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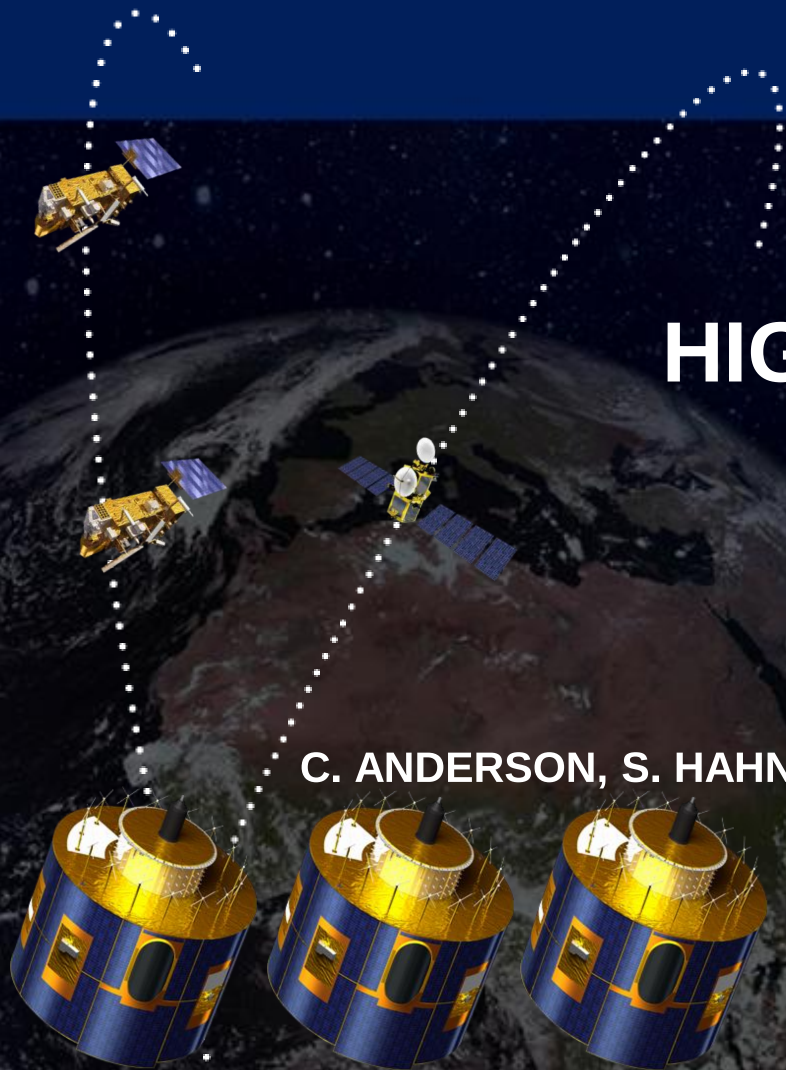
REPORT ON THE 2014 ASCAT HIGH-RESOLUTION PROCESSING WORKSHOP

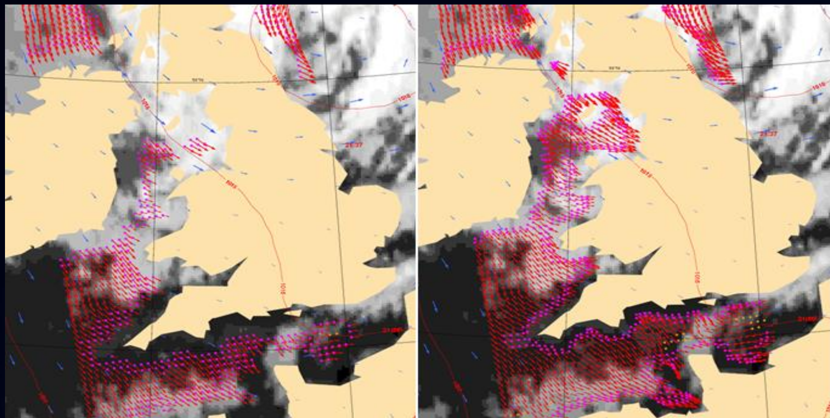


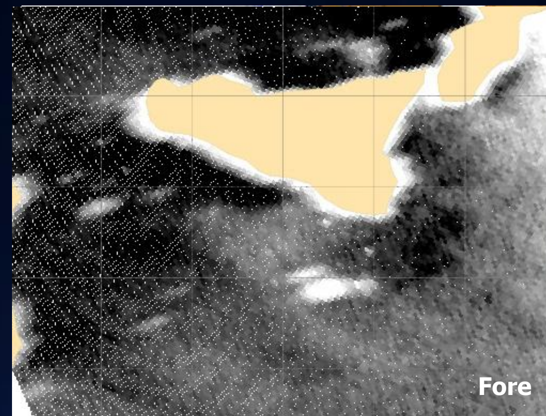
A. STOFFELEN, J.FIGA-SALDANA,

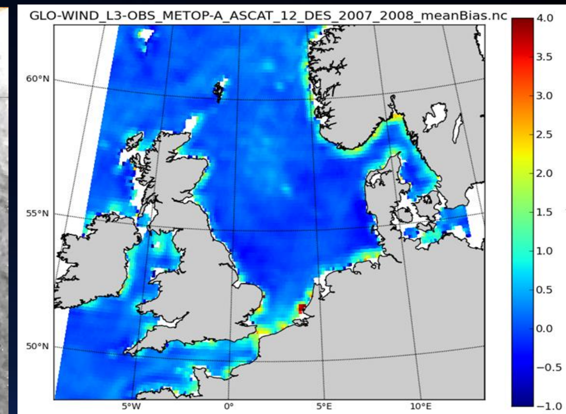
C. ANDERSON, S. HAHN, M. HIGGINS, D. LIN, [illegible]. LINDSLEY, S. SOISUVAN, F. TICCONI,

