NWP SAF

Product verification

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OVWST, 18-20/05/'09

Quality Guidance

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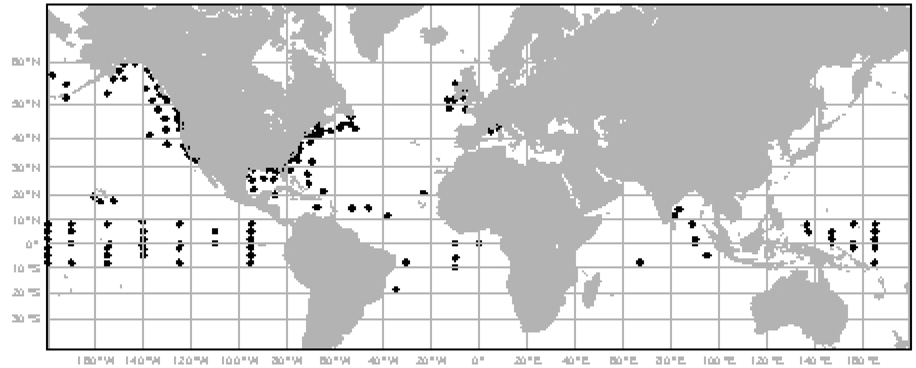
- Several products exist; how to guide our users ?
- How to trade off processing options ?
- Two main issues:
  - Sampling; not all sets have the same QC / coverage
  - Representativeness error, or, how smooth can an application accept the product to be

- Elaborated 2 tests for product comparison:
  - ➢ Dual product collocation with a representative set of buoy data (kindly provided by ECMWF), or NWP data
  - ➢ Spectral analysis (discussed at last OVWST with Ernesto)

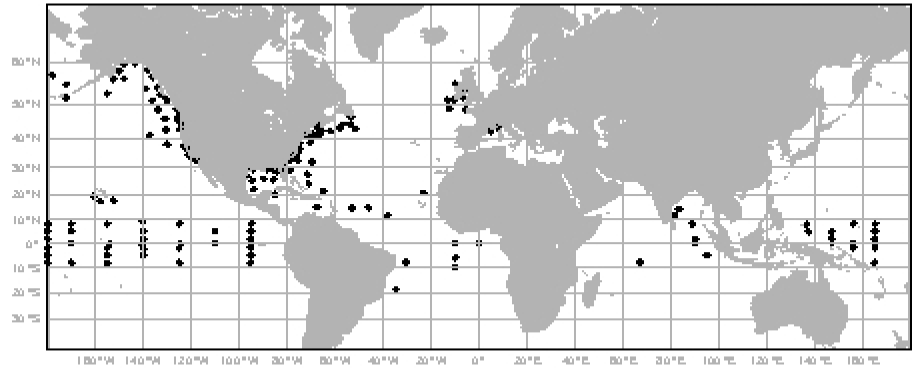
Buoy verification



SeaWinds 25-km product	# wind vectors	speed bias	stdev *u*	stdev *v*
NOAA product, including **outer swath**	3845	0.25	2.54	2.51
NOAA product, no outer swath data	3276	0.20	2.47	2.18
OSI SAF, no outer swath data	3061	-0.48	1.79	1.88
NOAA product, collocated OSI SAF	2954	0.15	2.19	1.99
OSI SAF, collocated with NOAA product	2954	-0.49	1.76	1.83

- Outer swath winds appear degraded in NOAA product
- OSI SAF winds verify better with buoys than NOAA does (in RMS)
- OSI SAF wind is biased low
- OSI SAF collocation much helps NOAA wind SD and bias (rain)
- NOAA QC has modest impact on OSI SAF product

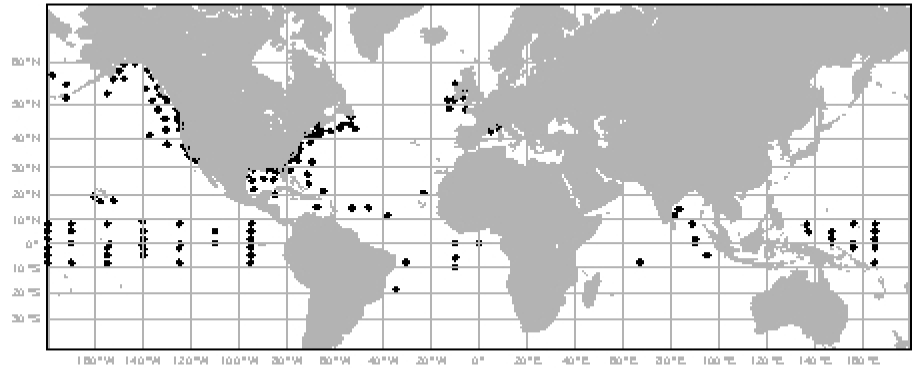
Buoy verification



SeaWinds 25-km product	# wind vectors	speed bias	stdev *u*	stdev *v*
New NOAA, including **outer swath**	4023	0.09	2.54	2.33
New NOAA, no outer swath data	3342	0.10	2.57	2.24
OSI SAF*, including **outer swath** data	3756	-0.49	1.84	1.95
OSI SAF*, no outer swath data	3033	-0.46	1.85	1.93
OSI SAF, collocated with OSI SAF*	2926	-0.48	1.78	1.88
OSI SAF*, collocated with OSI SAF	2926	-0.48	1.78	1.87

- New NOAA product less QC and higher wind SD, bias slightly reduced
- OSI SAF wind is slightly degraded on basis of new NOAA, due to QC
- Outer swath similar quality as inner swath, due to 4 noise values

Buoy verification



OSI SAF 100-km product	# wind vectors	speed bias	stdev *u*	stdev *v*
no MSS used	3156	-0.21	2.16	2.06
MSS used	3155	-0.25	2.03	2.06
MSS*, no outer swath data	3163	-0.23	2.11	2.07
MSS*, **outer swath** data	3925	-0.25	2.09	2.12
MSS collocated with MSS*	3038	-0.25	2.01	2.04
MSS* collocated with MSS	3038	-0.25	2.04	2.03

- MSS beneficial at 100 km (nadir)
- OSI SAF wind is slightly degraded on basis of new NOAA, due to QC
- Outer swath similar quality to inner swath, due to 4 noise values

