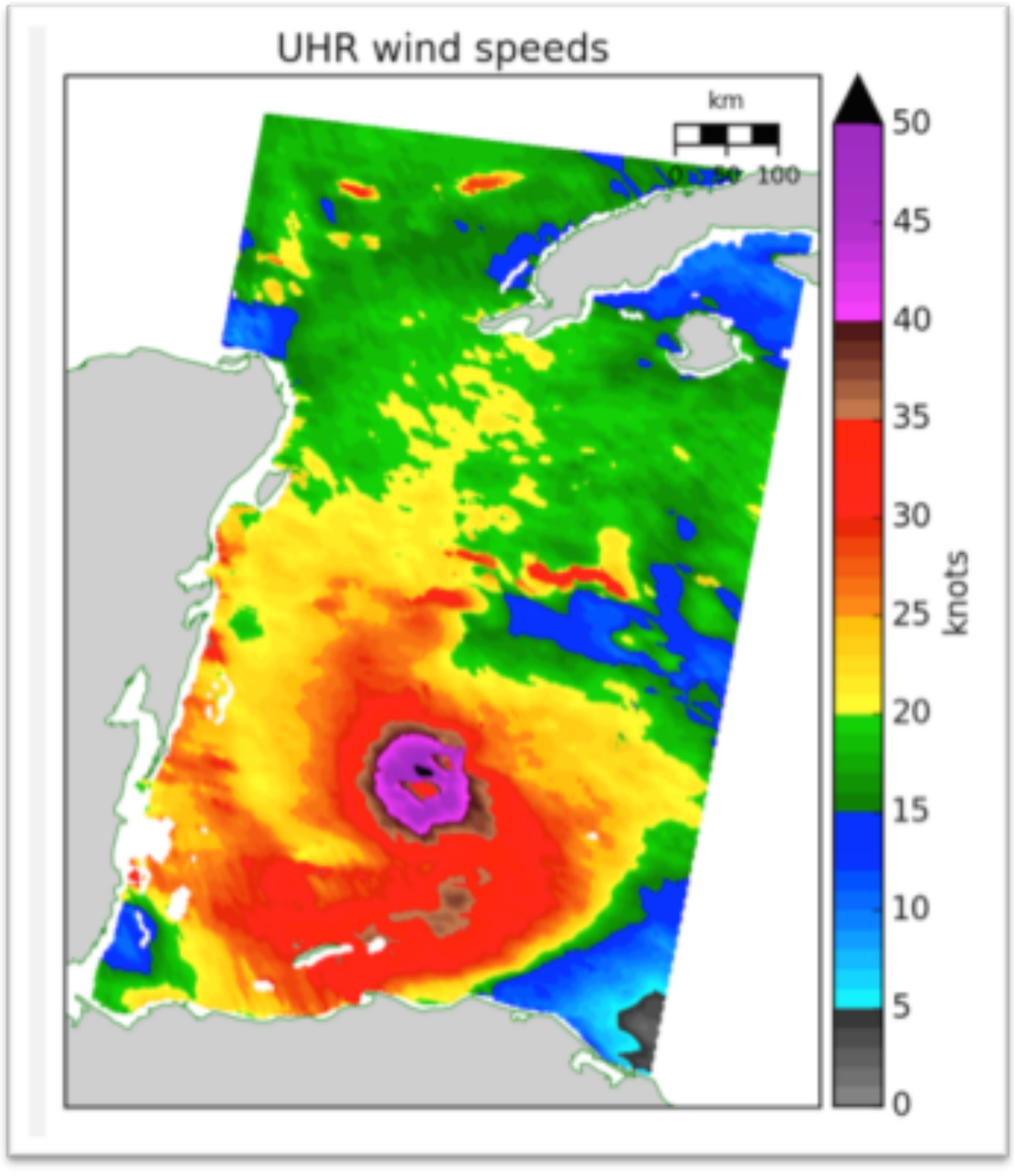


See for more details in this session:
✓*Lindsley&Anderson poster*
✓*Stoffelen&Figa Saldana presentation*

Richard Lindsley and David Long parameterize the ASCAT spatial response function, use "land fraction" to assess contamination, and retrieve wind within few km of the coast.