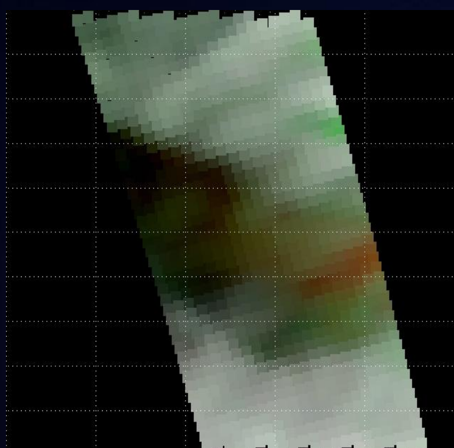
J. VOGELZANG, J.W. WILSON

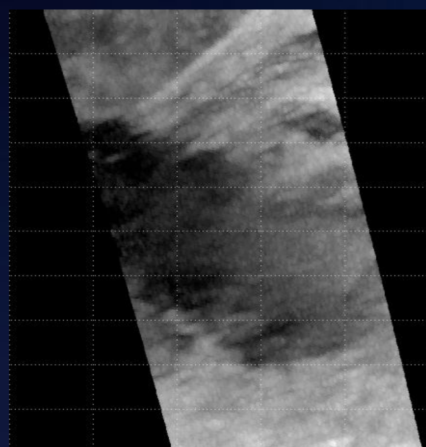
Background











- How to appropriately handle the high resolution content in the ASCAT data, what are the scales of that high resolution and how are those transferred during the processing

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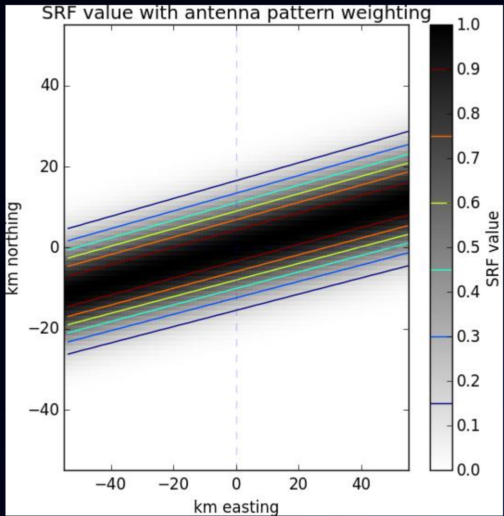
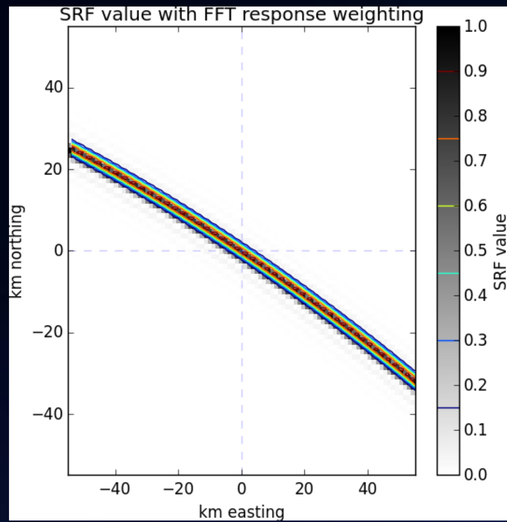
Issues

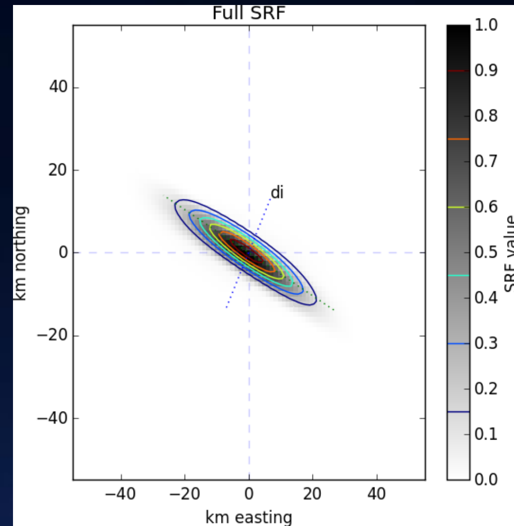
- Size, shape and orientation of the ASCAT full resolution measurements footprint
- The estimation of Kp and its validation
- Geophysical noise vs. instrument noise
- Spatial sampling windows and resolution
- Land fraction and measurement noise in the full resolution data
- Effect and handling of corner reflectors

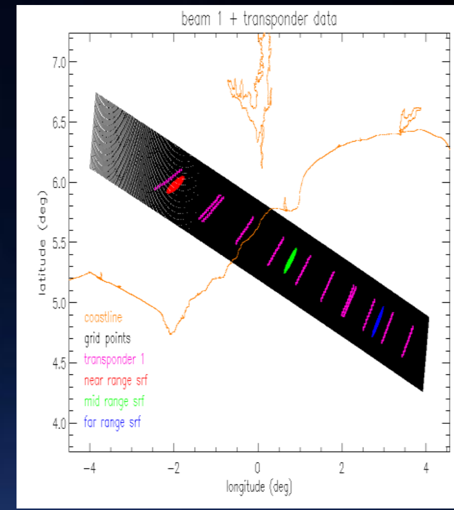
Workshop: Held Nov 17th, 2014 in Darmstadt, Germany