Bias due to σ⁰ averaging

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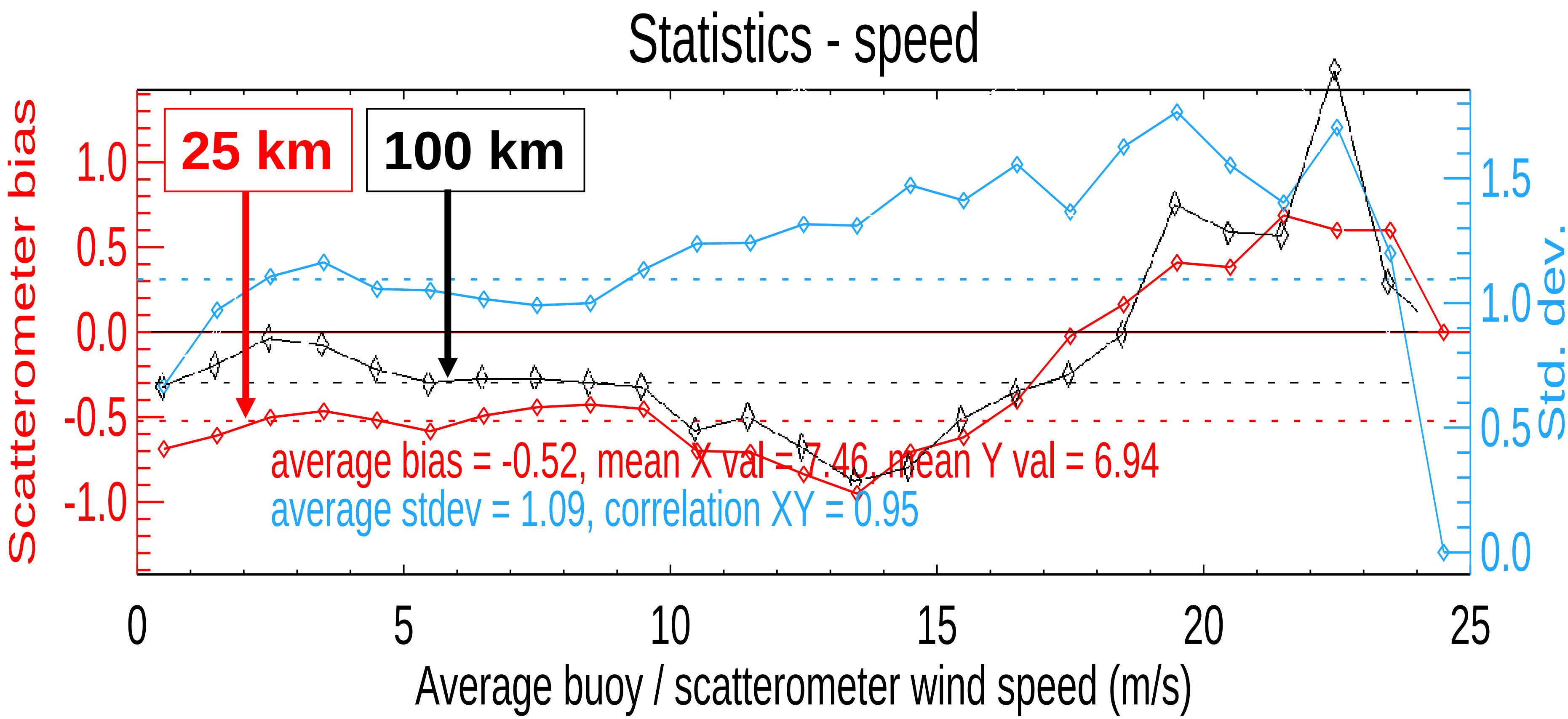
- 100-km product increases low speeds
- At coarser resolutions speeds should be lower instead ?



Bias due to σ^0 averaging

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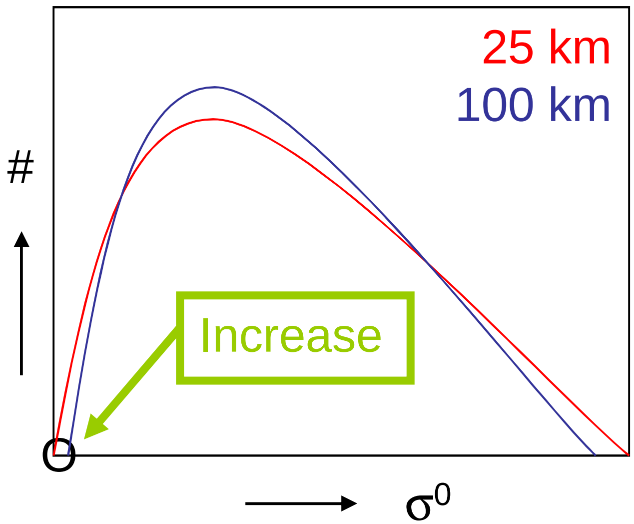

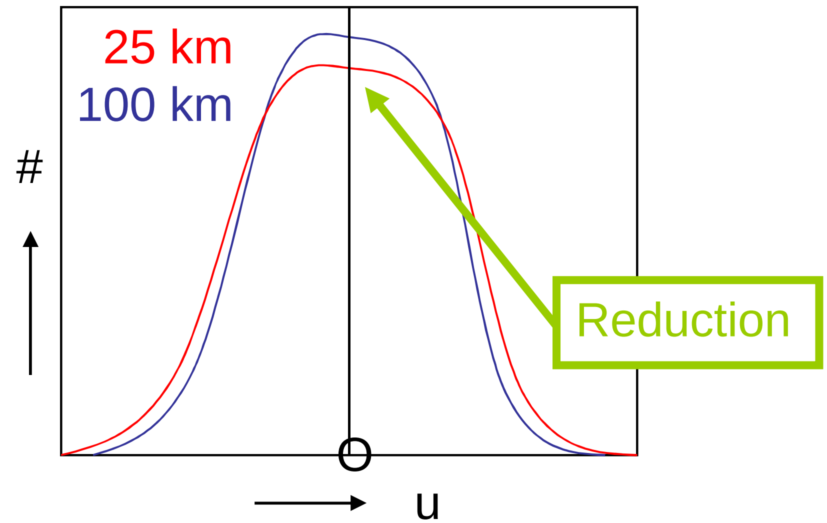

- σ^0 distribution is steep for low values; a low value at a 25-km WVC most likely has a neighbour WVC σ^0 value that is higher; this removes low (extreme) values when averaging to 100 km
- The wind vector distribution is flat for low values; a low 25-km WVC most likely has similarly low WVC neighbour amplitudes at varying direction; more low wind vector amplitudes are expected at 100 km
- 25-km GMF will not provide good 100-km winds !
- We verified that noisier (>Kp) σ^0 data indeed provide speed bias as well