ASCAT Near-Coastal Wind Retrieval with Land Fraction Thresholding

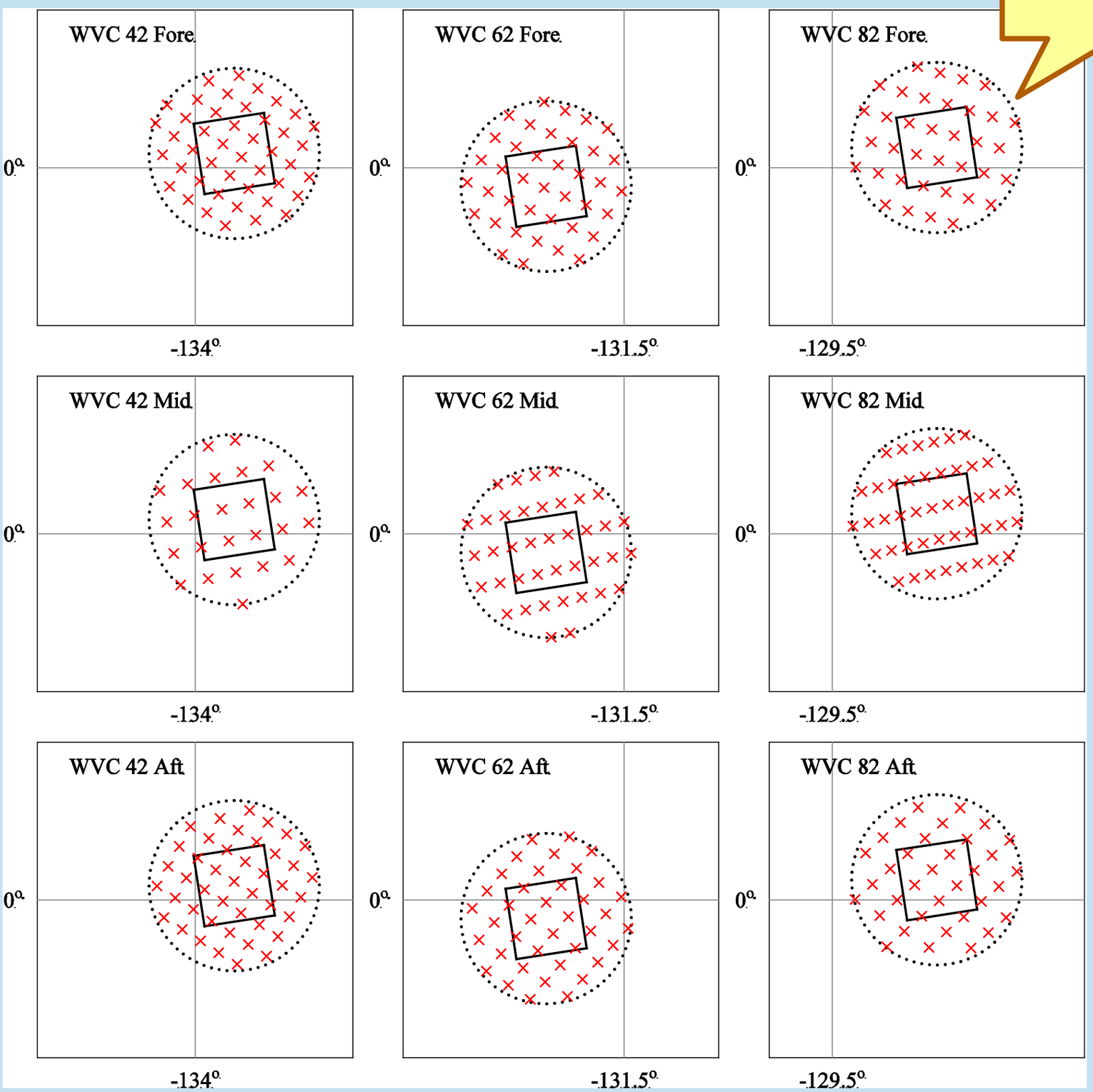
- Near-coastal backscatter measurements can be contaminated by land resulting poor winds
- Land fraction approach used to discard land-contaminated backscatter measurements
- Dynamic land fraction threshold selected based on local conditions to control for maximum tolerable wind error
- Permits retrieval of near-coastal winds within a few kilometers of the coast, better with UHR