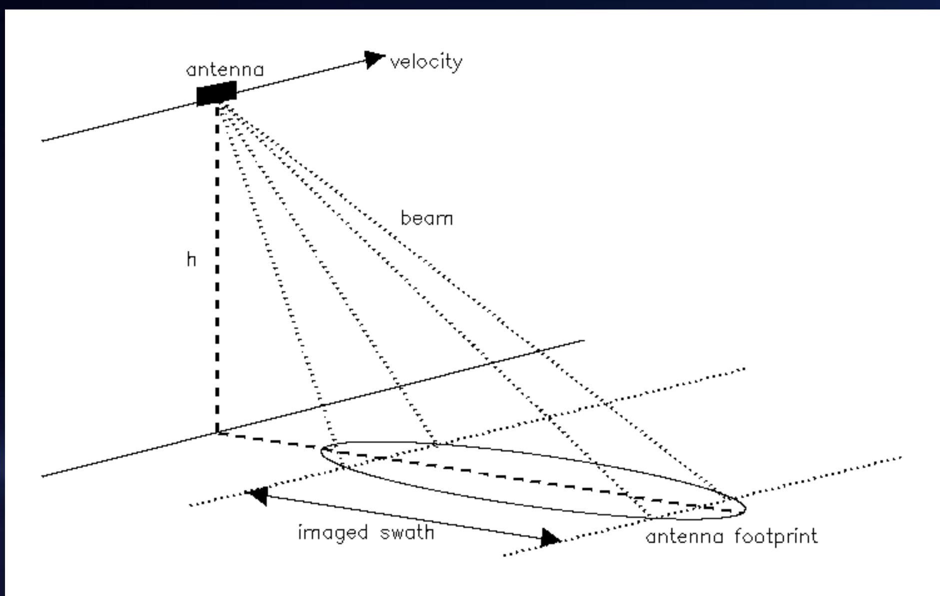
Estimation and validation of the ASCAT SRF

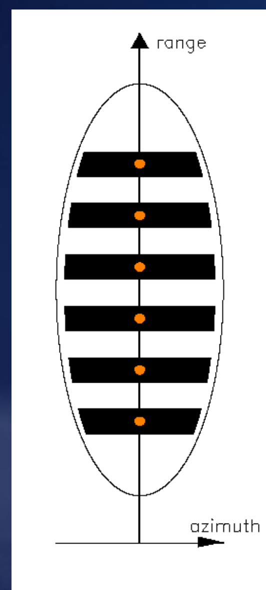












ASCAT Spatial Response Function (SRF) modelled and validated with actual data, also with transponder point target responses

(R. Lindsley/C. Anderson)

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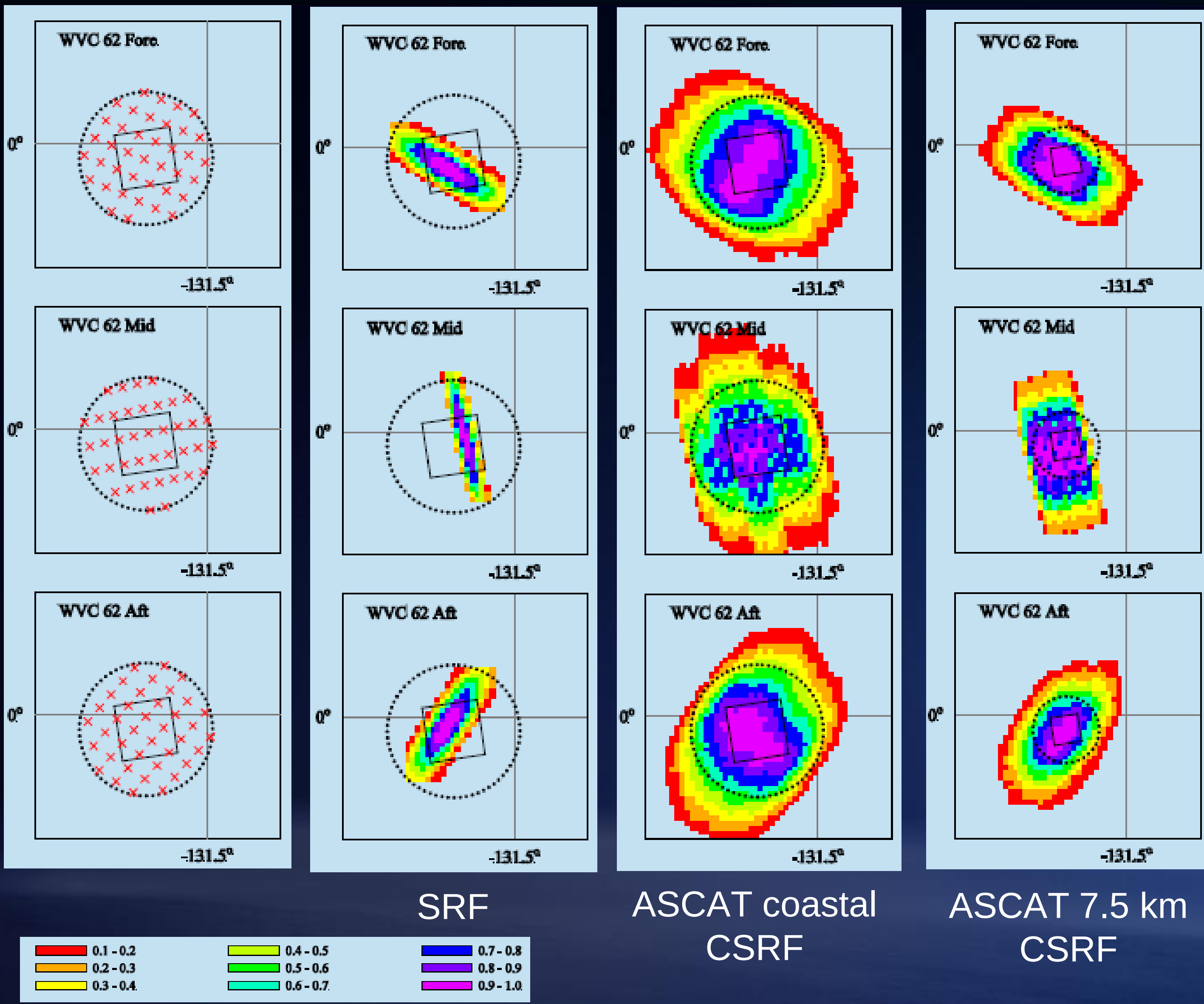
SRF and Cumulative Spatial Response Function



Optimum averaging radius: 7.5 km seems OK, but may depend on application

Varying averaging radius over the swath?

Ellipse rather than circle to match CSRF for fore, mid and aft?

How to control coastal CSRF?