FFT detrending methods

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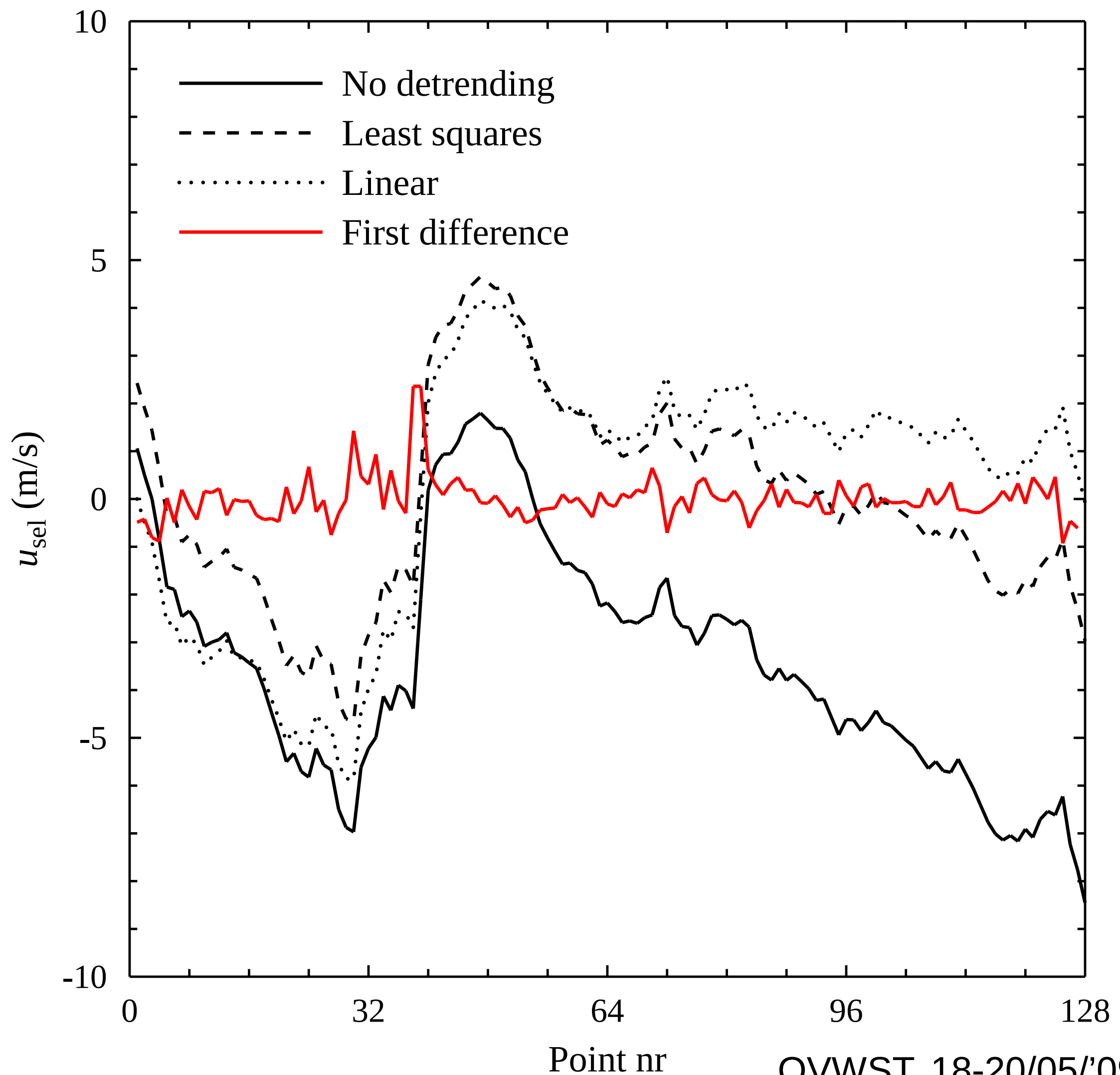

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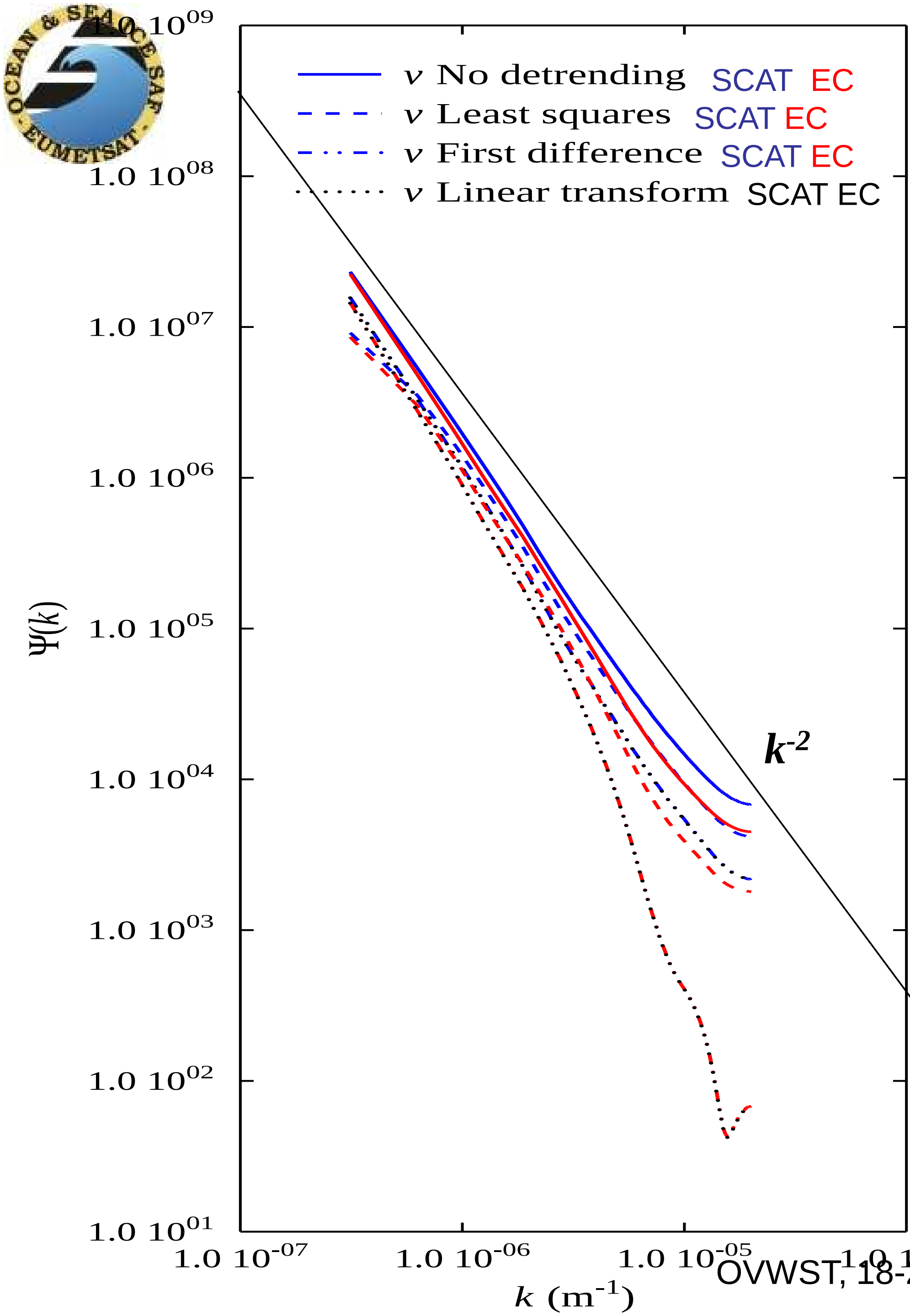
- Over a few 1000 km the wind vector generally changes
- FFTs assume infinite periodic continuation of the series
- A step function between the last and first point of the series adds small-scale FFT noise
- This is aliasing of variance on scales beyond the FFT domain on the tail's spectrum