Jur Vogelzang and Ad Stoffelen

NWP SAF
Numerical Weather Prediction

ASCAT product improvements



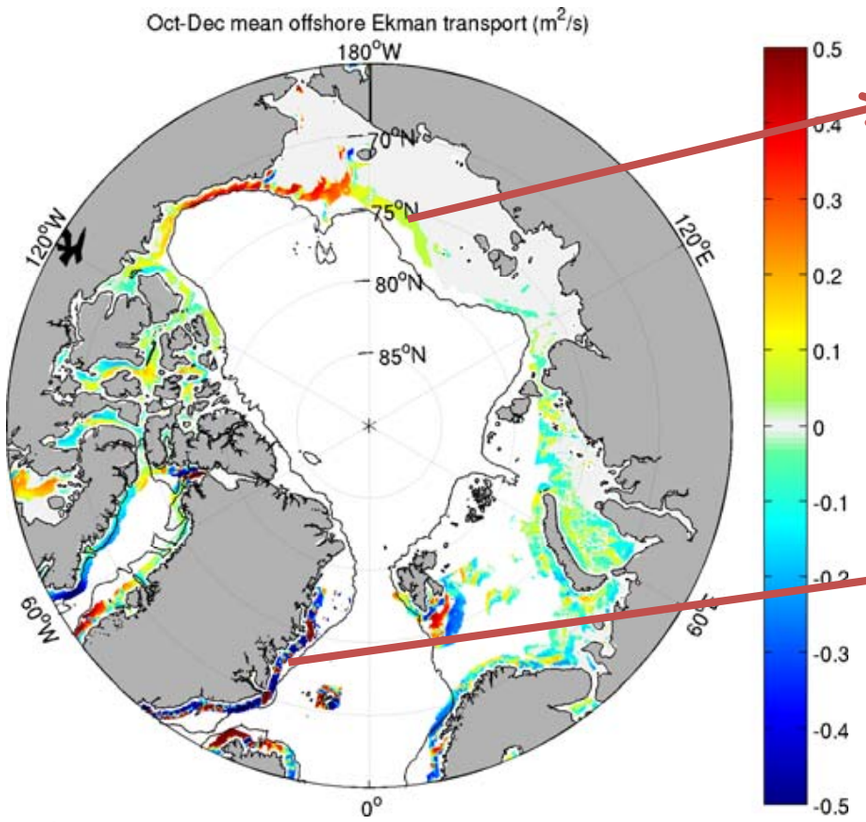
Jur Vogelzang
Ad Stoffelen
KNMI

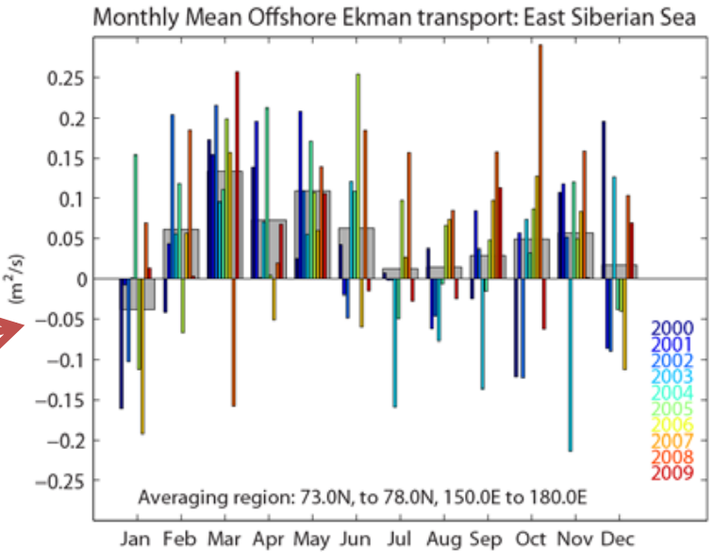
- Figure shows centers of antenna footprints (red crosses) contributing to WVC (black squares) in ASCAT-coastal
- Low density in mid beam at small incidence
- Define more optimal WVC's w.r.t. footprints