(J. Vogelzang)

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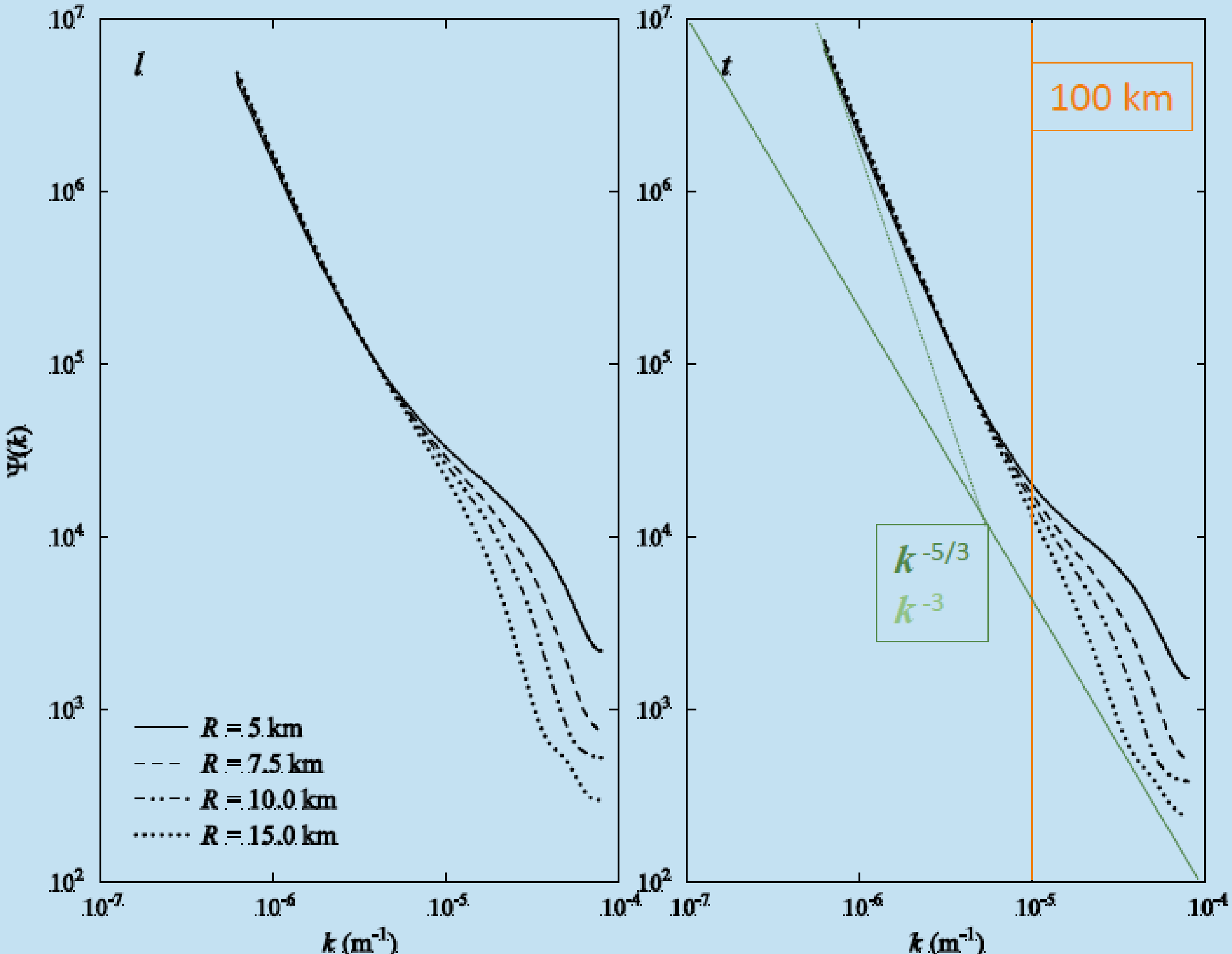
High resolution winds – CSRF effects?

Statistical analysis - spectra



What is going on at small scales?

Effects above 1/100km for all R

Bump at 1/50km for small

Larger deviation from $k^{-5/3}$ for larger R

Differences for l and t in filtering shapes; l has generally more large-scale gradient

(J. Vogelzang)

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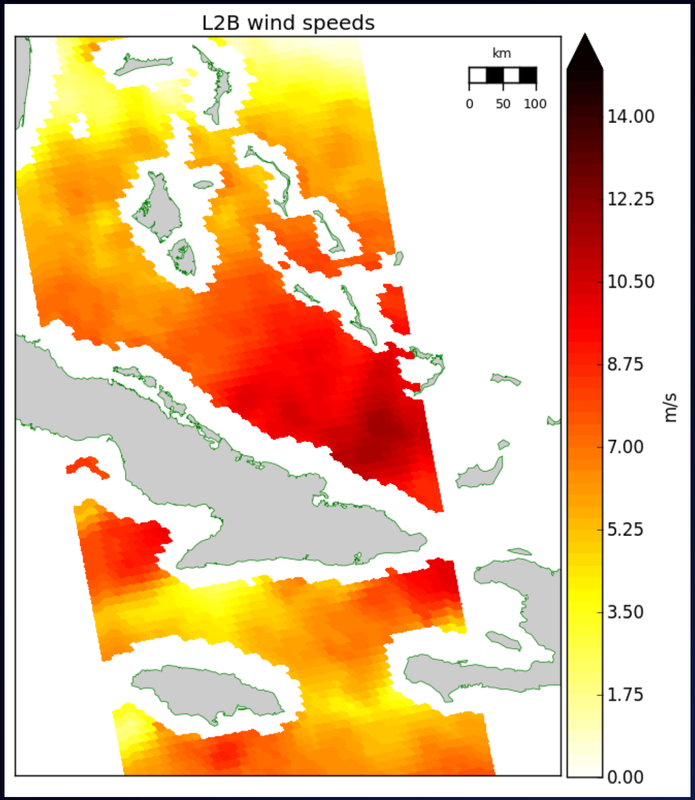
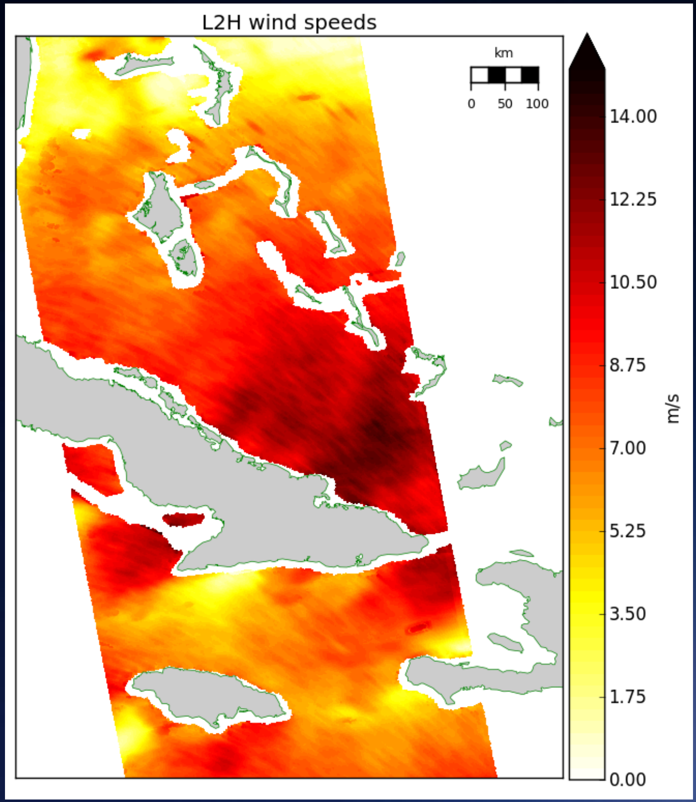
High resolution winds and coastal masking