Detrending

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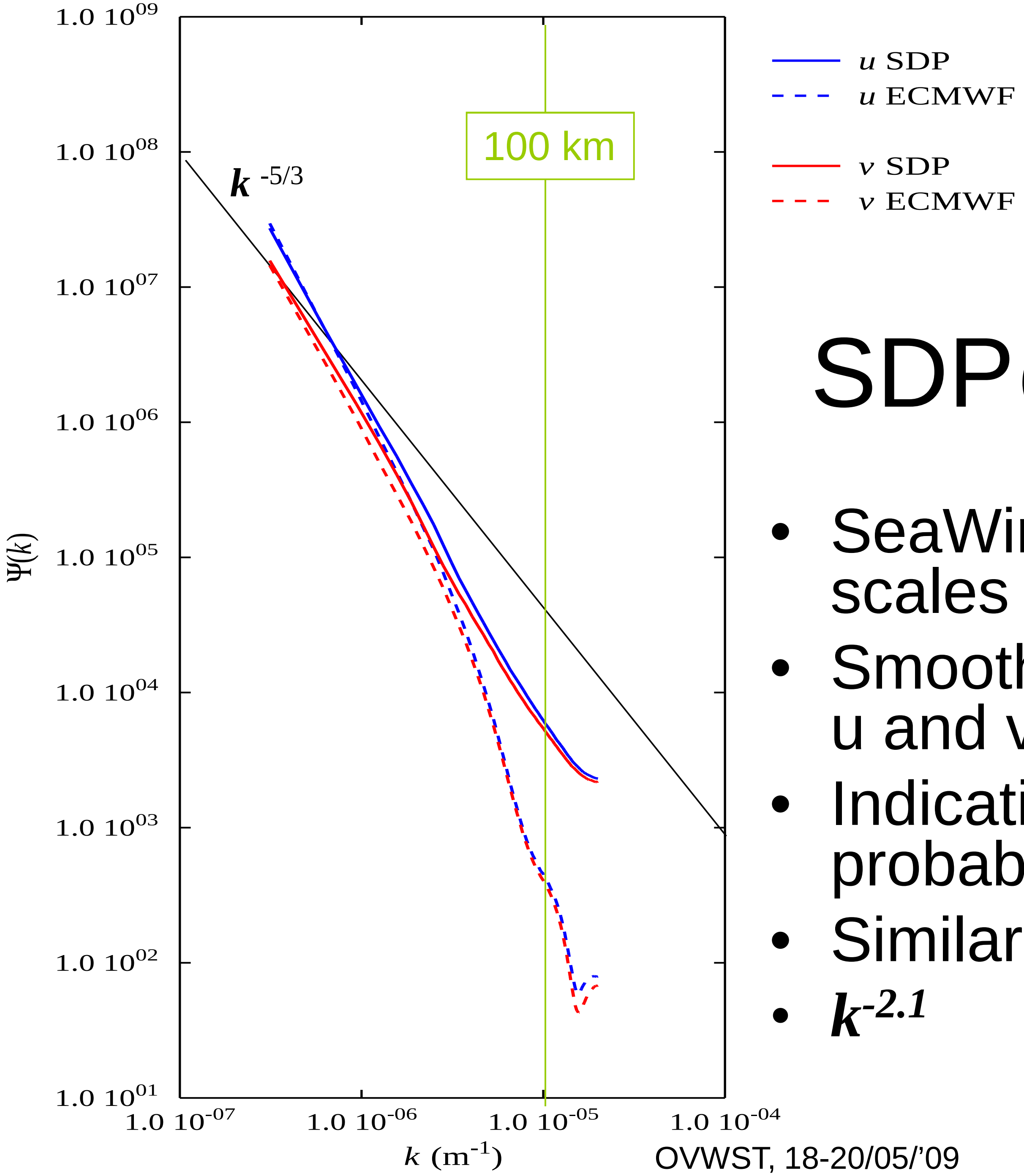
- A trend FFTs to k^{-2}
- Only first difference and matching first and last point by linear transform remove the large-scale aliasing on the FFT tail



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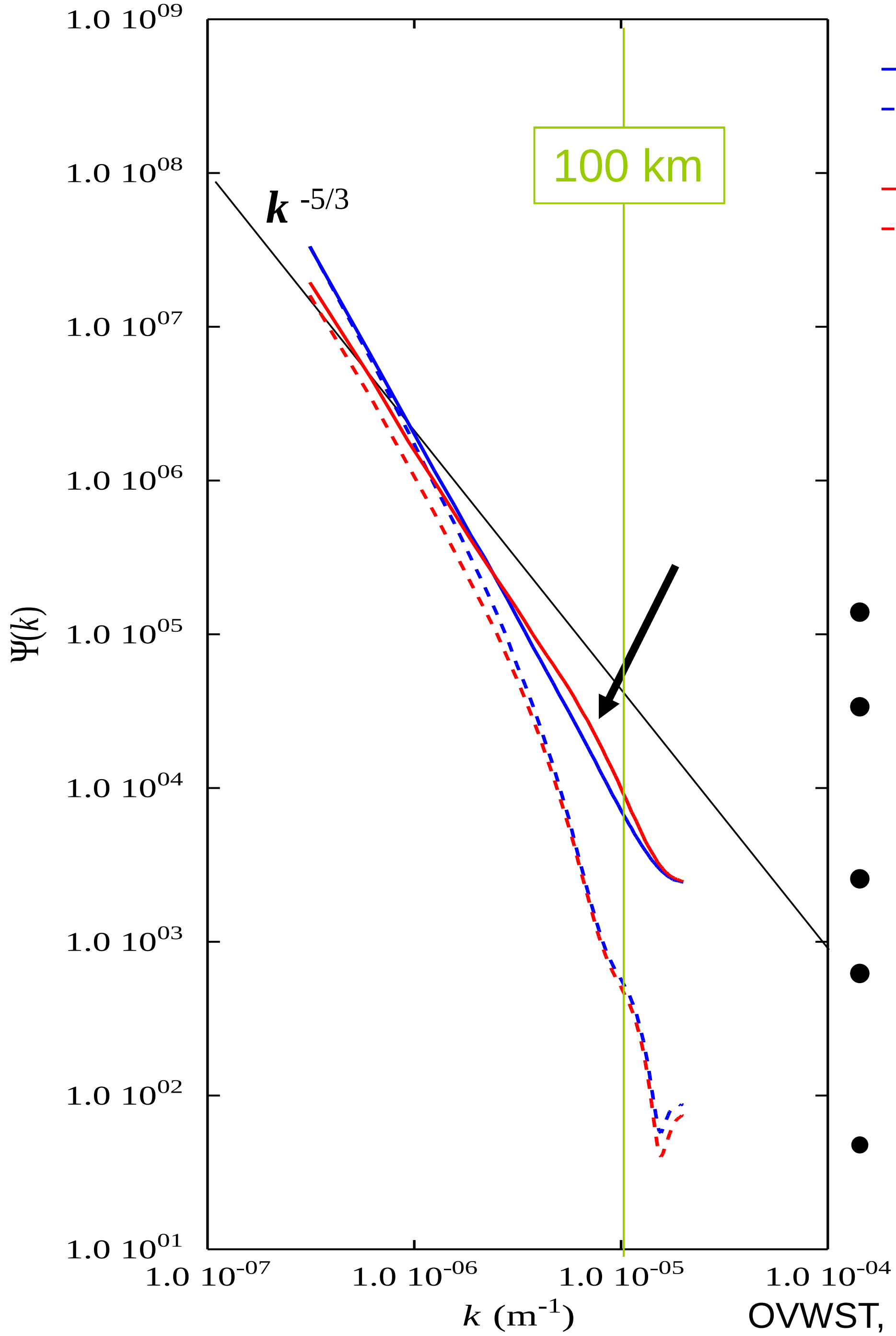
SDP@25 (MSS)

