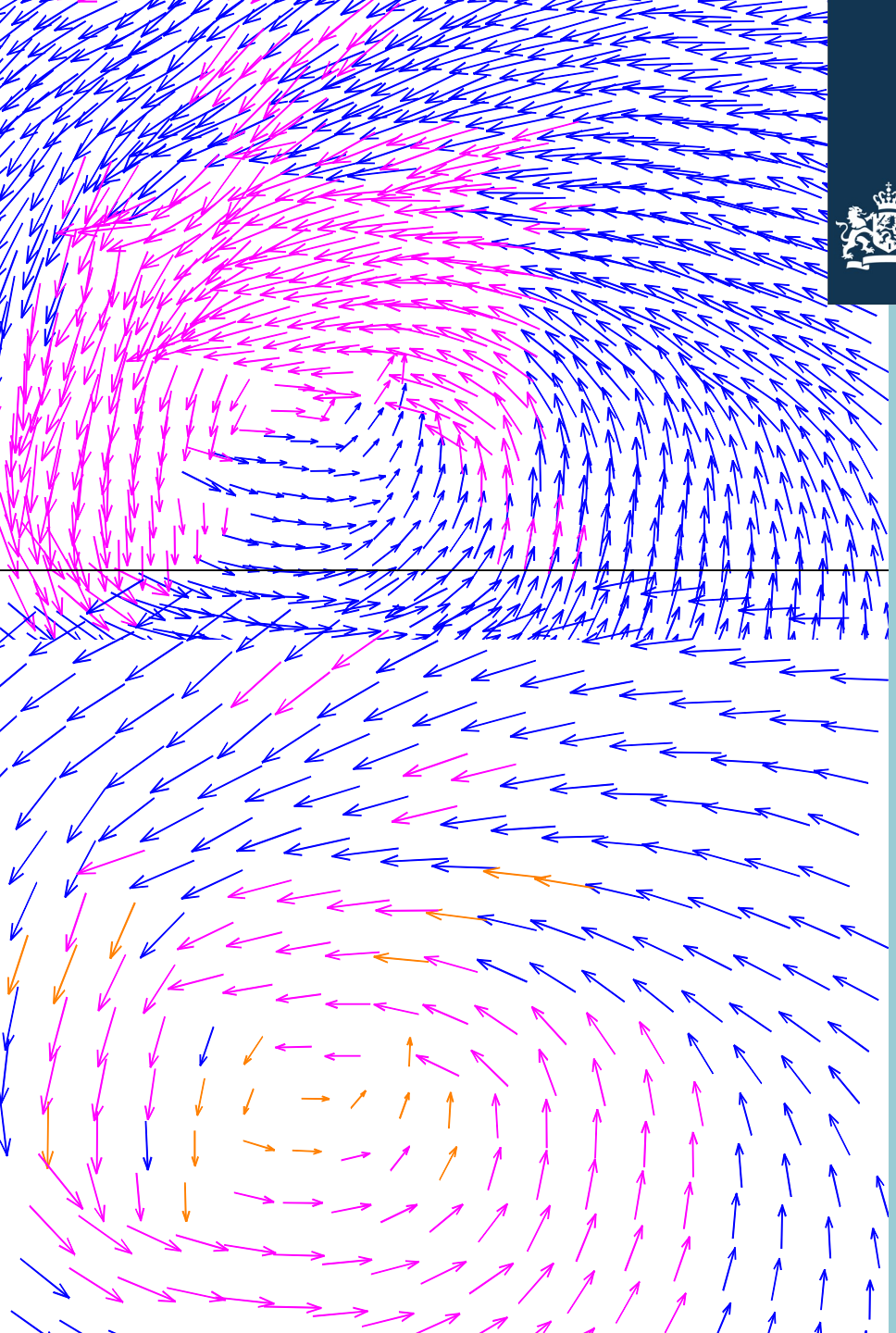

OSI SAF Ocean and Sea Ice

NWP SAF Numerical Weather Prediction

Royal Netherlands
Meteorological Institute
Ministry of Infrastructure and the Environment