Nominal winds



Winds using LCR < -20 dB

(R. Lindsley)

Next step: dynamically chosen Land Contamination Ratio (LCR) threshold

$$\mathrm{LCR} \triangleq \frac{\iint_{\mathrm{land}} h_i(x,y)\,dx\,dy}{\iint_{\mathrm{SRF}} h_i(x,y)\,dx\,dy} \approx \boxed{\frac{\sum_{x,y} L[x,y]h_i[x,y]}{\sum_{x,y} h_i[x,y]}}$$

land	$\mathrm{LCR} = 1$
ocean	$\mathrm{LCR} = 0$
mixture	$0 < \mathrm{LCR} < 1$

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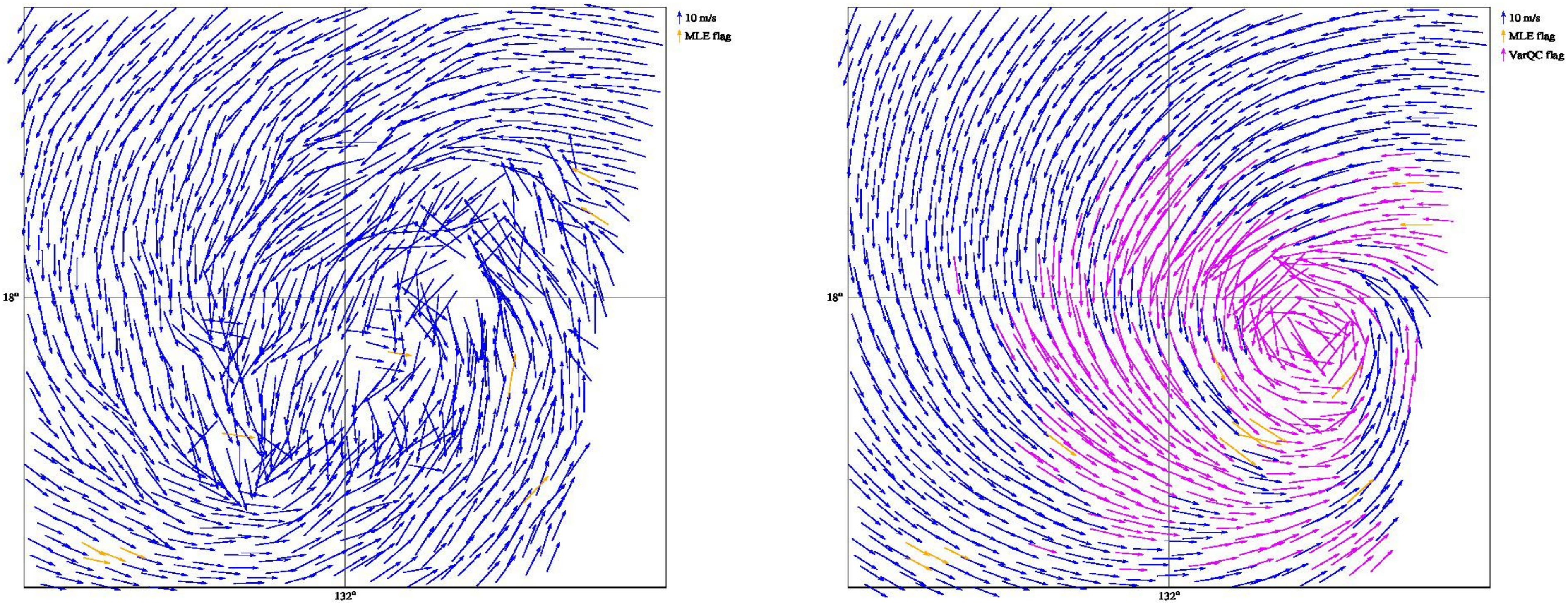
High resolution winds – handling extreme winds



Variational ambiguity removal
(2 solutions)

(J. Vogelzang)