- SeaWinds contains small scales down to 50 km
- Smooth decay, same for u and v
- Indication of noise floor, probably due to rain
- Similar to NOAA products
- $k^{-2.1}$



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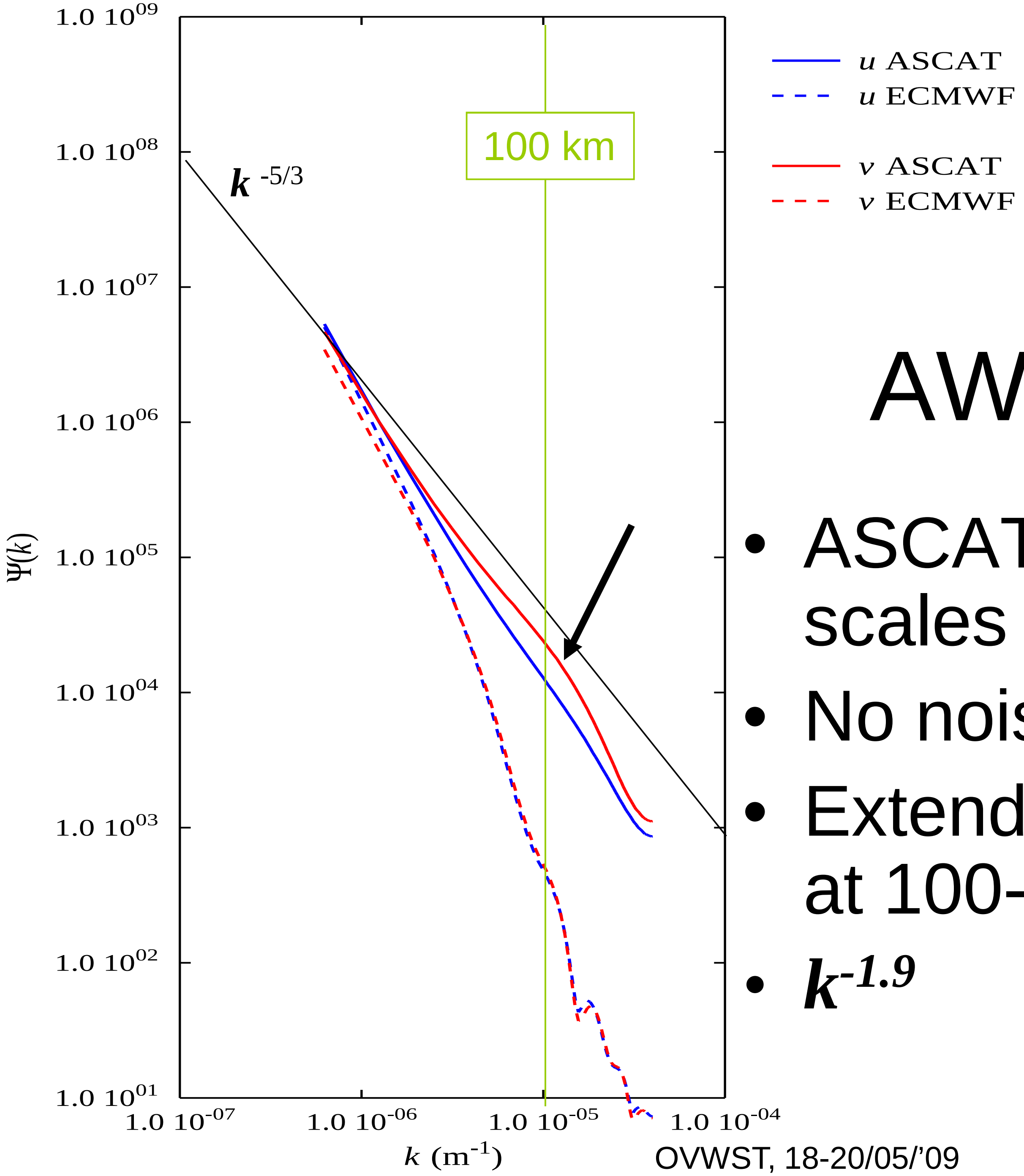
AWDP@25

- Same period as SDP
- ASCAT contains more variance below 1000 km
- Less of a floor than SDP
- Small bump at 150-km scale in u
- $k^{-2.0}$



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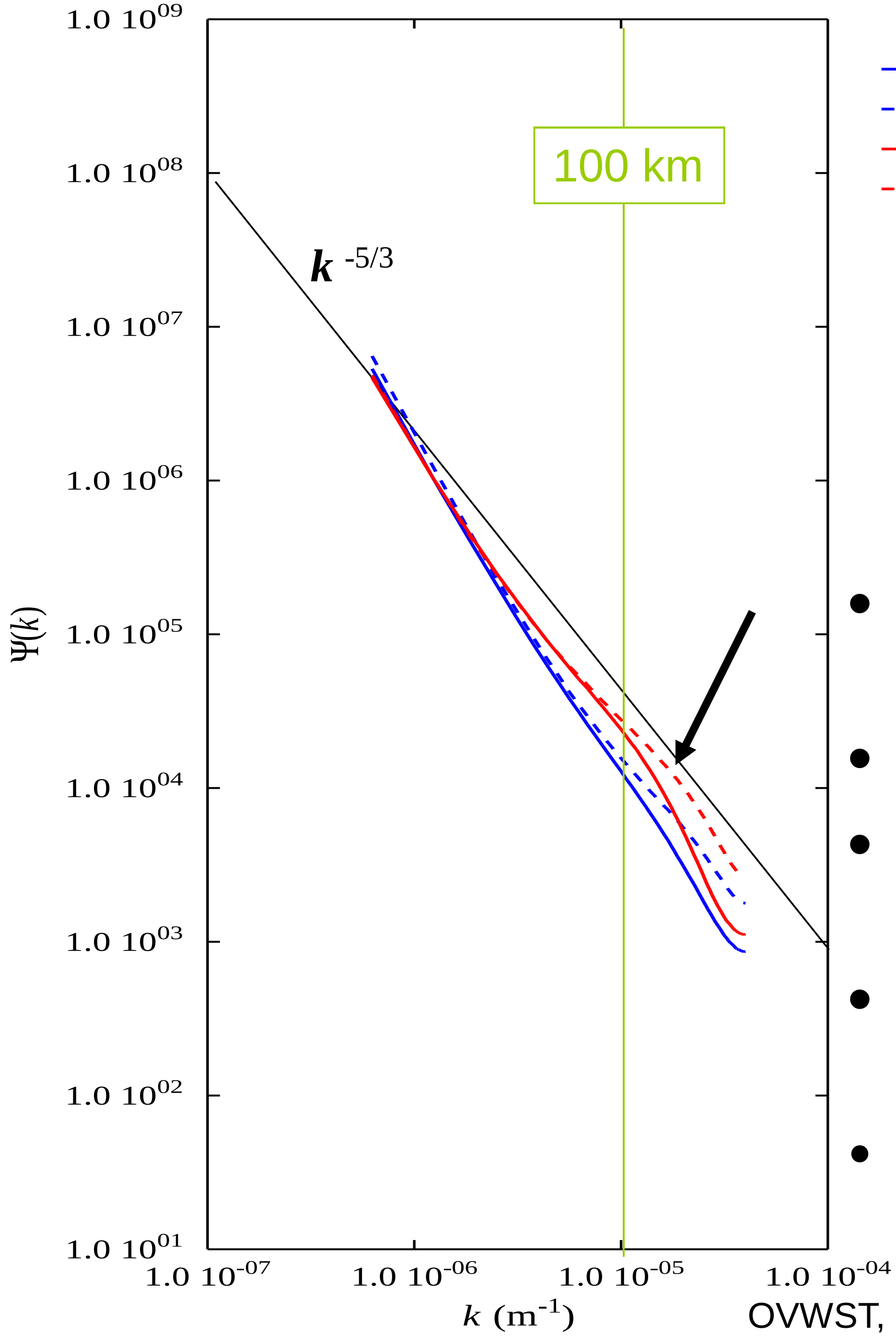
AWDP@12.5