High-resolution scatterometer winds near the coast

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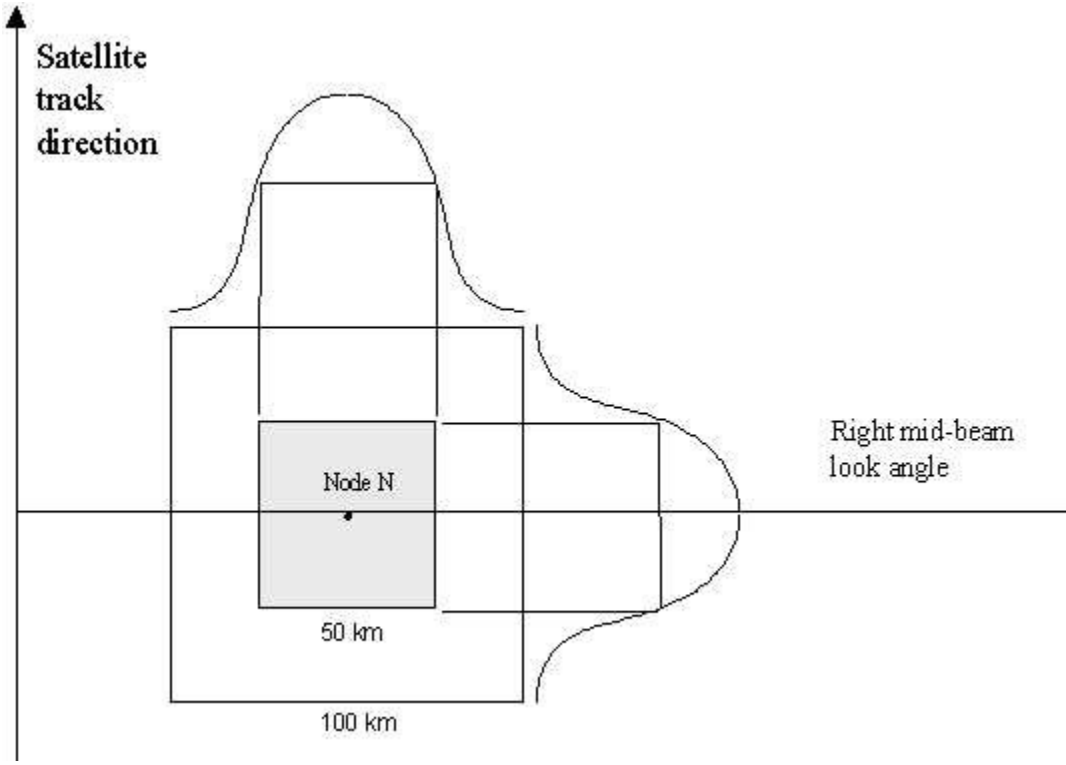
coastal motivation for box winds

- Problem: radar backscatter from land is much higher than from sea, therefore a conservative land mask is necessary
- Hence no winds can be computed near the coasts, in bays and in areas between islands
- Wind data in coastal areas are very important since they are close to densely populated areas

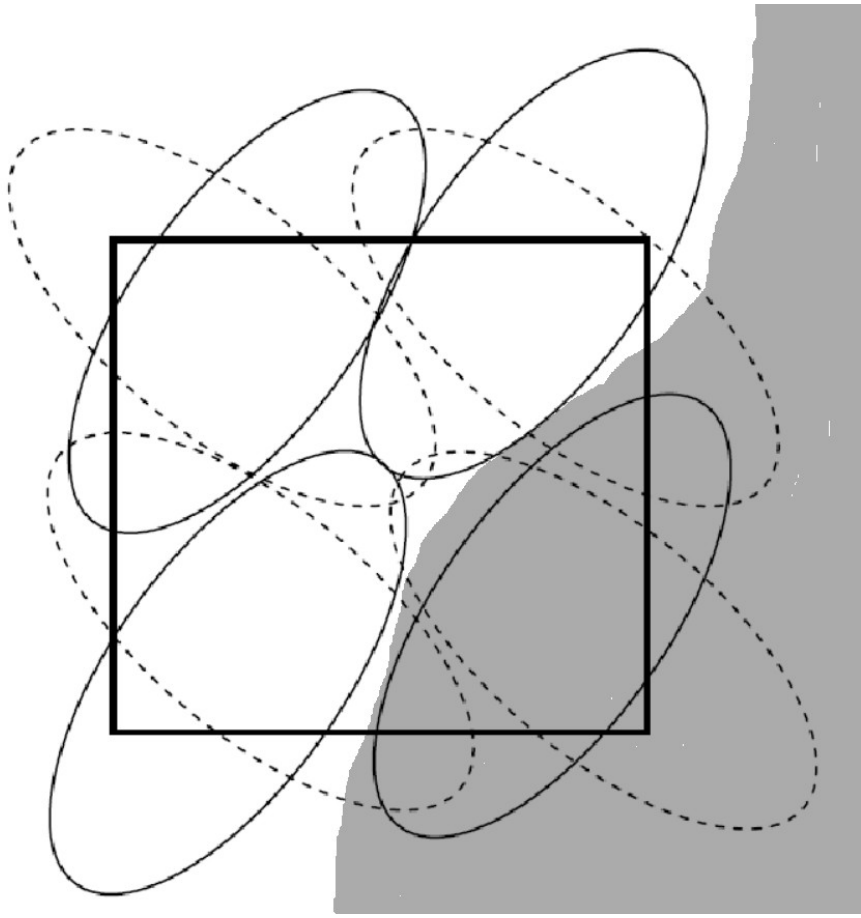
WVC backscatter

- Hamming filtering does not allow processing near the coast
- Reliable winds can not be obtained closer than ~70 km (25 km product) or ~35 km (12.5 km product) from the coast