Variational ambiguity removal
(multiple solutions)
Wind speed up to 50 m/s

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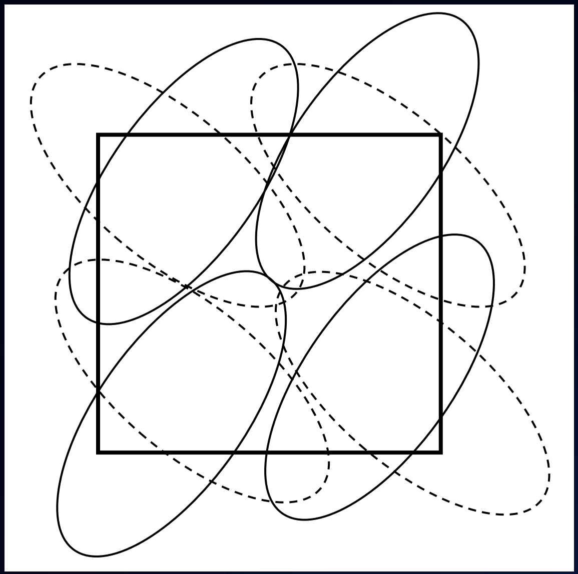
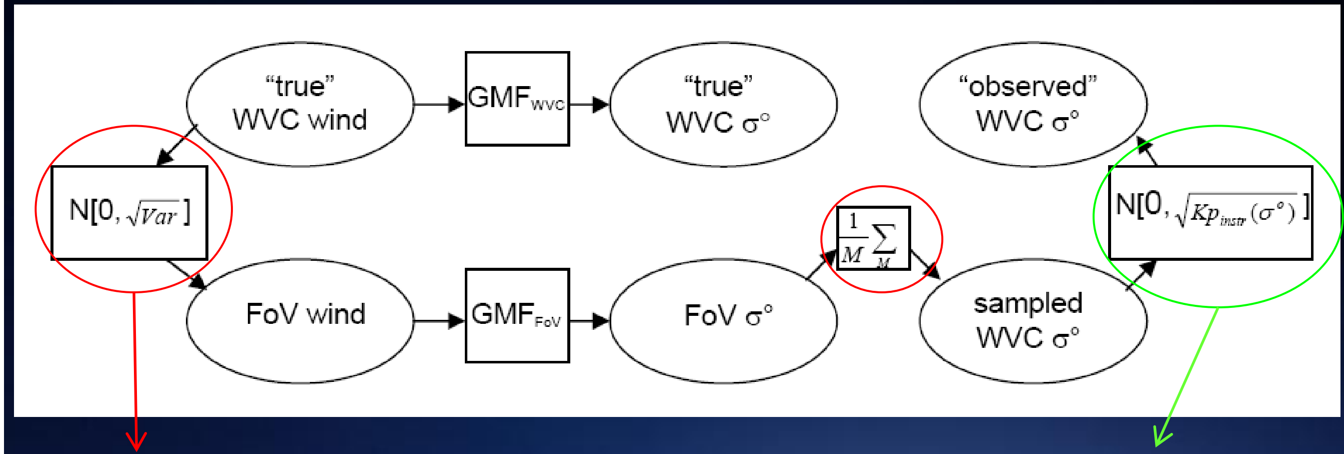
Measurement uncertainty – model of geophysical noise