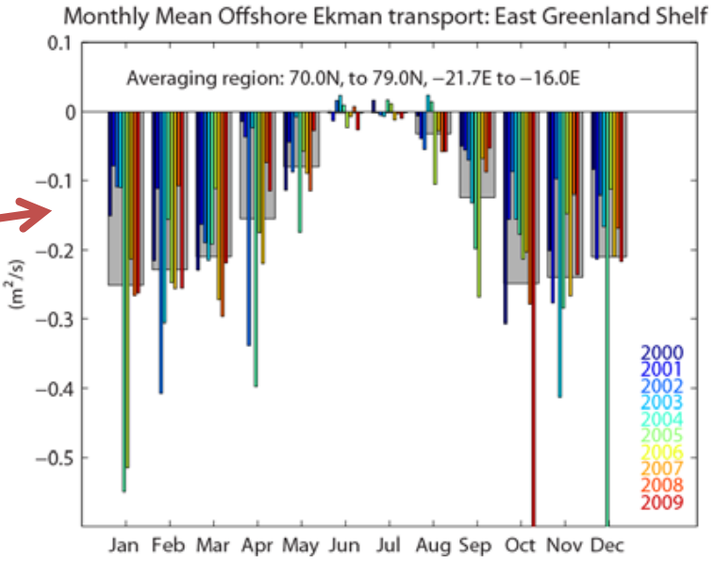
Steve Morey combines scat wind & numerical model in a global index of coastal upwelling

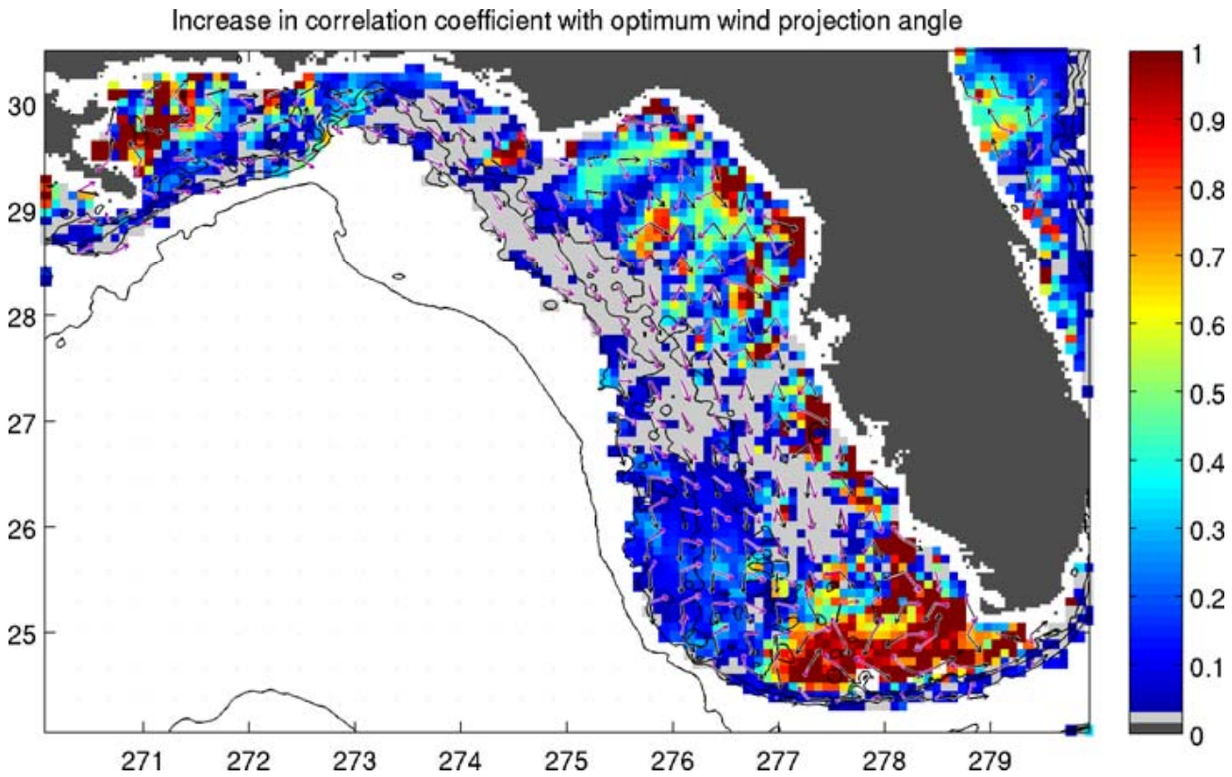
An Improved Scatterometer-Derived Global Coastal Upwelling Index Database - Steve Morey (FSU)

Global scatterometer-derived wind products are used to produce a database of upwelling indices for all coastal regions. This database is analyzed to characterize spatial and temporal variability of upwelling in different regions.