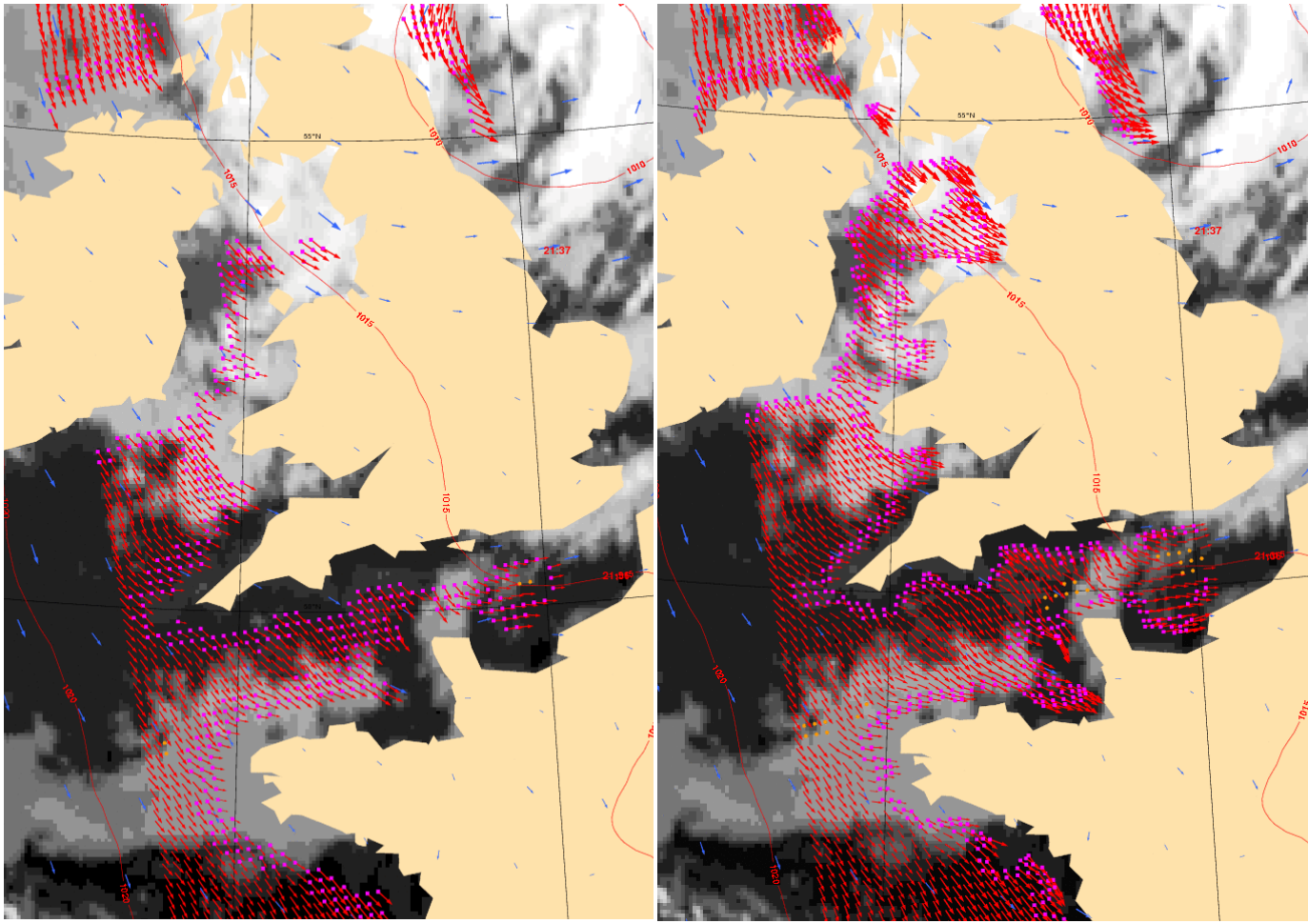
Idea for coastal product

- Use full resolution (FR) product with all footprints
- Use only these measurements that are over sea (high-res land-sea mask)
- Box averaging of backscatter rather than Hamming filtering reduces smearing, but may increase the noise