- ASCAT contains small scales down to 25 km
- No noise floor
- Extended bump in u at 100-km scale
- $k^{-1.9}$



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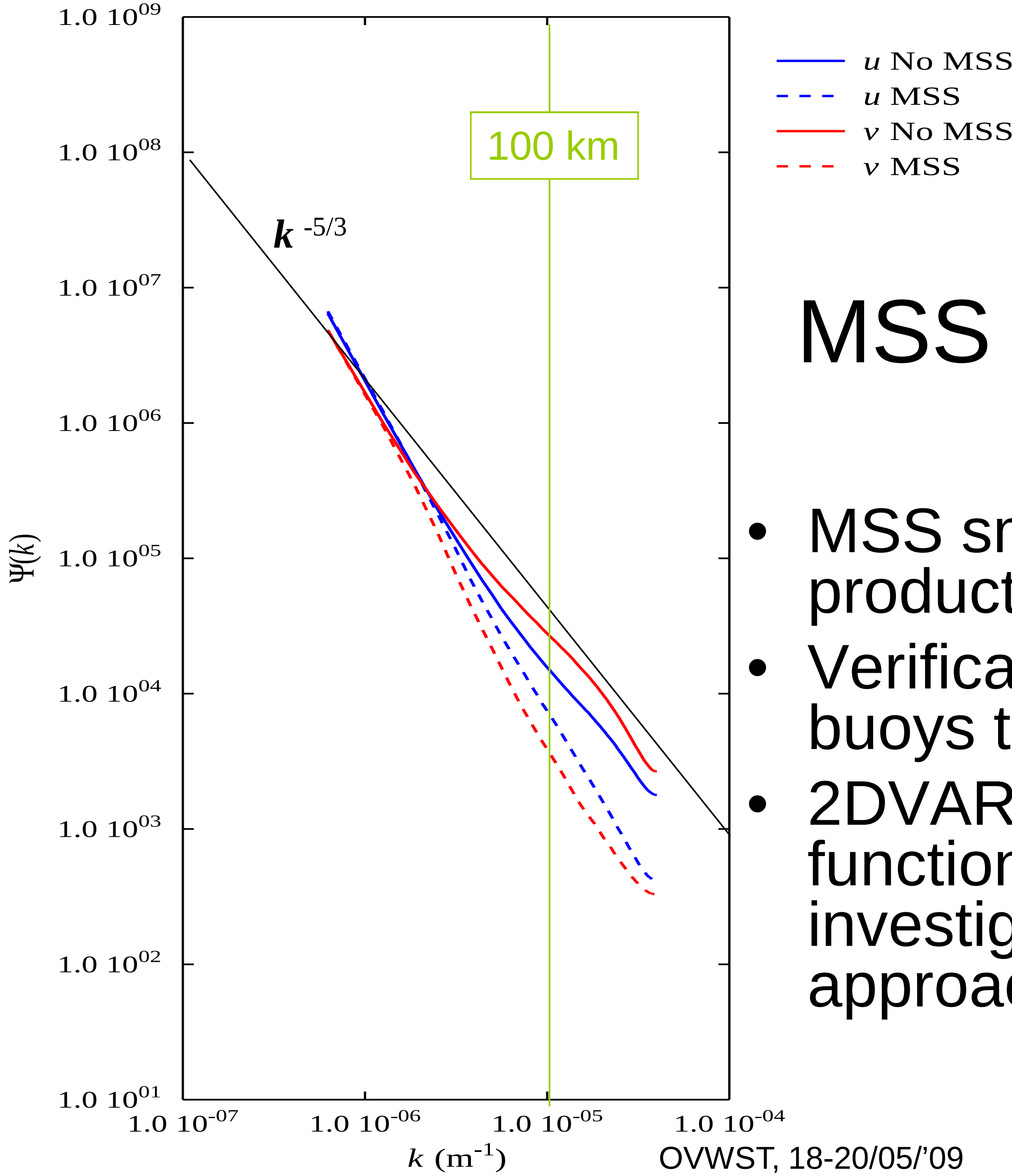
Box AWDP@12.5

- Box averaging maintains more tail variance
- No apparent noise floor
- Buoy verification confirms this; see later presentation
- Still u bump, but at lower wavelength (?)
- $k^{-1.8}$, pretty close to -1.67 for 3D turbulence Nastrom and Gage 1987



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MSS ASCAT@12.5

- MSS smooths ASCAT box product
- Verification of MSS with buoys to be done
- 2DVAR spatial filter functions are being investigated with FFT approach

Conclusions

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- Dual product collocation with buoys reveals clear relative quality characterictics
  - The SDP@25km product verifies better than NOAA
  - SDP@25km is about 0.4 m/s lower than ASCAT (0.5 m/s w.r.t. buoys)
  - NOAA rejects fewer WVCs than SDP, but accepted points do not verify well
  - SDP winds based on the new NOAA SeaWinds BUFR verify slightly worse, but provide good quality outer swath winds with SDP
  - NOAA outer swath winds are clearly degraded
  - MSS in SDP@100km OSI SAF notably reduces the wind component RMS with respect to buoy data
  - Wind-speed dependent bias correction for the products is ongoing
- FFT tool is applied to further quantify product characteristics
  - ASCAT contains more small-scale variance than SeaWinds products
  - ASCAT winds based on 12.5-km Box-averaged σ^0 product contains most variance
  - SeaWinds products show noise floor
  - ASCAT winds show bump in u component, not explained entirely by Hamming filter
- Work in progress

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SAF

Thank you!