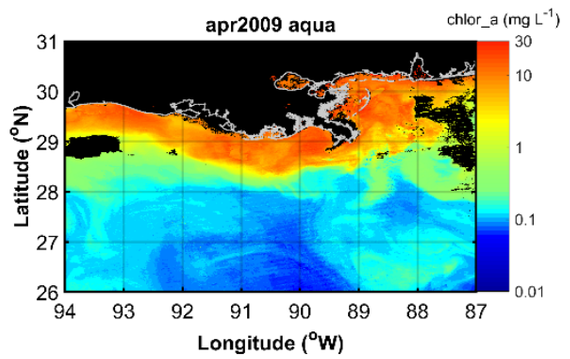


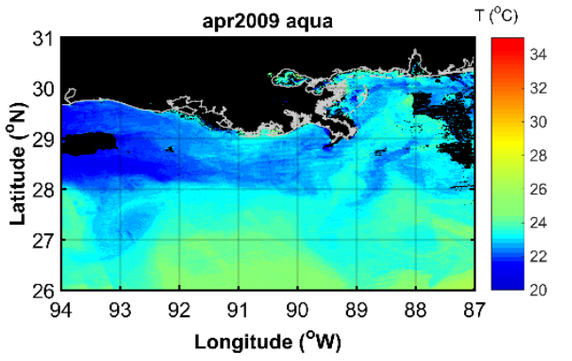
Numerical model results are analyzed to develop a modified method of computing upwelling indices that improves the relationship between the index and cross-isobath upwelling in coastal regions with complex topography. This image shows an example of the improvement in correlation between upwelling index and near-bottom cross-isobath flow when using the modified index versus the classic upwelling index calculation.

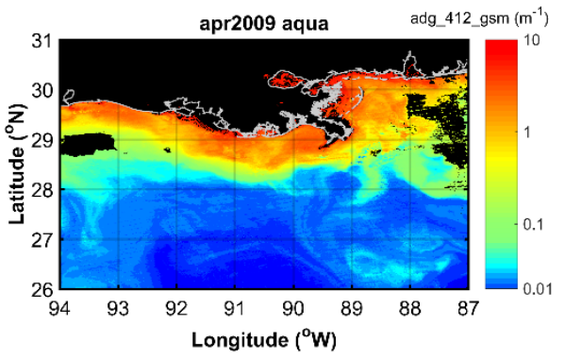
Steven Lohrenz (UMassD) and collaborators: Using satellite winds to estimate air-sea CO_2 flux. Wind availability is a limiting factor in coastal regions, where pCO_2 variation is naturally high.