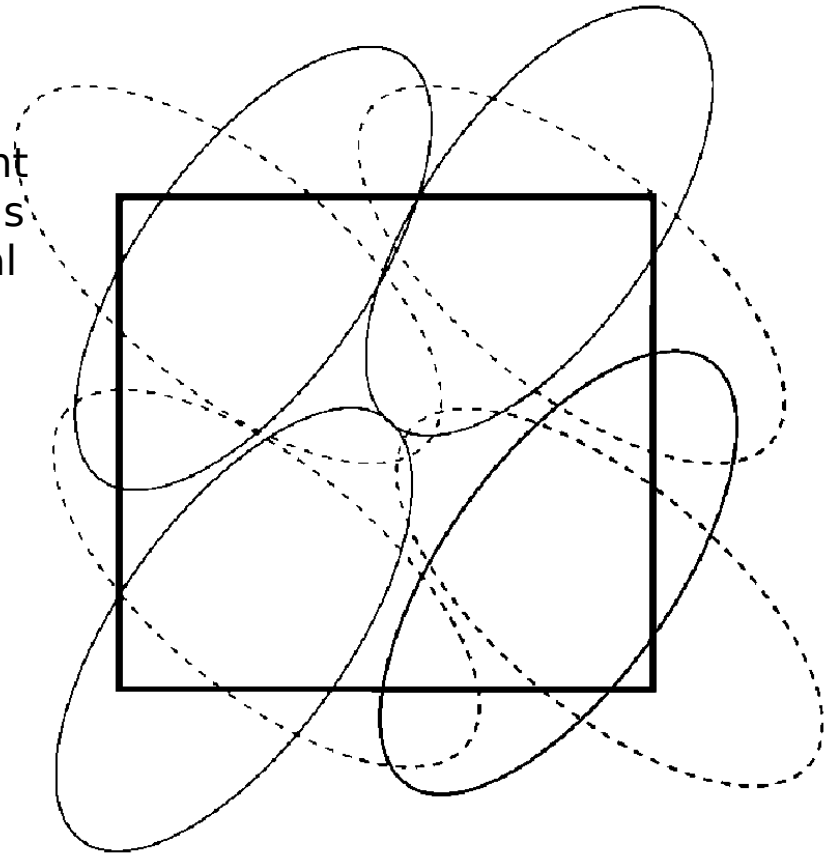
Operational vs. coastal, 12.5 km

- Coastal winds 15-20 km from land vs. ~35 km for operational product
- Coastal winds are consistent, but what is their quality?