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Buoy and NWP verification

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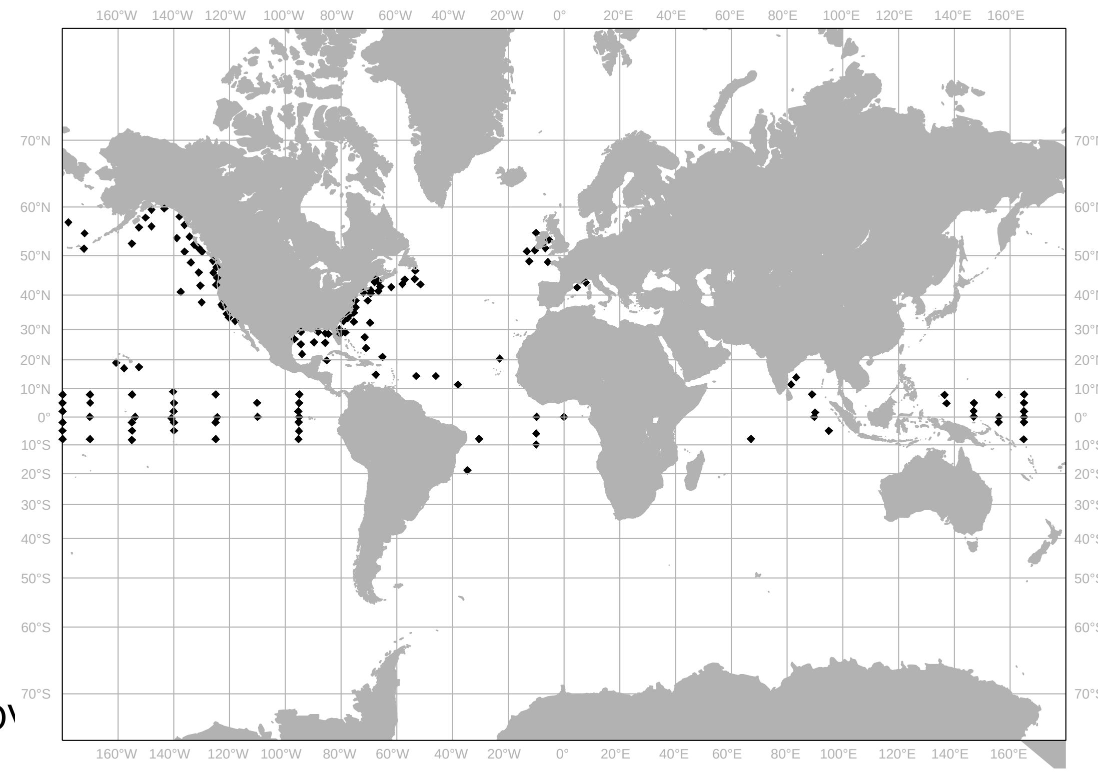
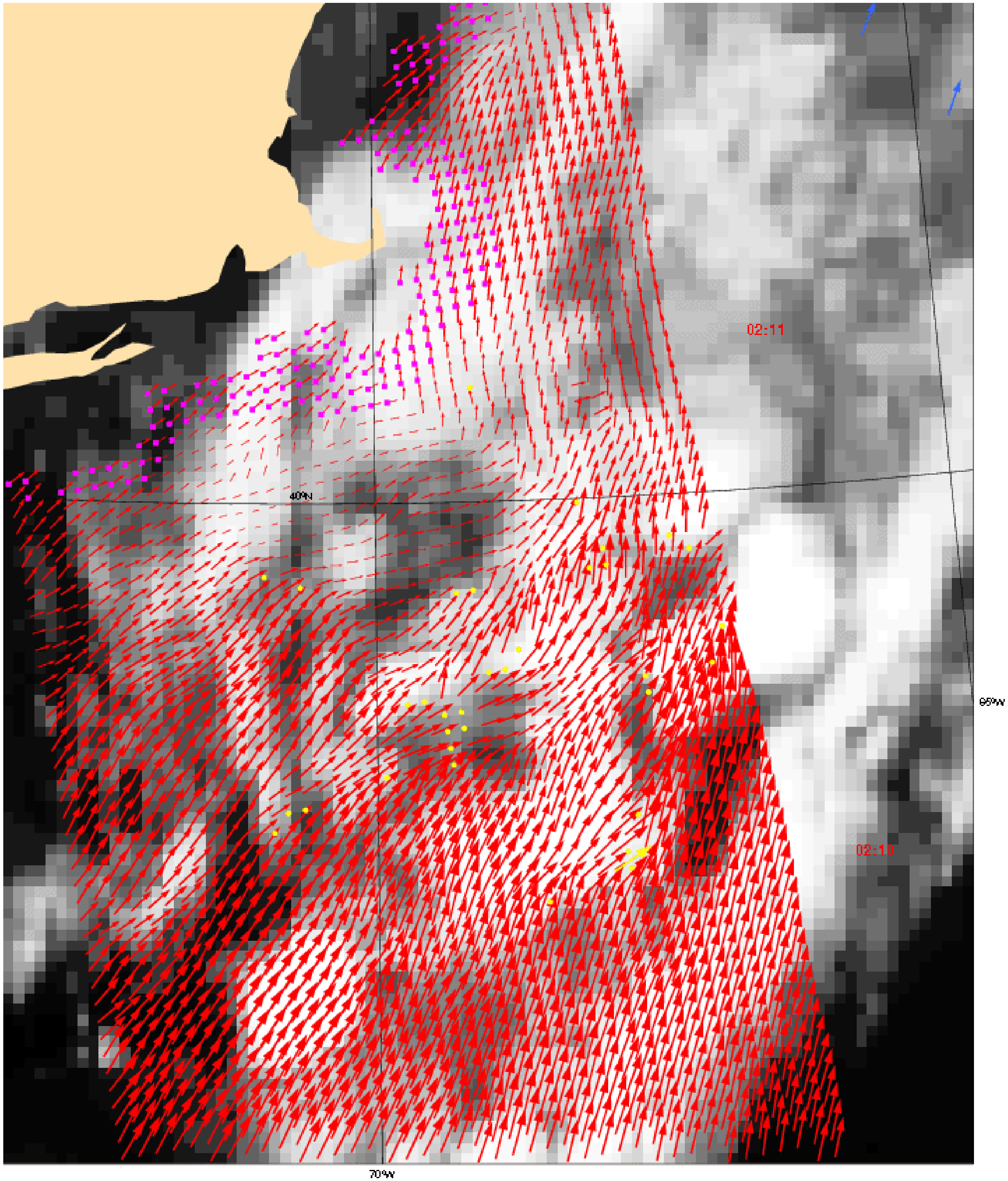
- ASCAT 25 compares best to buoys; ASCAT 25 compares best to ECMWF as well
- SeaWinds 25 is slightly noisier than ASCAT 25; SeaWinds 100 compares much better to ECMWF winds than SeaWinds 25
- Low-res products good for global NWP; Hi-res for ocean applications and nowcasting

ASCAT 25		SeaWinds 25		SeaWinds 100	
SD u [m/s]	SD v [m/s]	SD u [m/s]	SD v [m/s]	SD u [m/s]	SD v [m/s]
1.76	1.79	1.84	1.83	2.19	2.00





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Experimental 12.5-km product