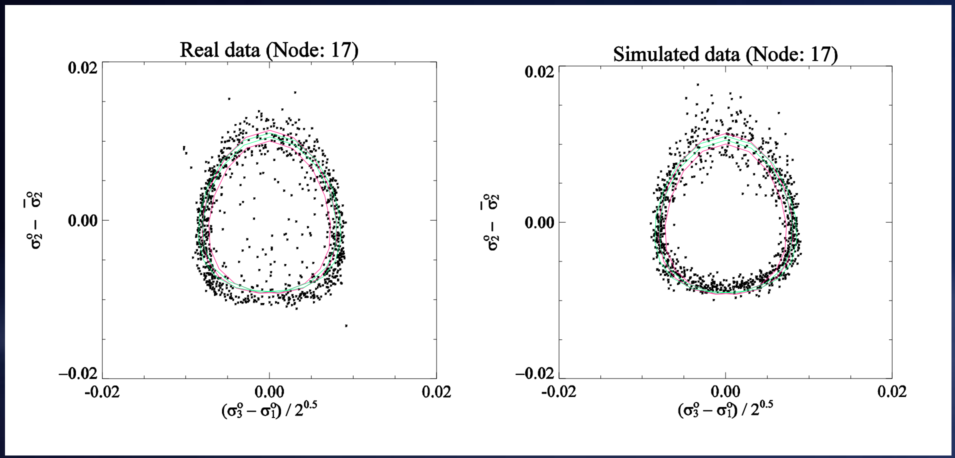


Simulation



Inter-beam noise

Intra-beam noise

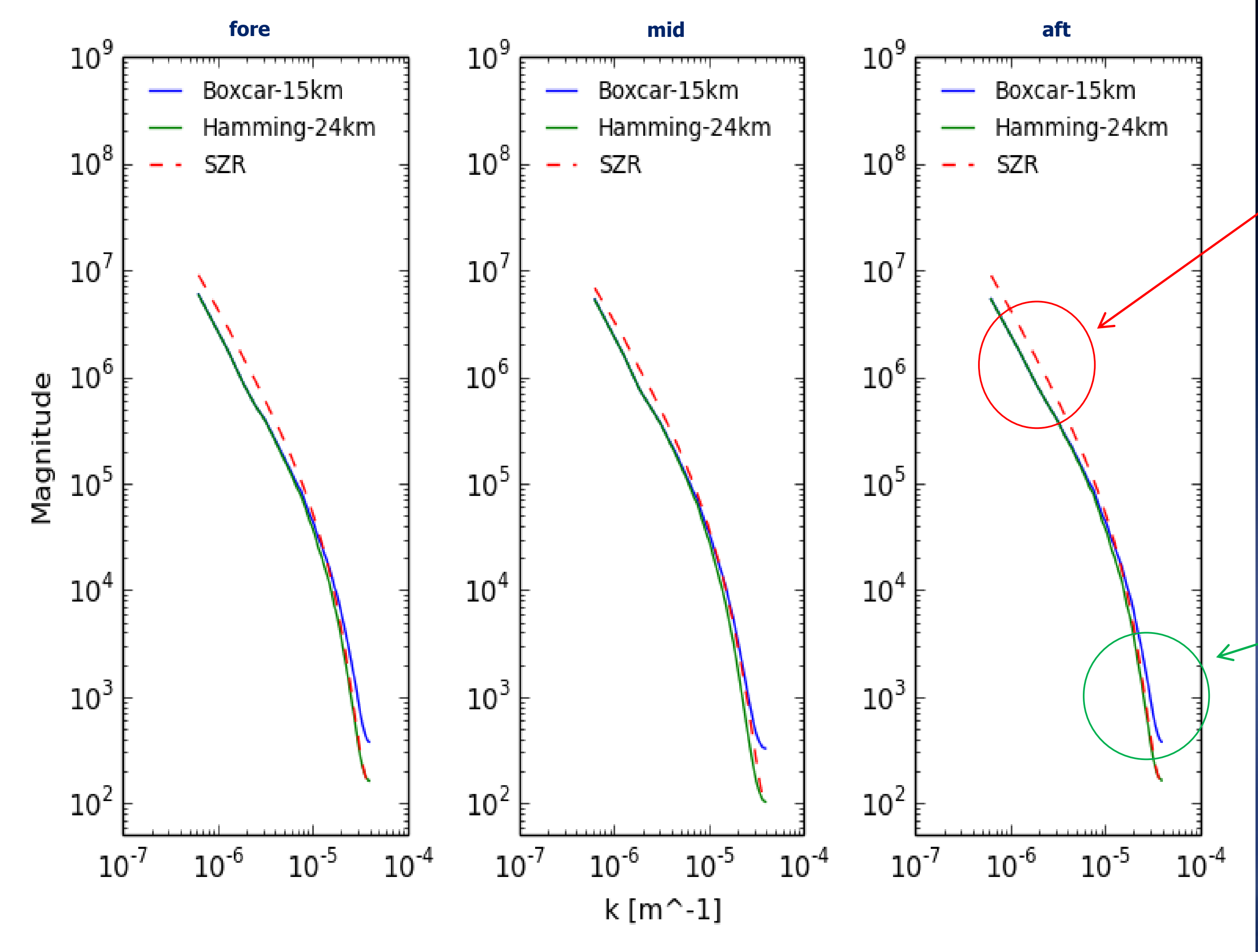


Optimal combination:

M = 8; $\sqrt{Var}$ = 0.55 m/s

(W. Lin & M. Portabella)

NRCS spectra over land



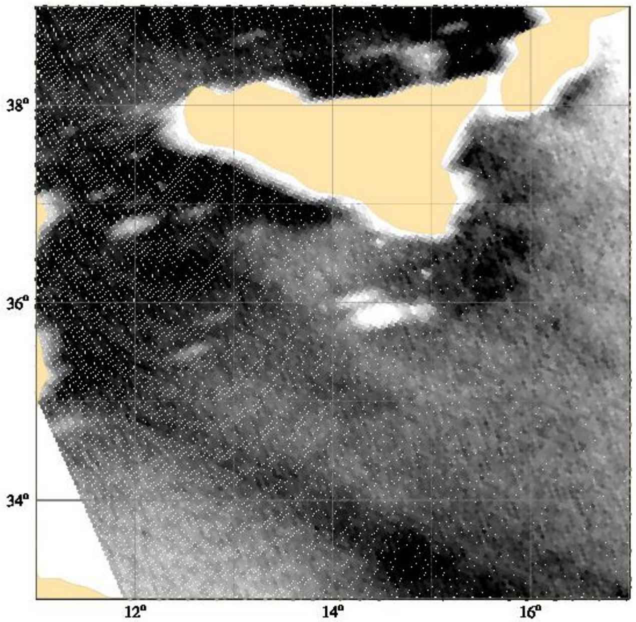
At higher spatial scales, behaviour determined by footprint of spatial averaging window (2D or square, v.s. Circular

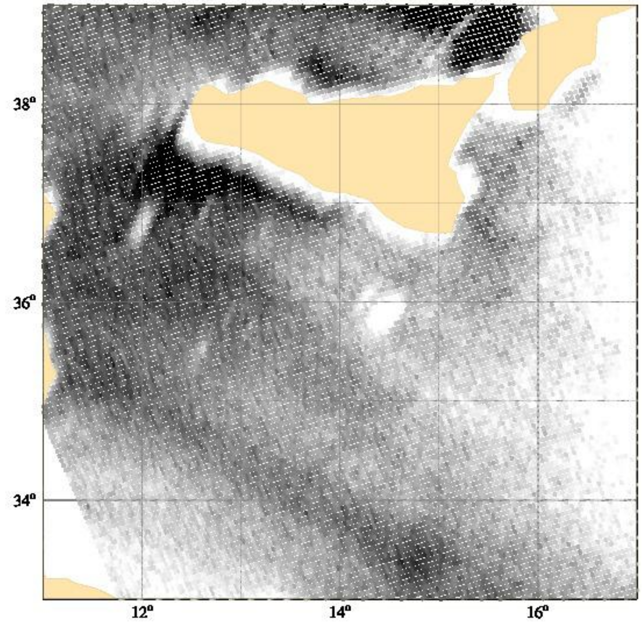
At lower spatial scales, the behaviour is determined by weighting of spatial averaging window (Hamming v.s. Box-car)

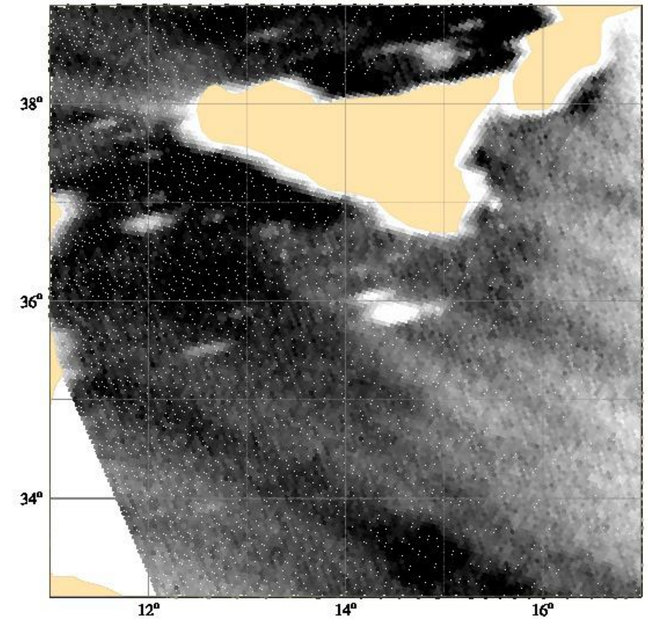
(S.Hahn)