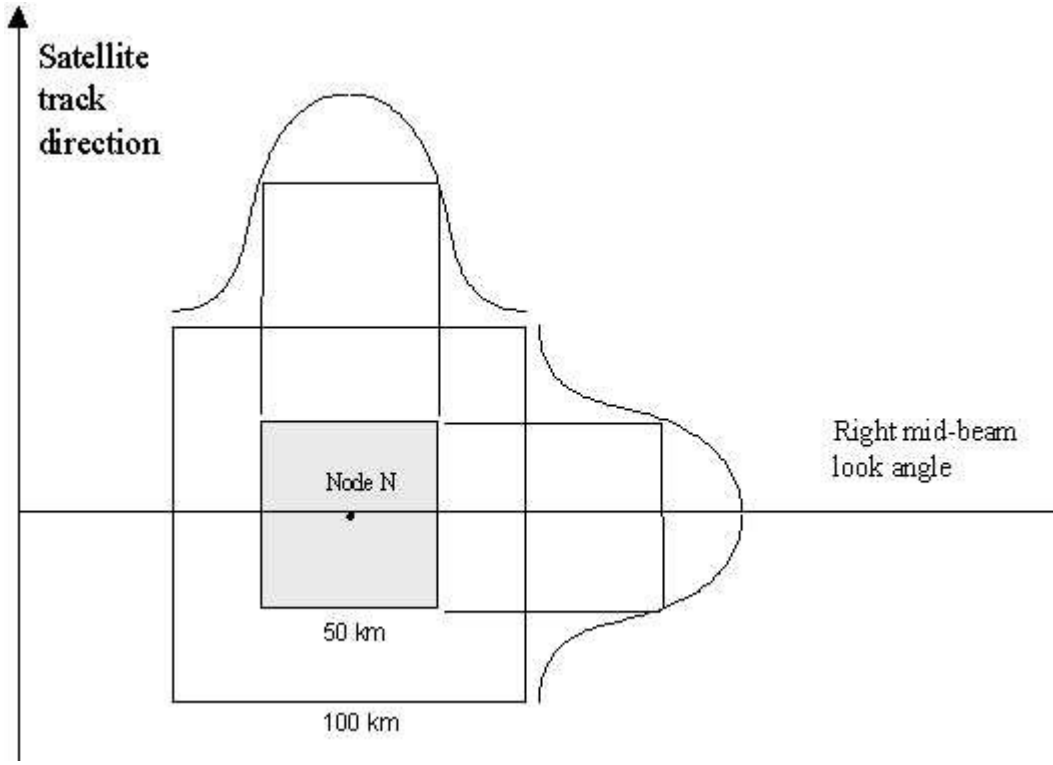
Box averaging in open ocean

- Kp noise is constant for a constant effective averaging area, which can be set
- Adding footprints to an IFOV leads to observed areas well outside the WVC; this causes correlation between WVCs and suppresses aliasing
- Aliasing contributions would occur in different azimuth directions for the three beams and is thus further suppressed by the wind retrieval
- Box IFOV smaller scale than Hamming
- The three different IFOVs correspond to different area-mean winds; this causes the so-called geophysical noise in the wind retrieval, only substantial for low winds