- See yesterday's talk

QuikSCAT vs ECMWF

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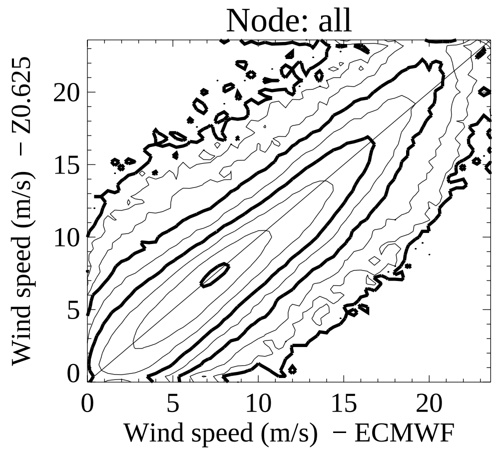
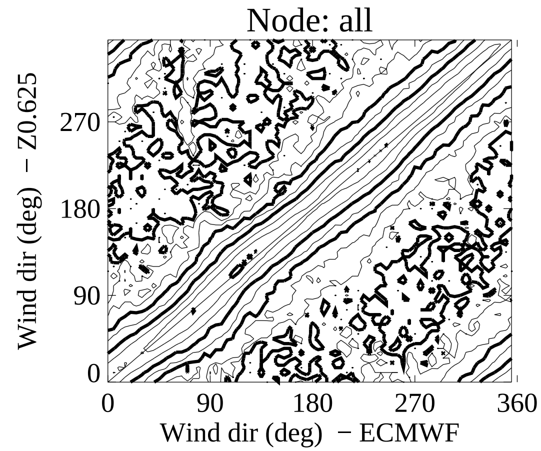
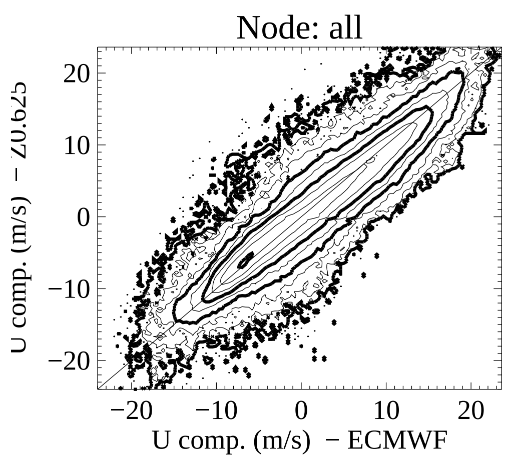


N=4540535
mx= 7.50 my= 7.26
m(y−x)= −0.24 s(y−x)= 1.49
cor_xy= 0.91



N=3855708
mx= 177.46 my= 177.88
m(y−x)= 0.42 s(y−x)= 14.12
cor_xy= 0.99



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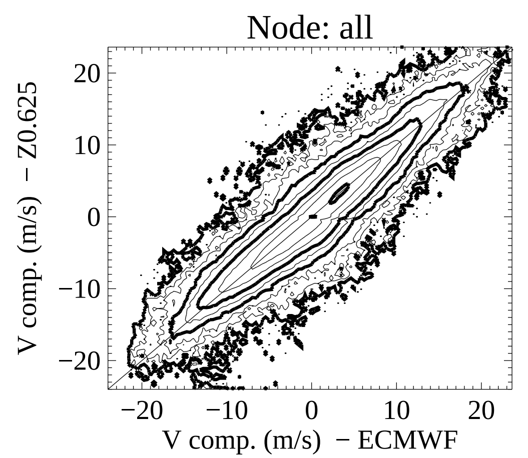
mx= 0.23 my= 0.13
m(y−x)= −0.10 s(y−x)= 1.60
cor_xy= 0.97



N=4540535
mx= 0.74 my= 0.70
m(y−x)= −0.04 s(y−x)= 1.58
cor_xy= 0.96

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ASCAT vs ECMWF

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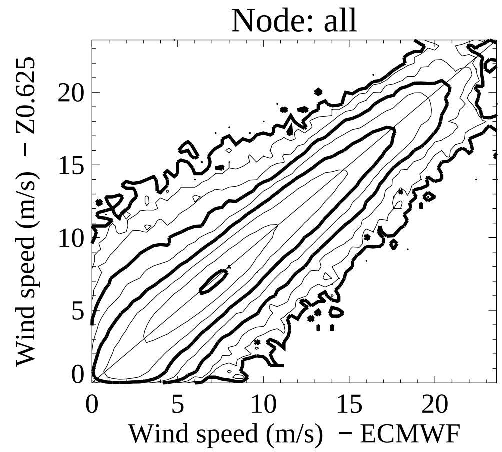
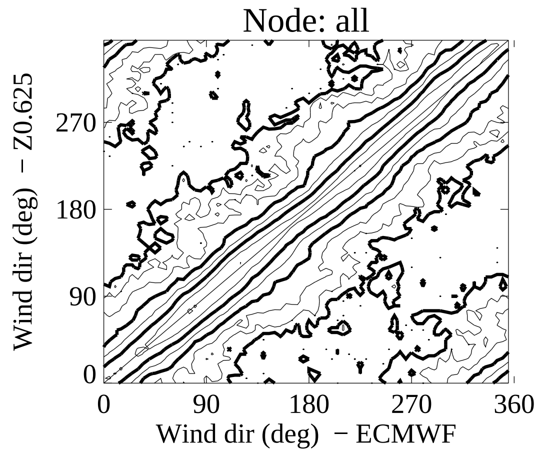


N=2305231
mx= 7.59 my= 7.55
m(y−x)= −0.05 s(y−x)= 1.28
cor_xy= 0.94



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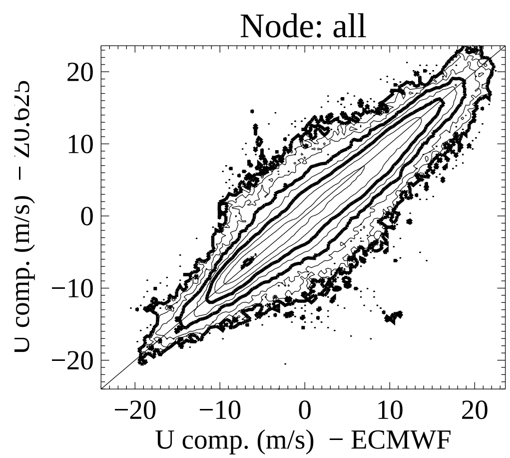
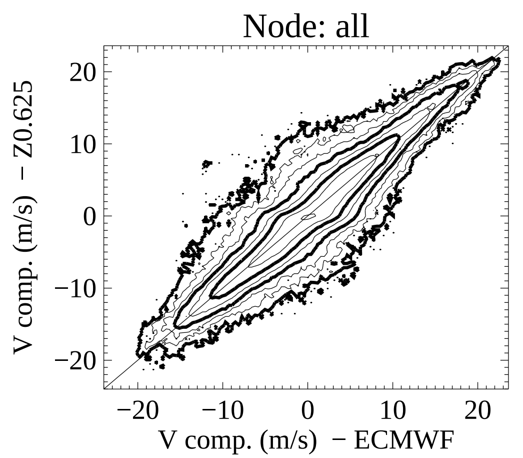
mx= 177.57 my= 177.86
m(y−x)= 0.29 s(y−x)= 15.75
cor_xy= 0.99



N=2305231
mx= 0.23 my= 0.11
m(y−x)= −0.12 s(y−x)= 1.52
cor_xy= 0.97



N=2305231
mx= 0.75 my= 0.72
m(y−x)= −0.03 s(y−x)= 1.62
cor_xy= 0.96

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