Point scatterers

(J. Vogelzang)

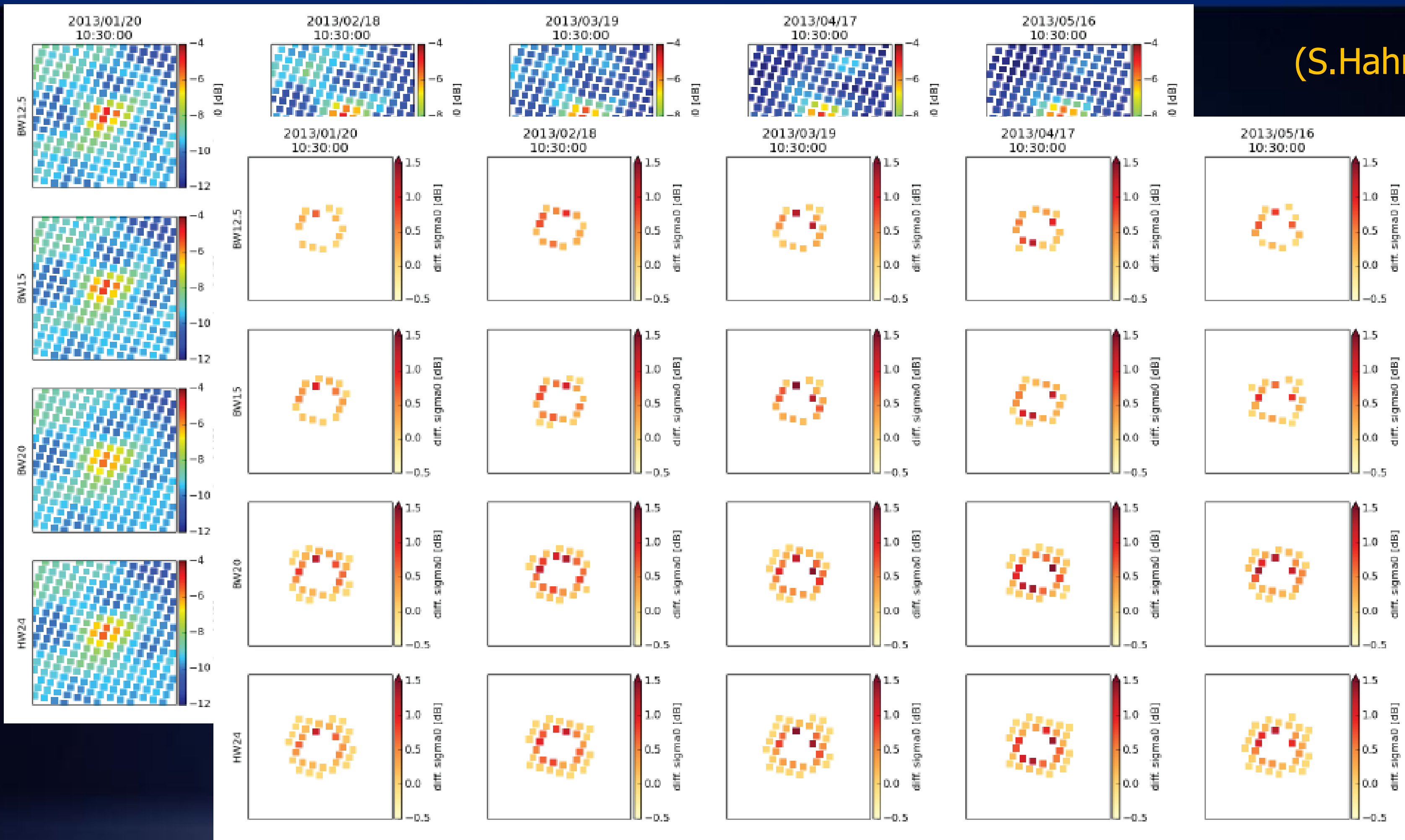






Over ocean: ships ad off-shore platforms

Point scatterers



(S.Hahn)

Over land: city contamination on soil moisture

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Main findings (I)

- ASCAT SRF successfully modelled - will be used for accurate land fraction estimation

- Scatterometer measurements are re-sampled – CSRFs not symmetrical and their shape and size do not vary linearly with the re-sampling window size. For higher resolution, adaptive re-sampling window sizes are recommended

- ASCAT data re-sampled to a 12.5 km grid with top hat circular filter of 15 km radius equivalent to the operational 12.5 km Hamming Window product, both over ocean and land. The additional advantages (removing coast contamination and point scatterers) lead to the recommendation to EUMETSAT to replace the HW product

- ASCAT winds re-sampled at 6.25 km contain high wind and small scale variability information, but it is recommended to use variational AR from multiple solutions (MSS)

Main findings (II)

- Noise of re-sampled data increases with decreasing re-sampling windows, but noise is not white, opening the possibility for successfully using de-convolution techniques for resolution-enhancement (e.g. The SIR method developed by BYU)

- Useful tool for modelling geophysical noise developed to understand the propagation of measurements noise during the re-sampling and beam collocation processing

- Current accuracy of the ASCAT slice data not enough to detect automatically point scatterers, but if their location is known (permanent RFI sources, cities, lakes, coast lines, etc), their removal in the re-sampling process increases the quality of the final geophysical data (winds or soil moisture over land)

Thanks

von Karman Vortices off Madeira