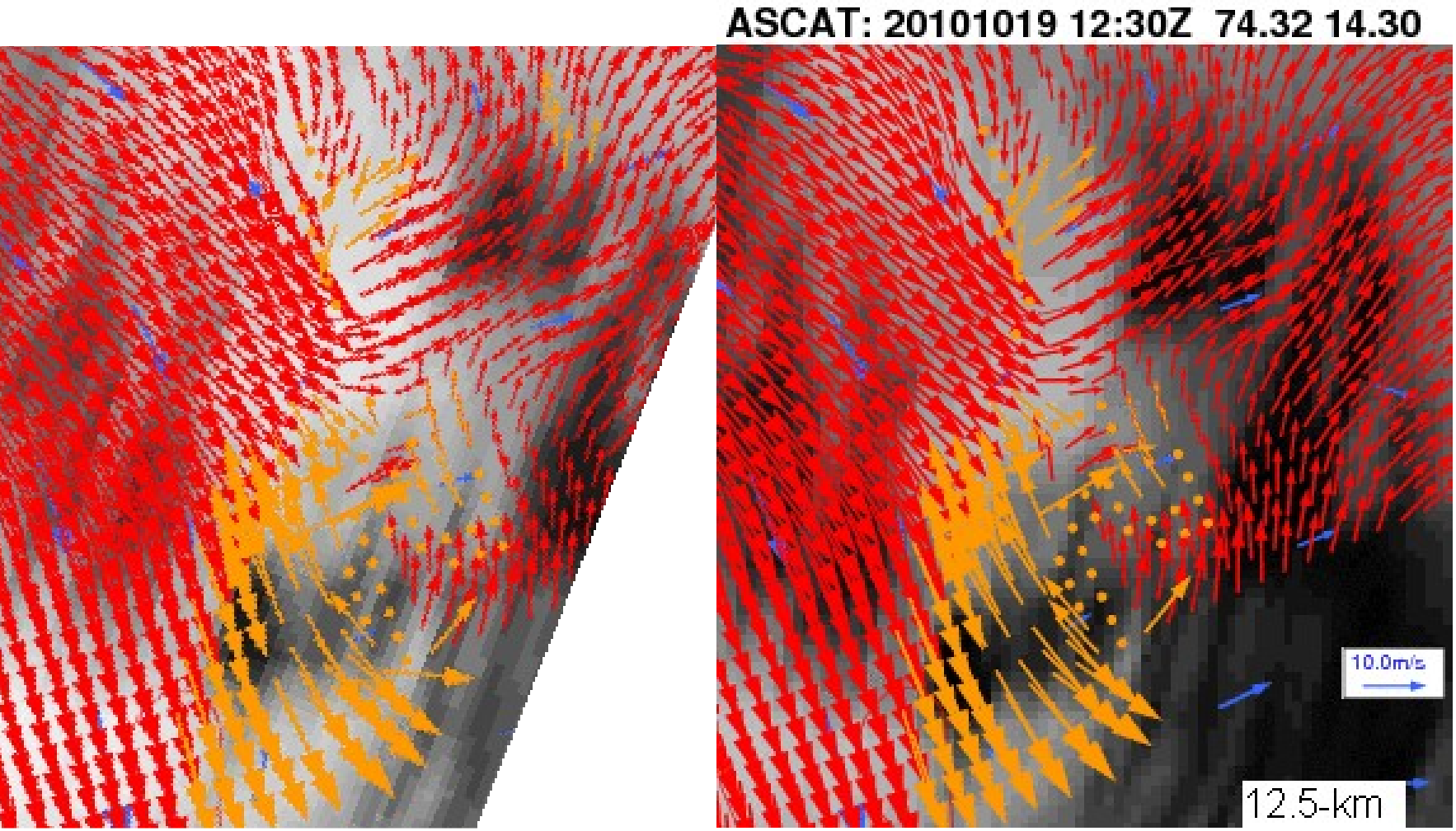


Hamming filter

- Backscatter variations are smoothed out since measurements of up to 70 km away from the WVC centre are used in the spatial averaging (25 km product); local details are lost/reduced
- Broad filter: larger-scale variations dominate over smaller-scale variations due to spectral slope of $k^{-5/3}$; IFOV wind differences may persist and thus geophysical noise near fronts/lows