Example for April 2009

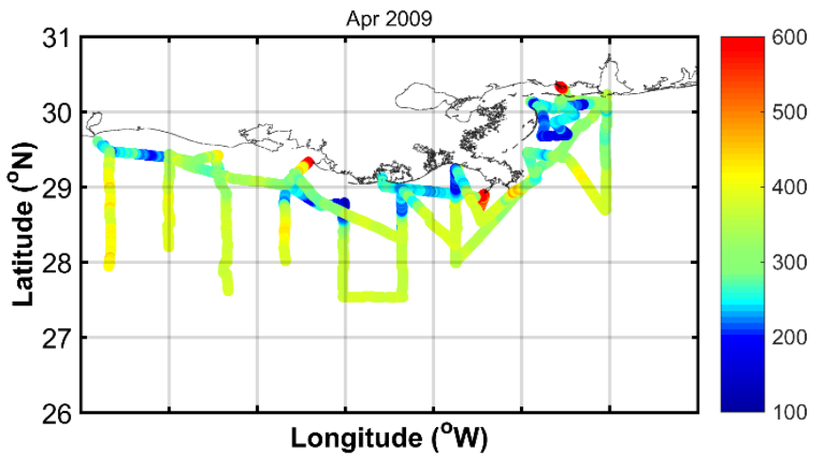
Satellite derived SST, chl, and adg





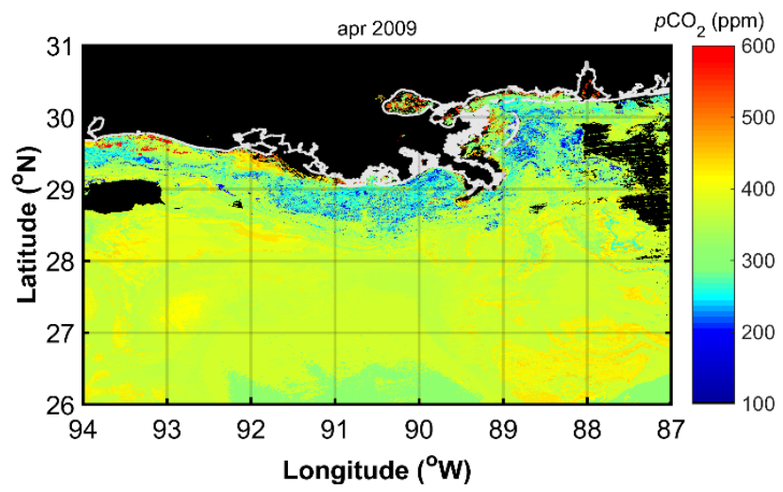


Ship-based pCO_2



Regression tree analysis

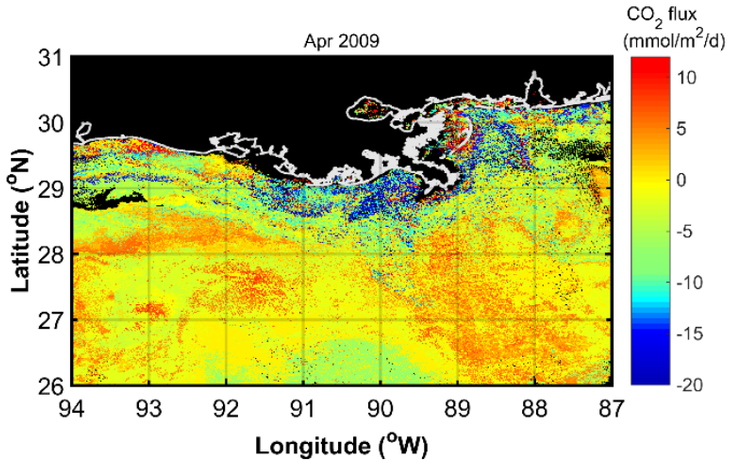
Satellite-derived pCO_2



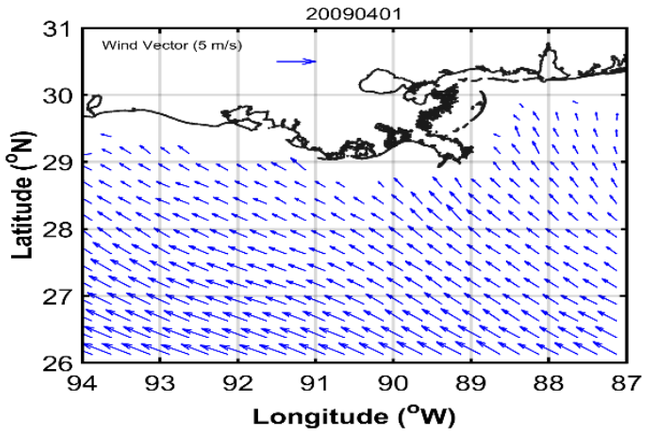
CCMP winds

$F = k\ s\ \Delta pCO_2$

Gas transfer parameterization



Satellite derived air-sea CO_2 flux



Satellite winds

Coastal Scatterometry Working Group

Discussion suggestions:

1) Goals: come up with
   - "good stories" in anecdotal form rather than science form
   - (multi-platform) climate applications in coastal regions

2) Future collaborative projects

3) Problems that need to be addressed