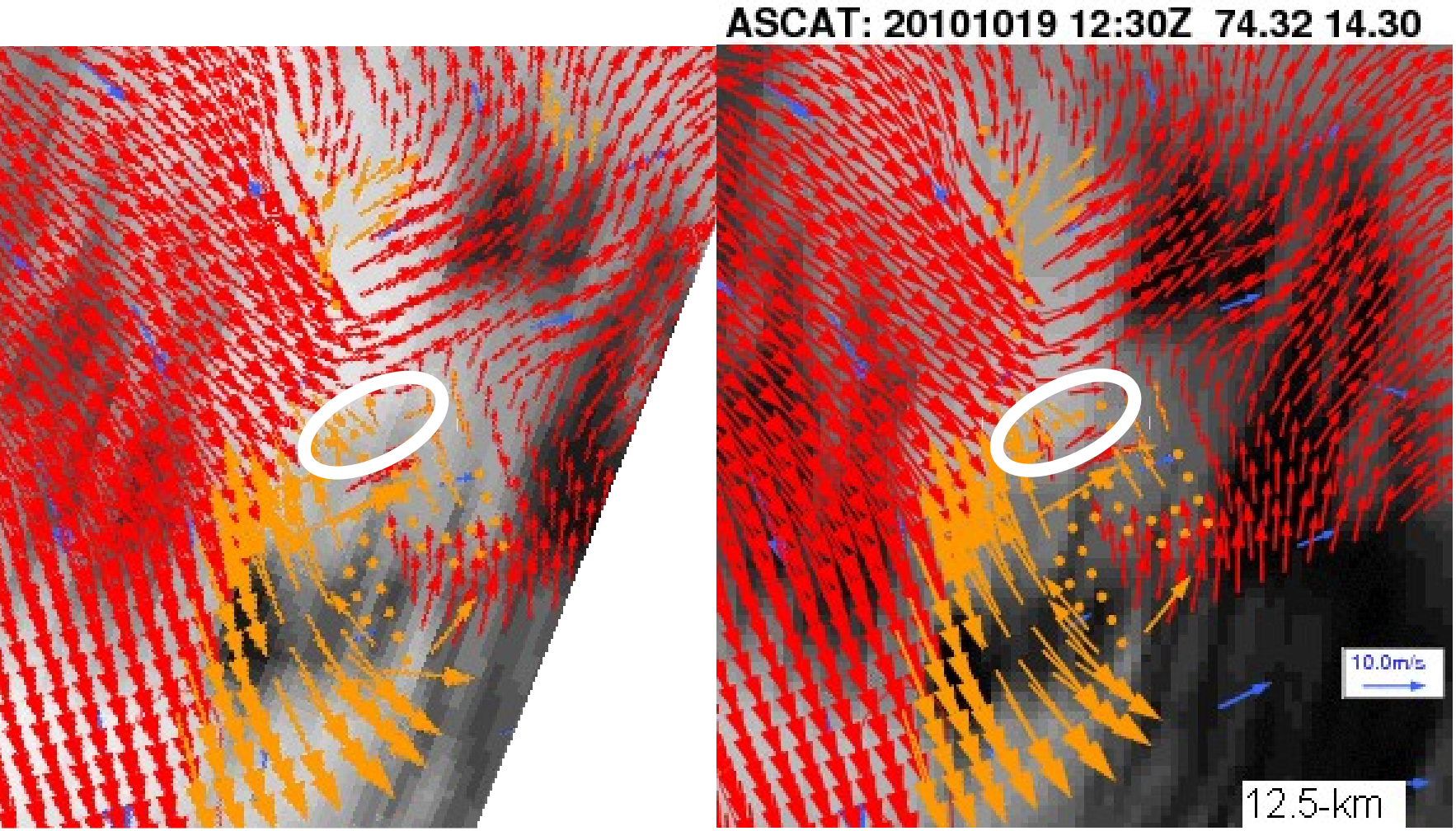


Box versus Hamming



- Find a difference
- Small QC and AR differences

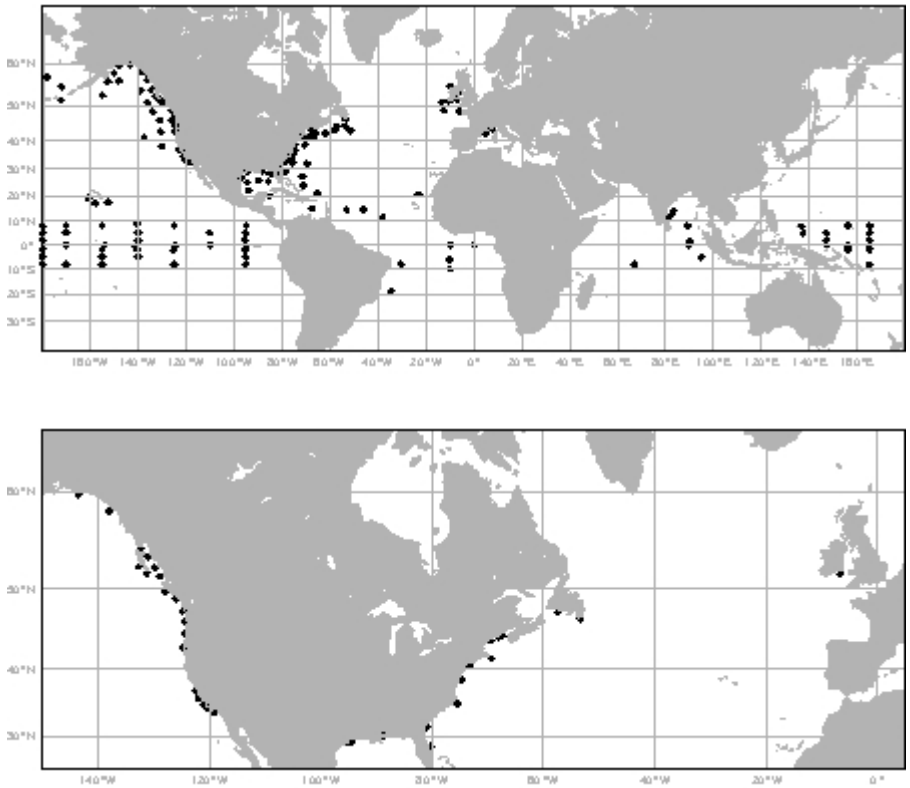
Box versus Hamming



- Find a difference
- Small QC and AR differences

Validation against buoy winds

- Processed six months of ASCAT data
- Use two sets of buoys: one with buoys > 50 km from the coast and one with buoys < 50 km from the coast



Validation against buoy winds

- 6-7% more vectors, mainly low winds; the smaller box, the lower QC and the more winds
- Rmax=12.5-km slightly noisier than collocated Oper.
- Rmax=15-km and 20 km less noisy than Oper.

	12.5-km product	# wind vectors	speed bias	stdev *u*	stdev *v*
1	Operational	14513	-0.28	1.46	1.58
2	R_{max} = 20 km	15373	-0.29	1.43	1.56
3	R_{max} = 15 km	15476	-0.29	1.46	1.59
4	R_{max} = 12.5 km	15498	-0.29	1.48	1.61
5	Operational, collocated data set	12761	-0.28	1.43	1.56
6	R_{max} = 20 km, collocated data set	12761	-0.28	1.43	1.54
7	R_{max} = 15 km, collocated data set	12761	-0.29	1.44	1.54
8	R_{max} = 12.5 km, collocated data set	12761	-0.29	1.45	1.57

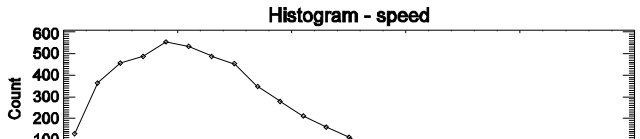
Validation against buoy winds

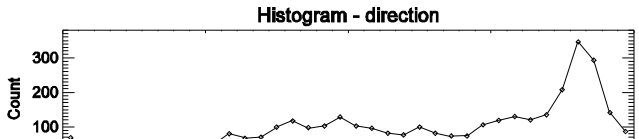
- Coastal winds are more variable due to sea breezes, katabatic winds, currents, etc.
- Buoys scores similar to open ocean however
- Rmax=12.5-km noisiest, Rmax=15-km/20-km less noisy

	12.5-km product	# wind vectors	speed bias	stdev *u*	stdev *v*
1	R_{max} = 20 km	4752	-0.23	1.54	1.59
2	R_{max} = 15 km	4768	-0.22	1.54	1.61
3	R_{max} = 12.5 km	4789	-0.23	1.57	1.60
4	R_{max} = 20 km, collocated data set	4596	-0.23	1.51	1.57
5	R_{max} = 15 km, collocated data set	4596	-0.24	1.51	1.57
6	R_{max} = 12.5 km, collocated data set	4596	-0.25	1.54	1.58

Validation against buoy winds

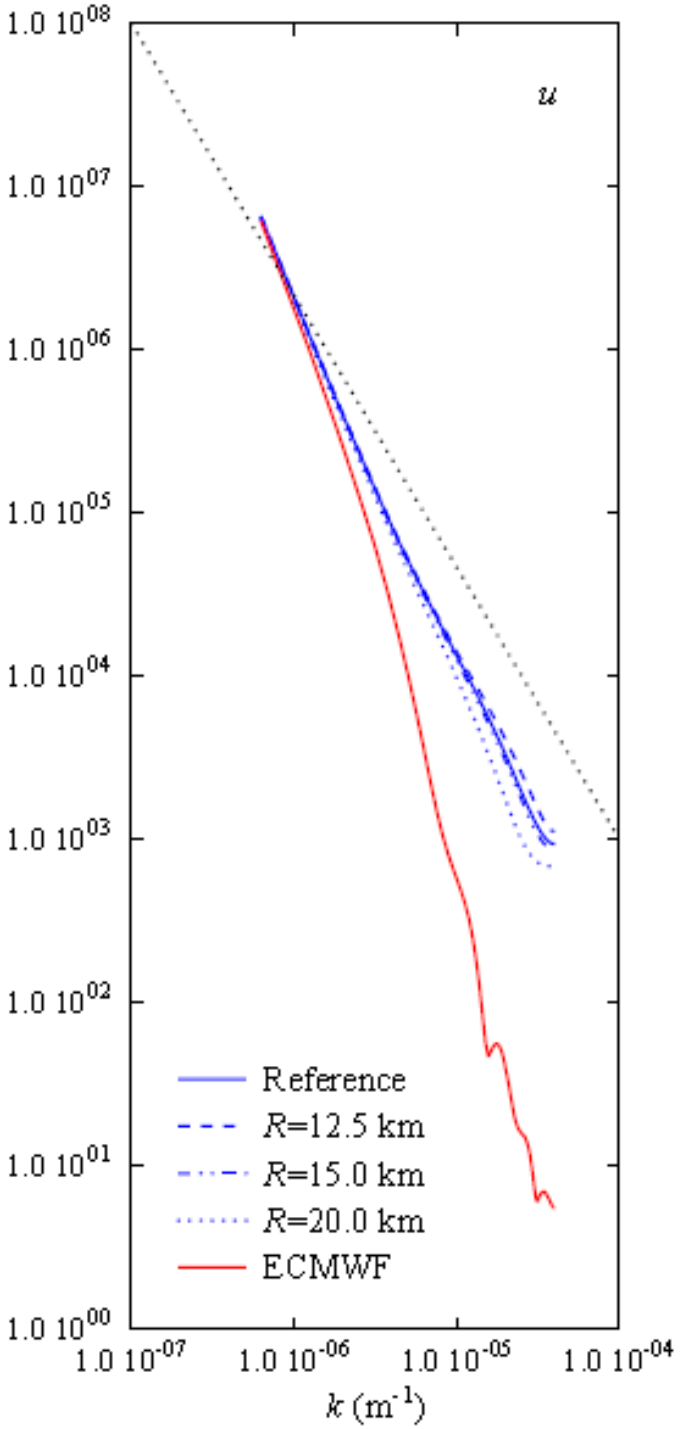
- Coastal data set





Spectra

- Box products close to 3D turbulence spectra of $k^{-5/3}$
- R=20km shows small tail effect (aliasing)
- R=15km spectrally very similar to operations



Conclusions

- We succeeded to create an ASCAT coastal wind product from the full resolution level 1 product
- The coastal product approaches land as close as 15-20 km
- The product quality at full sea is as good as the quality of the nominal 12.5-km product for R=15km
- The product quality near the coasts is very similar to that at full sea
- Product has been under review by beta users and EUMETSAT and is publicly available
- The limited noise in the products is very encouraging; ultra-high resolution winds in variable conditions may well be feasible (e.g., polar lows, TCs)

The future: 6.25 km data grid?

- Left: coastal product at 12.5 km grid size, right: ultra high resolution product at 6.25 km grid size
- Product still looks consistent but data quality not yet validated